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Global Transmission Report

Information and analysis on the global electricity transmission industry

ISO-NE's 2050 Grid Study

Focus on transmission to absorb RES penetration

New England, a region in the northeastern US encompassing Maine, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island, is undergoing a transformative shift in its power system.

The catalyst for this change lies in the commitment of five out of the six New England states to reduce carbon dioxide emissions by at least 80 per cent by 2050.

This commitment has spurred significant alterations in the grid's resource composition, with a notable increase in the adoption of renewable energy sources (RES) like wind and solar photovoltaic (PV) generation.

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Chile's Net-Zero Plans

Focus on RES, transmission and storage systems

Chile is actively working towards achieving carbon neutrality by 2050, defined under the Ley Marco de Cambio Climático or Framework Law on Climate Change of 2022.

Under this, the country has taken various regulatory steps with a focus on making renewable energy sources (RES) the key generation source, streamlining transmission network expansion, and promoting energy storage systems.

Chile's Agenda Inicial para un Segundo Tiempo de la Transición Energética or Initial Agenda for a Second Stage of the Energy Transition aims to make RES the country's main energy generation source.

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Baltic Offshore Wind Transmission

Highlights from GTR conference 2023

Offshore wind (OSW) is emerging as a driving resource for strengthening the security of energy supply in the Baltic Sea region. Given the ongoing energy supply challenges, the Baltic Sea countries are taking steps to collaborate and accelerate the development of the OSW industry in the region. Last year in August, eight Baltic Sea countries pledged to develop 20 GW of OSW capacity by 2030.

However, insufficient grid capacity and limited offshore infrastructure pose a huge challenge to realising this ambition.

Global Transmission Report organised its fourth annual conference on Baltic Offshore Wind Transmission on November 15, 2023, at Sofitel Warsaw Victoria, Poland.

The conference focused on the plans, opportunities, technology and solutions for developing the OSW industry and the related transmission infrastructure to meet the region's energy security goals.

This led to insightful discussions on different stakeholders' experiences, perspectives and lessons learned in OSW energy and grid development in the Baltic Sea region. Some of the key takeaways from the conference are presented below.

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ISO-NE's 2050 Grid Study (contd...)

Simultaneously, the region is witnessing a surge in electrification, particularly in the heating and transportation sectors, leading to an overall increase in consumer demand for electricity. This shift is influencing usage patterns, introducing fluctuations in peak demand on both a seasonal and daily basis.

On November 1, 2023, ISO-NE published the draft 2050 Transmission Study, which gives a broad outline of the amount and type of transmission infrastructure required to provide reliable, cost-effective energy to the region through the clean energy transition. It was the result of the New England States Committee on Electricity's (NESCOE; a not-for-profit entity that represents the collective perspective of the six New England governors in regional electricity matters) vision statement 'New England States' Vision for a Clean, Affordable, and Reliable 21st Century Regional Electric Grid' released in October 2020, which recommended that the ISO New England (ISO-NE) work with stakeholders to conduct a comprehensive long-term regional transmission study.

The study has two main objectives, first, to determine the region's transmission needs to serve load while satisfying North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Council (NPCC), and independent system operator (ISO) reliability criteria, and second, to develop roadmaps for transmission upgrades designed to satisfy those needs while considering both the feasibility of construction and cost. It addresses specific transmission concerns within New England by developing sets of potential solutions for different regions, called roadmaps. These roadmaps, focusing on areas with high-likelihood concerns (HLC), are high-level plans identifying the necessary transmission upgrades to support future demand and meet reliability criteria. They offer strategic insights into potential transmission solutions, considering both construction feasibility and cost factors. The roadmaps include conceptual projects addressing concerns, such as offshore grids to transmit power from offshore wind (OSW) facilities to population centres. Each roadmap comprises several major components, including rebuilds of existing lines and other elements to formulate complete solutions for the relevant region.

Preliminary results from the study indicate that around 4,000 miles (6,437 km), accounting for 50 per cent of the region's transmission line mileage, may face overload by 2050 with the coming up of new RES projects. To mitigate this, the study estimates that New England must make substantial investments in upgrading its power transmission infrastructure, with a potential expenditure of up to USD26 billion by 2050.

Present Infrastructure

New England currently has an installed capacity of about 13,958 MW, the majority of which is based on natural gas. The power generation landscape is undergoing a transition, moving away from traditional sources such as coal, oil and nuclear power towards a more sustainable mix that prominently features natural gas and RES. Coal and oil-fired plants are primarily reserved for peak demand periods. New England is a net importer of electricity through interconnections with neighbouring power systems in New York as well as the Canadian provinces of Quebec and New Brunswick. In 2022, the share of imports in total energy was 14 per cent.

The New England transmission system comprises about 9,000 miles (14,483 km) of high-voltage transmission lines at 115 kV, 230 kV and 345 kV. These lines are generally more extensive in the southern states compared to the northern region. The transmission infrastructure is designed with longer distances between fewer lines in northern New England.

In terms of interconnections, New England is intricately linked with neighbouring power systems in the US and eastern Canada, with a total of 13 interconnections. Nine of these interconnections are with New York, encompassing two 345 kV lines, one 230 kV line, one 138 kV line, three 115 kV lines, one 69 kV line and one 330 MW, ±150 kV high voltage direct current (HVDC) line known as the Cross-Sound Cable interconnection.

Additionally, New England is connected with the Maritimes in Canada through two 345 kV alternating current (AC) lines; has two HVDC interconnections with Québec, Canada; a 120 kV AC interconnection with a 225 MW back-to-back converter station in Highgate, northern Vermont; and a ±450 kV HVDC line with terminal configurations enabling the delivery of up to 2,000 MW at Sandy Pond in Massachusetts.

Table 1: New England's installed generation capacity by source, November 2023

Source	Installed capacity (MW)	Share in total capacity (%)
Natural gas	7,392	53.0
Nuclear	2,121	15.2
Hydro	830	5.9
RES	788	5.6
Coal	224	1.6
Net imports	2,596	18.6
Others	7	0.1
Total	**13,958**	**100**

Note: Data is as of November 29, 2023. Renewable energy sources (RES) include refuse (39 per cent), wood (25 per cent), wind (23 per cent), solar (10 per cent), landfill gas (4 per cent).
Source: ISO-NE

ISO-NE 2050 Transmission Study

ISO-NE's latest draft study represents its first detailed examination of the region's transmission system beyond the traditional 10-year planning horizon. It is in line with ISO-NE's revision to the New England Open Access Transmission Tariff to incorporate a new transmission planning process designed to look beyond the current decade-long planning horizon, which was approved by the Federal Energy Regulatory Commission (FERC) in early 2022.

The study includes sets of potential solutions or roadmaps designed to assist stakeholders in facilitating the clean energy transition. It assumes the retirement of all coal, oil, diesel, municipal solid waste-fuelled generation, and a portion of today's natural-gas-fuelled generation by 2035. The remaining natural gas, biomass, nuclear, hydroelectric and RES generators are assumed to continue operating through 2050. The retired generation and increased load are offset by a substantial rise in wind and solar generation, battery energy storage and increased imports. By 2050, the region's RES capacity will be about 97 GW comprising 59 per cent solar, 36 per cent wind (onshore and offshore), and 5 per cent battery storage facilities.

Based on the above capacity addition, ISO-NE studied several transmission-related challenges that may arise as a result of the clean energy transition. Key takeaways or observations of the study are as follows:

Reducing peak load significantly reduces transmission cost: The study has suggested maintaining peak load at 51 GW in New England. Any load increase beyond this results in a significant escalation in transmission costs.

Targeting and prioritising HLCs is highly effective: The study identifies HLCs that are anticipated to persist across a wide spectrum of potential future conditions associated with the accelerating clean energy transition. Consequently, addressing these concerns is deemed higher priority compared to other potential challenges identified in the study.

Incremental upgrades can be made as opportunities arise: The study suggests that many identified concerns within the system could be effectively addressed through reconductoring, that is, the strategic approach of rebuilding existing transmission lines with larger conductors, rather than expanding the system into new locations.

Generator locations impact transmission requirement: The study reveals that the specific location of generators significantly influences the required transmission upgrades for reliability. Efforts were made to optimise new generator locations, particularly for OSW, solar PV and batteries in import-constrained regions to reduce the number and severity of overloads during peak loads.

Transformer capacity expansion is crucial: The study highlights that increasing electrification leads to load growth, requiring additional RES in the power system. This heightened load and generation can strain existing transformer capacity so transformers could be added to the transmission system while determining their exact locations can be done later on.

Proposed transmission solutions

Based on key takeaways, the study suggested conceptual projects (specific to the study's input assumptions) that are useful in addressing HLCs mainly for the north-south region, and to support Boston imports and northwestern Vermont imports. The study, however, does not recommend one roadmap over another. The inclusion of multiple roadmaps provides a basis for comparison, aiding decision-making by New England stakeholders.

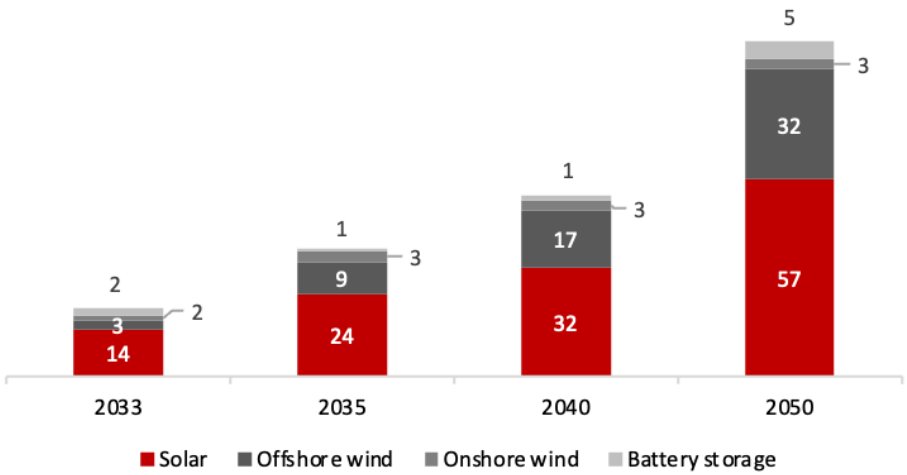
North-South/Boston Import Roadmaps

In addressing the identified concerns related to the north-south (N-S) and Boston import interfaces, four distinct roadmaps are formulated to provide stakeholders with diverse mitigation examples.

N-S/Boston Import Roadmap #1: AC Roadmap

- 345 kV AC lines connecting the Surowiec substation in Pownal, Maine, to the Timber Swamp substation in Hampton, New Hampshire, and further to the Ward Hill substation in Haverhill, Massachusetts. These lines are primarily overhead lines (OHL), with short underground cable (UGC) sections as needed.

Figure 1: Expected installed RES capacity in 2050, by source (GW)



Source: Draft 2050 Transmission Study

- 345 kV line (partially OHL and UGC) from Ward Hill to the Wakefield Junction substation, continuing to the Mystic substation in Everett, Massachusetts.
- An AC cable from the 345 kV Stoughton substation to the K Street substation in Boston, Massachusetts, addresses import issues in the southern and western portions of the Boston sub-region.

These upgrades, along with ancillary rebuilds of existing transmission lines, are necessary to meet the 51 GW winter peak load. There would, however, be limited flexibility due to constrained rights of way (RoW).

In addition to the major upgrades described above, this roadmap would require approximately 666 miles (1,072 km) or 1,058 miles (1,703 km) of OHL rebuilds to reliably serve a 51 GW load or 57 GW load respectively.

N-S/Boston Import Roadmap #2: Minimisation of New Lines Roadmap

This roadmap aims to minimise new lines by prioritising rebuilding of existing lines with larger conductors. It requires a new 345 kV partially OHL/UGC Ward Hill–Wakefield Junction–Mystic line and the third Stoughton–K Street AC cable. The omission of new lines in Maine or New Hampshire would necessitate additional rebuilds of 918 miles (1,447 km) for a 51 GW winter peak load. It would be potentially easier to site but may pose stability and voltage performance challenges.

N-S/Boston Import Roadmap #3: Point-to-point HVDC Roadmap

This roadmap involves a single 1,200 MW Surowiec–Mystic HVDC line, which could be constructed as OHL, UGC or undersea cable, providing flexibility for siting. It would also require approximately 624 miles (1,004 km) of OHL rebuilds for a 51 GW load. Potential challenges are related to land availability for large DC/AC converter stations.

N-S/Boston Import Roadmap #4: Offshore Grid Roadmap

It would involve utilising an offshore grid framework by connecting up to three OSW plants to import power into Boston. Its configurations include connections between Brayton Point, K Street and Mystic, with additional connections for the 2050 scenarios. It requires about 606 miles (975 km) of OHL rebuilds for a 51 GW load.

However, there could be challenges due to the high costs of numerous offshore connections. Other projects to resolve concerns in Boston include the conversion of three existing 230 kV lines to 345 kV standards in the western portion of greater Boston; and a new substation in Cambridge, Massachusetts, tying together lines serving Kendall Square and neighbourhoods in western Boston.

Northwestern Vermont (NWVT) Import Roadmaps

In addressing identified concerns in northwestern Vermont around Burlington, four roadmaps are recommended.

NWVT Import Roadmap #1: PV-20 Upgrade and Doubling of K-43 Roadmap

It focuses on upgrading the PV-20 line from New York to Vermont from 115 kV to 230 kV and introduces a parallel 115 kV OHL to the existing K-43 line from New Haven to Williston.

This requires a 230/115 kV transformer at the Sandbar substation in addition to three new 345/115 kV transformers. The plan involves about 120 miles (193 km) of 115 kV OHL rebuilds for a 51 GW load.

NWVT Import Roadmap #2: Coolidge-Essex Roadmap

This plan envisages the new 345 kV Coolidge–Essex line, which is approximately 90 miles (145 km) long, potentially expanding the existing transmission RoW. It would also require 105 miles (169 km) of 115 kV OHL rebuilds for a 51 GW load. It involves installing a new 345/115 kV transformer at an existing substation.

NWVT Import Roadmap #3: New Haven-Essex and Granite-Essex Roadmap

It requires a new 345 kV New Haven–Essex line and a new 230 kV Granite–Essex line along with new substation equipment at Essex for both lines. The plan would entail 79 miles (127 km) of 115 kV OHL rebuilds for a 51 GW load, along with installing two new 345/115 kV transformers at existing substations.

NWVT Import Roadmap #4: Minimisation of New Lines Roadmap

It is essentially a variation of the first roadmap with the potential elimination of the new line parallel to K-43 and suggests adding parallel cables to two UGC sections instead. It would require about 142 miles (229 km) of 115 kV OHL rebuilds and involves installing three new 345/115 kV transformers for a 51 GW load.

Southwest Connecticut Import

The Southwest Connecticut (SWCT) area, akin to Boston, presents a densely populated urban landscape with soaring power demand and limited OHL corridors. The study emphasises the requirement for new OSW and battery storage facilities in this area and identifies a set of solutions resulting in a single representative roadmap.

It involves the installation of three new 115 kV UGCs in the Norwalk-Stamford area: Norwalk–Glenbrook, Ely Avenue–Norwalk Harbor, and South End–Cos Cob. Additionally, the plan calls for rebuilding 96 miles (154 km) of 115 kV OHLs and 6 miles (10 km) of 345 kV UGCs.

Two 345/115 kV transformers must be added to reliably serve a 51 GW winter peak load. Repurposing an unused UGC segment of the Long Mountain–Norwalk path is recommended, allowing for increased power flow and overcoming challenges posed by the densely populated areas.

Transmission costs

The report suggests that substantial investments are required to upgrade the power transmission infrastructure in New England

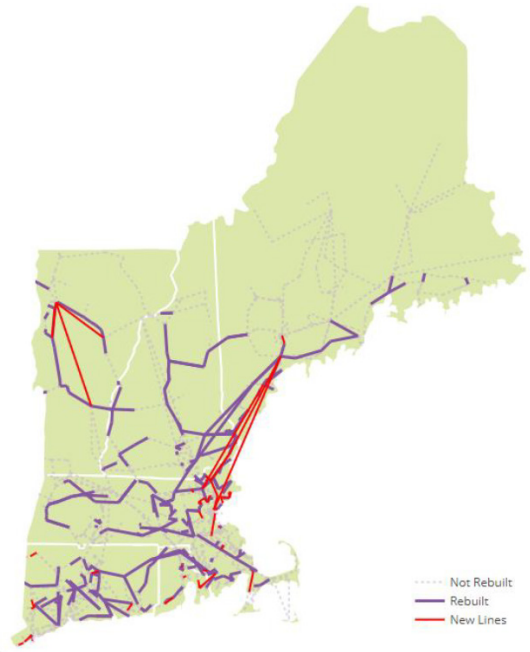
Table 2: Estimated cumulative costs by year

Year	Maximum load served (GW)	Total cost range (USD billion)	Cost breakdown per area	
			Cost (USD billion)	Area
2035	35	6-9	2.8-5.0	N-S/Boston
			0.6-1.1	NWVT
			0.5	SWCT
			1.7	Miscellaneous HLC
			0.4	Non-HLC
2040	43	11-13	5.0-6.5	N-S/Boston
			0.8-1.3	NWVT
			0.7	SWCT
			2.8	Miscellaneous HLC
			1.4	Non-HLC
2050	51	16-17	7.5-7.9	N-S/Boston
			0.9-1.5	NWVT
			0.8	SWCT
			3.1	Miscellaneous HLC
			3.3	Non-HLC
2050	57	23-26	10.2-12.8	N-S/Boston
			1.2-2.0	NWVT
			1.6	SWCT
			3.1	Miscellaneous HLC
			6.6	Non-HLC

Note: N-S: north-south; NWVT: northwestern Vermont: SWCT: southwest Connecticut: HLC: high-likelihood concerns. The above costs are only part of the required total investment in the transmission system. Other costs include asset condition projects unrelated to this study, and costs required to meet voltage, stability and short-circuit needs.

Source: Draft 2050 Transmission Study

Figure 2: Map of transmission upgrades and additions in New England by 2050



Source: Draft 2050 Transmission Study

by 2050. A cost of around USD0.75 billion for each additional GW of capacity, up to 51 GW, and USD1.5 billion per GW, up to 57 GW, is estimated in the report. Spread out over 26 years, the total cost to serve a 51 GW winter peak load is approximately USD16 billion to USD17 billion, translating to an average annual spending of USD0.62 billion to USD0.65 billion. Similarly, to serve a 57 GW winter peak load, the total cost of USD23 billion to USD26 billion results in average annual spending of approximately USD0.88 billion to USD1 billion.

Outlook

As the ISO finalises the 2050 Transmission Study, which is the first phase of long-term planning, it is currently discussing the second phase to establish a process to enable the states, through NESCOE, to move policy-related transmission projects forward, with an associated cost allocation. This effort began at stakeholder meetings in October 2023 and will continue through early 2024.

To ensure an ageing transmission system does not become a bottleneck to the evolving power system, given ongoing RES build-outs and expected electrification, ISO-NE is committed to ongoing forward-looking analysis and longer-term transmission planning studies, collaborating with stakeholders to identify optimal paths forward in ensuring reliable and economically efficient electricity delivery.◆

Chile's Net-Zero Plans (contd...)

The Primer Tiempo de la transición energética or First Stage of the Energy Transition initiative, which focused on promoting RES, mainly solar photovoltaic and wind, resulted in an increased share of RES (including hydro) in the total generation mix from 40 per cent in 2014 to 58 per cent in 2022.

This has further increased to 62 per cent as of October 2023 with a total installed capacity of 34,345 MW.

To enable further RES penetration, the country has planned to retire 28 installed coal projects with a cumulative capacity of over 5,529 MW by 2040.

To support the country's decarbonisation plans, the government is currently working on two bills—one that prohibits the installation and operation of coal-fired thermal power plants (that are less than 30 years old as of December 31, 2025), and another that prohibits the injection of electricity from fossil fuels into the country's national electric system from 2030.

Further, the political, regulatory and urgent works actions of the Second Stage agenda highlight the importance of a strong transmission network to support large-scale integration of RES projects. As part of this, Chile has announced the 'Transición Energética: Transmisión como un sector habilitante' or 'Energy transition: Transmission as an enabling sector' Bill, the purpose of which is to modify the Ley General de Servicios Eléctricos (LGSE) or General Law on Electricity Services (LGSE) to allow the transmission segment to present itself as an enabling sector for energy transition. It calls for the implementation of transmission projects that are timely and resilient, such that they adapt to temperature variations and are capable of transporting large volumes of RES power.

To further support the network expansion, in October 2023, Chile's Comisión Nacional de Energía (CNE) or the National Energy Commission, through Exempt Resolution No. 478, published the Informe Técnico Definitivo del Plan Anual de Expansión de Transmisión del Sistema Eléctrico Nacional (SEN) or Definitive Technical Report of the Annual Transmission Expansion Plan for the National Electrical System for 2022.

This report outlines 42 expansion works involving an estimated investment of USD1,053 million.

These works include 15 national projects valued at approximately USD662 million and 27 regional works totalling around USD391 million.

Additionally, in July 2023, the Ministerio de Energía or Ministry of Energy of Chile presented the draft Energy Transition Bill to the Comisión de Minería y Energía del Senado or Mining and Energy Commission of the Senate, with a focus on modifying the tariff revenue allocation mechanism, improving the transmission system, and promoting energy storage projects.

This marks the beginning of the legislative processing of the bill by the Commission.

A major focus of the bill is to expedite the establishment of enabling infrastructure, with a particular emphasis on the efficient development of electrical transmission works especially in the south-central regions.

The bill also aims to support the tendering of storage systems in the northern region, with the projected operational timeline set for 2026. This initiative is expected to attract an investment of about USD2 billion.

The bill further proposes changes in the industrial organisation of the generation sector and suggests altering the tariff revenue allocation mechanism.

The bill includes 'congestion rent', which aims to insure generators against short- and long-term issues like the eviction of regulated contracts and market concentration.

In 2023, Chile also enacted a new Law 21505 to promote energy storage and electromobility. It highlights the following measures: participation of pure storage systems in the electricity market, enabling the connection of infrastructure that combines generation and consumption, temporarily lowering the annual tax for electric and clean vehicle permits, and authorising new business models for electromobility.

Existing infrastructure

As one of the early adopters of electricity sector reforms, Chile's electricity generation, transmission and distribution sectors are completely owned by private companies with the government retaining only a surveillance role and regulatory powers, especially over the determination of certain tariffs.

As of October 31, 2023, the total installed power generation capacity in the country reached 34,345 MW, of which 62 per cent was based on RES, and 38 per cent on conventional sources of energy.

In 2022, the 350 MW Bocamina II thermal power plant, and units 14 and 15 of the Tocopilla thermal complex, with a total capacity of 268 MW, were closed.

Chile's Sistema Eléctrico Nacional (SEN) or National Electric System includes Sistema Interconectado Central (SIC) and the Sistema Interconectado del Norte Grande (SING) (which are connected via a 500 kV line) along with two independent systems, Aysen electric system (including Port Aysen and Coyhaique), and the Magallanes electric system (including Punta Arenas, Port Porvenir and Port Natales). All these are coordinated by Coordinador Eléctrico Nacional (CEN).

As of November 2023, Chile had a total transmission line length of 31,284 km at the 110 kV to 500 kV voltage levels. Of the total installed capacity, 60 per cent of the line length was at the 220 kV level, 15 per cent was at 500 kV, and the rest was at low voltage levels. In December 2022, AES Andes S.A. energised the country's first 345 kV line.

Future plans

As per the estimates of CNE, the power demand in the country is likely to increase by 2.16 per cent to reach 77 TWh by 2023 and 93 TWh by 2032.

Table 1: Growth in Chile's installed electricity capacity (MW)

	2006	2014	2021	2022	2023*
Hydro	5,156	6,438	6,839	7,255	7,531
Thermal	2,574	7,353	9,232	9,155	8,683
Natural gas	3,853	4,506	4,348	4,348	4,323
Solar	-	221	4,543	6,715	8,520
Wind	2	740	2,896	3,909	4,596
Biomass and biogas	122	444	521	555	597
Other renewables	-	18	45	95	95
Total	**11,707**	**19,719**	**28,423**	**32,032**	**34,345**

*Note: *–Data is as of October 2023.*
Source: Comision Nacional de Energia (CNE); Global Transmission Report

Generation expansion

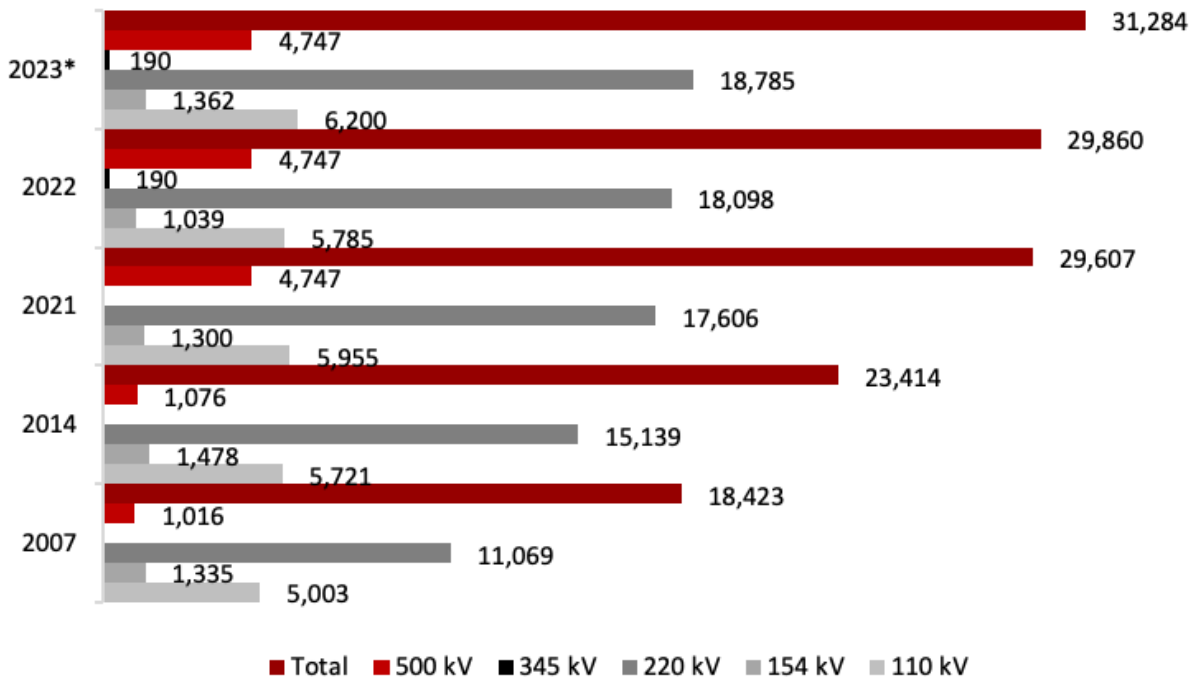
To meet the growing electricity demand, under its latest Plan de Obras de Generación 2022, CEN plans to add over 17 GW of generation capacity, which will be based entirely on RES. This includes 47.5 per cent based on wind, 21.3 per cent on solar [photovoltaic (PV) and concentrated solar power (CSP)], 17.2 per cent on battery storge capacity and 10.5 per cent on synchronous capacitor projects.

The proposed capacity also includes the installation of 215 MW of geothermal and 400 MW of pumped storage capacity.

In addition, about 3.7 GW of thermal capacity will be retired by 2029.

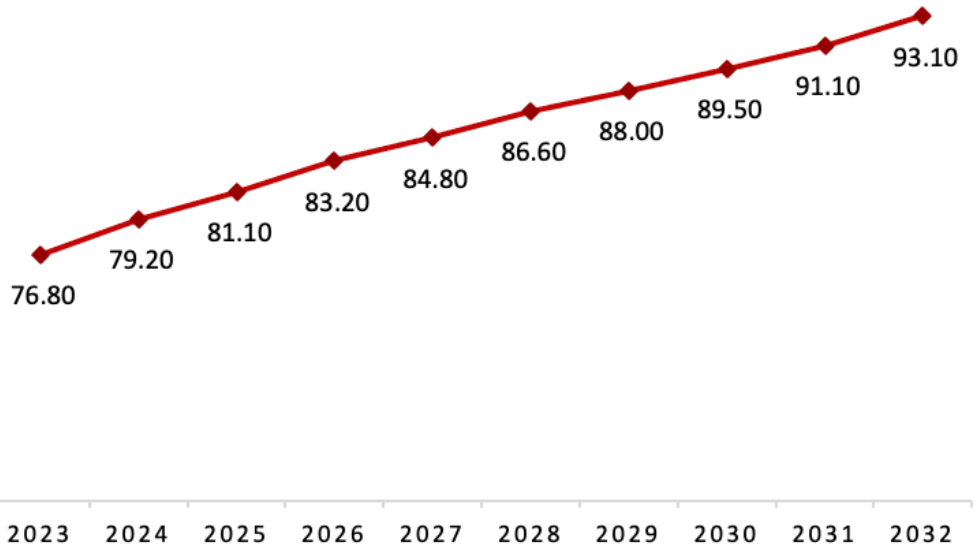
As per the estimates of the energy ministry, as of September 2023, 85 plants (based entirely on RES) with a cumulative capacity of 4,352 MW were under construction in the country with a total investment of USD6.3 billion.

Figure 1: Growth in Chile's transmission line length (km)



*Note: * Data is as of October 31, 2023.*
Data for 2021 and 2022 includes line length for Medium Electric System (SSMM) as well.
Source: Comision Nacional de Energia; Coordinador Eléctrico Nacional; Global Transmission Report

Figure 2: Expected growth in electricity demand in Chile (TWh)



Note: Data shows results of medium electricity demand growth scenario.
Source: CNE's Proyección de Demanda

Transmission expansion

As per the mandate of LGSE, CNE is required to carry out a process of transmission planning annually, which must consider, at least, a horizon of 20 years.

Under this it has recently approved the Annual Transmission Expansion Plan 2022, which contains the proposals presented by the promoters of transmission expansion projects, the CEN expansion proposal, and CEN's own analysis-based projects.

For the Sistema Nacional de Transmisión or National Transmission System, the report includes 15 projects, of which 10 are expansions of existing facilities with an investment of USD90 million, and five are new projects of USD572 million.

For the Zonal Transmission System, 27 expansion works are presented, of which 12 are expansions of existing facilities, with a budget of roughly USD58 million, and 15 are new works amounting to approximately USD333 million. Construction of these works is estimated to commence in the first half of 2025.

Table 2: Expected addition to generation capacity in Chile (MW)

	2023-27	2028-32	2023-32
Battery	2,900	50	2,950
Pumped storage	-	400	400
CCSS	1,800	-	1,800
Wind	5,850	2,300	8,150
Geothermal	215	-	215
Solar PV	600	1,800	2,400
Solar CSP	-	1,250	1,250
Total	**11,365**	**5,800**	**17,165**

Note: CCSS – condensadores sincrónicos or synchronous capacitors; CSP – concentrated solar power; PV – photovoltaic. Data shows Scenario E2 of the Plan de Obras de Generación 2022, which assumes 100 per cent transition towards RES by 2030.
Source: Plan de Obras de Generación 2022, CEN

Table 3: Chile's key planned transmission projects

Project	Construction period (months)	Reference value (USD '000)
National projects		
2x500 kV Digüeñes–Nueva Pichirropulli line	84	3,45,080
2x500 kV Entre Ríos–Digüeñes line	60	1,02,512
Digüeñes substation	60	73,049
Second circuit of the 2x500 kV Ancoa–Charrúa line	60	60,262
Installation of a new flow control system for sections of the existing 220 kV Las Palmas– Centella line	30	35,353
220 kV Manuel Rodriguez substation	54	16,160
Amplification of the 220 kV Kimal substation	36	8,135
Zonal projects		
Expansion of the 220 kV Lastarria substation with a new transformer and a new 110 kV yard	60	11,068
Amplification of the 110/13.2 kV Taltal substation	36	5,474
Amplification of the 110/13.2 kV Recoleta substation	36	4,858

Source: CNE

Key planned national level projects are the 2×500 kV Digüeñes–Nueva Pichirropulli line, with a reference investment of USD345 million; the 2×500 kV Entre Ríos–Digüeñes line, with a reference investment of USD102 million; the 500 kV Digüeñes substation (USD73 million); the 220 kV Manuel Rodriguez substation (USD16 million); and installation of a new flow control system for sections of the existing 220 kV Las Palmas–Centella line (USD35 million).

The national expansion projects include the laying of the second circuit of the 2×500 kV Ancoa–Charrúa line, with a reference investment of USD60 million (to increase transmission capacity in the southern zone of the National Electric System to at least 1,700 MVA); and expansion of the 220 kV Kimal substation, with an investment of USD8.1 million [to facilitate the connection of the second 2×220 kV link associated with the New Kimal–Lo Aguirre high voltage direct current (HVDC) line project].

Upcoming transmission expansion plans

Presently, the Transmission Expansion Process for 2023 and 2024 is in progress. CEN has concluded the 2023 Transmission Expansion Process with 30 transmission projects involving an investment of USD380.6 million.

In July 2023, it submitted a supplement report for the Propuesta de Expansión del Sistema de Transmisión 2023 or Expansion Proposal of the Transmission System 2023 to the CNE for final approval.

The supplementary report includes seven new projects worth USD114.3 million, of which two projects (USD25.9 million) are national projects, while the other five are zonal projects (USD88.4 million). The report also includes 23 amplification projects – seven national projects of USD182.4 million and 16 zonal projects of USD83.9 million.

Further, in October 2023, CEN, within the framework of the transmission planning procedure stipulated in Article 91 of Law 20,936 of 2016, released the Diagnóstico del Uso Esperado del Sistema de Transmisión or Diagnosis of the Expected Use of the Transmission System report.

This marks the initial phase of the 2024 Proceso de Planificación de Transmisión or 2024 Transmission Planning Process.

The report aims to share the diagnosis of the expected use of the electric energy transmission system for the period 2023-43 in order to receive comments from all the stakeholders as part of the preliminary stage of development of transmission expansion project proposals, which will be submitted to the CNE in January 2024.

Conclusion

Overall, Chile has been taking various steps to strengthen the electricity sector, with an aim to have a more detailed path towards its decarbonisation plans. Timely implementation of these initiatives will help the country maintain a smoother energy transition.◆

Baltic Offshore Wind Transmission (contd...)

Keynote with Ministry of Energy, Lithuania

Lukas Satkauskas, Specialist, Sustainable Energy Policy Division, Ministry of Energy, Republic of Lithuania, on behalf of **Daiva Garbaliauskaitė**, Vice Minister, Ministry of Energy, Republic of Lithuania, highlighted the opportunities and challenges presented by energy transformation. By 2035, the country plans to achieve self-sufficiency in electricity generation by transitioning to 100 per cent renewable energy sources (RES) and becoming a net exporter of high-value-added RES products. The share of RES will increase from 20 per cent to 100 per cent in just one decade. Wind energy will contribute to almost two-thirds of the total annual electricity generation. Hydrogen production will become a major consumer of green energy and serve as a flexibility source. Lithuania aims at building 1.4 GW of OSW capacity across two projects, which can meet nearly 50 per cent of the country's electricity demand at 6 TWh per year.

The development will have a positive impact on the transport and building sectors as well as the development of Klaipeda port and will help decrease electricity imports by up to 30 per cent. The first 700 MW project tender was launched on March 30, 2023, on a free subsidy basis and awarded in mid-October 2023. The developer is responsible for preparatory works such as the environmental impact assessment (EIA), wind speed measurements and seabed surveys. The second tender is scheduled for January 15, 2024. For this, the tender rules are flexible and information about the studies carried out until the auction will be provided to developers. Completed tasks include the special territory planning document, EIA, measurement of wind speeds and the seabed survey. The National Regulatory Authority will organise the tender and grant the permit, which is valid for 41 years, including 8 years for design and construction, with the possibility of extending the term.

The tender will follow a two-stage process where the first stage will involve the submission and registration of tender documents and proposals. The proposal could be based on either the annual amount of potential promotion (MWh), the desired strike price (EUR per MWh) and promotion volume (EUR) or a development fee (EUR). Stage II will involve a qualification check and evaluation of proposals as well as identification of a potential winner followed by verification related to correspondence to national security requirements.

The winner will be the one who asks for the lowest support. In the event that the tender participant does not ask for support, it should propose the development fee. The winner will be the one who proposes the largest development fee. The winner is expected to be announced in the third quarter of 2024. It is planned that the offshore parks should start producing electricity in 2030.

Country Plans and Policies

Dr Niels Anger, Head of Unit for EU Energy Policy, Federal Ministry of Economic Affairs and Climate Action, Germany, discussed the country's OSW policy and cross-border cooperation. Germany has an ambitious OSW capacity target of reaching at least 30 GW by 2030, 40 GW by 2035 and 70 GW by 2045 from the current 8.3 GW OSW installed capacity. The Offshore Wind Act 2023 increased the targets and future tender volume in addition to allowing the tendering of non-centrally pre-investigated sites and acceleration of permitting procedures. Notably, the 2023 tender generated high payments of up to EUR13 billion for 7 GW for non-pre-developed sites. In 2024, 8-9 GW will be tendered with the share of pre-developed sites at 5.5 GW. Between 2025 and 2028, around 4 GW will be tendered annually. For centrally pre-investigate sites, the auction design involves a financial component (bids in EUR; 60 per cent weightage) plus four qualitative criteria (40 per cent weightage). The first round involves the submission of bids in EUR cents per kWh with the criterion of the lowest reference price. If there are positive bids, the lowest price will be chosen and a market premium [in the form of a one-sided contract for difference (CfD)] will be granted. In the case of several zero-cent bids, there will be a second round of dynamic auction where the criterion is the acceptance of pre-defined thresholds of payments. In both cases, 90 per cent of the income will be used for offshore grid levy.

German projects in the Baltic Sea are the Bornholm Energy Island (BEI) (Germany–Denmark) and Baltic WindConnector (Germany–Estonia–Latvia). The regulatory framework for cross-border exchange in the emerging situation will be defined by the European Union (EU) electricity market design (EMD) as well as clear rules for cost-benefit sharing and cross-border cost allocation (EU Guidance expected next year). For the BEI project, in June 2023, the two governments signed a legally binding inter-governmental agreement (IGA) complementing the transmission system operator (TSO) cooperation agreement between Germany's 50Hertz and Denmark's Energinet. As per the agreement, electricity will be transported via new connections to Germany (2 GW) and to mainland Denmark (1.2 GW). The main terms include equal sharing of infrastructure costs for project-related grid infrastructure on Bornholm; the congestion income among TSOs; as well as the RES target amounts of the project. This is just the start of a process that will connect the Baltic Sea markets and eventually lead to a meshed grid.

Karlis Goldstein, Head for Renewable Energy, Ministry for Climate, Republic of Estonia, discussed the plans for the country's journey to 100 per cent decarbonisation. Estonia's RES share in the energy mix stood at 38 per cent in 2021 and ranked tenth in the Sustainable Development Global Index 2023. By 2030, the country aims to achieve 100 per cent RES electricity production. Estonia's current annual electricity consumption is roughly 8 TWh while a 1 GW OSW park can generate about 4 TWh or 50 per cent of the national consumption. Theoretically, if 100 per cent of the current transport and heating is replaced with fossil fuel electricity, electricity consumption would increase by 3.5 TWh. In contrast, electrification will reduce the overall final energy consumption by 9.5 TWh translating into a 30 per cent reduction. Wind will play a critical role in the generation mix. The ELWIND project is a collaborative project between Estonia and Latvia. The OSW areas have been identified and the EIAs are underway, which will be followed by permitting. The plan is to develop 1 GW each on both sides and then interconnect the Estonian mainland directly to Latvia through a hybrid link, which will serve as an interconnector and integrate the physical OSW generation. The challenges include

permitting, aligning the legislation and auctions as well as technical aspects. Estonia is part of the 810-km Baltic WindConnector based on a 2 GW, 525 kV high voltage direct current (HVDC) bipole, which is currently in the pre-feasibility study stage and was submitted to the EU's Ten-Year Network Development Plan 2024 (TYNDP) in October 2023. It will be completed post-2035. The concept of meshed grids in the Baltic Sea is important as Estonian OSW generation potential is much more than the national consumption requirements and the idea is to offer it to other European countries.

Accelerating Offshore Wind in the Baltic Sea Region

Alfredo Paris, Group Senior Vice President, Head of Renewables, Hitachi Energy, provided a comprehensive overview of the current dynamics in the RES sector with a focus on OSW and the broader infrastructure essential for the energy transition. Given the increasing global demand for equipment across sectors and regions, there is a need for a stable and attractive market with clear visibility for investors. Recognising Europe's achievements in setting ambitious OSW targets and focusing on implementation through the EU's Wind Action Plan, Paris cautioned about the need to reassess project execution models in the face of evolving challenges such as interest rate increases, inflation, and raw material costs. Transmission grids will play a central role in the energy transition. OSW interconnections are moving from point-to-point connections to hybrids and mesh grids. Paris advocates a shift from a cost-centric competition to a value-driven approach in supply chain contracts. He cited the example of Germany's TSO TenneT, which is making anticipatory investments in transmission infrastructure. However, regional disparities remain, particularly in Poland where OSW plans have not aligned with TSOs plans. Overall, the industry is adapting to the new reality with a focus on addressing capacity constraints through early investments in manufacturing, engineering and project management.

Jaroslaw Broda, CEO, Baltic Power [a joint venture between ORLEN S.A (51 per cent) and Canada's Northland Power (49 per cent)], offered insights into the historical trajectory and future challenges of OSW development. Considering challenges in the supply chain, he expressed concerns about the rapid push to increase annual OSW capacities from 3 GW to 10-15 GW within one to three years.

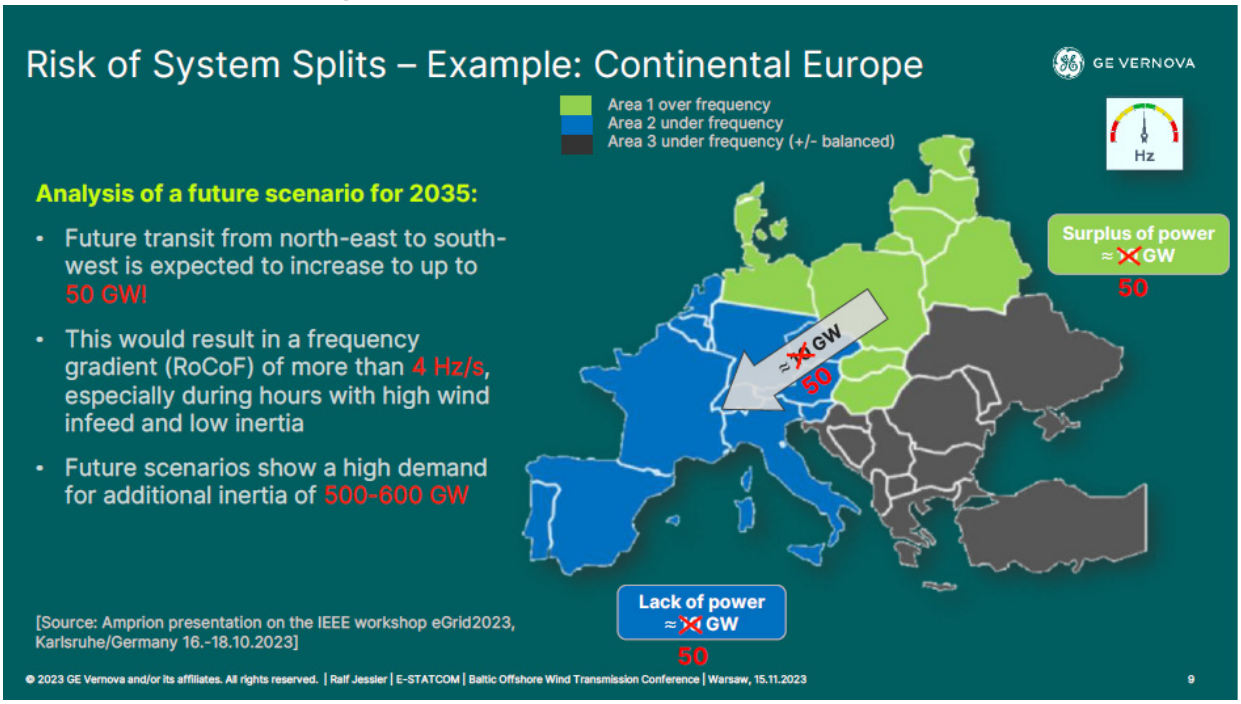
Further, the aim to continuously decrease electricity prices amid rising commodity and labour costs in Europe without corresponding investments could lead to huge challenges for the industry. Prices have peaked, reaching over EUR4 billion for a 1 GW project. There have been some withdrawals by oil companies from OSW projects due to unrealised returns and potential greenwashing costs. The success factors for obtaining the final investment decision (FID) and financial closure (FC) of Poland's first OSW 1.2 GW Baltic Power are attributed to strong support from sponsors, positive government response facilitated by the Polish contract for difference (CfD) and European financing changes, and a dedicated multinational team. Going forward, there is a need for early development efforts to prepare OSW projects for reasonable investor consideration, to attract foreign investments and maintain Polish industry competitiveness in addition to building a robust transmission grid for successful decarbonisation efforts.

Grzegorz Rapsztyn, Head of the EIB Group Warsaw Office, European Investment Bank (EIB), expressed a positive outlook on the OSW market in the Baltic Sea estimating it at 100-150 GW until 2030. Poland, which has an OSW potential of 33 GW, accounts for a project pipeline of 5.9 GW. EIB, with experience in over 20 European OSW projects, has contributed EUR10 billion in financing for 9 GW of OSW capacity. Recently, EIB provided EUR610 million in financing to the Baltic Power project, both directly in project finance and as funding to the Polish National Promotional Bank. He acknowledged the complexities of project finance for the project involving 25 financial institutions but credited the stability in the Polish market due to a robust 25-year support scheme. The indexation adjustment of CfD to inflation and adjustment to the Euro is the major advantage of the scheme. This enables a positive outlook for the Polish project pipeline despite challenges including disruptions to global supply chains, commodity price fluctuations, and competition from Chinese players. EIB is committed to continue financing OSW projects in alignment with its strategy of dedicating 50 per cent of financing to green investments, including through the EC's REPowerEU programme.

Solutions for Grid Interconnection and Stability

Ralph Jessler, Business Development Leader at FACTS, GE Renewable Energy, discussed the challenges arising from the transition to RES; the changing dynamics of energy consumption driven by electrification of sectors like transportation and heating and consumers becoming prosumers; and the consequent impacts on grid stability. For instance, Germany aims to increase RES capacity by 360 GW in six to seven years and plans to add 50 million electric vehicles (EVs), 1 million charging stations, 10 GW electrolysers and 6 million heat pumps, which will all be grid connected. The challenges posed by replacing traditional synchronous generators with inverter-based resources (IBRs) have led to the focus on reactive power compensation, voltage stability and frequency stability. Some of the solutions to address these are fixed series compensation (FSC), static var compensators (SVC) and static synchronous compensators (STATCOM). The integration of energy storage systems like supercapacitors within the STATCOM framework will address the requirements for quick, short-term energy response to stabilise grids during faults or fluctuations. At the European level, the analysis of a future scenario for 2035 indicates that future transit from north-east to south-west Europe is expected to increase to up to 50 GW. This would result in a frequency gradient [rates of change of frequency (RoCoF)] of more than 4 hertz per second (Hz/s), especially during hours with high wind infeed and low inertia. Future scenarios show a high demand for additional inertia of a whopping 500-600 GW. This requires measures to be taken to control system splits in high- and low-inertia systems. To address this issue, GE has redesigned its conventional STATCOM, which can also provide inertia or momentary active power of large amounts through energy storage in the form of supercapacitors. The innovative solution is called energy-STATCOM (E-STATCOM) flexible alternating current (AC) transmission system (FACTSFlex). It is a combined solution for grid voltage and frequency stability in response to increasing TSO challenges. It is grid-forming converter compliant and can support the grid under normal, alerted, emerging, blackout and restoration states without having to rely on capabilities from synchronous generators.

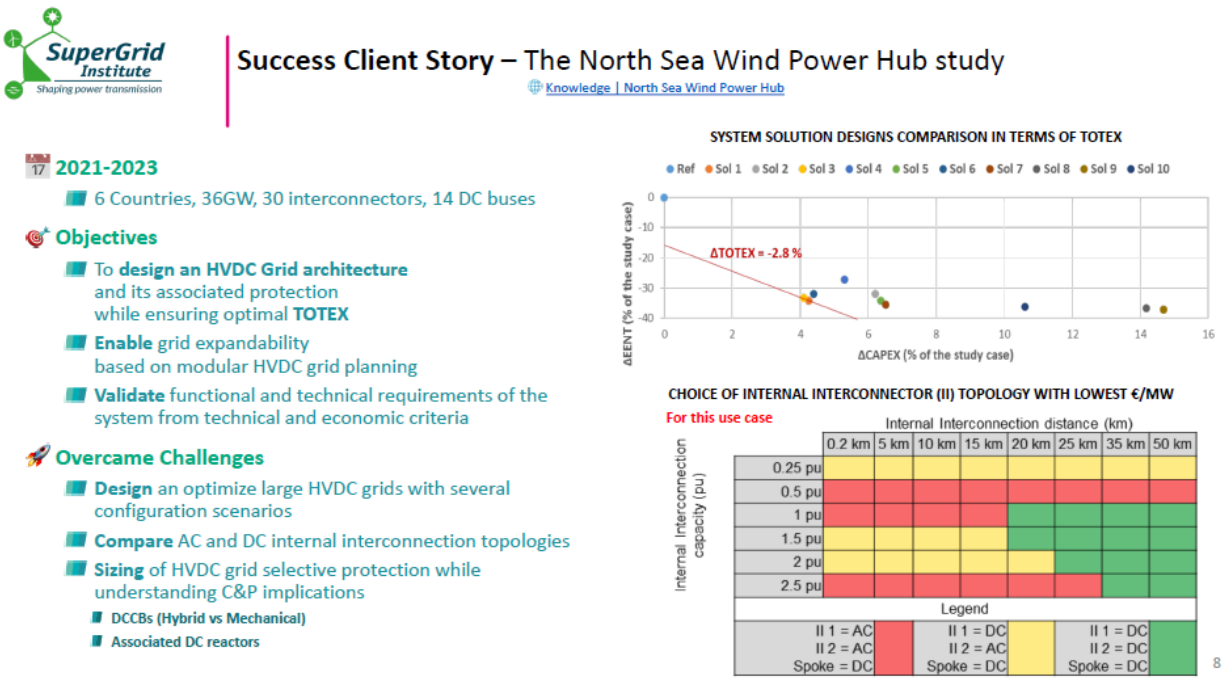
Figure 1: Risk of system splits in Continental Europe



Source: Presentation by Ralph Jessler, Business Development Leader at FACTS, GE Renewable Energy

William Leon Garcia, Technical Business Developer, Super Grid Institute, presented a comprehensive roadmap for integrating OSW energy into Europe's power grid through HVDC. By 2050, 83 GW of OSW is expected in the Baltic Sea region, which requires doubling grid infrastructure investments, including thousands of kilometres of seabed cables and offshore electrical substations. Holistic network planning and design approaches conclude that multi-terminal multi-purpose HVDC is the most optimal solution. It allows for mutualising assets, effectively increasing the number of onshore connection points and paths for energy transmission to consumers. To address the technical complexity involved, there is a need for early studies including techno-economic analysis, feasibility and pre-design studies to ensure reliability, efficiency and cost-effectiveness in implementing these technologies. He discussed successful case studies, including participation in the North Sea Wind Power Hub (NSWPHO) study, which involved assessing the integration of 36 GW of OSW capacity across 30 interconnectors and up to 14 DC buses and designing a grid

Figure 2: Details of NSWPH Study



Source: Presentation by William Leon Garcia, Technical Business Developer, Super Grid Institute

architecture. Other ongoing studies include Network-DC, HVDC Wise and InterOPERA, all of which emphasise the importance of techno-economic analysis, reliability models for components, system feasibility studies, and regulatory frameworks in making informed decisions about OSW integration. There is a need for collaboration among TSOs, technology providers, and research, development and innovation (R&D&I) experts to ensure efficient OSW grid integration.

O&M of Subsea Cables

Andreas Hallenger, Service Sales and Account Manager, NKT, highlighted the challenges faced by cable systems in terms of the substantial impact of failures despite being robust and reliable. He focused on three key aspects: prevention, preparation and mitigation. Prevention involves considering operation and maintenance (O&M) during the planning stages, wider corridors and risk assessments. Preparation encompasses proactive maintenance, internal and external monitoring, and comprehensive surveys. To reduce the number of spare parts, NKT's adaptive rigid sea joint allows sharing of spare joints across assets. Mitigation actions involve having a structured repair preparedness plan, service level agreements and a turnkey solution to reduce downtime in case of failures. For instance, with good preparation and prior experience, NKT repaired the failed Baltic cable between Germany and Sweden within a record 30 days in 2020. A holistic approach with proactive measures could significantly minimise downtime and mitigate the substantial impacts of cable failures.

Tom Lowehr, International Business Development Manager – Offshore Wind, Tampnet, which owns and operates approximately 5,000 km of fibre optic subsea cables supporting the telecom and oil industries across the North Sea and Gulf of Mexico, discussed the importance of internal monitoring of cables. There is a growing need to ensure the resilience of offshore infrastructure, especially after geopolitical events like those in the Baltic Sea. He drew parallels between telecom and power systems, discussing the strategies employed by Tampnet to build resilience in its networks, such as creating rings and mesh networks to avoid outages. The company is looking at cooperating with TSOs to improve the safety and security of power cables through the installation and activation of sensor technologies and the potential utilisation of offshore assets for telecom support, especially in emergencies. The challenges of ownership and responsibility concerning data from these collaborative efforts signal the need for dialogue among stakeholders for the effective utilisation of shared infrastructure.

Integrating Offshore Wind – TSO Perspective

Olivier Feix, Head of Group Strategy and Corporate Development, 50Hertz Transmission GmbH, highlighted the TSO's recent initiatives in OSW transmission. It has connected four OSW areas in the Baltic Sea so far and is working on delivering 15 GW of offshore connections in the Baltic and North seas, including hybrid connections. It is also working to establish a meshed offshore grid together with its partner TSOs. International cooperation and interconnection are key to making use of the Baltic Sea potential for up to 93 GW of OSW energy. 50Hertz has built interconnections with Denmark through the Kontek and Combined Grid Solution (Energinet) and is working with Energinet for the BEI project, Svenska kraftnat (SvK) for Hansa PowerBridge, Elering and AST for Baltic WindConnector as well as Litgrid for a future hybrid interconnection. A challenging market environment, the need to apply innovative and new technologies for the first time and complex stakeholder management are the challenges facing energy islands and hybrid OSW projects.

50Hertz has strengthened cooperation with Baltic TSOs by signing a joint letter of intent (LoI) with AST, Elering and Litgrid in May 2023. In addition to the Baltic WindConnector project, the TSOs are currently evaluating potential synergies with ELWIND and the potential integration of OSW capacity in both Estonian and Latvian seas. In addition, 50Hertz and Litgrid are conducting market simulations and cost-benefit analyses to assess a potential hybrid interconnector between Germany and Lithuania. These projects will increase European socio-economic welfare; integrate untapped OSW potential; reduce CO_2 emissions; increase security of supply; foster the European internal electricity market by providing cross-border trading capacity; and contribute to the closer connection of Baltic countries to continental Europe.

Interconnectors and Hybrid Grids

Natalia Zajon, Head of the Maritime Special Planning Unit at the Maritime Economy Department, the Minister of Infrastructure, Poland, highlighted the country's coherent plans for the Baltic Sea, mainly attributed to strong cooperation among all the maritime spatial plan (MSP) partners and planners. This gives confidence to investors to plan the grid internationally. For future planning, it is very important to have a holistic framework that incorporates the challenges and issues faced by all the stakeholders involved in Baltic Sea grid planning. Every country is obliged to plan at least 30 per cent of marine protected areas, including at least 10 per cent of strictly protected marine areas. OSW is a nascent industry and in the learning process of how meshed grids will develop. Poland is working on a legal system and is in discussions with other sea users (like fishermen and maritime transportation) to have multi-use areas to have more space for future OSW projects, which has a potential of 33 GW in the country. MSP involves organising space, which requires specific policies and concepts on defence, energy, environment, etc., so that planners can make reasonable and working plans.

Johanna Meyer, Senior Expert, Future of Energy Supply, German Energy Agency (dena), emphasised the need for political commitment to providing security to TSOs regarding their long-term plans for offshore grid connection. It is important to have a flexible framework that promotes development and can incorporate the unique challenges and design of every project. This requires a long-term planning horizon and a streamlined permitting process. Political cooperation is vital for planning hybrid interconnectors. It is an extremely complicated task involving agreements on the market framework, auction design across countries and supply chain in addition to MSP aspects to find solutions to areas where national interests and systems collide. Thus, a pan-European solution is required. Germany has its first MSP for the Baltic Sea in place. Further, a new draft plan explores OSW development in the North Sea. Germany is in talks with the Netherlands to decide which parts of the shipping lanes to use for OSW. Discussions are also underway to incorporate offshore hydrogen in Germany's MSP.

Janis Locmelis, Head of ELWIND Project Division, Investment and Development Agency of Latvia (LIAA), highlighted the significance of the ELWIND project for both Estonia and Latvia. It will support both countries' plans to further increase RES exchange. It will also help create skilled labour and staff, and help the local economy by giving a boost to start-ups and new enterprises. There is strong cooperation between the countries, which together have managed to attract EUR18.7 million in funding for joint studies. There needs to be a clear bifurcation of environmentally protected and offshore network development land to have a clear idea about the prospects of the industry. MSP planning is a complex procedure, which considers the interests of the defence ministry, environmental ministry, shipping industry and local communities regarding tourism activities, along with the OSW industry.

Supply chain development

Konrad Wróbel, Member of the Management Board, ORLEN Neptun, developer of the Baltic Power project, highlighted the challenges in supply chain development for OSW projects. Given the difficulties faced globally in establishing robust and efficient supply chains, there is a need for local supply chains to enhance stability and reduce risks. ORLEN has introduced five new projects totalling 5.2 GW for the second phase of Poland's OSW development in the Baltic Sea. To address supply chain challenges, ORLEN is constructing an installation terminal in Świnoujście to facilitate the creation of a local supply chain in the West Pomerania region. Localising the supply chain will help increase control over the key performance indicators (KPIs) and mitigate risks associated with long-distance supply chains. Poland's sector deal with suppliers has set an ambitious target of reaching up to 45 per cent of local content in the second phase from 25-35 per cent in the first phase. There is a need for closer collaboration in Europe to create a strong European supply chain, leveraging the competencies present in various European countries and minimising costs associated with transporting elements from distant locations like Vietnam or China. A universal set of regulations and collaboration is essential to reduce costs and improve efficiency. He suggested collaboration with EC and other developers to create tools for a future European supply chain and emphasised the importance of addressing safety concerns.

Zbigniew Szyca, Commercial Director, Stocznia Szczecińska Wulkan, shared insights into the shipyard's transition to an active participant in the emerging OSW market. Positioned strategically in West Pomerania, the shipyard is emerging as a significant supplier to key companies like ORLEN, PGE and Vestas, leveraging its proximity to Vestas' new facility. The shipyard embraced new standards, policies and training initiatives, envisioning a shift from a shipyard to an engineering, procurement and construction (EPC) contractor in the future. It has evolved to gradually become a supplier of services and small items and has expanded its reach to foreign markets. The primary challenge lay in adapting to a new market—OSW—leading to the need for training, implementing new policies, and diversifying operations. The shipyard's state-owned status did not limit its reach in the Polish market, with initial contracts coming from Europe. While recognising the importance of the Polish deal for local content, Szyca stressed the need for increased communication and relationship-building among companies. The absence of a unified European platform hinders the creation of a strong European player globally. Efforts towards digitisation and automation were directed at standardising processes for small items, aiming to reduce costs and enhance efficiency in the fabrication and delivery of goods for OSW projects. There is a need to address the bottlenecks of lack of installation vessels and service fleets for OSW projects as well as standardisation and work safety processes.

Developers' Perspectives and Expectations

Joanna Wis-Bielewicz, Head of Market Development, Region Europe, Ørsted, highlighted the supply chain challenges facing the industry, which require substantial investments. The leading suppliers have received government support, enabling them to fulfil their obligations and deliver the contracts. However, they suffer from liquidity issues as some of these contracts were signed three years ago based on historical price levels. Under the EC's proposed wind package, the guarantees for suppliers through well-targeted financial instruments would be welcome as it would be challenging for them to deliver the industry requirements on private banking conditions. OSW auctions are based on both financial and non-financial criteria. However, the just transition criterion used in the Polish bidding process was debatable as it gave high points to companies that produce 100 per cent energy based on coal. The second phase is divided among the two leading Polish state-owned companies. Strong partnerships are needed to develop 18 GW of OSW in Poland.

Kamil Kobyliński, Head of Offshore Wind Poland, TotalEnergies, gave an overview of the financial challenges facing the OSW market. Banks have started prioritising projects for financing as OSW development is not as attractive as it was a decade ago. For Poland, which aims to develop 20 GW of OSW by 2040, it is important to develop OSW as a part of an integrated value chain. TotalEnergies prefers local or regional partnerships for developing OSW projects. In addition to OSW development, developers should focus on integrating the whole value chain and plan the development of the offshore transmission network including interconnectors or energy carrier hubs. The regional players must immediately start effectively planning and implementing it to utilise the full OSW potential in the Baltic Sea. This requires the TSOs in the region to work more effectively.

Anu Eslas, Head of International Business Development, Ignitis Renewables, emphasised that the future is about interconnection and energy hubs. However, TSOs are not willing to start feasibility studies without clarity on who will pay or before the investment decisions are secured. Developers should be allowed to work together with the TSOs to execute transmission projects faster as the former are aware of the timing of FID and the grid requirement. It can start with some pilots to see if developers are willing to invest and take risks. The developers control their pipeline of projects, which are smaller and hence will allow them to approach it innovatively.

Emelie Zakrisson, Head of Offshore Wind Development, Sweden, OX2, highlighted that the challenging OSW market conditions can be an excellent opportunity for newcomers that are aware of the conditions. It allows them to use the first mover advantage and build up new partnerships. Conditions will improve in the future, opening the market to everybody. The auctions conducted in different markets indicate that OSW can be built at reasonable prices on a large scale. There is a need to rethink the supplier-buyer relationship and build strong partnerships. Climate change demands a faster build-out, which requires all stakeholders to take bold actions.◆

Agenda/Structure

- Accelerating Offshore Wind in Europe
- Policy and Regulatory Developments
- Grid Innovation and Technology
- Subsea Cables and their Monitoring and Protection
- Managing Permitting Challenges
- Community Engagement in Building Grids
- Developers' Expectations and Priorities

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DOE allocates funds for grid strengthening and grid resilience

The US Department of Energy (DOE) has allocated USD42 million across 15 projects in 11 states to enhance the reliability, resiliency and flexibility of the national power grid through the development of next-generation semiconductor technologies.

This initiative, part of DOE's Unlocking Lasting Transformative Resiliency Advances by Faster Actuation of power Semiconductor Technologies (ULTRAFAST) programme, aims to enable more effective control of grid power flow and enhance the protection of critical infrastructure assets.

The projects are managed by DOE's Advanced Research Projects Agency-Energy (ARPA-E), an agency that advances high-potential, high-impact clean energy technologies across technical areas strategic to US energy security. They align with the Investing in America agenda, focusing on modernising the power grid, accelerating clean energy deployment, and enhancing national security.

Key projects include:

- GaNify (State College, Pennsylvania): Developing an optically isolated, power-integrated building block for improved control of power electronics converters. (Award amount: USD3,060,000)
- Georgia Institute of Technology (Atlanta, Georgia): Creating a novel semiconductor switching device from wide-bandgap III-Nitride material to enhance grid control. (Award amount: USD2,700,000)
- Great Lakes Crystal Technologies (East Lansing, Michigan): Developing a diamond semiconductor transistor to support the control infrastructure for a grid with distributed generation sources. (Award amount: USD2,301,538)
- Lawrence Livermore National Laboratory (Livermore, California): Working on an optically-controlled semiconductor transistor for future grid control systems with higher voltage and current capabilities. (Award amount: USD3,000,000)
- NextWatt (Hoffman Estates, Illinois): Developing an ultrawide-bandgap optical triggered device for fast protection in solid-state transformers. (Award amount: USD2,268,750)
- Opcondys (Manteca, California): Creating a light-controlled grid protection device to suppress sudden transient surges on the grid. (Award amount: USD3,178,977)
- RTX Technology Research Center (East Hartford, Connecticut): Developing semiconductor switching modules triggered by wireless radio frequency signals for improved control of power electronics converters. (Award amount: USD2,500,000)
- Sandia National Laboratories (Albuquerque, New Mexico): Working on a novel solid-state surge arrester to protect the grid from fast electromagnetic pulses. (Award amount: USD2,560,000)
- Texas Tech University (Lubbock, Texas): Developing a photoconductive semiconductor switching device for improved grid control. (Award amount: USD3,070,735)
- University of Arkansas (Fayetteville, Arkansas): Creating a heterogeneously integrated high-power semiconductor module for applications in the electric power grid. (Award amount: USD2,931,177)
- University of California, Santa Barbara (Santa Barbara, California): Developing ultrawide-bandgap switching devices for higher voltages and speeds, enabling more sophisticated grid control. (Award amount: USD3,122,356)
- University of Illinois at Urbana-Champaign (Urbana, Illinois): Working on optically triggered diamond semiconductor switching devices for breakthroughs in electricity grid protection. (Award amount: USD2,982,311)
- University of Pennsylvania (Philadelphia, Pennsylvania): Developing an integrated module with wide-bandgap power devices, and optical control and sensing for improved electric grid control. (Award amount: USD2,240,309)
- University of Wisconsin-Madison (Madison, Wisconsin): Creating an optically triggered semiconductor switching device to reduce power losses and enhance performance. (Award amount: USD2,990,321)
- University of Tennessee, Knoxville (Knoxville, Tennessee): Developing scalable, light-triggered semiconductor switching modules with integrated sensing for grid protection. (Award amount: USD2,759,821)

Additionally, DOE has completed two years of the Bipartisan Infrastructure Law (BIL), under which it has allocated USD5.5 billion to over 160 states, tribes, and enterprises for strengthening grid reliance.

This includes USD3.46 billion allocated under the Grid Resilience and Innovation Partnerships (GRIP) programme, marking the largest single investment in the country's electric transmission and distribution (T&D) infrastructure to improve grid reliability and support clean energy generation. The latter allocation was made in October 2023 for 58 projects across 44 states.

This is part of the overall USD62 billion provided by BIL to DOE to lay the foundation for a strong clean energy economy. Over the past two years, DOE has also allocated BIL funds for promoting battery manufacturing; supporting clean energy transportation infrastructure; supporting clean energy solutions for families, businesses, and communities; and accelerating the deployment of clean energy technologies.

Going forward, DOE plans up to USD3.9 billion under the GRIP Program; USD6 billion to accelerate decarbonisation projects in energy-intensive industries, such as iron and steel, aluminium, cement and concrete; up to USD3.5 billion to boost domestic production of advanced batteries and battery materials nationwide by supporting new, retrofitted, and expanded domestic facilities for battery-grade processed critical minerals, battery precursor materials, battery components, and cell and pack manufacturing; and USD60 million to train a qualified, diverse clean energy workforce.

It has also recently announced the USD3.5 billion worth second funding phase of the USD6 billion initiative aimed to boost domestic production of advanced batteries and battery materials nationwide. To avail

this funding, applicants are required to submit their concept papers with the DOE by January 9, 2024, and their full application by March 19, 2024.

FERC affirms commitment to finalise regional transmission planning rules

In a recent response to a letter from the National Caucus of Environmental Legislators (NCEL) regarding the Federal Energy Regulatory Commission's (FERC) notice of proposed rulemaking (NOPR) on regional transmission planning in Docket No. RM21-17, the commission's chairman has reiterated the FERC's dedication to finalising the rules.

While stating that a robust transmission network is required to have a reliable electricity supply, and access new low-cost generation sources, FERC has highlighted the importance of incorporating state perspectives in the ongoing efforts to shape a reliable, affordable and sustainable electric grid.

Under NCEL's letter, dated October 4, 2023, more than 230 state lawmakers from 43 states had urged FERC to finalise and strengthen its proposed regional transmission planning and cost allocation rule.

The chairman expressed his appreciation for NCEL's engagement and acknowledged the importance of their role in influencing the electric generation mix and ensuring consumer access to reliable and affordable electricity.

FERC highlighted the final rule on generator interconnection released in July 2023 as the first in a series of important measures aimed at achieving a sustainable electric grid. It stressed the importance of efficiently planning and constructing much-needed new transmission facilities, considering the extreme weather events experienced in recent years.

Furthermore, NCEL's perspective on incorporating advanced transmission technologies while planning the transmission system, was acknowledged by FERC for their efficiency and cost-effectiveness. The chairman committed to including the states' perspectives and encouraged continued participation in this and other proceedings before FERC.

FERC publishes Chairman Reliability Report for 2023

FERC on November 9, 2023, published the Chairman Reliability Report to provide an update on the commission's developments and initiatives aimed at fortifying the reliability of the nation's bulk electric system (BES) during 2023. The report covers cyber-security measures, responses to physical attacks, preparations for extreme weather events, and strategies to ensure reliability amid changing energy resource dynamics.

In January 2023, FERC issued the 'Final Rule on Internal Network Security Monitoring for High and Medium Impact Bulk Electric System Cyber Systems'. It directs the North American Electric Reliability Corporation (NERC) to develop and submit within 15 months of the effective date new or modified Reliability Standards that require internal network security monitoring for all high-impact BES cyber systems with and without external routable connectivity and medium-impact BES Cyber Systems with external routable connectivity.

In March 2023, NERC submitted Reliability Standard CIP-003-9 and got FERC's approval for the same. It required entities with BES facilities whose assets are designated low-impact to have methods for determining and disabling vendor remote access, as well as expand existing security controls to provide greater visibility into electronic communication between low-impact BES cyber systems and vendors. It allows detection and the ability to disable vendor remote access in the event of a known or suspected malicious communication. CIP-003-9 will become effective on April 1, 2026.

Then, on April 21, 2023, Order No. 893 was issued as a final rule providing incentive-based rate treatment for utilities making certain voluntary cybersecurity investments. It establishes incentive-based rate treatments to encourage utilities to invest in advanced cybersecurity technology and participate in cybersecurity threat information sharing programmes to benefit consumers. During the same month, NERC also presented its evaluation of the Physical Security Reliability Standard in light of recent physical attacks on the BPS.

FERC has also approved extreme weather final rules. Under Order No. 896 issued on June 15, 2023, Transmission System Planning Performance Requirements for Extreme Weather report was issued, while directing NERC to submit the new or revised reliability standards by December 23, 2024.

Other developments of the year include the following:

On May 18, 2023, the FERC approved NERC's Inverter-based Resources (IBR) IBR Registration Work Plan in Docket No. RD22-4-001.

On October 19, 2023, FERC approved the new reliability standards for IBRs.

On July 27, 2023, the FERC approved Order No. 2023 on Improvements to Generator Interconnection Procedures and Agreements.

NERC warns of risks to BPS in upcoming winter

NERC has released a Winter Reliability Assessment for the upcoming three-month period from December 2023 to February 2024, outlining key findings related to the generation resource and transmission system adequacy across North America. The assessment evaluates the capacity to meet projected winter peak demands and identifies potential reliability issues and regional risks. The main focus of the report is on electricity generation, transmission capacity, and operational concerns that may arise during the winter months.

Over 20 per cent of the US bulk power system (BPS) is at risk of insufficient electricity supplies during peak winter conditions. Areas at greatest risk for electricity supply shortfalls this winter include those under Midcontinent Independent System Operator (MISO), Midwest Reliability Organisation – SaskPower (MRO-SaskPower), Northeast Power Coordinating Council – Maritimes (NPCC-Maritimes), NPCC-New England, PJM Interconnection (PJM), Southeastern Electric Reliability Council – East (SERC-East), SERC-Central, Southwest Power Pool (SPP), Texas Reliability Entity (RE), and Electric Reliability Council of Texas (ERCOT).

Curtailment of electricity transfers during high regional demand or transmission system congestion is identified as a growing reliability concern.

In situations such as energy emergencies or system congestion, reliability coordinators (RC) and balancing authorities (BAs) may curtail transfers following established procedures and protocols. While curtailing transfers can address issues in one part of the system, it may lead to supply shortages or impact local transmission operations in another area. For instance, during the Winter Storm Elliott, firm exports were curtailed from Pennsylvania, New Jersey, and Maryland due to widespread energy emergencies in the US Eastern Interconnection.

Areas under MRO-SaskPower, NPCC-Maritimes, NPCC-New England, SERC-Central, and SERC-East may need to depend on imports of electricity supplies. The concern is that a wide-area cold snap affecting regional demand or generator availability could pose additional challenges in areas heavily reliant on imports for managing high electricity demand.

Load forecasting in winter is becoming more complex, with extreme cold temperatures and irregular weather patterns leading to deviations from historical forecasts. Electrification of the heating sector and the integration of variable-output solar photovoltaic (PV) distributed energy resources (DERs) add to load forecast uncertainty. Underestimating electricity demand in extreme cold weather can lead to ineffective operational planning and potential resource shortfalls. As per the new cold weather reliability standards, generator owners and operators are obligated to implement plans for cold weather preparedness and provide cold weather operating parameters to RCs, transmission operators, and BAs for use in operating plans.

FERC approves PJM's USD796 million transmission plan

FERC has approved the USD796 million transmission upgrade plan presented by PJM, despite objections by certain parties earlier. With this, PJM has received approval for the transmission infrastructure upgrades designed to address the planned retirement of 1,282 MW Talen Energy's Brandon Shores plant near Baltimore by June 1, 2025.

In response to Talen Energy's decision to retire its coal-based plant, PJM's Board had approved a grid solutions package to enhance the grid and prevent potential reliability issues. FERC, in its decision, considered PJM's determination that the proposed grid upgrades were necessary by June 1, 2025, categorising them as an immediate-need reliability project. This classification exempts them from competitive solicitation for transmission solutions. To this, objections were raised by the Maryland Public Service Commission (PSC), the state's ratepayer advocate, and the Organisation of PJM States Inc. (OPSI).

It included concerns that the retirement of Brandon Shores was foreseeable due to factors such as the plant's age, low capacity factors, and Talen's financial troubles. The protestors argued that PJM violated its operating agreement, failed to consider alternatives adequately, and did not follow proper planning procedures for the proposed upgrades.

However, these objections were deemed by FERC to fall outside the purview of the case. FERC justified the urgency of the upgrades, categorising them as an immediate-need reliability project to avert potential reliability challenges associated with the power plant's retirement. FERC expressed optimism about PJM's ongoing stakeholder process, examining potential alterations to the grid operator's generation retirement and transmission planning processes. PJM is contemplating extending the notice period for generation deactivations to allow for required transmission upgrades, potential new competitive entries, and a smooth deactivation process.

However, FERC expressed some reservations about the grid planning process, suggesting that PJM's extensive reliance on immediate-need reliability solutions might indicate a broader deficiency in the region's proactive, scenario-based multi-value planning. Concerns were also raised about the nature of the transmission upgrades, linking them to Maryland's emissions mandates and highlighting the risks associated with depending solely on a regional capacity market. FERC expressed encouragement for PJM's stakeholder process to reassess its generation retirement and transmission planning procedures.

BPA proposes amendments in FPA and transmission tariffs

The Bonneville Power Administration (BPA) has proposed amendments to its open access transmission tariff and the Federal Power Act (FPA) to modify the non-rate terms and conditions for transmission and interconnection services in the tariff. BPA has therefore suggested significant modifications to its large generator interconnection procedures (LGIP), effective June 30, 2024.

The current first-come, first-served serial interconnection study process will be replaced with a more efficient first-ready, first-served cluster study process. Under this new approach, BPA will group together large generator interconnection requests that meet specific readiness requirements and study them as a cluster, rather than examining each request individually. This streamlined approach is expected to significantly reduce the time and cost associated with the interconnection process for both BPA and interconnection customers. The proposed modifications also provide for early dissemination of high-level information to interconnection customers, enabling them to make informed decisions throughout the process. Additionally, the modifications would allow customers to share the costs of identified network upgrades, fostering a more equitable and cost-effective approach to interconnection.

The new cluster study process and cost-sharing arrangements are expected to lead to substantial cost reductions for both BPA and interconnection customers. Early information sharing and the structured cluster study process will also enhance the predictability and transparency of the interconnection process for all stakeholders. The process will facilitate the integration of renewable energy resources into the grid, supporting the transition to a cleaner and more sustainable energy future.

Interconnection requests received prior to 15 days after the publication of the Federal Register notice establishing the transition close date, will have the option of being processed under the new cluster study process or continuing with the existing serial study process. Requests submitted after the transition close date will be held until the opening of a new

cluster request window, in accordance with the revised LGIP procedures.

BPA invited interested parties to review and comment on the proposed modifications. A prehearing conference was held on November 14, 2023, and petitions to intervene were to be filed by November 16, 2023.

New England to invest up to USD26 billion in transmission by 2050

According to the ISO New England (ISO-NE) 2050 Transmission Study, New England is set to make substantial investments in upgrading its power transmission infrastructure, with a potential expenditure of up to USD26 billion by the year 2050. However, the study also suggests that implementing measures to reduce peak demand through the use of stored fuels and energy efficiency programmes can help curtail the cost to approximately USD17 billion.

The study anticipates a surge in power demand due to the increasing electrification of heating and transportation. This growth in demand will be accompanied by a larger portion of power generation coming from offshore wind and other renewable sources situated farther from end-users. The region's aging transmission system could become a significant bottleneck to progress if it fails to keep up with the evolving power system.

The study further outlines the cost estimates for necessary transmission upgrades – amounting to around USD750 million for each additional GW of capacity, up to 51 GW. Beyond this, the cost would double to USD1.5 billion per GW, up to 57 GW. To mitigate peak load, the study proposes the limitation of power demand to 51 GW. This can be achieved through measures such as – using stored fuels like natural gas, for heating during extremely cold days, encouraging consumers to reduce electricity usage during high-demand periods; and the more aggressive implementation of energy efficiency programmes.

OPSI urges PJM to address grid reliability concerns

In a letter addressed to the Board of Managers of PJM, OPSI, a body made up of the regulatory commissions of the 14 jurisdictions in the PJM region, expressed apprehension regarding PJM's response to the evolving landscape of the BPS.

Highlighting the urgent nature of the changes in the power sector, OPSI conveyed concerns about the region's reactive approach to these shifts and underscored deficiencies in the existing processes. The OPSI Board urged PJM's support in finding solutions that prioritise reliability and affordability in light of rapid changes in load forecasts and available supply, leading to pronounced grid reliability issues within the PJM footprint.

In PJM's Transmission Expansion Advisory Committee meeting on October 31, 2023, there was an announcement of proposed transmission upgrades of unprecedented scale, estimated to cost nearly USD6 billion, which are intended to accommodate a substantial 7,500 MW increase in demand from data centre developments, coinciding with the deactivation of many generators. This dual challenge poses imminent threats to grid reliability. Recognising that transmission upgrades may be a necessary solution to reliability challenges, OPSI acknowledged the potential factors contributing to high costs and their impact on retail consumers.

OPSI emphasised the need for solutions tailored to PJM or aligned with actions taken by states within their jurisdiction. The former encouraged a holistic approach that considers both transmission and non-transmission alternatives, respecting state jurisdiction over integrated resource plans and generation mix.

The letter, issued on November 28, 2023, had already received approval from Delaware PSC, PSC of the District of Columbia, Illinois Commerce Commission (ICC), Indiana Utility Regulatory Commission, Kentucky PSC, Maryland PSC, Michigan PSC, New Jersey Board of Public Utilities, North Carolina Utilities Commission, Public Utilities Commission (PUC) of Ohio, Pennsylvania Utility Commission, Tennessee PUC, and PSC of West Virginia.

In response to OPSI's concerns, PJM is expected to engage in collaborative discussions with stakeholders, examining potential solutions that extend beyond transmission planning. The outcome of these deliberations will likely shape the future direction of PJM's grid reliability initiatives.

ETCC report reveals concerns over FERC's electricity price hike

The Electricity Transmission Competition Coalition (ETCC), a nationwide 93-member coalition dedicated to enhancing competition in US electricity transmission infrastructure, has recently published a report titled FERC's USD277 Billion Electricity Price Hike, shedding light on the potential consequences of the latter's failure to enforce electricity transmission competition.

The report asserts that FERC's NOPR, a document issued by FERC describing proposed changes to its current regulations that were under consideration in April 2022, not only fails to support the expansion of competition but retreats from existing regulations aimed at promoting transmission competition. It emphasises the critical need for cost-effective and competitive transmission infrastructure, especially as the nation aims for reliability and a clean energy transition. With an estimated USD2.1 trillion investment required for new electrical transmission lines the report contends that embracing competition through competitive bidding can reduce transmission project costs by an estimated 40 per cent.

Highlighting the importance of competition for innovation, price regulation, and consumer benefit, the report criticises FERC's proposed rule for potentially subjecting ratepayers to decades of escalating prices devoid of competitive pressures. A nationwide survey featured in the report indicates that 91 per cent of US citizens are concerned about rising electricity costs, and 88 per cent support policymakers embracing electricity transmission competition to mitigate these expenses.

The report underscores that FERC needs to enforce Order No. 1000, a final rule that reforms its electric transmission planning and cost allocation requirements for public utility transmission providers, which was designed to eliminate monopolistic practices and bring in an era of competition. It points out that FERC's failure to enforce this order has resulted in

only 3-8 per cent of transmission projects being competitively bid on a regional basis. The report further contends that, if left unaddressed, this lack of competition could lead to an unprecedented USD277 billion electricity price hike.

ACORE report recommends MISO-PJM interregional grid expansion

The American Council on Renewable Energy (ACORE) has released a report called Billions in Benefits: A Path for Expanding Transmission between MISO and PJM. As per this report, the transmission constraints between the mid-Atlantic and mid-western grid regions impose significant annual costs on consumers, with the expectation that these costs will escalate as efforts towards decarbonisation and electrification intensify. MISO and PJM, the two largest regional transmission organisations (RTOs) in the US, share a complex and intertwined border, offering an opportunity to address these constraints and optimise the grid.

The report provides a comprehensive overview of the steps that can be taken by MISO, PJM, FERC, states, and other stakeholders to effectively plan and finance interregional transmission. Key recommendations are collaborative development of effective mechanisms for planning and financing interregional transmission involving MISO, PJM, FERC, and states; adoption of proactive multi-value planning with broad cost allocation for regional transmission within PJM's footprint; empowering merchant transmission developers to propose inter-regional solutions and ensuring full compensation for the value derived from their projects; and optimisation of seams transactions to enhance the efficiency of energy market transactions across regional boundaries.

The report underscores the substantial benefits of expanded inter-regional transmission between MISO and PJM, encompassing energy cost savings, capacity benefits, support for renewable expansion, and increased value during severe weather and extreme events. The proposed solutions aim to enhance coordination and planning, with the overarching goal of reducing costs for consumers and fortifying grid reliability in the face of evolving energy dynamics.

SunZia faces setback in construction in Arizona

The SunZia Southwest Transmission Project (SunZia) had encountered a setback in November, as construction work along a 50-mile (80.5 km) stretch has been halted after about two months due to concerns raised by Arizona indigenous groups (particularly leaders of the Tohono O'odham Nation – a collective government body of the Tohono O◉odham tribe in the US), regarding the preservation of cultural sites. However, despite objections from Native American tribes, construction crews have resumed activities on the SunZia project. Federal land managers (in a letter sent on November 27, 2023 to the developer – Pattern Energy Group LP), indicated that the timing of information provided by the tribes did not support pausing work. The Bureau of Land Management (BLM) lifted the temporary suspension, and construction resumed, with a scheduled meeting between the agency and tribal leaders set for December 11, 2023. BLM emphasised the project's significance in transitioning the nation to a clean energy economy, expressed commitment to implementing the project with minimal impact, and highlighted previous consultations with tribal representatives during the temporary pause. Tohono O'odham expressed disappointment at the decision to allow construction to continue before the meeting. Developers have argued that they have collaborated with tribes over the years, conducting surveys to identify cultural resources in the San Pedro Valley, and affirmed the company's commitment to supporting the consultation process with tribes and adopting any mitigation measures resulting from the ongoing talks.

The SunZia project, being developed by Pattern Energy Group LP, entails the construction of an over 550-mile (885-km), bi-directional, ±525 kV high voltage direct current (HVDC) transmission line from the SunZia East converter station near Corona, New Mexico to the SunZia West converter station in Pinal County, Arizona, along with the installation of two HVDC voltage source converter (VSC) stations; two new 0.75-mile (1.2 km), 500 kV lines from the SunZia West converter station to the 500 kV Pinal Central substation; and two 1,500 MW thyristor-controlled breaking resistors (AC choppers) integrated with the SunZia East converter station in New Mexico. The SunZia project originates in Torrance County in east-central New Mexico, traverses 353 miles (568 km) southwest into the Valencia, Socorro, Sierra, Grant, Luna and Hidalgo counties, before continuing through Arizona. In Arizona, it traverses over 199 miles (320 km) in five counties, namely, Greenlee, Graham, Cochise, Pima and Pinal, before interconnecting with the Western Interconnection southeast of Phoenix.

SunZia has been in the permitting, approvals and permissions process for around 15 years, and is now facing delays in its construction timeline. About 30 per cent of the project route traverses federal lands administered by BLM, Bureau of Reclamation, and US Fish and Wildlife Service, and SunZia Transmission has secured right-of-way (RoW) agreements with state land offices in New Mexico and Arizona. Pattern Energy, which is investing about USD8 billion in the venture, has reassured its commitment to address tribal concerns. Despite the setback, Hitachi Energy has commenced the design and engineering of the HVDC Light converter stations, which is Hitachi Energy's VSC-HVDC technology, for the project.

In September 2023, Pattern Energy commenced the construction of the project after BLM issued the notice to proceed. The transmission project is expected to begin commercial operations in 2025. However, legal challenges and ecological concerns, including impacts on wildlife habitat and migratory bird flight patterns, persist in various regions along the transmission line route.

FERC upholds abandoned plant incentive for LRTP project

FERC has reaffirmed its decision to grant the 'abandoned plant incentive' to ITC Midwest, despite objections raised by the consortium of Industrial Energy Consumers of America, the Coalition of MISO Transmission Customers, the Resale Power Group of Iowa, and the Wisconsin Industrial Energy Group, collectively known as Consumer Alliance. The incentive allows ITC Midwest to receive certain benefits or compensation for the investments and efforts they made in planning and developing the project even

if it is later abandoned or not completed for reasons beyond the company's control.

The dispute primarily revolves around the Iowa right-of-first-refusal (ROFR) statute litigation, and concerns over the Mississippi River crossing portion of the Skunk River–Ipava Long-Range Transmission Plan (LRTP) Project approved as part of the East-Central transmission corridor planned under MISO's LRTP Tranche 1 approved in July 2022. The USD594 million project involves the construction of a 345 kV transmission line, spanning approximately 125 miles (201 km) between Henry County, Iowa and Fulton County, Illinois. The project's Iowa portion has been assigned to ITC Midwest by MISO under Iowa's ROFR law, while the Illinois segment has been planned for bidding. On August 8, 2023, FERC approved the incentive rate treatment request of ITC Midwest for the project.

The consumer alliance argued that ITC Midwest's right to develop the project hinges solely on the Iowa ROFR statute, which is currently under legal challenge. Under its recent decision, FERC has highlighted that granting incentives in the presence of legal or regulatory uncertainty is consistent with the policy behind the award of transmission incentives. It stated that it would assess the prudence of ITC Midwest's expenditures in any future filing seeking cost recovery associated with the project.

MISO selects ATXI to develop 345 kV transmission line in Missouri

MISO has selected Ameren Transmission Company of Illinois (ATXI), a subsidiary of Ameren Corporation, along with Missouri Electric Commission for a USD84 million transmission project in northwest Missouri. This is the second competitively bid project from the LRTP Tranche 1 portfolio approved by MISO's board of directors last year.

The Fairport to Denny to Iowa/ Missouri State Border 345 kV Competitive Transmission Project includes two 345 kV lines and a new Denny substation near the existing Fairport substation. The first line spans 42-mile (67.6-km), from Denny to the Missouri/Iowa State Border and the second 345 kV line will connect the Denny substation to the Fairport substation.

Ameren will now move forward on executing the Selected Developer Agreement following a rigorous competitive selection process that included nine proposals from four developers to construct, own, operate and maintain the project. MISO issued a request for proposal (RfP) for the project on December 5, 2022, and developers had until May 19, 2023, to complete submissions. This is the second of five competitive projects identified out of LRTP Tranche 1 to complete the competitive selection process. The competitive selection process for the remaining three will continue through the first half of 2024.

The project is expected to be in service by 2030.

NYPSC grants approval for various transmission projects

The New York State Public Service Commission (NYPSC) has granted approval for USD1.4 billion in funding for NY Transco's Propel NY Energy transmission project. This initiative, chosen by the New York Independent System Operator (NYISO) to address the Long Island Offshore Wind (OSW) Public Policy Transmission Need, involves the construction of new and upgraded underground and submarine transmission lines and stations.

The Propel NY Energy project, a collaboration between the New York Power Authority (NYPA) and NY Transco, aims to enhance the electric transmission network on Long Island, parts of New York City, and Westchester County. Its objectives include improving reliability, resiliency, and facilitating the delivery of clean OSW energy to homes and businesses across New York State.

Furthermore, NYPSC has granted authorisation to NY Transco to facilitate the transfer of specific interconnection facilities to Orange and Rockland Utilities (O&R), ensuring the prompt interconnection and operation of the Rock Tavern to Sugarloaf project. This initiative aims to enhance transmission capacity, facilitating the movement of power from upstate to downstate New York. The Rock Tavern to Sugarloaf project, integral to the New York Energy Solution (NYES) Project, is designed to address contingencies arising from the increased transmission capacity across the Central East and Upstate New York/Southeast New York interfaces.

NYPSC has also authorised NY Transco to transfer certain interconnection facilities to Consolidated Edison Company of New York, Inc. (Con Edison), for the timely interconnection and operation of the NYES project, which aims to modernise the ageing infrastructure.

Kentucky PSC partially approves LG&E/KU's energy transition plan

The Kentucky PSC has granted partial approval to PPL Corporation's Louisville Gas and Electric (LG&E) and Kentucky Utilities (KU), for their USD2.1 billion energy transition plan. As a part of this plan, the PSC has approved a 125 MW/500 MWh Brown battery energy storage system (BESS) facility along with a solar project. However, it directed LG&E/KU to file a separate application requesting a site compatibility certificate for the Brown BESS.

While rejecting calls for joining a regional transmission organisation, the PSC encouraged LG&E/KU to consider it for maximising investments and reliability benefits. The commission also approved an increase in energy efficiency and demand-side management (DSM) programmes to USD340.7 million.

Additionally, the approved plan focuses on the retirement of two coal-fired generating units, totalling nearly 600 MW, and 47 MW of gas-fired generation. Simultaneously, the utilities will embark on constructing a new 640 MW gas-fired plant to offset the lost capacity. However, the PSC rejected the request to retire two other coal-fired units totalling nearly 900 MW, and replacing them with a second 640 MW gas-fired plant. The plan also approved the construction of a 120 MW solar plant in Mercer County, Kentucky and the acquisition of a similar solar facility in Marion County. Additionally, the PSC approved four solar power purchase agreements totalling 637 MW.

Con Edison plans transmission upgrades climate change

Con Edison, a US-based energy provider, has proposed a comprehensive Climate Change Resilience Plan designed to

safeguard its systems against the escalating impacts of climate change. The plan encompasses strategic infrastructure upgrades across New York City and Westchester County, prioritising resilience measures to protect customers from the intensifying challenges posed by severe heat waves, storms and floods.

Key components of the proposed plan include the placement of overhead electric lines underground to shield them from storms, elevation of critical infrastructure, enhancement of water resiliency in flood-prone areas, and the integration of technology for improved customer communication during emergencies. Proposed projects include the replacement of 103 miles (165.8 km) of overhead line and 36 miles (57.9 km) of underground line, strategically aimed at minimising outages resulting from contact with trees or debris. Moreover, the plan outlines the replacement of 391 underground transformers and network protectors within flood zones with units designed to operate effectively even when submerged in water, enhancing the system's resilience during flooding events. To further bolster performance during extreme heat, Con Edison plans to add switches and split some cables in the underground transmission system, introducing redundancy by allowing cables to follow two paths.

Additionally, the company proposes the installation of two weather-monitoring stations in Westchester County, furnishing real-time and long-term insights on weather and climate to facilitate advanced preparation. Complementing these technological upgrades, Con Edison's green infrastructure initiatives involve constructing rain gardens, bioswales, permeable pavement, and natural retention ponds on company property.

To implement the proposed upgrades, Con Edison expects to make an investment of approximately USD903 million between 2025 and 2029. The estimated rate impact for customers during this period is USD173 million, potentially translating to a residential bill increase ranging from about USD1.12 to USD1.70 per month, depending on usage.

The Climate Change Resilience Plan follows Con Edison's Climate Change Vulnerability Study, completed in September 2023, which revealed that temperatures are rising at a faster rate than previously projected by climate science. Notably, the study underscored the increasing threats posed by severe weather events in the region, exemplified by events like Hurricane Ida and Tropical Storm Isaias.

Xcel Energy faces opposition for 345 kV WWTC project

Xcel Energy's plans for the new 345 kV Western Wisconsin Transmission Connection (WWTC) project have raised concerns among Chippewa County residents regarding potential impacts on the environment, residences, and tourism due to the transmission lines.

WWTC is a new USD500 million transmission line in western Wisconsin to enhance grid reliability, amid the transition away from coal-fired power plants and increased integration of wind power from Minnesota and the Dakotas. The line is anticipated to start at an existing substation near the city of Blair in Trempealeau County, connecting with another transmission line near the city of Owen in Clark County or the village of Sheldon in Rusk County. The project includes the replacement of single-circuit (S/C) transmission lines with new double-circuit (D/C) poles, incorporating both existing and new transmission lines.

The company is exploring potential route options, with most following existing corridors such as transmission lines or along roadways and state highways, to minimise the impact on landowners and communities. Two main route options are under consideration: Route 1 will be 96-100 miles (154.5-160.9 km) long, estimated to cost USD398 million to USD407 million; and Route 2 will be 80-82 miles (128.7-131.9 km) long, estimated to cost USD263 million to USD280 million. Both routes largely follow existing utility lines to minimise impact.

But a letter from the town of Anson opposed Route 1, citing its potential impact on the Old Abe State Trail and the town's development objectives, to which Xcel Energy has replied, emphasising the common practice of reusing existing infrastructure corridors to reduce the impact on landowners and communities.

Xcel Energy has been collaborating with MISO and energy companies in the Upper Midwest to identify and implement new transmission projects. The latter are integral to managing the evolving energy system and ensuring the seamless connection of low-cost renewable energy with customers.

The company plans to file a certificate of convenience and public necessity (CCPN) with the PSC of Wisconsin in mid-2024. The final route will be determined after the commission's review, with a decision expected in mid- to late-2025. Construction, if approved, is projected to commence around 2026 and take approximately two years.

New York shares update on Smart Path Connect transmission project

The Governor of New York has shared advancements in the Smart Path Connect transmission project, including energisation of over half of the project's upgraded transmission lines, encompassing 36 miles (57.9 km) in Mohawk Valley and 38 miles (61.2 km) in North Country.

The project, being developed by NYPA and National Grid New York, entails an investment of USD1.1 billion. This multi-faceted project involves rebuilding about 100 miles (160.9 km) of 230 kV lines to either 230 kV or 345 kV, along with associated substation construction and upgrades along existing transmission RoW in Clinton, Franklin, St. Lawrence, Lewis and Oneida counties in northern New York. It will also include replacing the age-old wood H-frames installed in the 1950s with steel poles, and replace or upgrade around ten substations along the path of the transmission lines.

Specifically, the project includes the construction of approximately 45 miles (72.4 km) of transmission network eastward from Massena to the town of Clinton, known as the Northern Alignment, and construction of approximately 55 miles (88.5 km) of transmission southward from Croghan to Marcy, known as the Southern Alignment, and several substations. Once complete, it will help in unlocking the existing and untapped renewable resources in the region and yield significant production cost savings, emissions reductions, and decreases in transmission congestion.

New York's transmission investments are totalling nearly 1,000 miles (1,609.3 km) of new and upgraded transmission lines.

Several other transmission projects in the state are progressing towards completion or are already in service, contributing to the state's comprehensive strategy for a cleaner and more resilient energy future.

BLM approves 500 kV gen-tie line in Maricopa County

The US BLM has approved the request of HV Sunrise, LLC, for a 30-year RoW grant to construct, operate, maintain and eventually decommission a 500 kV gen-tie line on BLM's land to facilitate the delivery of solar energy to the grid in Arizona. The final route crosses about 1.14 miles (1.8 km) of BLM land. High voltage gen-ties like this one are vital to connect clean energy projects on non-federal land into the grid.

The line, upon completion, will link the 150 MW Harquahala Sun Photovoltaic Solar Power Plant situated on around 1,000 acres in west Maricopa County, Arizona, to the existing Delaney substation, both located on private lands. The line would be situated about 60 miles (96.6 km) west of Phoenix in Maricopa County and spans approximately 1.14 miles (1.8 km) on BLM land. BLM has issued a notice to proceed, and the construction on BLM land is anticipated to take approximately three months.

In 2022, BLM conducted a thorough analysis of the proposed line, resulting in the issuance of a final decision record, environmental assessment, and a finding of "no significant impact". This development aligns with BLM's commitment to promoting environmentally sound renewable energy projects on public lands.

FERC issues orders for Black Hills, Horus and Ameren

In a series of regulatory developments, FERC has issued significant orders pertaining to Black Hills Colorado Electric, LLC (Black Hills), Horus West Virginia I (Horus), LLC and Ameren Illinois Company (Ameren). These orders encompass a settlement agreement, a waiver request, and a detailed review of Ameren 's formula rate update.

Black Hills, on September 12, 2023, had submitted an uncontested settlement agreement addressing proposed revisions to its tariff for transmission service. The agreement aimed to transition from a stated transmission rate to a forward-looking transmission formula rate. Filed on October 4, 2023, it received certification from the judge as an uncontested settlement. FERC, in its decision released on November 16, 2023, stated that the settlement agreement appears to be fair and reasonable, and in the public interest, and was thus approved.

FERC granted Horus West Virginia I, LLC's request for a waiver of certain open access transmission tariff (OATT) requirements. The waiver includes the exemption from filing an OATT, establishing and maintaining an open access same-time information system (OASIS), and complying with standards of conduct. The waiver, however, is contingent upon specific conditions, such as the limited and discrete nature of customer interconnection facilities and the commitment to training employees with access to non-public transmission information. The waiver remains in effect unless there is a material change, requiring notification to FERC.

Pertaining to Ameren, on March 14, 2023, the company submitted its annual informational formula rate update, as mandated by the formula rate protocols within MISO's open Access Transmission, Energy, and Operating Reserve Markets Tariff. Southwestern Electric Cooperative and others had submitted a formal challenge to certain inputs in Ameren's 2023 Annual Update. FERC granted in part and denied in part the challenge, directing Ameren to submit a compliance filing within 60 days to address specific concerns.

APS and TEP reveal resource plans for Arizona

Arizona Public Service (APS) and Tucson Electric Power (TEP) have revealed their resource plans, outlining significant additions of renewable energy, energy storage, and other resources over the next 15 years, as detailed in documents submitted to the Arizona Corporation Commission.

APS plans to add about 2 GW of batter storage by 2027 and will issue frequent all-source solicitations to meet its energy needs. For instance, its 2023 request for proposals seeks at least 1,000 MW, including 700 MW of renewables and transmission options. Emphasis is placed on the need for high-voltage transmission to access out-of-state wind resources, especially in New Mexico and other Rocky Mountain states, which offer significant value to customers due to their low cost and output diversity.

APS also intends to invest in over 6 GW of solar and wind power, along with energy efficiency, demand response, and microgrids, as part of its comprehensive strategy.

TEP plans to add about 1.33 GW of batter storage by 2038. Its plan may evolve over time to adapt to changing circumstances, but for now also includes the addition of 2.24 GW of wind and solar power, and 400 MW of gas-fired generation.

Both APS and TEP are responding to the surging demand for energy in Arizona, driven by population growth and industrial development. These plans underscore their commitment to transition towards cleaner, more reliable, cost-effective and sustainable energy sources and storage solutions, while ensuring that they can meet the evolving energy needs of their customers, as they shift away from coal-fired generation.

BGE completes second BESS project in Chesapeake Beach

Baltimore Gas and Electric (BGE) has completed its Fairhaven battery storage facility, marking the second BESS project in Chesapeake Beach. Operational since November 10, 2023, the Fairhaven facility has a capacity of 2.5 MW/9.74 MWh, and aims to augment service reliability for BGE customers in southern Anne Arundel County and select areas of Calvert County.

The Fairhaven BESS and its predecessor in Chesapeake Beach were developed in alignment with the Maryland Energy Storage Pilot Project Act, enacted in 2019.

This legislation aims to explore avenues maximising storage value for customers, utilities and the electric grid, fostering innovative commercial approaches for energy storage. Together, the two BESS projects are set to enhance service reliability and enable BGE to sidestep costly undergrounding upgrades to 10 miles (16.09 km) of electric distribution equipment.

Redwood to decommission BESS at Anahola substation

US company Redwood Materials (Redwood) is collaborating with Kaua'i

Island Utility Cooperative (KIUC) to decommission its initial storage project at the Anahola substation, featuring a 4.6 MWh BESS.

The 14.53 MW Anahola Solar PV Park is located in Hawaii.

As this site approaches its end-of-life phase, Redwood is overseeing its sustainable decommissioning, transportation, and recycling at their facility in Northern Nevada.

In line with their commitment to long-term battery circularity, the decommissioning and recycling of stationary storage are integral aspects of Redwood's operations.

Canada and Manitoba announce clean investment of CAD476 million

The governments of Canada and Manitoba have announced a joint investment of CAD475.6 million aimed at fortifying Manitoba's clean electricity grid. The investment comprises CAD314 million allocated to Manitoba Hydro to replace the eight hydroelectric turbines at the Pointe du Bois generating station and an additional CAD161.6 million designated for the construction of a new 230 kV transmission network in the Portage la Prairie area.

The investment in the Portage area capacity enhancement project aims to facilitate the development of a new transmission line to bolster the reliability of services for customers in southwest Manitoba while assisting Manitoba Hydro in meeting the growing demand for electricity.

Of the CAD161.6 million joint investment, CAD70.9 million will be invested by the Government of Canada and CAD90.6 million by the Government of Manitoba.

The CAD314 million joint investment in the Pointe du Bois station will increase the plant capacity by 52 MW, providing eastern Manitoba with cleaner and more reliable electricity.

Of the total amount, nearly CAD200 million will be contributed by the Manitoba government while CAD114.1 million will be invested by the Canadian government.

(CAD1=USD0.74)

Canada's Hydro-Québec announces CAD90 billion investment

Canadian Hydro-Québec has unveiled a plan to invest a minimum of CAD90 billion for the development of new power generation facilities and transmission lines. The primary goal of this growth strategy is to steer the province away from fossil fuels and towards clean energy.

Hydro-Québec is set to construct approximately 5,000 km of fresh power transmission lines, triple its wind power generation, expand existing hydropower facilities and establish new ones, and enhance energy efficiency through collaboration with its existing customer base.

The projected cost for executing this extensive plan up to 2035 is estimated to fall within the range of CAD155 billion to CAD185 billion. To secure the essential financing, Hydro-Québec will explore alternative funding sources, including the issuance of bonds and other external financing options.

(CAD1=USD0.74)

Hydro One strengthens Ottawa's transmission system in Canada

Canadian Hydro One Inc., Ontario's largest electricity T&D company, has successfully concluded a CAD46.9 million investment in transmission line upgrades, enhancing the resiliency and reliability of the electrical infrastructure in Ottawa.

The upgrades resulted in a 66 per cent increase in the electrical capacity of the power lines from 650 MW to 1,080 MW. The project entailed reinforcing transmission towers, replacing power lines, and upgrading insulators along a 12-km stretch of the 230 kV D/C transmission line between Merivale transformer station (TS) and Hawthorne TS. The project, initiated in July 2020, was completed in time for the winter season; ensuring power availability during peak demand.

This improvement aims to ensure reliable energy supply to meet the growing demand in the Ottawa area. Additionally, the project would facilitate the transfer of more power from generation facilities in eastern Ontario to the rest of the province and enable the import of additional clean energy from Quebec.

Hydro One is also planning to modernise the Merivale TS to accommodate the region's growth. This initiative involves expanding the TS footprint to house two new 230 kV transformers and a new operations building.

(CAD1=USD0.74)

Hydro One unveils draft ESR for St. Clair Transmission Line

Hydro One has unveiled the draft Environmental Study Report (ESR) for the St. Clair Transmission Line project, marking a significant step in soliciting public feedback on the proposed initiative.

Under the project, a new 230 kV, 60-km transmission line will be constructed between the Lambton TS in Lambton County and the Chatham switching station in the municipality of Chatham-Kent, utilising about 80 per cent of existing corridors while updating an existing transmission line. In addition, it will include the expansion of the Lambton and Wallaceburg TSs, and the Chatham switching station, as well as an upgrade of the Wallaceburg TS from 115 kV to 230 kV.

Based on information gathered and feedback received in June 2023, the developer selected Route Alternative 2 as the preferred route for the project. The chosen route will replace an existing 115 kV line with a 230 kV line, and involves the construction of new 230 kV lines to connect the Lambton TS and the Chatham switching station. In the same month, the developer also sought public comments on the preferred route of the project.

The draft ESR encapsulates the outcomes of the Class Environmental Assessment (which Hydro One had initiated under Ontario's Environmental Assessment Act in February 2022), and delineates the route selection process and potential impacts on both natural and socio-economic environments. Hydro One has also emphasised its commitment to integrating public input into the project's various stages, including design, development, construction, operations and maintenance. Over the course of nearly two years, the company has collaborated closely with Indigenous communities, local residents, directly affected property owners, and businesses. The report draws on extensive field studies, encompassing over 85 sites,

and asserts that potential effects can be effectively managed through standard environmental mitigation measures.

In a related development, the Chatham-Kent council is taking steps to safeguard local water wells, particularly in areas like North Kent, during the construction of the proposed St. Clair transmission line. In response to the concerns raised by Water Wells First, a community group that is trying to stop the black water crisis in Chatham-Kent, Hydro One's commitments include ensuring tower foundations do not interact with the aquifer and remain between approximately 33 feet to 100 feet, depending on the depth of the soil, above the top of the aquifer layer; not using pile driving to install tower foundations; and using helical screw piles due to their simpler installation process, and minimal noise and vibration levels.

Hydro One is inviting interested parties to submit feedback on the draft ESR report until December 7, 2023. During the public comment period, it will disseminate the report online, and provide electronic and hard copies at designated locations for public access. Hydro One would continue to engage with stakeholders, including Water Wells First, to address their concerns.

The transmission line project was proposed, to meet the growing power demand in Ontario. It is expected to be operational by the end of 2028, with construction starting in the spring of 2027.

Hydro One expects early completion of Chatham–Lakeshore line

Hydro One has announced that the Chatham–Lakeshore Transmission Line project is progressing ahead of schedule and is anticipated to be completed by the end of 2024, a year earlier than initially planned. This accelerated timeline is expected to result in a cost reduction of approximately USD15 million from the initial USD268 million.

The transmission line aims to enhance the reliability and resiliency of the electricity network in the Windsor-Essex region, contributing to the area's clean energy future. Under the project, a 230 kV, 49-km lone D/C transmission line will be constructed from the Chatham switching station in the municipality of Chatham-Kent to the Lakeshore switching station in the municipality of Lakeshore to deliver approximately 400 MW of clean electricity to the region.

Hydro One is actively engaging with Indigenous communities, allowing five local First Nations the opportunity to invest in a 50 per cent equity ownership stake in the transmission line component. Also, a significant portion of the project will involve the sourcing of materials and services from qualified indigenous businesses, aligning with the goal of sourcing 5 per cent of all purchases from indigenous businesses by 2026. The project will thus play a crucial role in supporting the flourishing agri-food and battery manufacturing sectors in Windsor-Essex.

In June 2023, Hydro One—through Voltage Power Limited, a subsidiary of Aecon Group Inc.—commenced the construction of the line in Chatham-Kent, Ontario.

Puerto Rico's Governor vetoes SB 484

The Governor of Puerto Rico has vetoed Senate Bill (SB) 484, which aimed to amend the Puerto Rico Municipal Code, allowing municipalities to conduct preventive maintenance and repairs on the energy T&D system along with private companies contracted for these purposes.

The Governor vetoed the Bill, emphasising potential disastrous consequences for ongoing efforts to rebuild the electrical grid. Although the Bill had commendable intentions, it was highlighted that it had contradictions with efforts of central government, existing laws and agreements related to the transformation of the electrical system as well as what was contracted by the government in the Autoridad para las Alianzas Público Privadas de Puerto Rico (APPP) or Public-Private Partnerships Authority (P3A) for the operation and maintenance (O&M) of the electricity distribution system, with LUMA Energy (manager of country's transmission and distribution network) as an in charge. The P3A is a government organisation that leads the transfer of investments for Puerto Rico's infrastructure.

As per the Governor, the Bill contradicts Law 120 of 2018 (Law to Transform the Electrical System), which establishes a legal framework to facilitate the sale, disposition, and/or transfer of assets, operations, functions, and services of the Puerto Rico Electric Power Authority (PREPA) and implement safeguards to ensure a fair and transparent process in the sale, disposition, and/or transfer of PREPA assets, operations, functions, and services. The law defines applicability of Public-Private Partnership Act in the context of the transformation of the Puerto Rico Electric Power System for the purpose of taking advantage of its strict transparency and flexibility processes as a basis for conducting negotiations that lead to a financially feasible electric power. The Governor mentioned that the mayors have the option to establish voluntary agreements with LUMA to ensure quicker restoration of electrical service in communities. This approach is seen as aligned with existing contracts and legal frameworks.

LUMA Energy introduces CBES in Puerto Rico

LUMA Energy, a power company responsible for T&D in the Commonwealth of Puerto Rico, has introduced the customer battery energy sharing (CBES) initiative in Puerto Rico, a battery emergency demand response programme aimed at enhancing service reliability for its customers. This pilot programme allows solar customers with BESS to actively contribute to increased grid stability during peak demand periods, mitigating rotating outages caused by generation shortfalls.

Under the CBES initiative, renewable energy service providers such as Sunnova Energy International Inc., Fortress Power, Sunrun, and Tesla will collaborate with LUMA Energy to manage the programme and enrol qualifying customers. When required, these providers will activate batteries owned by customers enrolled in CBES to supply energy to the grid, thereby reducing energy demand and improving overall system reliability for customers across Puerto Rico.

Customers participating in CBES will be compensated by their respective renewable energy providers for their battery response and energy contributions. The initiative is part of LUMA's broader Building a Better Energy Future initiative, which encompasses various programmes aimed at improving customer service, reliability, and community safety over the next 12 months.

Latin America

EPE releases technical note on operational flexibility in Brazil's SIN

Brazil's energy agency, Empresa de Pesquisa Energética (EPE), has published a technical note addressing the crucial aspect of operational flexibility in the Sistema Interligado Nacional (SIN) or National Interconnected System. EPE's earlier expansion planning studies indicated a growing share of variable renewable technologies in the future, thus the associated increase in energy production variability necessitates a focus on maintaining operational flexibility.

The technical note introduces methodologies for estimating and evaluating the requirements for operational flexibility. It includes numerical exercises with examples illustrating the application of these methodologies. The simulations involved the generation of system ramps based on gross and net load data, considering the horizon of the year 2032. Resource data were collected from the operational history and information provided by industry stakeholders.

Furthermore, the technical note outlines key actions that the electricity sector must undertake to facilitate the expansion of flexibility in the SIN.

The publication aims to enhance understanding and stimulate discussions on the critical subject of operational flexibility in the context of evolving energy landscapes and increasing renewable energy integration in the power grid.

In another development, EPE participated in the 27th edition of the Seminário Nacional de Produção e Transmissão de Energia Elétrica or National Seminar on Production and Transmission of Electric Energy in Brazil, from November 26-29, 2023, through presentations and discussions.

Considered the largest in Latin America and the second-largest globally on the subject, this year's seminar, organised by Brazilian state-run power company Centrais Eletricas Brasileiras SA's (Eletrobras) subsidiary, Centrais Elétricas do Norte do Brasil SA (Eletronorte), aimed to build upon pioneering initiatives from previous editions while incorporating new knowledge spaces and fostering integration. The seminar served as a platform for professionals, experts, and industry leaders to share insights, discuss innovations, and explore collaborative opportunities that contribute to the continued growth and enhancement of the power landscape.

Brazil's EPE report recommends interconnection of isolated systems in Amazonas

EPE has collaborated with Amazonas Energia, a power distributor, to conduct a study evaluating the benefits of interconnecting isolated systems in Amazonas, to explore alternatives for serving the isolated systems, fostering economic growth while mitigating environmental impacts.

The study reveals that the interconnection of 14 locations in Amazonas could lead to a subsequent decrease in fuel consumption costs and play a role in mitigating environmental impacts.

A comprehensive cost-benefit analysis was conducted for the interconnection of 18 isolated locations in Amazonas. The analysis, guided by reliability criteria, identified 14 locations where interconnection is expected to yield positive results.

The study categorises locations into seven groups, with detailed technical feasibility assessments provided by Amazonas Energia.

Challenges, such as increased costs for certain interconnection proposals, specifically for Lábrea, a municipality in the Brazilian state of Amazonas, have been highlighted, and recommendations include monitoring load evolution in planning cycles for specific locations, ensuring long-term viability.

The study underscores the sensitivity of the analysis to input data, necessitating a review of the study with any changes to the adopted assumptions. It emphasises the importance of accurate and reliable data for effective decision-making.

The report also lists locations that require continued monitoring for potential interconnection in the future.

ANEEL approves draft notice for Transmission Auction No. 1/2024 in Brazil

Brazilian energy regulator, Agencia Nacional de Energia Eletrica (ANEEL), has approved the draft notice for Transmission Auction No. 1/2024, marking the first auction of the year 2024 with an anticipated investment of BRL18.2 billion. The auction, scheduled for March 28, 2024, is expected to feature 15 lots comprising 69 projects across 14 states.

The auction is projected to attract significant investments, with six of the 15 lots expecting investments exceeding BRL1 billion each. The total construction involves 6,464 km of new transmission lines and sections, and 9,200 MW in transformation capacity.

Lot 6 stands out with an estimated construction cost of BRL3.39 billion, encompassing 726 km of transmission lines and two substations in the states of Bahia and Minas Gerais. It includes the construction of the 500 kV Jussiape–São João do Paraíso Circuit 1 (C1) and C2, S/C lines of 225 km each; 500 kV São João do Paraíso–Capelinha 3 C1 S/C line of 254 km; 500 kV Capelinha 3–Itabira 5 C1 S/C line of 241 km; sections of 500 kV line between Jussiape substation and 500 kV Igaporã III–Ibicoara C1 S/C line, of 2×3.0 km each; the 500 kV Jussiape and São João do Paraíso substations; along with synchronous compensation equipment.

The longest construction period is associated with Lot 12, spanning 72 months. It is located in Maranhão and Piauí, and involves the construction of the 500 kV Teresina IV–Graça Aranha C1 S/C line of 205.13 km and 500 kV Boa Esperança–Graça Aranha C1 S/C line of 188.4 km. The extended timeline is justified by the dependency on the delivery of the Graça Aranha substation, a component of Lot 1 from Transmission Auction No. 2/2023.

ANEEL has introduced innovations to enhance the bidding process security. Winning companies must demonstrate the implementation of similar work corresponding to at least 30 per cent of the scope of works in the contested lot. Economic and financial qualifications for proponents have been revised, requiring the winning bidder to present financial

statements certified by an independent auditor registered with the Comissão de Segurança e Câmbio or Securities and Exchange Commission.

In case the winning bidder is disqualified, the remaining bidders will be called in ascending order of the bid values to present qualification documents, provided they accept the disqualified bidder's financial proposal. If none of the remaining parties accepts the disqualified party's financial proposal, the ANEEL Comissão Especial de Leilão or Special Auction Committee may summon them for an extraordinary public session.

The draft will be issued in the coming days for consideration by the Tribunal de Contas Federal or Federal Court of Auditors. A technical clarification workshop on the main points of the event is scheduled for January 22, 2024. After the Federal Court of Auditors' consideration, ANEEL's Board of Directors plans to publish the bidding notice in February 2024.

ANEEL has also approved the notice for Transmission Auction 2/2023, scheduled for December 15, 2023 at the B3 headquarters in São Paulo. The auction includes three lots with a total investment of BRL21.7 billion.

The projects, spanning five states—Goiás, Maranhão, Minas Gerais, São Paulo, and Tocantins—encompass the construction of nine projects, contributing to the expansion of regional interconnections and export capacity.

Lot 1 involves the construction of approximately 1,468 km of direct current (DC) transmission lines, crossing Maranhão, Tocantins and Goiás. The bidding dynamics for Lot 1 include options for the entire lot or four sublots, with completion expected in 72 months.

Lot 2 includes transmission lines and sections totalling 330 km and 221 km, respectively connecting Silvânia to Nova Ponte, and Nova Ponte to Ribeirão Preto in Goiás, Minas Gerais, and São Paulo. The construction period for this lot is 66 months.

Lot 3 comprises a 388-km transmission line from Marimbondo 2 to Campinas in São Paulo, with a completion period of 60 months. The projects aim to increase interconnection capacity between the Northeast and Central West regions and expand the region's export capacity.

ANEEL estimates the construction of more than 3,000 km of transmission lines and 9,840 MW in conversion capacity in substations. The notice approval follows technical analysis by the Tribunal de Contas da União (TCU) or Federal Audit Court.

In a related development, the Ministério de Minas e Energia (MME) or Ministry of Mines and Energy of Brazil has classified electrical energy transmission infrastructure projects tendered in Transmission Auction No. 01/2023 by ANEEL, under the Regime Especial de Incentivos ao Desenvolvimento de Infraestruturas (Reidi) or Special Incentive Regime for Infrastructure Development. These projects have also been designated as priorities for issuing incentivised debentures, contributing to tariff reduction and stimulating private investment in critical infrastructure areas.

ANEEL had hosted the Transmission Auction No. 1/2023 on June 30, 2023 in São Paulo and awarded nine lots for BRL15.7 billion. Under these, total 6,184 km of transmission line length, and 400 MVA of transformer capacity have been planned in the states of Sergipe, Bahia, Minas Gerais and Espírito Santo.

(BRL1=USD0.20)

Brazil's Âmbar Comercializadora to import energy from Venezuela

Âmbar Comercializadora de Energia (Âmbar Energia), a company that develops and implements projects in thermal generation, transmission, and energy trading in Brazil, has received authorisation from the MME of Brazil, to import interruptible electrical energy from the Bolivarian Republic of Venezuela.

The import will be facilitated through the 230 kV Boa Vista–Santa Elena de Uiarén transmission line. However, imports through the Circuito Simples, a section of the line in Brazilian territory, must be preceded by authorisation from ANEEL.

The import of electrical energy aims to reduce the fuel consumption bill, via subrogation, of consumers, considering the difference between the price offer from Âmbar Energia and the unit variable cost of the plants in the current thermoelectric park in Roraima, Brazil. The authorisation, however, specifies that the import of energy is subject to approval by ANEEL, considering the amount to be subrogated after a statement from the Operador Nacional do Sistema Elétrico (ONS) or National Operator of the Electric System, and deliberation by the Comitê de Monitoramento do Setor Elétrico (CMSE) or Electrical Sector Monitoring Committee. These considerations include aspects related to price, volume, and additional guidelines. The company must also adhere to measures and actions ensuring the safe operation and supply of the isolated system.

The authorisation can be revoked under certain circumstances, such as non-compliance with obligations, disagreement with legislation, transfer of goods and installations to third parties, and after the interconnection of the Roraima system to the SIN. However, the revocation will not impose liability on the granting authority, Câmara de Comercialização de Energia Elétrica (CCEE) or Chamber of Electric Energy Commercialisation, or ANEEL, for charges, encumbrances, obligations, or commitments assumed by Âmbar Energia with third parties.

Brazil approves reimbursement for Waimiri Atroari indigenous land

Pró Amazônia Legal, the Steering Committee of the Structural Cost Reduction Program for Energy Generation in the Legal Amazon and Navigability of the Madeira River and the Tocantins River, under the MME, has sanctioned the allocation of funds for the reimbursement of amounts related to Waimiri Atroari indigenous land. The allocated funds constitute part of the heritage compensation for socio-environmental impacts on the Waimiri Atroari indigenous land due to the proposed Engenheiro Lechuga (Manaus)–Boa Vista project.

The recent approval authorises the disbursement of over BRL20 million by the federal government, distributed in three instalments to the developer of the transmission project, Transnorte Energia SA, a consortium between Brazil-based energy firms Eletronorte (49 per cent) and Alupar Investimento S.A. (51 per cent).

This compensation was previously approved in the Basic Environmental Plan – Indigenous Component and the Waimiri Atroari Program. The Manaus–Boa Vista

transmission lines, spanning 721 km, with approximately 122 km passing through indigenous land, are crucial for connecting the state of Roraima to the SIN.

The initiative is integrated into the Pró-Amazônia legal programme, which is a part of the Amazon Energy Program, and aligns with efforts to reduce fuel consumption costs in the country.

(BRL1=USD0.20)

Argentina plans expansion of high voltage line and inspects lines transformer station

The Ministerio de Energía or Ministry of Energy in Argentina opened technical offers and received financial offers for the 132 kV high-voltage line extension between Gran Formosa, Pirané and Ibarreta, in the province of Formosa.

The expansion initiative ensures a minimum increase of 77 per cent in the average electrical energy transmission capacity. The 132 kV high-voltage line will be constructed from the Simple Terna Gran Formosa transformer station (TS) to the Pirané TS, covering approximately 100 km. Another similar line will be constructed from the Simple Terna Pirané TS to the Ibarreta TS, spanning around 95 km. By creating a 195-km ring of lines, an additional 70.5 MVA of transmission capacity will be incorporated into the Formosa–Ibarreta corridor. Other key components of the expansion include the construction of the Gran Formosa 500/132 kV TS, expansion of Field 04 with a new exit to Pirané TS, Pirané TS expansion with adaptation of the 132 kV beach, and expansion of the Ibarreta TS with adaptation of the 132 kV beach. These enhancements involve transforming the system to a double bus with longitudinal sectioning. This upgrade is expected to not only address the current demand, but also anticipate future needs for the next decade in the province.

Seven competitive offers were submitted for this expansion project covering the areas of Formosa, Patiño and Pirané. The project is aligned with the Plan Regional Federal de Transporte Eléctrico or Federal Regional Electric Transportation Plan, and has been prepared in collaboration with provinces. It has a budget of about ARS21.02 billion, with financing from the Inter-American Development Bank (IaDB), Agence Française de Développement (AFD) and European Investment Bank (EIB). The project aims to contribute to the decarbonisation of the system by reconfiguring network usage, eliminating fossil-fuel generation, and facilitating the evacuation of renewable energy to the Sistema Argentino de Interconexión (SADI) or Argentine Interconnection System.

The Government of Argentina also inspected the Vivoratá TS in Mar Chiquita. This TS, coupled with the Bahía Blanca–Mar del Plata extra-high voltage (EHV) line, plays a pivotal role in electric transmission along the Atlantic coast. Both projects, dormant since 2016, were reactivated following the national government's commitment to invest in essential Argentine infrastructure.

The components of the projects include establishment of a new 500/132 kV TS in Vivorata, construction of 11 fields at 132 kV for corresponding high voltage lines, eight fields supplying localities on the Atlantic Coast, including Mar del Plata TS, Villa Gesell TS, Necochea TS and Balcarce TS, and construction of four fields at 500 kV with two power transformer banks of 450 MVA each. The investment value of the projects is approximately USD450 million.

Finally, the Secretaria de Energia or Secretary of Energy of Argentina, conducted a technical inspection at the Ezeiza TS and thermal power plant to evaluate the advancements made over the past year. The primary objective of the visit was to strategise and ensure a consistent supply of electrical energy during peak demand periods, particularly the summer season.

Ezeiza TS is funded by the national government and managed by Transporte de Energia Electrica en Alta Tension SA (Transener) and Empresa de Transporte de Energía Eléctrica por Distribución Troncal de la Provincia de Buenos Aires Sociedad Anónima (Transba). It is the largest in transformation power within the SADI, boasting an installed power capacity of 3,200 MVA, along with an additional 800 MVA in reserve. The Ezeiza TS also features an in-house chemical laboratory with over 27 years of experience, catering to both internal and external clients, including thermal/hydroelectric/nuclear power plants and wind farms, among others. Different facets of the TS were examined, including the manoeuvring yard, the 132 kV and 220 kV capacitor banks, and the ongoing repair of compensators.

At present, the Ezeiza TS is operational, with expansion plans encompassing the Plomer TS – an integral component of the Área Metropolitana de Buenos Aires (AMBA) I project. Notably, two compensators are undergoing significant corrective maintenance, representing an approximate cost of USD15 million, while a third is undergoing rotor repair at a cost of USD2 million.

(ARS1=USD0.0028)

ENRE approves transmission projects across Argentina

Argentina's energy regulator, Ente Nacional Regulador de la Electricidad (ENRE) or the National Electricity Regulatory Entity, has approved transmission expansion projects across the country.

Through its Resolution No. 821/2023, on a request made by Transmisión Comahue SA (Transcomahue), which was submitted at the request of the provinces of Río Negro and Neuquén, ENRE has granted authorisation for the expansion of their electricity transmission systems. The key components of this project include: a new 132/33 kV TS at Dina Huapi substation; a 132 kV high voltage line of 108 km connecting Alicurá to Dina Huapi substations; a 132 kV high voltage line extension of about 20 km from Dina Huapi to Bariloche TS; and two 132 kV fields at the Bariloche TS (under Transcomahue's jurisdiction) and the Alicurá substation (under Transener's jurisdiction].

In a parallel development, ENRE, through Resolution No. 820/2023, has authorised access and expansion of the electricity transmission capacity requested by the Ente Provincial de Energía del Neuquén (EPEN) or Provincial Energy Entity of Neuquén, at the behest of Yacimientos Petrolíferos Fiscales (YPF)—an Argentine multinational oil and gas company, Wintershall DEA (an international oil and gas company formed by the merger of Wintershall Holding GmbH and DEA Deutsche Erdoel AG), the Transitional Union of Aguada Pichana Este Companies, and the Argentine branches of Total Austral and Panamerican Energy. The approved expansion project entails construction of the Aguada Pichana

Este TS, featuring a 132/6.6 kV, 10 MVA transformer; an additional 132/6.6 kV, 10 MVA transformer in cold reserve; and associated equipment. It also involves the establishment of a 132 kV high voltage line spanning approximately 43 km between the new Aguada Pichana Este TS and the Loma Campana TS, with necessary adaptations in the Loma Campana TS for the connection of the new line, with a target maximum demand of 7 MW. The authorisation also includes the issuance of the corresponding certificate of convenience and public necessity (CCPN).

Additionally, ENRE has issued a request for the expansion of the electric energy transmission system in the Province of Buenos Aires. This request was made by Transba at the behest of the distributor, Empresa Distribuidora de Energía Norte (EDEN). The proposed work includes components such as disconnection and removal of transformers T1MD and T2MD; provision, assembly, and connection of the 132/33/13.2 kV – 40/30/40 MVA transformers; replacement of the 132 kV current transformers corresponding to the 132 kV fields of the T1MD and T2MD transformers, along with the execution of complementary works; works at the Bragado TS, involving the disconnection and removal of the 132/33/13.2 kV – 10/15/15 MVA T6BG transformer; assembly and connection of a 132/33/13.2 kV – 30/20/30 MVA transformer removed from the Mercedes TS; replacement of the 33 kV neutral current limiting reactance; and execution of complementary works, all under the jurisdiction of Transba. Five days were allotted for public access to these resolutions on the websites of ENRE and Compania Administradora del Mercado Mayorista Electrico SA (CAMMESA), the state-owned wholesale electricity company. Once the indicated terms expire without filing of opposition or registration of alternative projects, ENRE will proceed to authorise the required access and grant CCPN for the same.

Finally, Resolution No. 848/2023, issued by ENRE, has granted authorisation for the CCPN requested by Transba at the behest of Empresa Distribuidora de Energía Sur (EDES), an electric distribution company located in Buenos Aires, Argentina, for the expansion of the electric energy transmission system in the Province of Buenos Aires. The authorised work involves the replacement of the T1TO 132/33/13.2 kV – 15/10/10 MVA transformer with a 132/33/13.2 kV – 30/30/20 MVA transformer at the Tornquist TS, which operates at 132/33/13.2 kV and falls under the jurisdiction of Transba.

YPF Luz explores transmission works to support Argentina's renewables growth

YPF Energía Eléctrica S.A. (YPF Luz), a major player in Argentina's Mater term market (a platform where large consumers, such as factories, request power from renewables generators) with a 35 per cent share of energy sales, is evaluating the feasibility of investing in transmission works to support the growth of renewables.

Transmission bottlenecks are identified as a significant challenge affecting the expansion of the Mater market. Projects planned in congested corridors face obstacles in obtaining priority transmission dispatch capacity, hindering the overall growth of the country's electricity generation sector. The existing transmission challenges not only affect the Mater market, but also impede the broader expansion of Argentina's electricity generation capacity.

Changes to the regulatory framework of the Mater market allows generators to seek authorisation for expansion work in the transmission segment, to facilitate the integration of additional generation projects.

Senate Mining and Energy Commission of Chile approves Energy Transition Bill

The Comisión de Minería y Energía del Senado or Senate Mining and Energy Commission of Chile has approved the Ley de Transición Energética or Energy Transition Bill. This legislative proposal aims to modify the tariff revenue allocation mechanism, facilitate the development of transmission projects, and promote storage initiatives, among other measures, to expedite crucial actions for the decarbonisation process in the country.

The primary objectives of the Bill include creating conditions for the efficient development of electrical transmission projects, particularly in regions facing production challenges like Ñuble and Los Lagos due to transmission constraints. The initiative also aims to reallocate tariff revenues to enhance the distribution of risks associated with extraordinary congestion in the electrical system. The Bill received transversal support, with four votes in favour. Going further, it will undergo detailed analysis within the same parliamentary body before proceeding to a vote in the senate chamber.

This legislation is a key component of the Agenda Inicial para un Segundo Tiempo de la Transición Energética or Initial Agenda for a Second Period of the Energy Transition, which seeks to enable accelerated energy transition in accordance with the long-term objectives, outlined and agreed upon through the Política Energética Nacional y la Ley Marco sobre Cambio Climático or National Energy Policy and the Framework Law on Climate Change. Chilean Ministro de Energía or Minister of Energy, presented the law in Ñuble region in May 2023.

The Energy Transition Bill aims to address diverse energy needs across the country while acknowledging specific regional contexts. The law seeks to shape the regulatory framework required for comprehensive energy development. It focuses on aspects with wide agreement among stakeholders and aims to navigate issues with minimal contention, while also addressing impactful legal changes. The law also recognises that effective energy transition encompasses power generation and transmission, both of which are vital elements in the decarbonisation process. Significantly, the law can unlock stalled projects and boost energy availability throughout the country including Ñuble.

Chile's CEN releases reports on interconnection status and transmission

Coordinador Eléctrico Nacional (CEN) or National Electricity Coordinator of Chile has unveiled a report, offering an extensive overview of the interconnection status of projects within the Sistema Eléctrico Nacional (SEN) or National Electrical System. The report aims to enhance access to public information regarding initiatives seeking connection authorisation through the open access regime, as well as those already authorised or in the process of connecting to the SIN. The report provides

a detailed breakdown of the current status of connection requests processed during 2023, focusing on both the open access and connections stage. Project volumes are categorised by type and geographic location. A summary is presented for projects that have obtained entry into operation, which includes transmission, generation, and Pequeños Medios de Generación Distribuida (PMGD) or small distributed generation means, categorised based on their regulatory classification. As of October 2023, 226 connection requests have been processed (surpassing the total for 2022); there has been a reduction of over 50 per cent in average processing times for projects entering the process in 2022 and 2023 compared to previous years; and 21 GW renewable energy generation has been authorised without a declaration under construction, about 9 GW have been authorised with a declaration, and 6.6 GW are in the connection process.

The major objective of the report is to provide clear insight into project volumes, and provide industry actors with a clear idea of the volumes of projects at different stages of the interconnection process. The report also aims to facilitate the projection of ongoing and future connections to the system. Identifying geographic areas and substations with the highest concentration of network access and connection requests are expected to aim in strategic planning and resource allocation. The report also offers a historical perspective, tracing the evolution of the open access and connections process from 2018 to October 2023. To ensure the industry has access to the latest information, the report commits to quarterly updates starting in 2024.

Additionally, CEN, within the framework of the transmission planning procedure stipulated in Article 91 of Law 20,936 of 2016, (which includes a new electrical transmission system and created CEN, as an independent coordinating body of the national electrical system) has also released the Diagnóstico del Uso Esperado del Sistema de Transmisión or Diagnosis of the Expected Use of the Transmission System report. This marks the initial phase of the 2024 Proceso de Planificación de Transmisión or 2024 Transmission Planning Process. This report aims to share the diagnosis of the expected use of the electric energy transmission system for the period 2023-43 in coordination with companies, project developers, and the public. The goal is to gather comments and observations, serving as a preliminary stage for the proposal of transmission system expansion projects to be presented to the Comisión Nacional de Energía (CNE) or National Energy Commission, in January 2024.

The study analysed the behaviour of the SEN in six areas. An average annual SEN demand growth of 2 per cent to 2.3 per cent has been estimated in medium and high demand scenarios for the period 2023-43. The study included the characterisation of facilities, background information, and main results of the expected use of the Sistema Nacional de Transmisión (SNT) or National Transmission System. Issues identified in the current operation were also presented. The investment optimisation process considered five possible future expansion scenarios for generation plants, incorporating industry vision and accounting for coal plant retirements by 2030. The exercise considered various generation park expansion scenarios, highlighting potential developments in the north to the Maule region and from Ñuble to the south. Wind, PV, and storage technologies are emphasised, with a potential connection of up to 2.2 GW of BESS in the Norte Grande, featuring autonomy of 2 to 6 hours. CEN's team engaged in collaborative efforts with the industry through a programme of five modules. This initiative, initiated on June 7, 2023, included workshops with nine trade associations and individual unions. Topics covered in these sessions ranged from diagnosis of transmission systems to critical analysis of the planning process, union requirements, and potential transmission expansion alternatives. Stakeholder comments were due by November 27, 2023.

CEN announces award of 24 transmission works in Chile

CEN has announced the results of the bidding process for new works in the national and zonal transmission systems. The bidding process, encompassing Exempt Decrees Nos. 257/2022, 229/2021, 200/2022 and 185/2021 from the Ministerio de Energía or Ministry of Energy, involved the consideration of 29 works – 15 new works and 14 conditional expansion works. Of that, 13 new works and 11 conditional expansion works were awarded, constituting 83 per cent. The value of new works stands at USD20.7 million and that of conditional expansion works at USD72.1 million.

The awardees are Sociedad De Transmisión Austral S.A. which won the maximum number of projects; followed by Ferrovial Power Infrastructure Chile SPA, Alupar Chile Inversiones SPA, Empresa De Transmisión Eléctrica Transemel S.A., Besalco S.A., and Colbún S.A.

The works of Group No. 1, composed of the new flow control system through the Parinas–Lo Aguirre line and expansion of the Parinas substation, were considered void, after the application of the maximum value set by the CNE through Reserved Exempt Resolution No. 506 of October 23, 2023.

Group No. 8 works, composed of the Nueva Seccionadora La Invernada substation and expansion of the 220 kV Celulosa Pacífico substation, were dropped due to non-reception of offers.

The adjudication record has been available since November 3, 2023, and successful bidders are required to formalise acceptance. The acceptance will be part of the files sent to the Ministry of Energy, CNE, and the Superintendencia de Electricidad y Combustibles (SEC) or Superintendence of Electricity and Fuels, for publication of the respective award decrees.

SGA initiates EIS for Corinto Solar PV Park and associated line in Chile

The environmental qualification process for the Corinto Solar PV Park project, managed by Gestión Ambiental SA (SGA) – a Chilean consulting company of environmental management, has been initiated by submitting the project's environmental impact study (EIS) to the Servicio de Evaluación Ambiental (SEA) or Environmental Evaluation Service in Chile.

The project comprises two lots, each with capacities of 73.6 MW and 160.3 MW, connected to an electrical transmission line. Energy generated by the park will be transported through a 220 kV high voltage line and injected into the SEN at the Nueva Maitencillo substation.

The proposed project, if approved, anticipates a 40-year useful life and will occupy approximately 265 hectares.

Chile unveils plan for allocating land to storage projects in Atacama

Within the framework of the commitments outlined in the Second Time Agenda for the Energy Transition presented by the Ministerio de Energía or Ministry of Energy of Chile, a plan for the allocation of public lands for energy storage projects has been jointly presented by the Ministry of Energy and Ministerio de Bienes Nacionales or Ministry of National Assets.

This initiative, unveiled in Copiapó, Atacama, aims to address a specific hurdle identified by developers earlier in the year, emphasising the unavailability of public land as a crucial factor hindering the accelerated construction of storage systems. The programme will enable companies to propose storage initiatives and apply for the direct allocation of land for such projects in geographical areas defined in coordination with CEN.

Land for energy storage solutions totalling 13 GWh is expected to be allocated, with a distribution between the regions of Atacama, Arica and Parinacota. Atacama, with favourable conditions for renewable energy generation, especially solar and wind, is poised to contribute significantly to storage projects.

In another development, the Ministry of Energy, in collaboration with the International Energy Agency (IEA), organised a seminar: Electric Networks for a Sustainable, Safe, and Affordable Energy Transition, on the significance of electrical networks for the ongoing energy transition in Chile. The event, held on November 14, 2023, delved into crucial aspects outlined in the latest report titled Electricity Grids and Secure Energy Transitions prepared by the IEA.

Additionally, the scope of the Energy Transition Law Project and the Second Time Agenda in Chile, promoted by the Ministry of Energy, was discussed during a seminar. It was highlighted that two-thirds of the system expansion works are currently behind schedule. The process of planning, construction, and bidding for transmission is designed to limit costs, but adjustments are needed to align with the speed of the ongoing energy transition. The event featured discussion panels on the importance of having a robust and resilient electrical grid system and the need for technologies and infrastructure that strengthen the network to be adaptable to various functions. It was also highlighted that storage systems play a crucial role in supporting the network.

Grid concession signed between MINEM and Peru companies

Peru's investment promotion agency, ProInversión, announced the signing of concession contracts between the Ministerio de Energía y Minas (MINEM) or Ministry of Energy and Mines, and companies Interconexión Eléctrica Saesp (ISA) and Alupar Inversiones Perú, for five electrical projects to enhance the power infrastructure in the departments of San Martin, Arequipa, Lambayeque, and Piura. ProInversión had awarded contracts for these projects on August 25, 2023.

These projects aim to benefit residents in the regions of San Martin, Arequipa, Lambayeque and Piura, and have been divided into two groups.

Group 1 encompasses the:

- 500 kV San José–Yarabamba line and associated substations project;
- 220 kV Piura Nueva–Colán Instalaciones de Transmisión de Conexión (ITC) or Transmission Connection Facilities (ITC) link and associated substations; and
- 220 kV Belaunde Terry–Tarapoto Norte double-circuit ITC link and associated substations.

These projects have been awarded to ISA and entail a total investment cost of about USD85.96 million. Additionally, the annual operations and maintenance (O&M) cost is projected at USD2.67 million, representing a substantial 39 per cent cost savings for the state.

Group 2 includes the:

- 220 kV Lambayeque Norte ITC substation with sectioning of the 220 kV Chiclayo Oeste–La Niña/Felam line, and associated substations project; and
- 220/60/22.9 kV Piura Este substation and associated existing 60 kV lines connections.

This group has been awarded to Alupar Inversiones Perú, with a total investment cost of about USD32.16 million and an annual O&M cost projected at USD0.9 million. This represents a 17 per cent cost savings for the state.

All five projects will be executed under the public-private partnership (PPP) mode, with a concession period of 30 years of commercial operation, plus the construction time varying between 32 to 50 months for each project.

Peru's ProInversión unveils PPP projects portfolio, including transmission

ProInversión has presented a portfolio of 55 PPP projects and asset projects, totalling nearly USD15 billion, during the P3 2023 World Forum, a globally influential conference dedicated to the growth and enhancement of PPPs, organised by the Canadian Council of Public-Private Partnerships (CCPPP) in Toronto, Canada. The projects are slated for awards between 2024 and 2026.

ProInversión delivered a presentation titled `Peru: Promoting the closing of the infrastructure gap through PPP', unveiling Peru's portfolio encompassing diverse sectors, including transmission line projects.

ProInversión is showing active participation in international events and roadshows with an aim to attract international developers and operators to enhance competition and ensure the success of international public projects under the PPP framework.

Panama–Colombia interconnection construction to begin shortly

Panama's state-owned electricity transmission company, Empresa de Transmisión Eléctrica SA (ETESA), has provided an update on the progress of the electrical interconnection project between Panama and Colombia. The construction of the line is expected to begin by the end of 2023 or early 2024.The project, which was announced in 2008, entails the construction of a 500 kV, 500-km, HVDC line connecting the power grids of both countries. The USD500 million project is being funded by IaDB and will cover 220 km in Panama and 280 km across Colombia, from a substation in Panama City to the Cerromatoso substation in Colombia. It

will have the capacity to transport up to 300 MW of electric power in either direction. The line route has been divided into three sections: a 220-km land section on the Panamanian side; a 130-km underwater section; and a 150-km land section on the Colombian side. The design and technical structure for the underwater section, which runs from Guna Yala in Panama to Cerro Matoso in Colombia, are already in place. The cross-border link will eventually be interconnected with a regional grid project called Sistema de Interconexion Electrica de los Paises America Central (SIEPAC)—a 230 kV, 1,796-km-long transmission line linking Panama, Costa Rica, Honduras, Nicaragua and El Salvador.

Since its announcement, the project has been facing various environmental and cost-related issues, due to which the president of Panama halted the project in 2012. After that, both countries tried to revive its development multiple times, but several issues related to its cost, the environment, delayed decisions, etc. prevented its resumption. In September 2022, after a delay of almost 15 years, the developer defined the line route under the EIS of the project, which is likely to be completed soon. Following this, the project will be open for bidding.

The project is currently in the feasibility phase, with technical and environmental studies nearing completion. ETESA's ongoing work plan for 2022-23 shows a 100 per cent execution of previous engineering or pre-design studies, including the definition of the environmental corridor, basic line design, HVDC station design, and marine cable specification. The detailed design study indicates that the project's EIS for Colombia is 90 per cent advanced, while Panama has received approval for EIS. However, challenges have arisen due to significant complaints from communities affected by the project, such as in the Wargandí and Guna Yala regions.

For the period 2024-26, the plan involves acquiring goods and services, initiating the process of setting up converter stations, and commencing construction and assembly. The regulators, Autoridad Nacional de los Servicios Públicos (ASEP) or National Authority of Public Services of Panama, and Comisión de Regulación de Energía y Gas (CREG) or Commission for the Regulation of Energy and Gas of Colombia, are collaborating on a regulatory harmonisation scheme.

The feasibility and execution of the Panama–Colombia electrical interconnection project is seen as foundational for advancing energy cooperation and integration in the region. The importance of interconnected operation lies in the fact that the regional market has been interconnected for over 40 years and completion of this binational interconnection would bridge the last missing link in the grid, fostering greater collaboration and efficiency in regional energy distribution.

Colombia's UPME invites investors for Bolívar substation project

Colombian mining and energy planning unit, Unidad de Planeación Minero Energética (UPME), has issued an invitation for bids for the selection of an investor and intervener for works related to the third 500/220 kV, 450 MVA transformer at the Bolívar substation.

The project involves the design, acquisition of supplies, construction, testing, commissioning, operation, and maintenance of: one bank of 500/220/34.5 kV, 450 MVA (3×150 MVA) autotransformers at the Bolívar substation; a single-phase 500/220/34.5 kV, 150 MVA reserve power autotransformer with a quick-change connection; one 500 kV and one 220 kV transformer bay in double bar configuration plus transfer disconnectors; extension of the busbar to 500 kV and 220 kV (including all necessary elements and adaptations); and supply and construction of all elements and adjustments for interface and compliance during construction, operation and maintenance. The transformation bay must maintain the configuration of the existing Bolívar 500 kV and 220 kV substations, and the equipment may be conventional air-insulated substations (AIS) or gas-insulated substations (GIS), or a hybrid solution.

The investor, once finalised, will be responsible for the selection and acquisition of the lot (if necessary); design, construction, operation and maintenance of the described works; and guaranteeing compatibility of the new transformation bay in functionality, power, communications, control and protections, with existing infrastructure.

As per MME's Resolution No. 40477, the project must come into operation no later than June 30, 2026.

ETESA to expedite tendering process of Fourth Line project in Panama

ETESA is planning to issue the tender for the Fourth Line transmission project in January 2024, recognising its necessity to accommodate the projected energy growth in the country. The project is expected to provide the national interconnected system with an unrestricted connection to power generation in the west and enable the transfer of electricity from this region to the load centre in the east.

The Chiriqui Grande–Panama III transmission line, also known as the Fourth Line project, will be implemented in two phases. Phase I involves the construction of a 300-km-long, 500 kV transmission line proposed to connect the 500/230 kV Chiriqui Grande substation to the Panama III substation, and expansion of the latter. At this stage, the line will operate at 230 kV and will allow transmission of 589 MVA under normal operating conditions and 797 MVA under emergency conditions. Phase II will include the energisation of the line at 500 kV, for which the 500 kV yards of the Chiriqui Grande and Panama III substations will be constructed so that the line transmits 1,280 MVA under normal operating conditions and 1,856 MVA under emergency conditions. The project has an estimated investment of up to USD760 million, an amount that is 52 per cent more than originally projected at USD500 million.

To execute the project, ETESA is opting for the PPP model, with assistance from the International Finance Corporation (IFC), the World Bank's private financial arm. The PPP model entails a 30-year payment period, and the project is expected to be self-sustainable, generating income to cover its costs.

Presently, ETESA is working in coordination with the Secretaría Nacional de APP (SnAPP) or National PPP Secretariat and preparing the Informe Técnico Final (ITF) or Final Technical Report of the project which includes feasibility study, the bidding documents and the PPP contract, which is expected to be presented to the Governing Body of the sector by December

2023. ETESA has stressed the urgency of initiating the tender by January 2024 to ensure that the infrastructure becomes operational between 2027 and 2028. If the tender is delayed further, ETESA is considering a backup plan involving the repowering of existing transmission lines to temporarily boost capacity. However, this solution is deemed insufficient in the long term, emphasising the critical need for the Fourth Line project.

Panama's ETESA undertakes expansion projects

ETESA has initiated the permit process for the expansion of the 230 kV Guasquitas–Panamá 2 transmission line, aiming to raise its capacity from 221 MVA to 500 MVA. The request for modification to the EIS was submitted to the Ministerio de Medio Ambiente (MiAMBIENTE) or Ministry of Environment.

The 393-km transmission line traverses the provinces of Chiriquí, Veraguas, Coclé, Panamá Oeste and Panamá, primarily transporting electricity from hydroelectric plants to Panama City. The infrastructure comprises 1,099 towers. The proposed modifications include changes to suspension chain accessories to ensure safe ground clearance and the replacement of armoured cables, contributing to the alleviation of congestion on the line. With load demand marking a 10 per cent year-on-year increase, the expansion is deemed necessary to meet the growing electricity needs in the country.

In another development, ETESA has awarded a project that involves the addition of a new 230 kV/34.5 kV T3 transformer with a capacity of 83 MVA at the Boquerón III substation located in the province of Chiriquí. ETESA conducted thorough studies and analysis of the SIN, leading to the inclusion of this project within the Plan de Expansión del Sistema Interconectado Nacional (PESIN) or Expansion Plan of the National Interconnected System. The installation of this power transformer will enhance the reliability of the SIN, ensuring continuous operation in the event of failures in the existing transformers. Additionally, this new transformer will facilitate the integration of new renewable energy plants, including hydroelectric and solar projects. The total investment for this project is approximately PAB6.78million. It is considered of significant importance for the province of Chiriquí and is part of ETESA's broader expansion plan in this region.

(PAB1=USD1)

World Bank to help strengthen Paraguay's electricity sector

A delegation from the World Bank visited Paraguayan Administracion Nacional de Electricidad (ANDE) to conduct a diagnostic assessment to identify current challenges, investment opportunities, and discuss key electrical infrastructure projects outlined in the ANDE Master Plan.

The Bank expressed its interest in collaborating with ANDE to address various issues in the Paraguayan electricity sector. The focus is on optimising the use of Paraguay's clean and renewable hydroelectric energy. ANDE's Master Plan for Generation, Transmission, Distribution, Marketing, and Telematics for the period 2021-30 was discussed, in which the planned works aim to meet the growing demand for electrical energy, maintaining Paraguay's commitment to 100 per cent clean and renewable electrical energy.

The meeting delved into various aspects of the Paraguayan electricity sector, emphasising the efficient use of electric energy, access to electric energy with social and environmental responsibility, and financing with Green Funds.

ANDE advances substation projects in Paraguay

ANDE, on November 16, 2023, successfully completed the expansion of the Santa Rita substation project, to enhance power supply in the region of Alto Paraná.

This project entailed doubling the power supply at the said substation in the Alto Paraná department by putting into service the second 41.67 MVA, 220/23 kV power transformer. This expansion was a part of the International Public Tender 1596/20, Lot 1, which involved the construction of the María Auxiliadora substation and expansion of the Santa Rita substation. The project, carried out by the División de Supervisión de Generación y Transmisión de la Gerencia Técnica de la ANDE or Generation and Transmission Supervision Division of the ANDE Technical Management, is expected to benefit customers in Santa Rita, a district in Alto Paraná Department of Paraguay, and its surrounding areas.

ANDE has also commissioned two 500 kV reactor banks at the Villa Hayes substation, which is part of the SIN. These reactor banks, each with a power capacity of 80 MVAr, will play a crucial role in enhancing operational flexibility and voltage control within the electrical system.

The project was executed through the ANDE Banco Europeo de Inversiones (BEI) or European Investment Bank International Public Tender No. 1514/19 and carried out by the Consorcio Siemens Rieder Reactores 500 kV. The total investment for the project amounted to USD7.98 million (inclusive of VAT) for local supplies and works. Approximately 150 personnel from both the contractor company and ANDE played a pivotal role in successfully commissioning the new facilities.

In another development, ANDE made a significant improvement in the Capiatá substation by commissioning an 80 MVA power transformer, which increased the installed power capacity at the substation by 25 per cent. This move is expected to have benefitted over 25,000 clients in Paraguay's Central department, particularly in the cities of Capiatá, San Lorenzo, Itauguá and Areguá. The installation of the new power equipment was initiated to meet the growing demand for electricity in the area. In addition to the transformer installation, adjustments were made to the protection, measurement, and control systems, leading to more efficient operations from the ANDE Central Control Center.

These efforts are part of ANDE's 2023-24 Summer Plan and were accomplished through the collaborative work of different units within the technical management, with the support of the distribution directorate and telematics directorate.

Bolivia's ENDE shares progress of Viloma transmission project

Bolivia's state-owned power utility company, Empresa Nacional de Electricidad Corporation (ENDE), has achieved 92 per cent progress in the construction of the Viloma substation in the Cochabamba department. The project, executed by Empresa De Luz Y Fuerza Eléctrica Cochabamba SA (ELFEC), a subsidiary

of ENDE, entails a total investment of BOB50.5 million.

The project also includes a 6-km, 115 kV line that will begin from Caporaya substation and will connect with the Viloma substation, with around 17 structures and a new 25 MVA transformer.

During the construction and assembly phase, significant logistical efforts were deployed, enabling parallel advancement in various aspects of the project. Currently, the assembly of 17 reticulated structures for the 115 kV D/C line is in progress.

The project is expected to benefit the communities of Sorata, Viloma, Caramarca, and Sindicato Agrario Cotapachi, located in the municipalities of Quillacollo and Sipe Sipe.

(BOB1=USD0.14)

CELEC EP strengthens substations across Ecuador

Ecuador's state-owned power company, La Empresa Pública Estratégica Corporación Eléctrica del Ecuador's (CELEC EP) transmission unit Transelectric, has inaugurated a 60 MVA mobile substation at the Policentro substation in Guayaquil. This initiative, part of Transelectric's broader plan, aims to repower key installations in Ecuador, including substations in Durán, Machala and Cuenca.

The new capacities planned for installation across the substations are as follows: Policentro substation with 60 MVA (already in operation); Durán substation with 225 MVA (ongoing expansion work); Machala substation with 225 MVA (civil works underway); and Cuenca substation with 150 MVA (expanding yards for new bays, allowing utilisation of the total capacity of the 150 MVA transformer).

The Policentro substation's repowering increases its energy delivery capacity to Ecuadorian state-run energy company, Corporacion Nacional de Electricidad (CNEL EP), benefiting the north-central sector of Guayaquil. The Durán and Cuenca substations' expansions, featuring new bays, will contribute to improved energy delivery to industrial and urban sectors, fostering the overall growth and development of the country. Meanwhile, the repowering of the Machala substation reinforces and secures electrical transmission services for the province of El Oro. The objective of these repowering projects is to increase the transformation capacity of the aforementioned substations, which add up to a total of additional 660 MVA capacity, to increase the delivery of energy to the distribution companies. A considerable increase in electricity demand is expected due to the expansion of urban and rural areas, including industrial and commercial sectors, due to which increased delivery of energy to distribution companies is imperative.

The completion of these works is scheduled for the end of 2023.

Transelectric has also installed a new 225 MVA transformer arrived at the Machala substation to enhance the delivery capacity of electrical energy transmission services to CNEL EP, in El Oro. The expansion of the Machala substation has thus achieved significant progress, reaching an overall completion rate of 70 per cent, with anticipated completion by end-December 2023. This enhancement is expected to ensure increased energy supply in the short term, catering to the growing demand in the province of El Oro. The electromechanical assembly of the transformer is expected to commence immediately.

Mexico's ICCM estimates requirement of 58,900 km of lines

International Chamber of Commerce Mexico (ICCM) has estimated that to sustain a gross domestic product (GDP) growth rate of 2.4 per cent annually, there is a need for the construction of 58,900 km of electrical transmission lines in the country. ICCM highlights a strong correlation between GDP growth and the installation of transmission lines, indicating that for every percentage point of GDP growth, 800 km per year of transmission lines need to be installed, as there is an estimated accumulated deficit of 4,370 km in transmission line installation from 2018 to 2022.

Additionally, infrastructure development for 100,974 MW in gas, wind and solar generation is deemed necessary, factoring in plant efficiency and utilising combined cycle, photovoltaic, and wind processes.

The projected investment required for this infrastructure development is approximately MXN2 trillion, equivalent to an annual investment of MXN132,318 million over fifteen years. The analysis is based on a constant increase in GDP over the next fifteen years, with a focus on the SIN.

Acknowledging the dynamism in the energy sector, ICCM notes that parameters used for the estimate could be subject to modification based on growth projections and capacity decisions. In the context of budget discussions, ICCM urges stakeholders to consider the energy needs for national growth and take prompt action to capitalise on the current situation, to meet or exceed the country's growth goals.

(MXN1=USD0.058)

CFE to expand transmission and generation infrastructure in Mexico

Mexican state-owned power company, Comisión Federal de Electricidad (CFE), has planned to boost its electrical generation capacity and transmission network, with an increase in generation infrastructure outpacing its energy transmission network, as per statements made by the company's director.

As the current six-year term from 2018 to 2023 concludes, the electrical transmission network is projected to extend to 111,218 km, marking a 3.6 per cent increase from 2018 levels. During 2018-23, CFE's key achievements included the addition of 2,600 km to the national transmission network. Additionally, another 608 km of transmission lines are currently under construction in the north-centre, while 755 km are currently under construction on the Pacific coast. On the generation side, CFE anticipates a 12 per cent increase in its installed capacity by adding 9,000 MW by the end of the six-year term. Of this new capacity, 1,500 MW will be attributed to clean energy sources, with an additional 1,000 MW originating from the PV project in Puerto Peñasco, Sonora.

In a related development, CFE has invited bids for the expansion of 115 kV Tecnológico–Lajas corridor covering a length of 71.2 km, including aerial sections in Nuevo León, Mexico. The project also includes capacity augmentation works at existing electrical substations, namely

Regiomontano, Ladrillera, Linares and Lajas. Under this project, CFE has planned to invest MXN427 million.

The project's scope includes the supply of equipment and materials for permanent installation, execution of electromechanical and civil works, evaluation of underground facilities, development of electromechanical and civil design concepts, and conduct pre-operational tests, geotechnical studies, and topographic surveys. The expansion project was made available to interested companies through an international open competition (CFE-0003-CACOA-0013-2023).

CFE specified that the contracting for the project would be at a fixed price, with evaluation based on price considerations. Companies interested in participating must have a minimum accounting capital of MXN98 million. CFE plans to grant an advance in each fiscal year during the project's execution, equivalent to 30 per cent of the scheduled amount for that fiscal year.

The clarification session has been scheduled for November 23, 2023; the opening of the technical offers on January 8, 2024; the opening of the economic offers on January 15, 2023; and winners' announcement on January 22, 2024.

The deadline for the execution of works spans 360 calendar days, from February 5, 2024, to January 29, 2025.

(MXN1=USD0.058)

Explosion occurs at Mexico's Juriquilla substation

An explosion occurred at the 115/13.8 kV substation in Juriquilla, Querétaro in Mexico, causing a fire that left several residential areas without electricity. The incident occurred around 6:00 am on November 8, 2023, and reports indicate that it was caused by an electric arc fire within the CFE substation.

The affected areas included Santa Rosa Jáuregui and residential neighbourhoods in Juriquilla. Authorities in Querétaro are investigating the incident.

However, local media reports suggest that the explosion resulted in the burning of a transformer and three switches, causing significant material damage to the electrical substation.

CFE personnel are actively working to restore electricity supply to the affected areas.

The Civil Protection Coordination of the State of Querétaro confirmed that emergency teams responded to the scene, and while there was material damage, there were no injuries or active fires upon their arrival.

Dominican Republic's ETED shares progress update on transmission network

Dominican Republic power transmission firm, Empresa de Transmision Electrica Dominicana (ETED), has shared a progress update on the country's transmission network during its sixteenth-anniversary celebrations on November 3, 2023.

Over the past four years, a nationwide portfolio of 44 transmission projects has been launched, with 31 already in execution, involving an investment of more than DOP24 billion. Upon completion, the Sistema Nacional de Transmisión (STN) or National System of Transmission will receive 733 km of lines, 260 km of optical ground wire (OPGW) cables, and 2,650 MVA of transformation capacity.

ETED has reduced transmission losses to an average of 1.65 per cent, positioning itself among the best companies in the region. It has also demonstrated an average availability of 99.27 per cent in lines and 99.96 per cent in substation assets. The company focuses on the conservation of transmission system infrastructure through maintenance programmes, repowering, and equipment upgrades.

ETED has facilitated the installation of ten renewable energy generation parks with a total capacity of 600 MW and three thermal generating plants with a capacity of 418 MW in three years, and ensured their transmission interconnection to the Sistema Eléctrico Interconectado Nacional (SEIN) or National Interconnected Electrical System.

ETED is poised to interconnect 1,800 MW of energy from renewable sources and another 1,600 MW of thermal energy in the coming years, with the support and participation of private investors.

(DOP1=USD0.018)

Asia Pacific

China to sell 183 GWh of power to Vietnam through Lao Cai

According to Vietnam Electricity Electric Power Trading Company's (EVNEPTC) recent negotiations with China, the latter had agreed to sell 90 GWh of electricity to Vietnam in November 2023 and 93 GWh in December 2023, through the northern Lao Cai province's transmission line.

The Vietnamese Ministry of Industry and Trade (MOIT) earlier stated that Vietnam was importing about 7 GWh from Laos and 4 GWh from China per day, which was very small compared to the electricity consumption of 445-450 GWh per day in northern Vietnam.

The National Load Dispatch Center , a unit of state utility Vietnam Electricity (EVN), had estimated that Vietnam would produce and import a total of 763.5 GWh-781.8 GWh of power per day in November 2023. The country's electricity output is expected to reach 281.1-281.7 TWh during 2023, recording a year-on-year growth of 4.75-4.96 per cent.

China's SGCC commissions UHVAC project and launches 220 kV project

As part of the first phase of the Zhangbei–Shengli ultra-high voltage alternating current (UHVAC) project, China's largest network company, State Grid Corporation of China (SGCC), has commissioned and put into operation the 1,000 kV Zhangbei substation expansion project.

With this, it has completed the expansion of the Zhangbei, Shengli and Ximeng stations under the first phase.

The UHVAC project, located in Hebei Province and Inner Mongolia Autonomous Region, is part of the 14th Five-Year Plan, to improve the UHV backbone transmission grid structure in North China, meet the collection and transmission needs of wind, solar and thermal power bases in Ximeng and Zhangjiakou areas, and improve transmission to Beijing-Tianjin-Hebei-Shandong, Jiangsu, and other receiving regions.

Under the project, SGCC expanded three 1,000 kV substations with an additional land area of 6.85 hectares, and installed nine new transformers, 12 high-resistance transformers, and nine switches. The project started construction in July 2023. The project is expected to be fully completed and put into operation by October 2024.

In another development, SGCC's subsidiary, State Grid Liaoning Electric Power Supply Company Limited, recently started construction of a 220 kV power transmission and transformation project in Dandong, a coastal city in north China's Liaoning Province.

The project involves the construction of a 220 kV power transformation station and 105.6-km transmission lines at an investment of CNY309 million. As a pilot for an intelligent power transformation station, it will be equipped with chips that are developed by SGCC.

(CNY1=USD0.014)

China's smart grid development on fast track

China is rapidly advancing its smart grid development, mainly driven by the need for stable and reliable power supply, as an increasing amount of power is generated from intermittent renewable energy sources (RES). The Huaon Industrial Research Institute has predicted that investment in China's smart grids is expected to experience a compound annual growth rate of 6.19 per cent from 2020 to 2025, reaching CNY158 billion by 2025.

Grid companies are also ramping up efforts to improve grid networks with advanced technologies. Recently, the State Grid Corporation of China's (SGCC) subsidiary, State Grid Shandong Electric Power Company's Laiwu power supply branch expanded the scope of drone inspection operations, and broadened the application of smart grids by conducting autonomous grid inspections using drones in some of its networks. The autonomous inspection system features real-time monitoring, inspection management, resource management, system management and statistical reporting functions. It enables real-time route editing and task deployment, on-site monitoring and automatic data collection throughout the entire operational process. Currently, the company uses drones to inspect grids at voltage levels of 1,000 kV and below, through 29 drone bases, each equipped with 75 drones.

(CNY1=USD0.14)

China's SGCC launches Qifan-19 ship for maritime transmission

China's largest network company, SGCC, launched the country's largest submarine cable construction ship on November 9, 2023. Known as Qifan-19, the ship was developed by SGCC independently for Guojiao No. 1, which is China's pioneering marine power transmission technology brand launched in August 2023.

The ship has a cable-carrying capacity of 10,000 tonnes and a displacement of 24,000 tonnes. It can be loaded with a 75-km, three-core, 220 kV AC submarine cable; 130-km, single-core, 300 kV DC submarine cable; or a 2,000-km, communication optical cable; and can lay and overhaul submarine cables in deep and open seas in China and Southeast Asia.

According to SGCC, the ship is equipped with the most advanced domestic, towed, water-spray cable burying machine, enabling a maximum buried depth of 4.5 metres, which can better protect submarine cables from anchorage loss.

SGCC claims that this machine has one of the deepest capacities in the world, as the present buried depth of submarine cables in other countries is usually 2 to 3 metres.

Currently, China's OSW energy development is focusing on deep and open seas, and transporting the power generated by OSW farms to land via submarine cables.

East China's Jiangsu to build 10 GW OSW energy base

East China's Jiangsu province is planning to build two clean energy bases with 10 GW generating capacity each by the end of 2027, to further promote the province's green and low-carbon development. By 2027, the installed capacity of OSW and offshore PV in Jiangsu's coastal areas is expected to increase by over 10 GW respectively.

To support this, SGCC subsidiary, State Grid Jiangsu Electric Power Company, will carry out a comprehensive application of power system technologies such as AC and DC transmission network, and new energy storage, to deliver clean energy in the northern and southern regions of Jiangsu. The company will also accelerate the transformation and upgrading of Jiangsu's backbone grids by promoting the construction of 500 kV coastal transmission channels.

Separately, the company will accelerate the digital transformation of power grids and further promote the aggregation and regulation of new energy, power load, and energy storage through collaborative operation and hierarchical control of the main power and distribution network, and micro-grids.

China's energy storage capacity to reach 300 GW by 2030

China's grid-connected energy storage capacity is expected to double by the end of 2023 compared to 2020, to reach 67 GW; with an outlook to expand to 300 GW by 2030. This was highlighted in a recent report from Wood Mackenzie—a UK-based research and consultancy group.

The report states that China will lead the global renewables energy market with a record-breaking 230 GW of wind and solar installations in 2023, which will be more than double the number of US and Europe installations combined.

China's wind and solar power investment for 2023 is expected to reach USD140 billion. China has been re-organising its power sector to support rapid electrification and expansion of renewables since announcing its 2060 carbon neutrality target in 2020.

China has reduced the share of coal in the generation mix by 10 percentage points in the last five years, with about 80 per cent of the reduction replaced by renewables and the rest mostly by nuclear power. Further, it has achieved low solar and wind curtailment rates of 2 per cent and 4 per cent respectively in 2022, improving project economics compared to previous years. China has earmarked USD455 billion for grid investments from 2021-25, up 60 per cent from the previous decade. This includes long-distance transmission lines over 1,000 km, which will unlockmore than 100 GW of renewables development in inland China.

CHN Energy, Longyuan plan 11 GW of clean energy in Chinese desert

China Energy Investment Corporation (CHN Energy) and its majority-owned unit, China Longyuan Power Group, have agreed to set up a CNY3 billion joint venture (JV) to build a multi-GW-scale clean energy desert base in China, including renewables and energy storage. The Badain Jaran (Gansu) Desert Base in Gansu province involves the construction of up to 11 GW of new energy capacity with supporting peak load regulation of thermal power, energy storage, and solar thermal power projects.

The JV is expected to fully utilise Longyuan's expertise and technological advantages in the field of new energy and take advantage of CHN Energy's strength in the development, construction and operation of thermal power projects. The JV could have a broad business scope including power generation, transmission and supply, solar and wind power generation technology services, energy storage, sales of solar thermal power generation equipment, leasing of PV equipment, and recycling technologies.

Under the terms of the agreement, Longyuan will invest CNY1.53 billion for a controlling of 51 per cent stake in the JV, while CHN Energy will provide CNY1.47 billion. The timing of the formal capital injection will be determined based on the progress achieved on the project, but no later than December 31, 2033. The project has not received approval yet. If approved and built, it will be among the world's largest renewable energy generating sites, behind the planned 20 GW Jiuquan wind base, which will also be located in Gansu.

(CNY1=USD0.14)

Indian CERC rules equal sharing for HVDC corridor tariff

The Indian energy regulator, Central Electricity Regulatory Commission (CERC), has ruled that 50 per cent of the tariff for the Raigarh–Pugalur–Thrissur HVDC transmission corridor developed by Power Grid Corporation of India Limited (POWERGRID), would be included in the national component, while the southern beneficiaries, including state-owned utility Tamil Nadu Generation and Distribution Company (TANGEDCO), would bear 50 per cent. Tamil Nadu and other southern states had been seeking for 100 per cent of the tariff to be included in the national component.

The project, which was completed in 2021, comprises two sections – the 1,830-km-long, 6 GW, ±800 kV ultra-high voltage direct current (UHVDC) bipole link between Raigarh in Chhattisgarh to Pugalur in Tamil Nadu passing through the states of Maharashtra, Andhra Pradesh, and Telangana; and the 165-km-long, 1 GW, ±320 kV HVDC line from Pugalur to Thrissur (Madakkathara) in Kerala (including 27 km of underground cable). The INR200 billion project facilitates the transfer of surplus power from Raigarh to the southern region, and is a part of the green energy corridor for the transfer of renewable energy from the southern states to the rest of India.

Earlier, CERC had notified a tariff that provided for 30 per cent of the tariff to be included as a national component to be borne by all power distribution companies, and the rest 70 per cent to be borne by the southern beneficiaries.

In March 2022, Tamil Nadu Chief Minister requested the Prime Minister to declare the project as an asset of strategic and national importance. In May 2022, the Ministry of Power (MoP) wrote to CERC, recommending that the transmission charges for the line be considered under the national component. However, in September 2022, CERC ruled that it was not an appropriate forum to declare any transmission asset to be of national and strategic importance.

TANGEDCO then moved the Appellate Tribunal for Electricity (Aptel) against the ruling. In July 2023, Aptel ruled in favour of Tangedco and directed CERC to pass a fresh order. Subsequently, CERC passed an order for the sharing of tariff in a 50:50 ratio between the national component and southern beneficiaries. POWERGRID commenced billing for the tariff in this ratio from October 27, 2023.

TANGEDCO had argued that CERC, in its earlier decisions, had declared the Biswanath Chariali/Alipurdwar (north-eastern region)–Agra (northern region) HVDC, and Mundra (western region)—Mohindergarh (northern region) HVDC transmission systems as having strategic and national importance. The transmission tariff for these assets was recovered on an all-India basis, though the southern region did not benefit. Tangedco had paid a total of about INR6,142.2 million for these corridors without any usage. Due to the refusal to declare the Raigarh–Pugalur corridor a national asset, Tamil Nadu alone incurs an expense of INR5 billion annually, which is passed on to consumers. Tangedco plans to file an appeal against CERC's latest order.

(INR1=USD0.012)

MoP approves Indian POWERGRID's revised route for OHLs in Rajasthan

The Indian MoP has granted authorisation to POWERGRID subsidiary, POWERGRID Bhadla Transmission Limited, for the establishment of overhead lines (OHLs) on a revised route to facilitate the evacuation of 8.1 GW of power from the solar energy zone in Rajasthan as part of Phase-II Part B. POWERGRID had acquired the special purpose vehicle in June 2021.

The modified route, named the 765 kV Fatehgarh II Pooling Station (PS)–Bhadla II PS D/C line (second), will pass through several villages in Fatehgarh and Pokharan. This decision follows the Central Electricity Authority's (CEA) prior approval for the OHLs across Rajasthan's solar energy zone. To address concerns related to the endangered Great Indian Bustard (GIB), POWERGRID Bhadla Transmission sought clearance from a technical committee mandated by a Supreme Court order. The committee approved the rerouting of approximately 36 km of the transmission line. The approved authorisation is valid for 25 years and is subject to specific conditions, including obtaining consent from relevant authorities, strict adherence to regulations, and compliance with the requirements of the Electricity Act, 2003.

In case part of the OHL passes through the GIB area, POWERGRID Bhadla Transmission has to comply with the directions of the Supreme Court and the technical committee to underground the lines and/or install bird diverters.

Indian PFCCL incorporates SPV for transmission projects

Indian PFC Consulting Limited (PFCCL) has incorporated a new special purpose

vehicle (SPV) – Halvad Transmission Limited, as a wholly owned subsidiary for development of the "Transmission system for evacuation of additional 7 GW of power from Khavda renewable energy park under Phase III Part A".

The scope of the project includes construction of the – 765 kV Halvad switching station with 765 kV, 2×330 MVAr bus reactors; 220 km, 765 kV Khavda Pooling Station 2 (KPS2) (gas-insulated switchgear – GIS)–Halvad D/C line; 240 MVAr switchable line reactor on each circuit at both ends of the KPS2–Halvad line; two 765 kV GIS line bays at KPS2 for termination of the KPS2–Halvad line; and 30-km line-in-line-out (LILO) of the 765 kV Lakadia–Ahmedabad D/C line at Halvad.

PFCCL has been nominated as the bid process coordinator (BPC) for the selection of a developer through tariff-based competitive bidding (TBCB) for this independent transmission project (ITP), by the Ministry of Power.

In another development, PFCCL has incorporated a SPV for the development of an ITP in West Bengal under the TBCB route. The SPV is Ramakanali B Panagarh Transmission Limited for the development of an intrastate transmission scheme consisting of Package-A (West Bengal): (i) 400/220/132/33kV GIS substation at Ramakanali-B along with associated transmission lines, and (ii) 220/33 kV GIS substation at Panagarh along with associated transmission lines. The associated transmission lines involve the construction of LILO of five existing lines at 400 kV, 220 kV and 132 kV voltages aggregating 114 route-km. In May 2023, central power utility Damodar Valley Corporation (DVC) appointed PFCCL as the BPC for the development of the intra-state transmission scheme.

The said scheme has a complementing portion in Jharkhand. DVC has appointed PFCCL as the BPC for this scheme consisting of Package B (Jharkhand): (i) 400/220/132/33 kV substation at Gola-B along with associated transmission lines, and (ii) 220/33 kV substation at Ramgarh along with associated transmission lines. Package B will also be implemented under the TBCB modality. PFCCL is in the process of selecting a technical consultant for the project survey and preparation of the project report for both the intra-state schemes – Package A (West Bengal) and Package B (Jharkhand).

India's POWERGRID announces investment plans for Indian projects

India's largest network developer, POWERGRID, has estimated a capital expenditure (capex) of INR1.88 trillion by 2032. Of this, the company is looking to spend INR1.16 trillion on interstate transmission system (ISTS) projects, INR370 billion on intra-state transmission projects, INR100 billion on cross-border business, and INR75 billion on international operations by 2032. It will also spend INR150 billion on smart metering infrastructure during this period. In the RES space, POWERGRID will add solar power projects, for which it has kept an amount of INR10 billion.

The company's capex target for the ongoing fiscal 2023-24 (ending March 31, 2024) is INR88 billion, which may extend to INR100 billion backed by the several projects it has in its portfolio. Till September 2023, POWERGRID's capex stood at INR42.46 billion.

It also aims to start data centre operations with a pilot project in Manesar, Gurugram and is exploring such centres in other areas. This will be taken up by the company's subsidiary PowerGrid Tele Services Limited. The capital expenditure earmarked for this venture is INR10 billion till 2032.

In another development, POWERGRID's committee of directors on investment on projects, has approved an investment worth INR3.67 billion in two projects in the states of Telangana and Gujarat.

The project in Telangana, with an estimated cost of INR1.43 billion, involves the augmentation of transformation capacity by a 1,500 MVA, 765/400 kV interconnecting transformer (ICT) (3rd) at the Maheshwaram substation. It is to be commissioned within 21 months from July 10, 2023 – the date of intimation by Central Transmission Utility of India Limited (CTUIL), which is by April 9, 2025.

The Board also approved the 'Transmission system for evacuation of power from the potential renewable energy zone in Khavda area of Gujarat under Phase IV (7 GW) – Part E4' at an estimated cost of INR2.24 billion. This is scheduled to be commissioned within 24 months from the date of intimation by CTUIL (July 10, 2023), which is by July 9, 2025.

(INR1=USD0.012)

India's POWERGRID wins two ISTS projects in TBCB auction

POWERGRID has been declared a successful bidder under TBCB to establish two ISTS projects on a build, own, operate and transfer (BOOT) basis.

The first project is the "Transmission system for evacuation of power from a renewable energy zone (REZ) in Rajasthan under Phase-IV (Part 1) (Bikaner Complex), Part A". It comprises the construction of a 765/400/220 kV PS at Bikaner III, two 400 kV D/C and one 765 kV D/C line along with bay extension works in the state of Rajasthan.

The second project is the "Transmission system for evacuation of power from Rajasthan REZ under Phase-IV (Part 1) (Bikaner Complex), Part D". It comprises the construction of a 765 kV D/C line along with bay extension works in Rajasthan and Uttar Pradesh.

In a separate development, POWERGRID's wholly owned subsidiary, POWERGRID Meerut Simbhavali Transmission Limited, has commissioned two GIS substation projects in the Indian state of Uttar Pradesh. POWERGRID had secured the project through TBCB, with a mandate to set up the 765/400/220 kV Meerut GIS substation and the 400/220/132 kV Simbhaoli GIS substation, along with the associated transmission lines. The latter include the construction of line-in-line-out of 765 kV Greater Noida–Hapur line at Meerut substation as well as 400 kV Simbhaoli–Muradnagar II (Ghaziabad) and Simbhaoli–Meerut D/C lines. POWERGRID Meerut Simbhavali Transmission is a SPV acquired by POWERGRID in December 2019 for the construction of the two substations.

Indian state launches first 400 kV GIS substation in Kottayam

The Indian state of Kerala put into operation the state's first 400 kV substation with GIS at Kuravilangad in Kottayam. The substation, established at a cost of

INR1.52 billion with financial assistance from the Kerala Infrastructure Investment Fund Board (KIIFB), is part of Kerala State Electricity Board Limited's (KSEB) TransGrid 2.0 scheme, which is designed to strengthen the power transmission network across Kerala. The new substation will help in the transmission of power from the Kudankulam Nuclear Power Plant (KNPP) in the state of Tamil Nadu to central Kerala through the 400 kV Tirunelveli–Kochi line. The power will then be redistributed to Kottayam, Alappuzha and Ernakulam districts through 220 kV lines.

To enable this, a network comprising four 400 kV feeders, two 315 MVA transformers and six 220 kV feeders, has been set up. The redistribution of power will take place through the 220 kV substations at Pallam, Ettumanur and Ambalamugal respectively. Further, feeders have been set up at four locations, and the installation of 400 kV lines, and 220 kV/110 kV substations and related multi-circuit lines have also been completed. It is reported that with the realisation of these substations and related projects, the annual transmission loss will be reduced by 119.65 GWh.

Built on 13.51 acres, the 400 kV GIS substation is equivalent to setting up a 24.7 MW power generation plant. It will also help increase the power import capacity of the state to 3,860 MW. The project will have low maintenance costs and downtime due to the deployment of GIS technology. It also required less than half the space of a conventional substation. Works on the project commenced in October 2020.

(INR1=USD0.012)

India's ReNew commissions first ISTS project in Karnataka

ReNew, India's leading decarbonisation solutions company, has announced that it has commissioned its first ISTS project, the Koppal Transmission Scheme, which will help in the transmission of 1,500 MW of renewable energy in the Koppal area of Karnataka state. The scheme was awarded to ReNew in 2021-22 and covers the construction of a new 400/220 kV substation at Koppal, along with 276 circuit-km (ckt-km) of 400 kV D/C quad moose transmission line with the extension of 400 kV GIS bays at the POWERGRID Narendra (New) substation. The remaining transmission for 3,500 MW is expected to be completed by June 2024.

In another development, ReNew signed an agreement for a second joint investment in the transmission sector with Norfund – the Norwegian government's investment fund for developing countries, and KLP – Norway's largest pension company, through their joint company KNI India AS. Norfund's share is from Norway's newly established Climate Investment Fund, managed by Norfund. According to the agreement, Norfund and KLP will invest INR730 million for a 49 per cent stake in the project in Gadag district in Karnataka. The project involves the construction of a 2×500 MVA, 400/220 kV substation at Gadag with 400 kV D/C transmission line from the Gadag substation to the Narendra (New) substation and 400 kV GIS extension at Narendra (New); and 3×500 MVA, 400/220 kV augmentation at the Gadag substation with 400 kV D/C transmission line from the Gadag substation to the Koppal substation and 400 kV AIS bays extension at the Koppal and Gadag ends. The commercial operations for this project are expected to start in two phases – in the last quarter of 2023-24 and first quarter of 2024-25.

ReNew has won three ISTS projects in Karnataka – part of the ISTS for transmission of 5 GW of wind and solar power potential identified in the state under Phase I for implementation and interconnection with the ISTS grid, for a period of 35 years. The central government-owned CTUIL will be responsible for billing, collection and disbursement of the revenue for these transmission projects.

(INR1=USD0.012)

Pakistan's Nepra grants transmission licence to Punjab Grid Company

Pakistan's National Electric Power Regulatory Authority (Nepra) has granted a transmission licence to Punjab Grid Company Limited (PGCL) – a newly created subsidiary of the Punjab provincial government. This allows the company to start electricity transmission operations across the province and facilitate power evacuation from generation plants, particularly RES projects that are not served by the national grid.

The licence would have a 30-year term ending on November 7, 2053, and could be renewed for a period as approved by the regulator. This will be the third provincial grid company (PGC) to have been given a transmission licence by the regulator after Sindh and Khyber Pakhtunkhwa. Nepra has directed PGCL to file a separate petition for determining the use-of-system charge of its projects for transmission lines and grid stations as stipulated in the relevant rules.

Punjab-based former Water and Power Development Authority (WAPDA)-distribution companies from Multan, Gujranwala, Lahore and Faisalabad had opposed the transmission licence to PGCL on various grounds. Nepra, however, overruled those objections. It noted that considerable investment had been made in the country's generation segment over the past decade and significant potential of hydro, solar and wind resources were located in the northern, centre and southern parts of Punjab. However, the availability of the required transmission and grid infrastructure is hindering the development of such resources, while existing plants are facing issues due to weak infrastructure in the north and south, including curtailment of power during the peak season. Therefore, Nepra opined that there is huge scope for investment in the transmission segment of the electric power sector. Notably, Section 18A of the Nepra Act allows the establishment of a PGC for transmitting electricity within a province.

In its submission, PGCL claimed that Punjab had the highest share in the country's installed generation capacity at 18,524 MW or 42.3 per cent, and the number of consumers at 26 million or 78.39 per cent; while electricity consumption stood at 83.68 TWh or 77.58 per cent with revenue collection from power sales at PKR1.8 trillion or 82.54 per cent.

(PKR1=USD0.0035)

Turkish SA-RA Energy offers to complete Pakistan's Dasu transmission project

Turkish company SA-RA Energy, which was the second lowest bidder for the tender for a 765 kV D/C transmission line from Dasu Hydro Power Station to Islamabad, has offered its services to the

Pakistan government to take over the contract for its timely completion. It made this submission while briefing the Senate Standing Committee on Power about the mis-procurement of the project. SA-RA pointed out irregularities in the award of the USD300 million contract (Lot 1) to Chinese SinoHydro Corporation for the World Bank-funded 157-km Dasu transmission line project. The World Bank had approved financing of USD700 million for two lots of the project, which are under construction.

SA-RA has alleged that the successful Chinese bidder does not have the appropriate experience. The former has held meetings with Pakistan's state-owned National Transmission and Despatch Company (NTDC) regarding the same. The committee, which was apprised that the matter is sub-judice in the court, deliberated at length the irregularities in the transmission line contract. It remarked that huge violations occurred in the award of contracts to disqualified firms for LoT-1 (SinoHydro Corporation), and LoT-II (Chinese Harbin Electric International and consultant, German GOPA Intec).

The World Bank has started the audit of the contract and the project will proceed further after its final report. The committee decided to convene an in-camera meeting so that a reconciliation can be reached to ensure that the World Bank does not withdraw funding and some relief is extended to the Turkish firm.

Nepal's energy ministry directs NEA to expedite 400 kV line construction

The Minister for Energy, Water Resources and Irrigation (MoEWRI) has directed the Nepal Electricity Authority (NEA) to complete the construction of the 400 kV Hetauda–Dhalkebar–Inaruwa transmission line immediately by taking necessary measures, such as help from local security personnel and administration.

The 288-km line starts from the Thanabhayang substation in Hetauda sub-metropolitan city in Makwanpur district, to the Inaruwa substation in Sunsari district, passing through Dhalkebar in Dhanusha district. It is divided into two sections: 134-km Hetauda–Dhalkebar and 154-km Dhalkebar–Inaruwa. The line, which involves the erection of 792 towers in Pahari, Shivalik Chure and Terai regions, traverses through 10 districts of Makwanpur, Bara, Rautahat, Sarlahi, Mahottari, Dhanusha, Siraha, Saptari, Udaipur and Sunsari, connecting and impacting a broad geographical area.

The project, which started construction almost nine years ago, is yet to be completed due to various obstacles. Currently, progress is being made with 4 km of wire installed in the Hetauda–Dhalkebar section and 40 km in the Dhalkebar–Inaruwa section. While foundations for 757 towers have been laid and 750 towers have been erected, 35 towers are facing delays due to local opposition. The line, stretching from Hetauda to Bhokraha Narsingh, has been hindered by local demands for a change in the route, procedural confusion in forest land use, delays in tree-felling approvals, and poor performance of the contractor among other things.

According to NEA, the project involves an additional budget of NPR10 billion split equally between the need for the distribution of compensation for the land under the transmission line, and construction professionals.

Due to the delay, power from the 456 MW Upper Tamakoshi Hydropower Project cannot be transmitted to the west from the Dhalkebar substation due to a lack of line capacity. Currently, there is only a 132 kV line from Dhalkebar to the west. Further, earlier in September 2023, Indian and Nepal reached an understanding on increasing the volume of power traded through the 400 kV Dhalkebar (Nepal)–Muzaffarpur (India) interconnection beyond 800 MW up to 1,000 MW, which is possible only once the Hetauda–Dhalkebar–Inaruwa project is commissioned in Nepal.

NEA is under pressure to complete the construction of the line within the next four months.

Nepal's NEA to strengthen Koshi grid and commissions Basantapur substation

The state-owned NEA is strengthening the ageing grid by constructing new lines and substations to reduce the load of the 132 kV substation at Duhabi in Sunsari for power supply in the Morang and Sunsari industrial corridors in Koshi province. To address the issue of frequent line tripping in industries mainly during summer, NEA is building new lines and substations and upgrading substation capacity to provide reliable and quality electricity to industrial and other customers in that area.

The plan is to reduce the existing power supply load at the Duhabi substation by supplying electricity from Inaruwa, which has substations based on 400, 220, 132 and 33 kV systems. Electricity generated from hydropower projects constructed or to be constructed on the Arun and Tamor rivers and their tributaries will be connected to the Inaruwa substation through the 220 kV Koshi Corridor transmission line. Meanwhile, electricity produced in the rivers of Taplejung, Panchthar and Ilam districts will reach Damak in Jhapa through the Kabeli Corridor transmission line. Further, a 132 kV transmission line is being constructed from the Inaruwa substation to deliver electricity to the substation under construction in the Barju rural municipality of Sunsari. Construction of this substation has been delayed due to the poor performance of the contractors – Chinese Shandong Taikai Power Engineering, and Nepalese Mudbhary & Joshi Construction. NEA has instructed the contractors to complete the construction by mid-March 2024.

Further, the foundations of 73 out of 80 towers on the 23-km, 132 kV Inaruwa–Biratnagar line have been laid and transmission wires have been supplied. However, construction of two towers could not be initiated due to local hurdles and of another five towers due to technical problems. Meanwhile, with the completion of the construction of a 33 kV double-circuit line from the Inaruwa substation to Khanar, which is in the final stage, the load of Duhabi substation can be reduced by 40 MW.

In another development, NEA put into operation the 220/132/33 kV Basantapur substation in Dharmadevi municipality, Sankhuwasabha district, Koshi province, Nepal. Built at a height of 2,450 metres above sea level, the substation is part of a 220 kV transmission line under the Koshi Corridor and will transmit electricity coming from Tumlingtar (in Sankhuwasabha district) and Dhungesanghu in the Taplejung district. It is considered to be important for the electrification of the eastern part of the corridor.

Through the entire Koshi Corridor project, about 1,000 MW of electricity can be transmitted from Tumlingtar to Basantapur, Dhungesanghu to Basantapur, and about 2,000 MW from Basantapur to Inaruwa. The corridor is Nepal's longest 220 kV transmission line so far.

Jointly financed by the Nepal Government, NEA and Export-Import Bank of India (India Exim Bank), the Koshi Corridor project aims to evacuate power from hydropower projects being constructed in the Taplejung, Tehrathum, Sankhuwasabha and Bhojpur districts of Koshi province, to the national grid. The hydropower projects are being built on the Arun and Tamor rivers and their tributaries, and will be connected to the Inaruwa substation through the 220 kV Koshi Corridor transmission line. Under the latter project, NEA has already commissioned the 30-km, 220 kV Tumlingtar–Baneshwar–Basantapur and 76-km Basantapur–Inaruwa lines.

Further, 200 kV substations constructed in Inaruwa of Sunsari district, and Tumlingtar and Baneshwar of Sankhuwasabha, have been operational since July 2022. The Indian company Larson & Toubro (L&T) was awarded a contract worth USD26.01 million in June 2018 to build the substations.

Currently, the last section of the Koshi Corridor project—the 34-km-long, 220 kV Basantapur–Dhungesanghu D/C line—is under construction, in addition to the 132 kV substation at the Dhungesanghu substation. Out of 128 towers on the Basantapur–Dhungesanghu line, only six towers are left to be constructed. Works are underway to complete the S/C, 26-km line by January 2024. The contract for the construction of the second circuit has been signed and the work has started with a target to complete it by February 2024.

Further, about 95 per cent construction of the Dhungesanghu substation has been completed. The 73 MW each Middle Tamor and Middle Mewakhola hydropower projects, which are in the final stage of construction in Taplejung, will be connected to the USD112 million Basantapur–Dhungesanghu transmission line. The latter was built with investment by the government of Nepal and a concessional loan of USD90 million from India's Exim Bank.

Sri Lanka's Cabinet approves key electricity sector reforms

The Sri Lankan Cabinet has approved the proposed Electricity Sector Reforms Bill, which will now be gazetted and presented in the Parliament for approval.

Once approved, the new Electricity Act will enable the unbundling of Ceylon Electricity Board's (CEB) services, restructure CEB, and improve efficiency, transparency and accountability in the power sector. It will also allow private sector participation across generation, transmission and distribution.

Bangladesh approves first OSW project

The Bangladesh government has given in principle approval to a green investment proposal worth USD1.3 billion for developing the country's first 500 MW utility-scale OSW project by Denmark's Copenhagen Infrastructure Partners (CIP) and Copenhagen Offshore Partners (COP), in association with Bangladesh's Summit Group. The three entities had jointly submitted the foreign direct investment (FDI) proposal in July 2023 to the government. The latest approval from the latter is for carrying out a detailed feasibility study and implementing the first phase of development with site exclusivity in the next three years.

The proposed project site is located offshore of Cox's Bazar district. Once operational, electricity will be supplied directly to the national grid via an onshore substation.

Vietnam's EVNNPT establishes committee for 220 kV interconnection with Laos

State-owned EVN subsidiary, National Power Transmission Corporation (EVNNPT), has established a Steering Committee and promulgated its working regulations for the construction of the 220 kV Nam Sum (Laos)–Nong Cong line in Vietnamese territory. The committee is responsible for directing, inspecting and advancing the construction to ensure its timely completion with the required quality, and compliance with regulations. The project is being managed by EVNNPT's unit, Northern Vietnam Power Projects Management Board (NPMB).

The Nam Sum–Nong Cong line is about 130 km long, including two circuits from connection point G1 (at the Vietnam–Laos border) to the 220 kV Nong Cong substation, including 299 column foundation positions and 99 anchorages. The route passes through the Que Phong and Quy Chau districts of Nghe An province spanning 77.31 km, and Nhu Xuan, Nhu Thanh and Nong Cong districts of Thanh Hoa province spanning 52.64 km. The entire route has up to 234 column foundation locations affected by forests.

The project is behind schedule due to issues with forest use conversion and site clearance. It is an urgent project under development for importing electricity from the Nam Sum hydropower plant cluster (Laos) to Vietnam to meet the increasing demand of the Northern region.

Construction on the project commenced in December 2021 and is expected to complete in January 2024.

First turbine installed at Laos' 600 MW wind project for export to Vietnam

The first turbine of the 600 MW Monsoon onshore wind project located in southern Laos, has been installed. The USD1.5 billion wind project is being developed by Impact Energy Asia Development (IEAD), a joint venture of Impact Wind Investment Limited (owned by Mitsubishi Corporation and an affiliate of Impact Electrons Siam) (55 per cent) and Thailand's BCPG Public Company Limited (BCPG) (which is a part of the Bangchak Corporation Plc group of companies) (45 per cent). PowerChina is the contractor for the project. It is Laos' first wind power plant although it has 4.9 GW of wind projects under development.

The Monsoon wind project is being constructed on an area covering 640 square km in the districts of Dak Cheung and Sanxay. The government of Laos has granted a 25-year concession with BCPG for the project, which is expected to become operational by 2025. Power generated from the project will be sold to the state-owned company EVN via a 500 kV transmission line, under a 25-year power purchase agreement (PPA) signed with EVN in July 2021.

Vietnam's EVNNPT makes progress on 500 kV projects

EVNNPT and Central Power Project Management Board (CPMB), subsidiaries of EVN, have launched the construction of the 500 kV Binh Duong 1 transformer station project in An Binh commune of the Phu Giao district, Binh Duong province of Vietnam. EVNNPT will provide the investment for the project while CPMB will manage it. Power Construction Consulting Joint Stock Company 4 is responsible for the construction survey and design; Joint venture PC1 Thang Long and Alphanam E&C will construct the station; and Power Transmission Company 4 will operate it.

The scope of the project includes the construction of a new 500/220 kV transformer station with two 500/220/35 kV transformers with a capacity of 900 MVA. The first phase will involve the installation of one transformer.

Once completed, the project will help improve the reliability of the electricity supply for Binh Duong province and the southern economic development region, support capacity and prevent overload for the 500 kV Song May and Tan Dinh substations, and ensure safe operation of the power transmission system.

Currently, the site clearance work for the project has been completed. CPMB has requested construction units and supervision consultants to strengthen and mobilise forces, and closely coordinate with the management unit to ensure quality and timelines. The project will be energised in 2024 under the direction of EVNNPT.

In another development, EVNNPT is making progress on the 500 kV Quang Trach–Pho Noi transmission line project. The 513-km project comprises four sections of Quang Trach–Quynh Luu (226 km), Quynh Luu–Thanh Hoa (91 km), Thanh Hoa–Nam Dinh 1 (73 km) and Nam Dinh 1–Pho Noi (123 km), and will boost interregional connections and help ensure power supply for the northern region.

The People's Committee in Vietnam's northern Nam Dinh province has approved an additional land use plan for the implementation of the Nam Dinh 1–Thanh Hoa and Nam Dinh 1–Pho Noi sections. With this, Nam Dinh became the first locality to approve the land use plan for the project. The province assigned 1.72 hectares and 9.88 hectares of land for the two sections respectively. The lines will pass through the Nghia Hung, Hai Hau, Truc Ninh and Nam Truc districts of the province. EVNNPT had recently proposed that local authorities should complete the handover of sites for lines by January 31, 2024 and February 29, 2024, respectively.

Separately, EVNNPT held a meeting with Thanh Hoa Provincial People's Committee for implementation of the Nam Dinh I–Thanh Hoa section. In Thanh Hoa province, the project passes through six districts, including Nga Son, Ha Trung, Hau Loc, Hoang Hoa, Yen Dinh and Thieu Hoa, with 133 column foundation locations, a route length of about 56.4 km, and land recovery area for the column foundations of 11.32 hectares, involving 490 affected households. For site clearance work, four districts have established compensation, support and resettlement councils, while two districts are in the process of doing so.

For this section, EVNNPT has recommended that the provincial Department of Natural Resources and Environment create conditions to speed up and shorten the approval time for mapping work on the project. Further, it has requested support from local units for land clearance procedures to hand over the site of the pier foundation and corridor before February 29, 2024.

To resolve problems related to land use expenditure of the Quang Trach–Quynh Luu and Quynh Luu–Thanh Hoa sections, the Deputy Prime Minister has given directives to the People's Committees of Nghe An and Ha Tinh provinces and the Ministry of Natural Resources and Environment to speed up the process.

PTC 3 speeds up Vietnam's North-South Expressway power project

State-owned EVN subsidiary EVNNPT unit, Power Transmission Company 3 (PTC 3), is speeding up the progress of the North-South Expressway power project passing through the Binh Dinh province. The project is divided into three parts – Quang Ngai–Hoai Nhon, Hoai Nhon–Quy Nhon and Quy Nhon–Chi Thanh – with a total length of about 118.8 km (passing through eight districts, towns and cities with 30 communes and wards) and has 11 intersections with 220 kV transmission lines managed by Binh Dinh Power Transmission (under PTC 3).

So far, Binh Dinh Power Transmission has coordinated with relevant parties to complete temporary line connections for seven of the 11 intersection points. Further, the renovation and relocation of two intersections of the 220 kV Quy Nhon–Tuy Hoa line and the Phu My–Phuoc An line with the North–South Expressway have been completed. Of the remaining intersections, one point is with the Quang Ngai–Hoai Nhon Expressway section, five points with the Hoai Nhon–Hoai Nhon Expressway section, and three points with the Quy Nhon–Chi Thanh Expressway.

To overcome difficulties and carry out the relocation of intersection points on schedule, Binh Dinh Power Transmission has increased the allocation of more human, material and vehicle resources. It will continue to coordinate closely with the Provincial Land Clearance Board and relevant parties to participate in monitoring activities, and for landowners' acceptance of renovation and relocation of the remaining intersection points.

EVNNPT meets Vinh Chau authorities to resolve 220 kV project siting issues

EVN's subsidiary, EVNNPT, and its branch – Southern Power Project Management Board (SPMB), held a working session with the Standing Committee of Vinh Chau City Party Committee (Soc Trang Province) and the Town People's Committee among others, to remove the issues with siting for the 220 kV Vinh Chau transformer station and connection project.

SPMB completed and energised Phase 1 of the project on time, as assigned, for the evacuation of wind power in the town in 2021. Currently, SPMB is working on Phase 2 to complete the entire project in the fourth quarter of 2023 at the request of the National Steering Committee for Electricity Development and the People's Committee of Soc Trang province.

The project is, however, facing difficulties in the compensation and site clearance work, as there are still some households that have not received land clearance compensation or corridor

support money and have not allowed installation of the transmission wires. All 18 foundations have been completed along with all 18 pillars erected, while wires have been installed from the transformer station to Position 2 and from pillars 6 to 10. To adhere to the energising schedule, EVNNPT and SPMB requested the Vinh Chau authorities to continue to organise and mobilise the households that have not received compensation so that they can hand over their premises to proceed with pulling the transmission wires.

Once completed, the 220 kV Vinh Chau transformer station will help – increase transmission output for EVNNPT, ensuring electricity supply for loads in Soc Trang province and surrounding areas, and contribute to releasing the capacity of renewable energy power plants in the region; and reducing the load on 220/110 kV transformers at 220 kV substations in Soc Trang, Bac Lieu and Vinh Chau, and on 110 kV lines in the region.

EVNNPT invites banks to finance 13 transmission projects in Vietnam

State-owned EVN subsidiary, EVNNPT, has issued a notice inviting banks and credit institutions to participate in financing 13 power transmission projects through competitive offers.

The projects include both transmission substations and lines with a combined investment of VND7,032.1 million. EVNNPT is seeking debt financing for about 70 per cent of this amount. Some of the projects include the expansion of the 500 kV West Hanoi, Lai Chau, and Chon Thanh substations, and 220 kV Thanh My–Duy Xuyen and Tuong Duong–Do Luong lines.

The related notice documents is available from December 1, 2023 with a deadline for submitting applications from December 21 to December 22, 2023.

(VND1=USD0.000044)

Philippines' ERC cuts NGCP allowable revenues by more than half

The Philippines' Energy Regulatory Commission (ERC) has pared National Grid Corporation of the Philippines' (NGCP) allowable revenues by more than half to PHP183,491 million, which is much less than the latter's original claim of PHP387,803 million as applied for under its fourth regulatory reset. In ERC's partial ruling on NGCP's tariff setting covering the 2016-20 period, it was emphasised that its allowable revenues had been at an average of PHP36.7 billion annually compared to the PHP77.56 billion annual revenues claimed by the company. The interim maximum annual review (iMAR) allowed NGCP to generate revenue of PHP51.47 billion in March 2022. This amount has been further slashed in the latest reset.

NGCP has called the ERC ruling a retroactive decision. The former has claimed that its legitimate business costs under the same rules applied to the National Transmission Corporation (TransCo) have been disallowed. NGCP took over the management of the national transmission system from TransCo in 2009 after the privatisation of the power grid operations and maintenance.

On its part, ERC has clarified that NGCP will still be allowed eventually to recover costs relating to planned capex projects that were disallowed in the partial rate-setting because these have not reached 80 per cent completion yet. There were only 12 transmission projects classified as energy projects of national significance (EPNS) that had been included in the capex calculation for the allowable revenue requirement of NGCP for the 2016-20 period. These are the 230 kV Calaca–Dasmarinas project; 230 kV Cebu–Negros–Panay (CNP) backbone project (Stage 1); 500 kV Western Luzon backbone project (Stage 1 – 500 kV Castillejos–Hermosa project); 230 kV Tuguegarao–Lal-lo (Magapit) project; CNP2; Pagbilao substation project; 230 kV Bataan grid reinforcement project; 69 kV Clark–Mabiga project; 500 kV Hermosa–San Jose project; Negros-Panay interconnection uprating project; Northern Panay backbone project; and the power circuit breaker (PCB) replacement project in Mindanao. The implementation of these specified projects had been spread from 2016 until 2020 with more than 80 per cent completion and a total capital outlay of PHP64.405 billion.

ERC qualified that at least 81 projects worth PHP49.955 billion had been categorised as construction work in progress (CWIP). Beyond these, there are other ongoing projects not accounted for yet in the review of the capex component for NGCP's rate-setting and may be recovered in the next regulatory reset as ERC will continue deliberating on the forward tariff regulation for NGCP, including its fifth regulatory period covering 2023 to 2028.

In NGCP's original filing, it applied for PHP145.75 billion worth of capex; with an additional bid of PHP3.5 billion worth of asset acquisitions. The substantially slashed cost recoveries on its capex application contributed to the resulting low allowable revenues.

(PHP1=USD0.018)

Philippines' NGCP's key projects face further delays in completion

NGCP PHP51.3 billion Mindanao–Visayas Interconnection Project (MVIP) has been delayed from reaching its full capacity once again from its original deadline this year. The delay has been caused by a TRO issued by the Supreme Court affecting the construction of NGCP's 230 kV Cebu–Magdugo transmission line, which is part of the Cebu–Negros–Panay Stage 3 (CNP3) Backbone Project. Completion of CNP3 is crucial to the full operation of the 450 MW MVIP, which is currently operating at around 60 per cent or 270 MW. CNP3 was also supposed to be completed this year as well.

MVIP involves the construction of a 92-km-long, 450 MW, ±350 kV HVDC submarine cable between the Santander (in Cebu, Visayas) and Dapitan (in Zamboanga del Norte, Mindanao) cable terminal stations (CTS); a 50-km-long, ±350 kV HVDC overhead transmission line (OHTL) from Santander CTS to the Sibonga converter station in Cebu; a 135-km-long, HVDC OHTL from Dapitan CTS to the new Aurora converter station in Mindanao; new converter stations, including associated electrode stations and electrode lines in Sibonga and Aurora; a new substation in Umapad, Cebu, including associated transmission line extensions from the Cebu–Lapu transmission line cable; CTSs in Santander and Dapitan; and expansion of the Magdugo (in Cebu) and new Aurora substations.

The Tourism Infrastructure and Enterprise Zone Authority (Tieza) had filed for a TRO in September 2022 against the

construction of the Cebu–Magdugo line because two of its tower sites were located on Tieza's property, which was intended to be developed into a golf course. NGCP, however, indicated that it had already issued a 'writ of possession' for the property since October 2022. Following the issuance of the TRO, NGCP has ceased all project-related operations near Tower 111 and the associated sections of Towers 110-112.

NGCP had submitted its response to the petition for certiorari that had been lodged with the Supreme Court on September 26, 2023 and is awaiting the final resolution of the case.

Both the MVIP and CNP-stage 3 transmission projects had been classified as EPNS. The full commercial operation of the MVIP project is being pushed aggressively by the DOE as it will enable the export of Mindanao's surplus capacity to the Luzon and Visayas grids.

(PHP1=USD0.018)

Philippines' NGCP seeks resolution of TRO on Panay–Guimaras tower sites

NGCP is seeking urgent resolution from the Supreme Court (SC) of a temporary restraining order (TRO) issued by the latter, blocking NGCP from working on a site of its 138 kV Panay–Guimaras interconnection project. The TRO was issued in favour of the petition for certiorari and prohibition filed by the Iloilo Grain Complex Corporation (IGCC), which also pleaded for a writ of preliminary injunction.

The TRO prevented NGCP from executing the writ of possession (WOP) issued on December 22, 2022. The SC ruling was a follow-through to earlier related orders issued by the Iloilo Regional Trial Court Branch 33, which had denied the motion for reconsideration by IGCC in January 2023. The dispute was then elevated to the SC, which granted the TRO.

The project involves the construction of a 1.7-km transmission line connecting the proposed Iloilo substation to the Ingore cable terminal station, which will serve as the connection point of the submarine cable to Guimaras Island. The project will address the increasing power demand in Iloilo City, and provide greater transfer capacity to and from the island, where renewable energy projects are being developed. At least two of the project sites are under the ownership of IGCC. NGCP has argued that it fully complied with the requisites for WOP issuance and that it hesitates to move forward with IGCC's proposal to re-route the line through a residential area directly traversing five households, as opposed to the open area traversed by the project's current route covered by the WOP. NGCP has also stated that it is committed to pushing for the immediate completion of this critical project.

Indonesia announces USD20 billion energy transition investment plan

Indonesia has released the Comprehensive Investment and Policy Plan (CIPP) 2023, which serves as the country's energy transition roadmap with an initial commitment of USD20 billion. Prepared by the Just Energy Transition Partnership (JETP) Secretariat team, CIPP includes several scenarios with renewable energy and carbon dioxide (CO2) reduction targets. It also makes policy reform recommendations and establishes a just transition framework.

The initial financing commitment, which will cover about one-fifth of the total investment needed to reach the 2030 JETP targets, is split between contributions from international partners such as the governments of the partnership co-leaders – Japan and the US, and private finance. CIPP estimates that over USD97.1 billion has to be invested in the period 2023-30 and USD580.3 billion between 2023 and 2050. The cost for just transition assessments and interventions will separately involve at least USD0.2 billion by 2030.

CIPP sets out five JETP investment focus areas (IFA) up to 2030. Transmission lines and grid deployment is IFA 1, which involves around 14,000 circuit-km at an investment of USD19.7 billion. IFA 2 is early coal-fired power plant (CFPP) retirement, and managed phase-out coal flexibility retrofits and early retirements, with an investment of USD2.4 billion; IFA 3 is dispatchable renewable energy acceleration involving a build-out of 16.1 GW at USD49.2 billion; IFA 4 is variable renewable energy (VRE) acceleration involving a build-out of 40.4 GW at USD25.7 billion; and IFA 5 is renewable energy supply chain enhancement.

New Zealand's regulator issues draft decision on Transpower's NZGP1

New Zealand's competition, consumer and regulatory agency, Commerce Commission, has issued its draft decision approving the national grid operator Transpower's proposed NZD392.9 million investment in the electricity transmission grid, based on the benefits to electricity consumers.

Transpower's proposal, known as Net-Zero Grid Pathways Phase One (NZGP1), comprises a series of investments to upgrade transmission network capacity for enhancing the existing grid backbone until 2035.

The NZGP programme comprises the large projects that are key to delivering the transmission system New Zealand needs to electrify the economy and meet decarbonisation targets, such as net zero emissions by 2050. It was initially submitted to the commission in December 2022, followed by an updated proposal in September 2023 due to the discovery of costing errors.

In its original form, the capex proposal sought approval from the commission to allocate around NZD393 million for three key projects: enhancing existing lines in Central North Island and the Wairakei region, and incorporating additional reactive support equipment at the Haywards substation to bolster capacity on the HVDC system that transports electricity between the North and South Islands.

The commission completed its evaluation of the proposal and is satisfied that the capex on the three key projects will deliver net benefits to electricity consumers. The commission's analysis indicates that the spend on the Central North Island and Wairakei projects is well justified given the expected development of new renewable generation that will need access to the grid in the near future.

However, the NZD103 million proposed investment in the HVDC link between the North and South Islands may not have immediate benefits for consumers. But the commission's draft decision approved this component based on firm assurance from Transpower to manage the timing risks.

Interested stakeholders can submit their feedback on the draft decision with initial submissions due on December 14, 2023. Cross-submissions on matters raised by other parties are due by January 25, 2024. The commission expects to release its final decision in February 2024.

(NZD1=USD0.60)

New Zealand's Transpower proposes higher charges to fund grid upgrades

New Zealand's national grid operator, Transpower, has submitted its proposed expenditure and service performance levels to the Commerce Commission for the fourth regulatory control period (RCP4) of five years beginning April 1, 2025. It has proposed a spending of NZD4.7 billion to continue to provide reliable and safe national electricity transmission service. During the next regulatory period, Transpower plans to undertake intensified work on the national electricity transmission grid to replace or upgrade ageing assets, most of which were built between the 1950s and 1970s. Over the next 10-15 years, an increasing level of replacement and refurbishment work is required to ensure safe and reliable grid performance.

The proposal estimates a capital expenditure of NZD2.25 billion over five years, which is 32 per cent higher compared to the current regulatory period, and NZD1.96 billion in operating expenditure, which is 20 per cent higher. Another NZD490 million has been set aside for additional reliability, resilience, and enhancement projects that are likely to be completed in this period. In addition to the expansion of the work programme, the figures reflect that Transpower's costs have increased through higher interest rates as well as inflationary pressures throughout the supply chain.

Transmission charges currently represent 8 per cent of the average household electricity bill and Transpower forecasts this will rise to an estimated 10 per cent of the average bill during 2025, which is an increase of around NZD7 per month.

Under the Commerce Act, Transpower is required to provide a five-year expenditure and quality of service proposal (for refurbishment and replacement) for the Commerce Commission to review. The latter uses this information and its own analysis to determine Transpower's expenditure allowances and service levels, which in turn determine the revenue Transpower will be able to recover from the industry. Transpower is currently operating in its RCP3, which ends on March 31, 2025. The Commerce Commission will consult on Transpower's proposal before releasing its final decision on RCP4 in late 2024.

(NZD1=USD0.60)

Australian TasNetworks delays North West Transmission Developments project

Tasmanian state power grid company, TasNetworks, has announced that its North West Transmission Developments (NWTD) project would be now built in two stages, with only 60 per cent of the original project included in the first stage.

The first stage will involve the construction of the Palmerston–Sheffield–Heybridge link, as well as the Stowport–Burnie link, which are required for the operation of the first Marinus Link cable. In the second stage, the Staverton– Hampshire Hills–Burnie section will be constructed in alignment with the second Marinus Link cable.

Marinus Link is a proposed 1,500 MW HVDC link to be built in two stages entailing around 250 km of undersea cables (USC) and 90 km of underground cables (UGC), as well as converter stations. The first stage involves a 750 MW link between Burnie in Tasmania and Hazelwood in Victoria. In the second stage, a second 750 MW HVDC cable was planned, but is subject to further negotiations after the Tasmanian and Australian governments announced a new deal in September 2023 to continue with only one cable following a cost blow-out. The decision to break NWTD into two stages follows the government decision to scale down Marinus Link.

Tasmanian investors, including multiple wind farm projects and HIF Global's electrofuel (e-fuel)_facility (that will be capable of producing up to 100 million litres of carbon-neutral e-fuels annually, obtained from green hydrogen and recycled carbon dioxide), that are relying on the second stage link of NWTD to connect their proposed developments to the grid, may need to review their investment decisions. The Tasmanian Chamber of Commerce and Industry has warned that the decision to delay the implementation of the entire project could prompt some renewable energy developers to abandon their projects, worth over AUD7 billion.

According to TasNetworks, construction on the first stage of the NWTD project will begin in 2025. Construction of the second stage will only take place if the state government decides to build a second Marinus connection.

Following this, Burnie's mayor heard the Burnie City Council's concerns about the impact of NWTD's delay and has committed to take it to the National Energy Regulator so that proposed renewable energy projects in the North-West would not be hindered.

(AUD1=USD0.66)

Australia to invest in 32 GW renewable and storage projects

The Australian Minister for Climate Change and Energy has announced the government's plans to increase its spending to underwrite new wind, solar and battery projects, in a bid to attract investments to stabilise the energy grid as coal-fired plants retire. The government has not announced the exact amount that will be invested in the capacity investment scheme originally designed to support 6 GW of batteries and other storage, and agreed with states in December 2022 to spur investment of at least AUD10 billion in renewable projects. According to the latest development, the scheme will now be expanded to 32 GW or around half the national electricity market's (NEM) existing capacity. Of that total, 23 GW would be for new wind and solar farms, with 9 GW for storage.

This was announced as the industry is struggling to meet the government's renewable energy target of 82 per cent by 2030 from around 40 per cent now, due to challenges in expanding transmission networks to handle new renewable projects located far from demand centres.

The capacity investment scheme involves the government underwriting new investments in renewable generation and storage through contracts for differences

(CfD) that share the risks between investors and taxpayers. The government will hold tenders for the capacity and agree floor and ceiling revenue for the projects. If revenue is below the floor, the government will pay the difference, and if the ceiling is exceeded, it will share the profits. The scheme has been piloted in New South Wales (NSW), South Australia (SA) and Victoria. Six successful projects in NSW – three large batteries and three virtual power plants (VPPs), with a combined capacity of 1 GW, were announced on November 22, 2023. NSW combined the long-term energy service agreement and the capacity investment scheme auction into one super tender making it the country's biggest storage tender. The six winning projects include:

- Akaysha Energy's 415 MW/1,660 MWh Orana battery, to be located in Wellington in central-west NSW, will provide firmed capacity to the state's first REZ and four hours of storage.
- AGL Energy's 500 MW/1,000 MWh Liddell battery, located in Muswellbrook at the site of AGL's shut-down Liddell coal plant, will delivers two hours of storage.
- Iberdrola Australia's 65 MW/130 MWh Smithfield Sydney battery, located in western Sydney.
- Enel X Australia is set to deliver three separate VPPs through a demand response project totalling 95 MW capacity with minimum dispatch duration of two hours.

All these projects are targeting commercial operations by December 2025, the year NSW's biggest coal plant—the 2.88 GW Eraring—is scheduled to shut down.

Meanwhile, the proposed expansion of the capacity investment scheme will begin in April 2024, with six-monthly auctions to follow until 2027. In addition to delivering its share of the underwriting, the federal government will also negotiate agreements with the states and territories to support smooth transition to net zero emissions by 2050. These agreements will cover a range of issues, including ensuring there are sufficient strategic reserves in the electricity market. While the federal government underwriting will only support renewable projects, the states can determine the form of strategic reserve.

Australia's Clean Energy Council, which represents the renewable energy industry, has welcomed the government's decision to expand the scheme, and expressed that it would facilitate the investment required to transition the energy system.

(AUD1=USD0.66)

Construction begins on 600 MW/1600 MWh BESS in Victoria, Australia

Construction has begun on a 600 MW/1,600 MWh BESS in Melton, Melbourne after the State Electricity Commission (SEC), an entity owned by the Australian state of Victoria, agreed to contribute AUD245 million for a major stake in the BESS. The amount represents the first SEC investment on behalf of the state, which has committed to invest AUD1 billion into 4.5 GW of clean energy resources to offset the closure of the coal-based Loy Yang A power plant planned for 2035.

The Melbourne Renewable Energy Hub (MREH), being developed by Equis Australia, comprises three BESS systems – including a 200 MW/800 MWh four-hour battery and two 200 MW/400 MWh two-hour batteries, with the capacity to power 20,000 homes. As per the deal, the two-hour batteries will be owned by Equis and SEC in the 70:30 ratio, while the four-hour battery will be owned at 51:49. The latter will be subject to a SEC offtake agreement for 100 per cent of its capacity, allowing it to directly ensure firming for solar and wind projects already contracted through state government auctions and future investments by SEC. The other two batteries will focus on the merchant market.

Tesla will provide 444 fully integrated Tesla Megapack BESS for the project. Grid companies AusNet and Lumea will provide connecting transmission infrastructure. Samsung C&T and Genus Plus Group will undertake the engineering, procurement and construction (EPC) of balance-of-plant systems of the project.

This represents the first phase and will become the biggest in Australia once it reaches full capacity of 1,200 MW/2,400 MWh. MREH has secured land and approvals for 1,200 MW, of which 600 MW has commenced construction through MREH Phase 1 with a schedule to be operational by 2025. The remaining 600 MW is currently being developed with longer-term storage solutions of up to 12 hours. It will contribute to Victoria's goal of establishing 2.6 GW of energy storage by 2030 and 6.3 GW by 2035.

(AUD1=USD0.66)

Pacific Green to build Limestone Coast battery park in South Australia

Pacific Green Technologies, a global leader in renewable energy solutions, has proposed to develop SA's largest energy battery park in Limestone Coast. For this, Pacific Green's wholly owned subsidiary, Pacific Green Technologies (Australia) Pty Limited, has entered into an exclusivity agreement to secure a strategically located land site adjacent to the 275 kV South East substation.

The proposed Limestone Coast energy park will comprise a 500 MW/1,500 MWh battery with the capacity to store almost 60 per cent of SA's residential solar output for up to four hours. It will also strengthen the region's grid stability and help to lower energy costs.

Given that the South East substation feeds into the 275 kV Heywood Interconnector between SA and Victoria, the BESS facility will also charge and discharge excess renewable energy to and from Victoria.

Pacific Green has yet to submit a development application to the state government for the project. The proximity of the facility to the substation implies that it would not need to construct transmission infrastructure.

The project is expected to commence construction in 2024, with the energy park anticipated to be operational in 2026.

TransAlta, BHP declare commercial operation of Australian hybrid project

TransAlta Corporation (TAC), which owns generation assets in Canada, the US and Australia, and Australian mining company BHP Group (BHP) have announced that the 48 MW Northern Goldfields solar and battery storage facility has achieved commercial operation and is now supplying

reliable electricity to BHP's remote nickel mining operations in Western Australia.

The facility consists of the 27.4 MW Mt Keith Solar Farm, 10.7 MW Leinster Solar Farm, 10.1 MW Leinster BESS and interconnecting transmission infrastructure, which is integrated into TransAlta's existing 169 MW Southern Cross Energy North remote network in Western Australia.

The project created more than 100 direct and indirect jobs in the Goldfields and Perth regions during the construction phase and will support ongoing employment opportunities during operations.

Kazakhstan's KEGOC doubles reliability of Zone West network

Kazakhstan's grid developer, JSC Kazakhstan Electricity Grid Management Company (KEGOC), has launched new 220 kV transmission network in Zone West of Kazakhstan. It has completed the construction of five 220 kV power transmission lines along the route – West Kazakhstan Energy Hub–Atyrau–Mangistau – with a total length of 780 km, to increase the network capacity and reliability of power supply to consumers in Zone West.

The project included the installation of over 4,200 transmission line towers, expansion of Uralskaya, Pravoberezhnaya, Inder, Kulsary and Tengiz substations, and the construction of a new Karabatan distribution substation.

The project deployed domestically produced metal and reinforced concrete foundations, conductors, insulators and transformers, which resulted in the share of Kazakhstani content of 70 per cent.

The capacity of the power grid has been significantly increased from 100 MW to 200 MW on the West Kazakhstan Energy Hub–Atyrau section, and from 50 MW to 200 MW on the Atyrau–Mangystau section, which has overall doubled the reliability of the Western Zone network.

Strengthening of the Western Zone power grid will also form the basis for its further interconnection with the Unified Power System (UPS) of Kazakhstan.

Europe

EC proposes action plan for grids to help achieve European Green Deal targets

The European Commission (EC) has published a communication, 'Grids, the missing link – A European Union (EU) Action Plan for Grids' to help deliver the 2050 carbon neutrality targets under the European Green Deal. The Action Plan aims to address the main challenges in expanding, digitalising, and better using the EU electricity transmission and distribution grids, given the fact that the electricity consumption in the region is expected to increase by around 60 per cent between 2023 and 2030. The EU has put in place a legal framework to support grid rollout, with the revised Trans-European Networks for Energy (TEN-E) Regulation and Renewable Energy Directive, and proposals for a Net-Zero Industry Act and a reformed electricity market design.

The actions focus on implementation and swift delivery to make it in time for EC's 2030 objectives, which include:

- Accelerating the implementation of projects of common interest (PCI) and developing new projects through political steering, reinforced monitoring and more proposals;
- Improving the long-term planning of grids to accommodate more renewables and electrified demand, including hydrogen, in the energy system by steering the work of system operators as well as national regulators;
- Introducing regulatory incentives through guidance on anticipatory, forward-looking investments and cross-border cost-sharing for offshore projects;
- Incentivising better usage of the grids with enhanced transparency and improved network tariffs for smarter grids, efficiency, and innovative technologies and solutions by supporting the cooperation between system operators and recommendations by the Agency for the Cooperation of Energy Regulators (ACER);
- Improving access to finance for grid projects by increasing visibility on opportunities for EU funding programmes, especially for smart grids and modernisation of distribution grids;
- Stimulating faster permitting for the grid's deployment by providing technical support for authorities and guidance on better engaging stakeholders and communities; and
- Improving and securing grid supply chains, including by harmonising industry manufacturing requirements for electricity connection.

To fulfil the objective set in the REPowerEU Plan (the REPowerEU plan put in place measures to make Europe independent from Russian fossil fuels prior to 2030 through energy savings, energy supply diversification, and accelerated RES deployment) to end imports of Russian fossil fuels, and the recently agreed target to reach a 42.5 per cent, with an ambition for 45 per cent, renewable energy share by 2030, the EU needs upgraded grids and strengthened energy infrastructure. The EU Action Plan for Grids was announced under the European Wind Power Action Plan tabled by the EC in October 2023. It followed the first High-Level Electricity Grids Forum that was hosted by the European Network of Transmission System Operators for Electricity (ENTSO-E) under the patronage of the EC in September 2023.

The Action Plan is also accompanied by a 'Pact for Engagement' to ensure broad stakeholder engagement in grid development. The pact underlines the importance of communication on the role of grids for the clean energy transition, more engagement in the fora focusing on grid acceleration and faster implementation of permit-granting rules, and regular dialogue with regulators on engagement activities. The 'Pact for Engagement' calls on EU countries, EU and national regulators, project promoters, and civil society to work together towards early and regular public participation in grid development projects, and respond to the views, ideas or concerns of local communities.

EC adopts sixth list of PCIs and first list of PMIs

The EC has adopted the sixth EU list of PCIs, and the first EU list of PCIs and projects of mutual interest (PMIs) established under the revised TEN-E Regulation. The latter was adopted in 2022 and ends support for

fossil fuel infrastructure and focuses on cross-border energy infrastructure of the future. The PCIs are the projects within the EU territory, and the PMIs will connect the EU with third countries. The EC will ensure the projects are swiftly completed and can contribute to doubling the EU's grid capacity by 2030 and meeting its 42.5 per cent renewable energy target.

The projects will benefit from streamlined permitting and regulatory procedures, and become eligible for EU financial support from the Connecting Europe Facility (CEF).

Out of the 166 selected PCIs and PMIs:

- Over half (85) are electricity, offshore and smart electricity grid projects, with many expected to be commissioned between 2027 and 2030.
- For the first time, hydrogen and electrolyser projects (65) are included, which will play a major role in enabling energy system integration and the decarbonisation of EU industry.
- The list also includes 14 carbon dioxide network projects in line with the EC's goals to create a market for carbon capture and storage.

The PCI and PMI list will now be submitted to the European Parliament and the Council of the EU for their scrutiny. Both co-legislators have two months to either accept or reject the list in full, but may not amend it.

This process can be extended by two months if requested by the co-legislators. Once the list is adopted, the EC will work with project promoters and member countries to support the rapid implementation of this list of projects, in line with the enhanced measures proposed in the EU Action Plan for Grids.

UK's NBL prepares for NeuConnect interconnector's first phase construction

NeuConnect Britain Limited (NBL), a consortium comprising Meridiam and Allianz Capital Partners representing the Allianz Group, Kansai Electric Power, and TEPCO Power Grid UK Limited., has commenced the first phase of construction works in the UK for the EUR2.8 billion NeuConnect, the first link between the UK and Germany.

Italian cable manufacturing company, Prysmian Group, installed the last of three underground ducts with an overall length of more than 1.2 km, completing this important first phase of construction on schedule. These works will allow Prysmian to begin onshore and offshore cabling in 2024. The company was awarded a EUR1.2 billion contract for the construction of the submarine connection in the beginning of March 2022.

NeuConnect is a proposed 725-km-long, ±525 kV HVDC subsea link from the Isle of Grain in Kent to Fedderwarden, near Wilhelmshaven in Germany, traversing British, Dutch and German waters.

(EUR1=USD1.08)

UK sets out plans to reform power network

The UK government has released a package of measures to speed up connections and rapidly increase grid capacity to boost energy security. The package includes the Connection Action Plan (CAP) and Transmission Acceleration Action Plan (TAAP).

The CAP sets out ambitious plans for the UK government, the country's energy regulator, the Office of Gas and Electricity Markets (Ofgem), and industry, to significantly accelerate connections. The total connection queue across transmission and distribution is around 500 GW, which is five times the amount that is currently connected. Also, several projects in the connection queue will not connect and many are hoarding capacity, preventing viable projects from connecting.

Hence, the government will move away from the 'first come, first served' approach, cutting the average delay that projects face from five years to six months. This plan will release over 100 GW of capacity from the current queue – equivalent to around a quarter of the electricity needed to power the UK's economy in 2050. The CAP sets out six key areas of action for the government, Ofgem, the electricity system operator (ESO), and the network companies to drive further action and significantly reduce connection timescales. These key areas include raising entry requirements, removing stalled projects, better utilising existing network capacity, better allocation of the available network capacity, improving data and processes, sharpening obligations and incentives on the ESO and network companies, and developing long-term connections process models aligned with strategic planning and market reform, to ensure they are integrated to deliver strategic outcomes for a timely and efficient transition to a net zero energy system.

The TAAP sets out steps to halve the amount of time it takes to build network infrastructure; a key part of ensuring viable projects can connect more quickly. It highlights the need to better standardise infrastructure and equipment design. Under the plan, ESO will convene a taskforce with transmission owners (TOs), the UK, Scottish and Welsh governments, Ofgem and the Energy Networks Association (ENA) to progress a set of electricity transmission design principles.

This workstream relates to the consideration of the standardisation of connection design where the ESO and network companies have been tasked to review and assess approaches to optimise the use of the existing network and bring forward beneficial changes.

By reducing delays in network build and speeding up grid connections, the two action plans taken together could bring forward around GBP90 billion of investment over the next decade. This includes GBP15 billion associated with the TAAP and GBP50-100 billion (GBP75 billion central estimate) associated with the CAP. These will also boost the deployment of renewable and low-carbon generation, ensuring energy security and supporting decarbonisation.

(GBP1=USD1.26)

UK's Ofgem announces new rules to speed up electricity grid connections

The UK's energy regulator, Ofgem, has announced new rules to speed up electricity grid connections for viable projects and allow stalled or speculative developers to be forced out of the queue. Till now the rule followed the 'first-come, first-served' system, which has led to a long queue of energy projects, aggregating almost 400 GW.

The development builds on the UK's National Grid Electricity System Operator's

(NGESO) five-point plan, which includes near-term initiatives with Ofgem support that will create capacity and acceleration of connection dates for transmission projects. The new rules would accelerate the transition to net zero by speeding up network build, which is vital to unlock new investment and hit national targets – 50 GW of OSW capacity by 2030 and 70 GW from solar by 2035. The new queue management rules will be implemented by NGESO starting November 27, 2023, and will be introduced to both existing and future grid connection agreements. NGESO will publish guidance on November 27, 2023 on how it will use its powers, with first terminations likely to happen as early as 2024.

UK's NGESO to accelerate 20 GW of grid connections for T&D network

The UK's NGESO will be accelerating the grid connection for up to 20 GW of clean energy projects to its electricity transmission and distribution networks in England and Wales. These works are part of ongoing collaborative industry efforts, together with the UK's energy regulator, Ofgem, and the government, to speed up connections. For the transmission network, 19 BESS worth around 10 GW will be offered dates to plug in, averaging four years earlier than their current agreement, based on a new approach that removes the need for non-essential engineering works prior to connecting storage. This would be carried out jointly with National Grid Electricity Transmission (NGET). The new approach to transmission storage connections – a flagship policy in the NGESO's five-point plan to speed up connections – comes as NGET undertakes an extensive review of projects in the connections pipeline in England and Wales to identify the ones that can come forward based on new planning assumptions agreed with the ESO. A further tranche of clean energy projects – primarily batteries and hybrids (batteries co-located with wind or solar) – will be offered accelerated transmission connections as part of another phase anticipated in 2024, which could bring forward another 10 GW.

UK's National Grid to refurbish Lincolnshire and Hertfordshire OHL

The UK's transmission system operator (TSO), National Grid, is delivering a GBP130 million refurbishment project to strengthen the existing OHL network between Lincoln in Lincolnshire County and Stevenage in Hertfordshire County. The line runs from Cottam power station near Lincoln to the Wymondley substation near Stevenage, passing near the towns of Newark, Stamford, Peterborough and Hitchin. The project forms part of National Grid's GBP1 billion annual investment in maintaining and upgrading its infrastructure to ensure a resilient and reliable network in England and Wales.

Work on the OHL is being implemented in two phases. The first phase of the works (from Lincoln to Peterborough) has already been completed, and for the second phase (Stamford to Stevenage) around 1,479 km of OHL conductors have been installed. In total, 2,919 km of conductor cable has been installed till now. The final circuit, which runs from Cambridgeshire to Hertfordshire, will be replaced to complete the project in 2024.

(GBP1=USD1.26)

Spain's Iberdrola announces GBP12 billion investment plan for 2024-28 in UK

Spanish power utility Iberdrola, which is the parent company of ScottishPower (Scotland-based vertically integrated energy company), has set a GBP12 billion investment plan for 2024-28 for the UK. ScottishPower is developing several renewable projects in the UK, and operates the transmission and distribution network through SP Energy Networks.

With more than GBP2 billion invested in the UK as part of its previously announced GBP6.7 billion programme for 2023-25, Iberdrola plans to build on this with investments of over GBP7 billion more during 2026-28. Around two-thirds of the 2024-28 investments will be dedicated to transmission and distribution electricity networks, driven by regulatory arrangements in place (RIIO T2 and RIIO ED2), as well as projects like the innovative GBP2.7 billion Eastern Green Link 1 (EGL1) subsea transmission cable, which received regulatory approval in November 2023. Construction for EGL1 will begin in early 2024 and, when completed, the link will transport enough clean green renewable energy to power up to 2 million homes and will increase the resilience of the UK's transmission grid. In addition, the company will continue investing in its East Anglia 3 offshore wind farm (OWF), as well as in onshore wind and solar projects, energy retail, and green hydrogen. These investments could be further increased with additional offshore wind opportunities, like East Anglia 1 North and East Anglia 2, which the company has ready for upcoming auctions.

(GBP1=USD1.26)

UK's SSE Plc announces increase to existing five-year investment programme

UK's SSE Plc (formerly Scottish and Southern Energy Plc) has announced an increase in its five-year investment programme following its strong financial performance in its 2023/24 published interim results.

Ofgem's Large Onshore Transmission Investments (LOTI) re-opener and the Accelerated Strategic Transmission Investment (ASTI) framework have given SSEN Transmission, the transmission business of SSE, a greater visibility of future growth. Additionally, significant inflation over the past two years, revised assessments of the physical work required, and greater certainty over supply chain costs, are some of the other key factors that led to the revised investment.

The Group has now upgraded its investment programme to GBP20.5 billion across the five years to 2027 for its transmission business. This is GBP2.5 billion higher than its previous target. This increase in capital investment is expected to be incurred across the three LOTI projects that have received approval of need from Ofgem, as well as the early construction costs expected on the ASTI framework projects – the first of which is Eastern Green Link 2. The latter will connect Peterhead in Aberdeenshire (Scotland) and Drax near Selby in North Yorkshire (England), and is expected to be operational by 2029.

(GBP1=USD1.26)

UK's SSEN launches delivery charter for 'Pathway to 2030' programme

The UK's SSE Networks Transmission (SSEN Transmission), the trading name for Scottish Hydro Electric Transmission

(SHET) and the transmission business of SSE Plc (which owns75 per cent of SSEN Transmission), has launched the ASTI Delivery Charter for delivering crucial transmission infrastructure for its GBP10 billion 'Pathway to 2030' network development programme. The 11 businesses from SSEN Transmission's supply chain and contractors named on the charter include Balfour Beatty, Burns & McDonnell, Hitachi Energy, IQA Elecnor, Linxon, Omexom Morgan Sindall Infrastructure, Morrison Energy Services, J. Murphy & Sons, NKT, Siemens Energy BAM, and Wood Power Solutions. These companies will be key in supporting SSEN Transmission's delivery of its ambitious 'Pathway to 2030' programme.

Earlier in August 2023, SSEN Transmission has announced ten selected 'preferred bidders' after a competitive process. These included all the aforesaid companies, except Hitachi Energy.

Major projects included in the Pathway to 2030 programme include the 2 GW Eastern Green Link 2, which is an undersea HVDC link between Peterhead in Scotland to Drax in England, and being developed through a joint venture with NGET. Further, two undersea HVDC links, one between Spittal in Caithness and Peterhead with 2 GW capacity, and the other between Arnish on the Western Isles and the north of Scotland's mainland with 1.8 GW capacity, are also planned. Notably, a new HVDC switching station at Peterhead will reduce the number of converter stations needed for future HVDC links, lowering costs and environmental impacts.

(GBP1=USD1.26)

UK's SSEN to do consultation for Western Isles Project and Fort–Augustus substation

The UK's SSEN Transmission, the transmission business of Scottish and Southern Energy (SSE), will be hosting a third set of consultations for the electricity infrastructure required at the proposed Lewis converter station and substation site as part of the Western Isles HVDC link. SSEN Transmission will be hosting a consultation event on November 8, 2023 to provide an update on the site selection process and confirm the company's selected site, and also on the underground cable from the HVDC converter station to Arnish Point.

The Western Isles Link involves an HVDC submarine and UGC connection between the islands and the new Beauly area converter station on the mainland.

The project includes the construction of an HVDC converter station, an alternating current (AC) substation near the Arnish Point landfall for the HVDC cable to the mainland, 81 km of USC from Arnish Point, Stornoway, to Dundonnell (Scottish mainland) and 75-km UGC from Dundonnell to the new HVDC converter station. NGESO's 'Pathway to 2030' Holistic Network Design (HND), published in July 2022, confirmed the requirement of the 1.8 GW link from the islands in place of the initially proposed 600 MW HVDC link.

SSEN is presently consulting on the full site selection process for the project. Construction on the project is proposed to begin in the spring of 2026 to be completed by 2030.

In another development, SSEN Transmission hosted a public consultation event on November 30, 2023, for vital upgrades to the Fort Augustus substation. The upgrade forms part of a wider programme of work to upgrade the second circuit of the Beauly–Denny OHL from 275 kV to 400 kV in order to accommodate new renewable energy generation.

The 137 km Beauly–Denny OHL runs from Beauly, north of Inverness, to Denny near Falkirk. It was the first 400 kV overhead line built in SSEN Transmission's network area and became fully operational in 2015. The OHL was constructed for operation at 400 kV, with one circuit operating at 400 kV and the second circuit operating at 275 kV. Due to increasing amounts of renewable electricity generation connecting to the transmission system, there is now a need to uprate the second circuit from 275 kV to 400 kV.

UK's SSE Renewables takes FID for Monk Fryston BESS project in Yorkshire

SSE Renewables – a subsidiary of SSE, has taken a final investment decision (FID) to proceed with the construction of the 320 MW/640 MWh grid-scale BESS project in Monk Fryston, Yorkshire. The project is said to be the largest BESS in the UK. The 320 MW battery will be located next to the UK's TSO National Grid's substation in Monk Fryston.

SSE Renewables' solar and battery portfolio currently comprises four projects under delivery in the UK totalling 550 MW, including: a 50 MW BESS site in Salisbury, a 150 MW BESS site in Ferrybridge, a 30 MW solar farm in Littleton, and now a 320 MW BESS site at Monk Fryston.

A 150 MW BESS site in the former SSE coal-power station at Fiddler's Ferry has also been consented, with construction potentially commencing as early as 2024, subject to reaching an FID.

Battery storage has a vital role to play in helping the UK and Ireland's decarbonisation efforts. The Monk Fryston project, which can run for up to two hours at a time, will be capable of storing power for release back to the UK national grid to manage peaks of energy demand. Construction on the project is expected to commence in 2024.

Construction works begin for Celtic Interconnector project

Construction works on the cable route from Knockraha in east Cork in Ireland have commenced for the Celtic Interconnector between Ireland and France. The link is being developed by Ireland's state-owned electric power transmission operator EirGrid and France's TSO Réseau de Transport d'Électricité (RTE).

The 700 MW project aims to increase electricity trade within Europe by connecting the north coast of Brittany (in France) to the south coast of Ireland. This direct HVDC link between the French and Irish markets will increase renewable energy integration, especially wind, in Ireland. The 575-km-long interconnector includes a subsea (500 km) and onshore cable to the converter station. The subsea connection will link the coast of Cork and the Ceinture Dorée (Gold Belt) coast in Brittany, passing to the west of the Isles of Scilly.

French cable manufacturer Nexans will design and install the entire cable between the two countries, while Siemens Energy will deliver the converter station at Ballyadam, as well as other high-voltage

transmission technology required at the network connection point at Knockraha.

Recognised as a PCI by the EU, the Celtic Interconnector responds to European challenges regarding energy transition and addresses climate change by facilitating progress towards a low carbon electricity mix.

The interconnector is scheduled to be energised by 2026.

Ireland's EirGrid signs MoU with French RTE for offshore interconnection

Ireland's TSO, EirGrid, has signed a memorandum of understanding (MoU) on 'Cooperation on Offshore Energy Interconnection' with French TSO, RTE, under the EU regulatory framework. The MoU aims to strengthen energy security, build an affordable energy system, and diversify energy supply in Europe, through cooperation between both TSOs.

The MoU also aims to assess the long-term interest of a new potential hybrid interconnection with Ireland. The TSOs also recognised the continued delivery of the Celtic Interconnector, the submarine power cable linking the electricity grids of the two countries. A joint working group will now be established to accelerate these activities, which are imperative for the achievement of the shared national and wider European ambition for climate neutrality.

NSEC countries launch 100 GW offshore wind tender plan

The North Seas Energy Cooperation (NSEC) countries have launched a collaborative effort to plan joint OSW tenders. The countries, which include Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway and Sweden, reportedly aim to conduct approximately 15 GW of OSW auctions annually and grant nearly 100 GW in awards by 2030.

The joint tender planning initiative aims to enhance coordination in critical areas like cables, pipelines, port infrastructure, and access to raw materials. This effort is designed to assist the European wind energy sector in its medium- and long-term financial planning.

In January 2024, ENTSO-E will release a joint infrastructure plan for the North Sea, drawing on input from NSEC countries. This plan will represent a significant step toward establishing a unified European energy system by 2050.

Hansa PowerBridge receives approval for land and sea sections

The Ministry for Economic Affairs, Infrastructure, Tourism and Labour of Mecklenburg-West Pomerania, Germany, has granted approval to the Hansa PowerBridge interconnector for the sections on land and in Germany's territorial sea. The application for planning approval for the interconnector between Germany and Sweden was submitted by the German TSO 50Hertz in May 2021.

The next step will be to obtain approval for the construction of the section within the German exclusive economic zone (EEZ) from the German Federal Maritime and Hydrographic Agency (BSH or Bundesamtes für Seeschifffahrt und Hydrographie).

The tenders for the production and installation of the cables, and for the converters and the associated construction work, will be finalised once this permit has been received, allowing work to begin in 2024.

The Hansa PowerBridge is an onshore/offshore cable connection, which will run from the Gustrow substation in Mecklenburg-Western Pomerania over Fischland (Germany), and through the Baltic Sea to Sweden. The project was announced in March 2014 with the signing of a MoU between Sweden's TSO Svenska Kraftnät and 50Hertz. In November 2015, both TSOs signed the cooperation agreement for setting up the project.

The project comprises two 700 MW cross-linked polyethylene (XLPE) cables along a 300-km-long route. The German land cable route (Güstrow substation – Dierhagen Ost landing) is about 70 km long, while the USC section within the territorial sea is about 80 km and in the German EEZ extends to around 25 km. The project will have a 60-km DC UGC on the Swedish side. The two converter stations will be located at Lüssow (Güstrow) and Hurva, in Germany and Sweden respectively.

Germany increases independence of Federal Network Agency

The German government has boosted the power of the country's energy regulator, Bundesnetzagentur (BNetzA) or Federal Network Agency. The proposal to increase the regulator's powers was contained in an amendment to Germany's Energy Act, and was passed in the Parliament. This move comes after the Court of Justice of the EU in September 2021, had stated that BNetzA must be more independent in applying the EU's electricity and gas regulations.

The proposed amendment deletes two paragraphs that subjected BNetzA to follow orders from the government, in line with the EU court ruling. This means Germany will now be able to change electricity network access fees, as BNetzA will be able to independently determine grid fees charged by electricity grid operators to recoup their investment.

With more than 800 distribution system operators (DSOs), Germany has glaring variations in local grid fees, with consumers in the Northern region being charged extra for grid access even though they contribute heavily to renewable electricity production from wind power.

The regulator is also likely to give special consideration to renewable power, with exemptions likely for grid operators who are expanding their grids, especially for renewables.

Germany's federal states, the Länders, will debate the proposal in December 2023; though their assent is not required to pass the law.

Germany's BNetzA authorises 380 kV line section between two TSOs

Germany's energy regulator, BNetzA or Federal Network Agency, has authorised the German power TSOs 50Hertz and TenneT to strengthen the power connections between their extra high voltage (EHV) grids. The approval pertains to the 47-km, 380 kV Wolmirstedt–Lower Saxony/Saxony–Anhalt border which is part of the larger Wolmirstedt–Helmstedt East–Wahle high voltage line project.

The larger 211-km project consists of two individual measures including—increasing the current carrying capacity of the

existing 380 kV line from the Wolmirstedt substation in the Börde district (Saxony-Anhalt) via Helmstedt East and Hattorf to the Wahle substation (all in Lower Saxony), in addition to replacing the old conductor cables with new high-temperature low-sag conductors (HTLS) in the western part. On the other hand, an additional 380 kV line is to be built from the Wolmirstedt network connection point via Helmstedt East to the Salzgitter network connection point. The new substation in the Salzgitter area is subject to a separate approval process.

The project is planned for commissioning in 2032.

TenneT publishes draft investment plan for Dutch grid

Dutch-German TSO, TenneT, has published the draft 'Investment Plan on Land' and 'Investment Plan at Sea' 2024 for the Netherlands' grid. The plan describes the projects needed over the next ten years to make the electricity grid ready for the future.

TenneT expects to carry out around 700 major infrastructure projects. These include grid extensions, replacement investments, new customer connections, OSW farms, and reconstruction projects. This is double the estimate in the previous 2022 investment plan. The fast-growing demand for additional grid capacity is the main reason for the increase in the portfolio, partly due to making industry more sustainable and the growth of heat pumps, charging stations, OSW turbines and solar farms. Among other things, TenneT will develop five larger 380 kV new power highways over the next ten years and modernise 140 high-voltage substations. To ensure grid reliability, a significant part is to be invested in maintenance and replacement of the existing grid. In addition, high-priority projects, such as the so-called Multi-Annual Programme for Infrastructure, Energy and Climate (MIEK) projects, have been identified in close cooperation with the various authorities.

The investment plan also reveals the progress of ongoing projects. Of the 252 grid expansion projects already planned, 60 projects have been moved up in the schedule compared to the investment plan of two years ago. Stakeholders can respond to the plans until November 29, 2023, post which the final plan will be sent to the Netherlands Authority for Consumers and Markets (ACM) in early 2024.

Spain's Red Eléctrica commences construction on 132 kV Eivissa–Bossa UGC

Spanish TSO, Red Eléctrica – a subsidiary of Redeia, has commenced construction work on a new 132 kV DC UGC between Eivissa and Bossa. The line will run through the urban centre of the city of Eivissa (from Camí dels Dominguets towards Avenida de la Pau and Sant Jordi) and to a lesser extent through Sant Josep (Avets Street), and has been divided into seven construction sections, each of them with different phases. It will entail an investment of more than EUR10 million and is scheduled to be in operation in 2025.

The project is included in the Planning of the Electricity Transmission Network 2021-26 with an objective of guaranteeing the safe supply of power for the entire south and west of the island of Ibiza. It forms part of the southern axis, which also includes the repowering of all existing electrical transmission lines in Ibiza (already carried out), a new 132 kV park attached to the existing 66 kV park at the San Jorge substation (currently under construction and scheduled to be commissioned in 2024), and the installation of an energy storage battery in the current Sant Antoni substation, which is currently sourcing public feedback and is scheduled to be commissioned in 2025.

(EUR1=USD1.08)

Italy's Terna commences work on Vandoies–Brunico

Italy's TSO, Terna, has commenced construction of a new UGC connection between Vandoies and Brunico in the province of Bolzano. The TSO will invest around EUR50 million on this 22-km new UGC, which will connect Terna's new power substation in Vandoies, near the local distributor's future primary substation, to the existing primary substation in Brunico. It will ensure reliable power supply for the Milan-Cortina 2026 Winter Olympics. The initial work phase will focus on the civil works required in preparation for cable laying. In 2024, several work sites will be active simultaneously, progressively affecting the other municipalities on the route, with an aim of project completion by 2025.

(EUR1=USD1.08)

Norway's Statnett collaborates with five TSOs to study hybrid connections

Norway's TSO Statnett has signed MoUs with five TSOs of the North Sea countries to study the feasibility of hybrid infrastructure for OSW. It has signed MoUs with Belgium's Elia, German TSOs Amprion and TenneT, Danish Energinet and UK's National Grid Ventures. Amprion and Statnett are now working together to investigate the feasibility of a hybrid interconnector between the two countries. This collaborative effort aims to assess technical and economic aspects, ultimately fortifying Europe's supply security and aligning with the development of the North Sea's offshore grid while contributing to the EU's climate objectives. The intended outcome involves the comprehensive calculation and analysis of joint energy scenarios to underpin this venture.

Concurrently, TenneT and Statnett will also explore the possibilities of a hybrid interconnector linking the two countries. Departing from traditional connections, this initiative seeks a parallel link between the two nations, leveraging their complementary wind profiles to revolutionise energy exchange. For example, when there is no wind in the German North Sea, wind energy can be imported from Norway, and vice versa. This would increase the security of supply for both countries. Meanwhile, a potential new hybrid interconnector between Denmark and Norway will bring power ashore from OSW areas near a Danish energy island in the North Sea and from a zone in the Norwegian North Sea called Sorvest F. The TSOs' examinations are to be completed at the end of 2024. Statnett is exploring hybrid grid solutions for OSW generation in the Sorvest F area, which is expected to be tendered in 2025.

The larger collaboration recognises the significance of swift adaptation to technical, regulatory, and economic frameworks for a shared European offshore grid. This adaptation is crucial to ensure

the successful commissioning of the first hybrid projects by the 2030s.

Finland's Fingrid publishes main grid development plan for 2024-33

Finland's TSO, Fingrid Oyj, has published its main grid development plan for 2024-33. Published every two years, the plan outlines the grid's development needs and investments for the next ten years. In the updated development plan, the total planned investments are estimated at EUR4 billion.

The grid investments are aimed at promoting Finland's competitiveness as a clean energy investment country and supporting its carbon neutrality goals by 2035. The investments will strengthen Finland's internal electricity transmission capacity and cross-border transmission connections, and enable the connection of new customer projects to the main grid.

The planned projects are based on various assumptions about the development of the electricity production and consumption structure in Finland, and require a permitting and regulatory environment that supports grid investments.

(EUR1=USD1.08)

Helios Nordic Energy plans to build BESS at Salo, Finland

Helios Nordic Energy Finland, part of Sweden-based Helios Nordic Energy – a developer of solar and BESS projects, is planning a BESS facility of up to 50 MW in Salo, Finland. The company plans to lease land from the Municipality of Salo next to the Hämeenkylä substation.

Finland's electricity TSO Fingrid is currently renovating the substation.

Swedish Svenska Kraftnat receives approval for new transmission lines in Sollefteå

Sweden's electricity TSO, Svenska Kraftnat (SvK), has received approval from the Swedish Energy Market Authority (Energimyndigheten) to build seven power transmission lines in connection with the new Nässe station in Sollefteå.

These lines form a part of SvK's investment programme NordSyd, under which the TSO plans to build around 2,000 km of new power lines and add around 35 stations (new or renewal) at an investment of SEK75 billion by 2040. At the same time, 2,500 km of power lines will be taken out of service. The aim is to renew the transmission network between electricity areas 2 and 3, and increase the current capacity of 7,300 MW up to more than 10,000 MW.

(SEK1=USD0.092)

Greek IPTO to form SPV for EuroAsia interconnector

Greece's Independent Power Transmission Operator (IPTO), Anexartitos Diacheiristis Metaforas Ilektrikis Energeias (ADMIE), intends to form a SPV for the 2 GW multi-terminal EuroAsia Interconnector between the national electricity grids of Israel, Cyprus and Greece (Crete), and Europe. The SPV formation will facilitate Cyprus' potential entry and other investors into the project.

In October 2023, ADMIE became the project promoter for the interconnector, which is a flagship EU's PCl and has been included in all five PCl lists since 2013. IPTO has been involved in the interconnector as a technical consultant since 2021 and contributed to the project's progress and in securing EUR657 million in funding through the EU's CEF. Later in June 2023, ADMIE entered into a strategic agreement with EuroAsia Interconnector Limited (EIL), a subsidiary of Cyprus-based Quantum Energy Limited developing the project, for the acquisition of a 25 per cent stake in the interconnector.

In October 2023, EIL announced its exit from the project and ADMIE became the project promotor. EIL and ADMIE are working closely together to ensure smooth transition to the new implementing agency. When completed, the interconnector between Greece and Cyprus will be the longest and deepest HVDC subsea cable project globally, with bi-pole cables of 2×900 km and a water depth of 3,000 metres. The project is moving into the construction phase and is expected to be completed in 2027.

PSE and Litgrid consider alternatives for Harmony Link

Lithuania's TSO Litgrid, and its Polish counterpart Polskie Sieci Elektroenergetyczne (PSE), are considering various alternatives for Harmony Link, the 700 MW HVDC interconnector between Poland and Lithuania.

This development comes after Litgrid and PSE, in April 2023, cancelled contractor tenders due to bids exceeding the project's budget of EUR680 million by almost 2.5 times. Post the tender cancellation, the TSOs are now considering various alternatives that could reduce costs and can be implemented at the earliest. The TSOs initially planned the link as a 330-km-long subsea cable that would link the Darbėnai substation in Kretinga district, Lithuania with the Žarnowiec substation in the Polish Pomerania region. Now, because of rising costs and delay in project implementation, one of the alternatives being considered by the TSOs is an overland cable. As per Litgrid, the infrastructure corridors of the planned Rail Baltica railway line between Poland and Lithuania could be partially used for the construction of the land cable. As preliminary assessments are still being carried out, both sea and land link alternatives are currently being considered.

It is expected that a decision on the method of implementation will be made in the first half of 2024.

(EUR1=USD1.08)

LitPol Link to be out of operation for two days

The LitPol Link interconnector bandwidth is scheduled to be unavailable for trading starting November 7, 2023 8:00 am until November 8, 2023 5:00 pm as Lithuania's power TSO Litgrid is preparing to connect the third autotransformer in the Alytus transformer substation. The 500 MW LitPol Link comprises two 163-km, 400 kV transmission lines between Alytus and Elk in Poland, and the Alytus converter station, and has been in operation since 2015. It is an important link for electricity trade and the reliability of the Lithuanian system, until the synchronisation of the Baltic grid with that of Continental Europe in 2025.

Baltic and Polish TSOs complete synchronisation studies

Lithuania's TSO, Litgrid, has reported that the Polish Institute of Power Engineering, Gdansk office, together with the Polish

PSE and Baltic TSOs—Estonian Elering, Latvian Augstsprieguma Tīkls AS (AST), and Litgrid, have completed a study to assess the technical feasibility of earlier synchronisation with the Continental European Network (CEN) grid. The results of the studies show that synchronisation in February 2025 is safe and technically possible, with the stability of the system ensured in all the analysed scenarios.

On August 3, 2023, the Baltic countries of Estonia, Latvia and Lithuania signed a joint declaration on the accelerated synchronisation of their electricity networks with the CEN to be achieved by February 2025.

The three Baltic TSOs established a plan for the steps to be taken to ensure the readiness of the Baltic energy system for accelerated synchronisation, which is essential for the safe operation of the systems in the region. Further, they decided not to extend the agreement for the Moscow-controlled Soviet-era power grid linking Belarus-Russia-Estonia-Latvia-Lithuania (BRELL) after August 2024, and to synchronise with CEN within six months thereafter.

Lithuanian Litgrid to invest EUR8 billion by 2050

Lithuania's TSO, Litgrid, will reportedly invest more than EUR2 billion in grid infrastructure by 2030 and over EUR8 billion by 2050. The majority of this investment will be made in building new lines, especially in the northern and western regions of Lithuania, because the consumption in Lithuania is in the east and most of the production will be in the west. The investments also include reinforcing the links with Latvia.

Although, there is currently enough capacity in the country's local transmission grid for the development of wind and solar projects, it will not be sufficient for the future, and hence network strengthening is vital for the country.

(EUR1=USD1.08)

Estonia's Elering to procure up to 400 MW in frequency reserves

Estonian TSO Elering is planning to procure up to 400 MW in frequency reserves to cover the deficit created by Estonia withdrawing from the BRELL electricity grid, which is planned in 2025. Estonia will require 250 MW-400 MW in reserves once it desynchronises from BRELL. The actual volume will depend on the levels of the country's unpredictable electricity generation. A public consultation is expected to be launched shortly. Reportedly, several companies have expressed an interest in setting up pumped hydro and gas-based power plants.

The procurement framework is expected to be finalised in 2024 so that long-term tender can be organised in 2025. The plan is to offer a long-term contract to ensure that the power delivery takes place in 2028-29.

Estonian CPTRA announces online auctions for two OWFs

The Estonian Consumer Protection and Technical Regulatory Authority (CPTRA) has announced online auctions for the development of two OWFs in the Liivi 1 and Liivi 2 sea areas, located northwest of Ruhnu Island.

The auction for Liivi 1 will begin on January 11, 2024 at 12:00 and end on January 17, 2024 at 12:00. The deadline for submitting applications for participation in the auction is January 4, 2024.

The auction for Liivi 2 will commence on December 7, 2023 at 12:00 and end on December 13, 2023 at 12:00. The deadline for submitting applications for participation in the auction is November 30, 2023.

Instructions for electronic auctions prepared by CPTRA, along with the user manual of the auction environment for applicants for a superficies licence, are available on the CPTRA website.

Ukraine's synchronisation with ENTSO-E completed

ENTSO-E has announced that Ukraine's power utility, Ukrenergo, has achieved compliance with the key technical requirements necessary to enable a permanent interconnection between the power systems of Continental Europe and Ukraine. Additionally, ENTSO-E has decided to increase the capacity limit for electricity trade from continental Europe to Ukraine and Moldova to 1,700 MW, reflecting an increase of 500 MW from the previous limit.

The synchronisation project with Ukrenergo began in 2017, with the signing of the agreement on conditions for the future interconnection.

In June 2018, the EC, together with the Baltic countries and Poland, agreed on a political roadmap for the synchronisation via Poland, with a target date of 2025. However, the geopolitical security situation after the Russia-Ukraine conflict has led the Baltic TSOs to speed up the project.

North Macedonia, Greece, Albania and Kosovo sign MoU for SEM establishment

North Macedonia's power transmission company MEPSO AD, and MEMO – the national electricity market operator, along with Greece's IPTO ADMIE, Albanian TSO Operatori i Sistemit të Transmetimit (OST sh.a), Kosovo's power grid operator KOSTT, and Albanian Power Exchange (ALPEX)– a joint venture company owned by OST and KOSTT, have signed a MoU for the merging of electricity markets and the establishment of a single electricity market (SEM). The SEM will be connected to the European market.

As per North Macedonia's power transmission company, MEPSO AD, the formation of SEM would improve market liquidity, ensure grid stability, integrate renewable energy sources, and increase transparency and competition in the region.

Montenegrin and Serbian TSOs to build Trans-Balkan corridor's last section

Montenegro's TSO Crnogorski Elektroprenosni Sistem (CGES), and its Serbian counterpart Elektromreze Srbije (EMS), have signed a cooperation agreement to build a 400 kV cable network as part of the Trans-Balkan electricity corridor.

The construction of the 84 km, 400 kV Bajina Basta (Serbia)–Višegrad (Bosnia and Herzegovina)–Pljevlja (Montenegro) line forms the fourth and final phase of the larger energy corridor, which is a regional network connecting the electricity systems of Bosnia, Montenegro and Serbia to Croatia, Hungary, Romania and Italy via overhead lines and submarine cables.

The first phase of the larger project was completed in May 2018 and entailed construction of the 400 kV double-circuit line stretching from Pancevo to the Romanian border within Serbian territory. The EUR29.6 million second phase, which was completed in 2022, included the construction of the 400 kV line linking Kragujevac 2 and Kraljevo 3, upgrade of the Kraljevo 3 substation to 400 kV, as well as equipping one 400 kV feeder bay in the 400/110 kV Kragujevac 2 substation. Under the first two phases, 120 km of the corridor had already been built on Serbian territory from Pancevo to the border with Romania, and from Kragujevac to Kraljevo in Serbia. The third phase entails the construction of a 109-km-long, 400 kV line from Bajina Basta to Obrenovac, upgrade of the Bajina Basta substation's capacity to 400 kV, and overhaul of the Obrenovac substation in Serbia. This phase is expected to be completed in early 2025 at an investment of EUR58.95 million.

Following this, construction of the last section is scheduled to begin and will be completed in 2027.

(EUR1=USD1.08)

EC approves CARMEN 2 project between Bulgarian and Romania

The EC has included CARMEN 2, the joint project of Bulgaria's Electroenergien Sistemen Operator EAD (ESO EAD) and its Romanian counterpart Transelectrica, and the distribution company Delgaz Grid S.A., in the sixth list of European PCI. With a timeline of 2023, CARMEN 2 is aimed at digitisation and expansion of the electricity transmission network of Bulgaria and Romania, to modernise and increase their transmission capacity to connect new renewable energy capacities under construction.

As a part of the project, ESO EAD will invest nearly BGN1 billion for the construction of new fully digitalised 400/110 kV substations, reconstruction and modernisation of existing substations and increasing their capacity, through transformation from voltage level 220/110 kV to 400/110 kV. The electricity transmission operator of Bulgaria also plans the construction of 222 km of new digitised 400 kV power lines. There will be a particular focus on capacity expansion in north-eastern Bulgaria to harness the region's high potential for renewable energy production estimated at more than 8,000 MW, including in the form of green hydrogen.

(BGN1=USD0.56)

Middle East and Africa

UAE's TAQA revises investment in transmission sector

The United Arab of Emirates (UAE)-based Abu Dhabi National Energy Company (TAQA) has released an updated 2030 investment plan, along with the financial results for the first nine months of 2023. TAQA plans to invest AED75 billion until 2030 towards power and water capacity expansion and UAE-based T&D networks. This figure includes the previously committed spend of AED40 billion between 2021 and 2030 to grow its UAE T&D networks. TAQA is also actively seeking to expand its T&D business beyond the UAE through both acquisitions and green field opportunities.

Building upon its 2021 growth strategy, the revised growth targets see TAQA aiming for 150 GW of gross power generation by 2030, up from the previous target of 50 GW, with around 65 per cent of its generation capacity coming from renewable energy sources compared to 30 per cent committed previously. This is backed by its leading stake of 43 per cent in Abu Dhabi Future Energy Company (Masdar), which plans to increase its clean generation capacity to 100 GW by 2030. In terms of net power generation capacity, TAQA is set to reach 50 GW by 2030, up from its current net capacity of 17 GW.

In terms of the financial results, during the first nine months of 2023, the TAQA Group revenues remained at AED39.5 billion compared to the corresponding period last year period, as the higher pass-through bulk supply tariffs and transmission use of system (TUoS) within the T&D segment, offset a decline in oil and gas revenue. Net income (TAQA share) was AED15 billion, which marks an increase of AED8.5 billion, driven by an in-part offset by a one-off AED1.2 billion deferred tax liability associated with the introduction of UAE corporate income tax from 1 January 2024. Net income excluding the one-off items (including the one-off gain of AED10.8 billion on the acquisition of a 5 per cent shareholding in ADNOC Gas) was AED5.4 billion, 17 per cent lower than the prior period, mainly due to lower contribution from the oil and gas segment. Capital expenditure during the period was AED3.3 billion, 34 per cent higher than the prior year, as project execution picked up pace in the T&D segment.

(AED1=USD0.27)

Iraq–GCC link on track for completion in 2024

Iraq has announced that the interconnection between the Gulf Cooperation Council (GCC) grid and Iraq is on track to be completed in 2024 to meet power demand in southern Iraq. The project, which is being implemented by the GCC Interconnection Authority (GCCIA) and Iraq, marks the first implementation outside the electrical grid system of the GCC countries [comprising Saudi Arabia, Bahrain, Kuwait, Oman, Qatar and the UAE] to increase the energy reliability in the Gulf network by connecting GCC with Egypt, Jordan and Iraq to establish a pan-Arab market

The project entails the construction of a 295-km-long transmission line connecting the Al-Wafra substation in Kuwait to the Al-Faw substation in suthern Iraq, to transfer 500 MW of electricity initially, and increase it to 1.8 GW subsequently. It also includes supplying and installing circuit breakers, electrical reactors, and measurement and control systems for the construction and expansion of the substations. Construction works on the interconnection commenced in June 2023. The contractors are KEC International (India), Calik enerji (Iraq), Kalpataru (India), Cegelec (Iraq), and National Contracting Company (Saudi Arabia).

Separately, the first phase of the Jordan–Iraq Power Transmission Project (JIPT), which entails the construction of a 300-km-long, 400 kV transmission line connecting the Al-Risha substation in Jordan with the Al-Qaim electrical transformation station in Iraq, has been completed. It is jointly being implemented by Jordan's National Electric Power Company (NEPCO) and Iraq's General Electricity Transmission Company – Central Region. With the

completion of the first phase, the project is expected to provide Iraq with around 50 MW of electricity particularly to Rutba town in Al Anbar province. Iraq will also receive additional power supply of 350 MW after the completion of the second phase. The third phase of the project includes the completion of the electrical connection between Iraq, Jordan and Egypt.

Oman's OETC completes first phase of Rabt interconnection project

Oman Electricity Transmission Company (OETC), a member of Nama Group and Oman's high voltage grid developer, has completed of Phase 1 of its North-South Interconnection Project (Rabt). This initiative, aimed at integrating Oman's disparate grids into one cohesive national network, has reached a significant milestone. The first phase, which spanned 670 km and included five major grid stations (at Nihada, Barik, Suwaihat, Al Duqm and Mahout) interconnected by overhead transmission lines, now operates at voltages of up to 400 kV. With this, the country's Main Interconnected System (MIS) serving the northern part of Oman's grid, now extends from Nihada in Al Dhahirah Governorate to Duqm Special Economic Zone (SEZ) in Al Wusta Governorate. Further, under this phase the isolated networks of Petroleum Development Oman (PDO) and Rural Areas Electricity Company (Tanweer) in Duqm SEZ have been interconnected.

With a total investment of approximately OMR372 million, the completionof Phase 1 sets the stage for the second phase, scheduled to launch in 2023. This upcoming phase will extend 400 kV transmission lines from Duqm further south, covering a distance of about 502 km to link up with the existing Dhofar System. The Rabt project, beyond its primary goal of integrating Oman's networks, holds immense strategic significance. It opens avenues for the development of solar and wind power projects in Al Wusta Governorate, contributing significantly to Oman's green energy ambitions. Furthermore, the interconnection enhances energy efficiency, bolsters security of supply, and strengthens electricity provision to PDO areas, reducing the organisation's reliance on gas-fired power generation.

(OMR1=USD2.60)

IEA urges Uganda to consider cross-border transmission lines

The International Energy Agency (IEA) has urged Uganda to develop transmission lines to neighbouring power markets to increase the supply of electricity based on its in-depth review of Uganda's energy and climate policies. According to the IEA report titled Uganda 2023: Energy Policy Review, approximately 20 per cent of the population of Uganda had access to electricity from the national grid, and almost all the electricity is generated from renewables, though hydropower and solar resources still remain untapped.

Uganda's main 132 kV transmission network has one interconnection with Tanzania and Kenya each, though the interconnection with Tanzania only allows Uganda to export. A new 220 kV line from Bujagali Hydro Power Plant to Rwanda is expected to be commissioned in the near future as well as distribution-level connections to the Democratic Republic of Congo (DRC). Additional interconnections with South Sudan, Tanzania, and the DRC are under study.

West African power utilities sign TSA for OMGV Energy Project

The national power companies of Gambia, Guinea, Guinea-Bissau and Senegal have signed a transmission service agreement (TSA) to create a loop high-voltage power transmission line in West Africa as part of the Projet Energie de l'OMVG or OMVG Energy Project. The signatories of the agreement signed in October 2023 in Senegal are the Société Nationale d'Electricité du Sénégal (SENELEC) of Senegal, Electricité de Guinée (EDG) of Guinea, National Water and Electricity Company (NAWEC) of Gambia, and Electricidade e Aguas da Guiné-Bissau (EAGB) of Guinea-Bissau, and L'Organisation pour la Mise en Valeur du Fleuve Gambie (OMVG) or the Organization for Development of Gambia River, which is the executing agency for the integrated development programmes in the region.

The 225 kV D/C line spanning the four countries will comprise 1,677 km of power lines, 4,000 lattice pylons raised with galvanised steel frames and 15 substations, which will interconnect the electricity grid of the four countries. The cost of the development is USD685 million. The OMVG Energy Project comprises the 128 MW Sambangalou Hydroelectric Development at Sambangalou Dam in the Kedougou region of Senegal, Kaleta Hydroelectric Development at Kaleta Dam in Guinea, and an interconnection transmission line circuit linking the two dams to the electric grid of the four countries. The project has been a subject of environmental and social impact assessment (ESIA) with a resettlement action plan (RAP) to meet regulations applicable within OMVG countries and those of the African Development Bank (AfDB), which is funding the project.

AfDB has recently recommended the remaining work be completed in Guinea-Bissau to connect the country to both the OMVG transmission network and the West African Power Pool (WAPP). It also suggests appointing a permanent maintenance operator for the transmission system immediately.

Nigeria's TCN to upgrade two substations

The Transmission Company of Nigeria (TCN) will upgrade two substations that will make more bulk power available to electricity distribution companies (DisCos).

A new 60 MVA, 132/33 kV Siemens power transformer has been delivered to TCN's 132/33 kV transmission substation in Ojo, Lagos for installation. This transformer is in addition to the existing two transformers and will increase the bulk power wheeling capacity of the Ojo substation from 96 MVA to 144 MVA, making available more bulk power supply to Ikeja DisCo.

TCN also received another 150 MVA power transformer at its New Haven substation in Enugu. The substation capacity will increase to 450 MVA on installation of the new transformer making more power available for delivery to Enugu DisCo. This rehabilitation project is funded by the World Bank.

South Africa's Eskom and China's SGCC strengthen collaboration

As part of the outcomes unveiled during President Xi Jinping's state visit to South Africa, a cooperation agreement between South Africa's state-owned energy company, Eskom Holdings SOC Limited

(Eskom) and the SGCC was among the significant pacts highlighted. The agreement reinforces a collaborative effort towards bolstering power and energy sectors in both nations.

Currently, South Africa is taking measures to address its power supply challenges, accelerate the development of new energy, and facilitate the green energy transition.

Eskom hopes to deepen cooperation with SGCC to ensure power supply, strengthen demand-side management, advance new energy consumption, foster the synergy of generation, grid, load and storage, and upgrade power grid technology to promote sustainable development of the power and energy industry.

During the meeting, SGCC's chairman highlighted the company's contribution to the development of Africa's power sector. It actively promotes the joint development of the Belt and Road Initiative (BRI) in Africa by participating in key power projects such as the 500 kV Ethiopia transmission project, the ±500 kV Ethiopia–Kenya HVDC project, and Egypt's 500 kV power grid upgrading project.

SGCC is committed to supporting South Africa in addressing power supply shortages, and will assist in carrying out comprehensive energy planning studies, while deepening exchanges and cooperation in power grid development, energy transformation and talent development among other things.

World Bank consents legal separation of Eskom's transmission division

Eskom has announced that the World Bank, a key strategic creditor of Eskom, has granted consent for the proposed legal separation of its transmission division from Eskom to the National Transmission Company South Africa (NTCSA). This move, a part of Eskom's turnaround plan aligned with the Department of Public Enterprises' (DPE) roadmap, aims to address the country's energy crisis sustainably.

NTCSA has already obtained licenses for transmission facility operation, electricity trading, and import/export from the National Energy Regulator of South Africa (Nersa). However, securing consents from the remaining financial creditors remains a final prerequisite for the legal separation of the transmission division.

Eskom emphasises that this separation is integral to its strategic objectives, facilitating improved grid access and incentivising investments in the generation sector. The ultimate goal is to enhance the country's energy security by promoting a robust supply system.

Eskom prepares plan to bolster South Africa's transmission infrastructure

Eskom is making notable progress on the implementation of its Transmission Development Plan (TDP), underscoring key developments toward integrating new generation capacity for the nation. This was announced in the TDP Implementation Forum hosted by Eskom on November 15, 2023, to update stakeholders on crucial advancements, a shift from the traditional TDP Public Forum, as stipulated in its transmission license issued by Nersa. Eskom has confirmed that the legal separation of the transmission business is in an advanced stage, with the NTCSA receiving approval for the requisite licences from Nersa. NTCSA is expected to start operating in the next financial year (starting March 1, 2024) subject to fulfilment of all suspensive conditions.

TDP 2022 indicated the need for approximately 14,000 km of extra-high voltage (EHV) lines, 170 transformers, and 105,865 MVA of transformer capacity over a decade. Currently, 46 expansion projects are underway, with 26 projects set to deliver 1,632 km and 11,290 MVA of transmission line and transformation capacity, enabling over 15,000 MW.

Of these 26 projects, half or 13 projects have commenced with construction, which will deliver 1,197 km of transmission lines and 3,290 MVA of transformation capacity, and enable over 10,000 MW of generation [Medupi Transmission Integration (4.8 GW), Kusile Transmission Integration (4.8 GW) and Garob Independent Power Producer (IPP) Integration at the Kronos substation (267 MW) by 2028]. The remaining 13 projects are in various phases of the procurement process, which will deliver 435 km and 8,000 MVA and enable 4,975 MW, mainly in the Northern Cape and Western Cape.

Eskom has approved ZAR26 billion in capital investment for transmission with several other projects also being budgeted. This includes two priority programmes – the first comprises 25 projects in existing substations unlocking 13,000 MW in five years, and the second includes 22 expedited transmission projects enabling 24,000 MW by 2033. Overall, 47 projects have the potential to unlock 37,000 MW between 2025 and 2033.

The newly developed Interim Grid Capacity Allocation Rules (IGCAR), a strategy facilitating the connection of shovel-ready projects from a first-come-first-served to a first-ready-first-served approach, are yielding intended results. The application of these rules showcased success, allocating grid connection capacity to numerous IPP projects in the greater Cape area.

Addressing the impediments faced by South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), Eskom cited grid capacity limitations as a hurdle delaying the integration of new solar and wind capacity, exacerbating the country's electricity shortages. Plans to procure 3,200 MW of wind energy during the sixth bidding window of the REIPPPP were cancelled due to insufficient transmission capacity, underscoring the urgency for infrastructure improvements.

To bolster its efforts, Eskom has now initiated a bidding process for the engineering, procurement, and construction of a new 400 kV gas-insulated substation, including switchgear, with submissions closing on June 18, 2024.

In October 2023, Eskom released its 2025 Generation Connection Capacity Assessment (GCCA), offering insights for developers aiming to pursue new generation projects. The report highlighted critical transmission network areas in regions ideal for wind and photovoltaic generation—such as the Northern Cape, Eastern Cape, Western Cape, and Hydra Central— which are currently lacking transmission capacity due to prior bid rounds and private off-take agreements. Despite efforts to expedite and prioritise transmission corridor strengthening,

necessary to alleviate these constraints, the commissioned upgrades are anticipated only from 2027 onwards, raising concerns about delays in addressing critical capacity needs.

Moreover, Eskom's reform strategy involves restructuring its generation, distribution, and transmission arms into distinct legal entities under Eskom Holdings. The registration of NTCSA is complete and set to commence operations in the upcoming financial year.

In another development, the South African Cabinet has approved the Just Energy Transition Implementation Plan (JET-IP), which set out several interventions and investments required for the country to transition to a low-carbon and climate-resilient economy in line with the nationally determined contribution presented to the United Nations (UN).

The International Partner's Group (IPG) has confirmed its commitment to funding South Africa in support of JET-IP with a total financing commitment of USD9.3 billion, increased from the initial USD8.5 billion. Initially comprising France, Germany, the UK, the US and the EU, the IPG was expanded earlier this year to include Denmark and the Netherlands.

(ZAR1=USD0.053)

Eskom prepares to deploy synchronous condensers in South Africa

Eskom is set to introduce 11 synchronous condensers into its transmission system in a proactive move to bolster grid stability amidst the increasing integration of variable renewable energy sources.

These condensers, identified as crucial elements for providing dynamic voltage support, inertia, and short-circuit current necessary for accommodating inverter-based technologies, are part of Eskom's strategy following a recent power system modelling study conducted by it.

The plan includes repurposing generators at the Camden and Grootvlei power stations to serve as synchronous condenser units after their decommissioning.

The deployment strategy outlines seven new synchronous condensers slated for installation at or near existing substations like Aggeneis, Gromis, Gamma, Koruson, Grassridge, and a pair at Ferrum. Additionally, the study highlights the necessity for synchronous-condenser functionality in the vicinity of the Avon open-cycle gas turbine plant in KwaZulu-Natal.

Addressing the rationale behind the selection of locations and sizes for these synchronous condensers, Eskom emphasises that these strategic placements are crucial to reinforce areas experiencing high penetrations of renewable energy within the network.

This determination was based on detailed power system analysis and simulation studies conducted in alignment with assumptions on renewable energy integration and the planned decommissioning of some baseload synchronous power stations, as outlined in the Integrated Resource Plan (IRP) 2019.

While Eskom has not disclosed the final capital investment figure, it expects repurposing the generators at Camden and Grootvlei to be more cost-effective than purchasing new machines.

The conversion expenses are estimated between USD20,000/MVAr and USD50,000/MVAr, while the expense for new synchronous condensers is projected to be at least double that amount

To execute this deployment strategy, Eskom plans to follow its procurement process to appoint an EPC contractor to design, construct and commission the infrastructure, before handing it over to Eskom for operations and maintenance.

South Africa's Eskom starts operation of first utility-scale BESS project

Eskom has officially commenced operations of the initial phase of its first utility-scale BESS project, part of a World Bank-funded programme. This ground-breaking initiative encompasses eight projects, collectively providing a storage capacity of 199 MW and the capability to discharge 833 MWh of electricity over a minimum of four hours.

The inaugural project, the Hex BESS site, boasts a capacity of 20 MW/100 MWh and is strategically located on Eskom's distribution network in Worcester, Western Cape. Notably, the batteries for this project were supplied by South Korea's Hyosung.

It was confirmed that despite initial delays at some sites, all seven of other Phase 1 projects are progressing as scheduled.

These include the Skaapvlei, Graafwater, and Paleisheuwel sites in the Western Cape, Elandskop and Pongola projects in KwaZulu-Natal, Rietfontein site in the Northern Cape, and Melkhout site in the Eastern Cape.

The Hex BESS site, officially opened on November 9, 2023, has the capacity to supply 100 MWh of energy daily, equivalent to the consumption of a town the size of Mossel Bay for approximately five hours.

Phase 1 also integrates around 2 MW of solar PV capacity coupled with the Rietfontein project, addressing electricity supply constraints.

While Phases 1 and 2 are funded through a World Bank loan component of USD3.75 billion, Phase 2, which aims to introduce an additional 144 MW/616 MWh of BESS, is temporarily on hold. Eskom awaits clarification from the National Treasury regarding the inclusion of BESS projects in the distribution business's capital projects without breaching debt-relief conditions. Phase 2 projects are located in Witzenburg and Ashton (Western Cape) and Cuprum and Kiwano (Northern Cape).

These sites were chosen to defer capital expenditure and provide various services to the grid, including ancillary services such as frequency regulation, voltage support, and reactive power control.

The BESS projects in Phase 1, including Hex, will play a crucial role in managing peak demand periods, reducing strain on the grid during peak hours, and minimising curtailment of variable renewable energy generators.

Eskom aims to use stored energy during high consumption times, subsequently recharging during off-peak periods, thus avoiding the need for costly peak power plants.

The costs for the BESS projects will be included in future revenue applications to the National Energy Regulator of South Africa.

In another development, Norwegian renewable energy solutions provider, Scatec ASA, has secured the preferred bidder status for the Mogobe (Ferrum) BESS project totalling 103 MW/412 MWh, under the first bid window of the Battery Energy Storage Independent Power Producer Procurement Programme (BESIPPPP) in South Africa organised by the Department of Mineral Resources and Energy (DMRE). Scatec will dispatch power under a 15-year PPA.

The bidding process, initiated on March 7, 2023, with submissions made on August 2, 2023, aimed to procure 513 MW of battery storage across specific Eskom transmission substations in South Africa's Northern Cape province.

The estimated total capex for the BESS project is ZAR3.1 billion, with Scatec's EPC contracts accounting for about 83 per cent.

Funding will be sourced from ZAR2.6 billion of non-recourse project debt and the remaining from equity contributions by the owners.

Scatec will hold 51 per cent equity in the project, with Perpetua Holding and Community Trust owning 46.5 per cent and 2.5 per cent, respectively.

Additionally, Scatec will provide EPC, operations and maintenance (O&M), and asset management (AM) services for the project.

DMRE anticipates concluding commercial negotiations by June 2024. This development signifies a significant stride towards enhancing South Africa's energy storage capacity and fostering sustainable energy practices.

In a related development, the Independent Power Producer Office (IPPO) is finalising the evaluation of 17 bids for BESS projects, aligning with the government's goal to procure projects with a combined capacity of 513 MW and a minimum storage of four hours. The second round for 1,230 MW is slated for launch in early 2024.

(ZAR1=USD0.053)◆

Agenda/Structure

- State Programs and Support
- Building the Infrastructure of the Future
- Digitalization at EV Charging Stations
- Electrifying Fleets
- Charging at Parking Facilities
- MUD Charging Strategy
- Business Challenges and Solutions
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Thailand's EGAT

To invest in strategic transmission initiatives

Thailand, which aims for carbon neutrality by 2050, is taking measures to bolster clean energy production. The focus is on stimulating production competition, enabling access to the transmission network, and ensuring equitable electricity pricing in a liberalised market. The state-owned vertically integrated utility, the Electricity Generating Authority of Thailand (EGAT), has a pivotal role to play in this transition. The company owns one-third of the country's installed capacity, has a natural monopoly in transmission and purchases bulk electricity from independent power producers (IPPs) and small power producers (SPPs). It sells electricity to its direct customers as well as the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA), which further distribute it to retail customers. EGAT also serves as the system operator for the National Control Center, which controls the dispatch of power plants, electricity generation and transmission nationwide, and is responsible for cross-border electricity trading. EGAT's other diverse business ventures include engineering, procurement and construction services, operation and maintenance, transmission system maintenance, by-products and telecommunications. Over the next 15 years (up to 2037), EGAT has planned a capacity addition of 9 GW. Further, it plans to invest TBH365 billion to add over 12,394 circuit km of transmission lines and 63,925 MVA of transformer capacity by 2030.

Existing capacity and network

As of September 2023, EGAT had an installed generation capacity of 16,238 MW or 33 per cent of the country's total installed capacity of 48,800 MW. Of this, steam and gas combined cycle plants accounted for 51.7 per cent (or 8,400 MW), thermal accounted for 22.7 per cent, hydro (including small hydro) for 18.7 per cent, pumped storage for 6.2 per cent and the remaining 0.7 per cent was based on solar, wind geothermal sources and diesel.

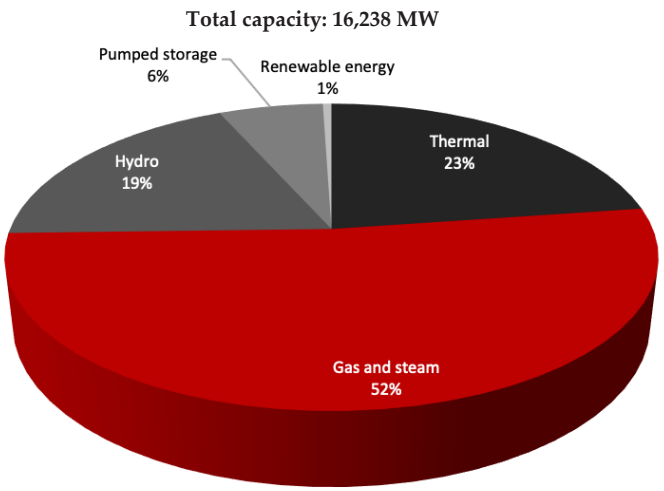
As of September 2023, EGAT owned and operated a transmission line length of 39,213 circuit km (ckt km), a transformer capacity of 1,83,182 MVA and 237 substations across the 69 kV to 500 kV voltages. The majority of the network is at 230 kV (40.1 per cent) closely followed by 132 kV (37.5 per cent) and 500 kV (22.3 per cent). Over half of the transformer capacity is at 230 kV followed by 500 kV (36 per cent) and 115 kV (11 per cent). EGAT is interconnected with the Lao People's Democratic Republic (PDR) power grid through 115 kV and 22 kV lines, and with the Malaysian grid via a 300 kV high voltage direct current (HVDC) line. Further, it purchases electricity from 10 projects with an installed capacity of 6,235 MW from the two countries, almost all of which are hydropower from Lao PDR.

Among the major projects commissioned over the last couple of years by EGAT is the 101-km, 500 kV Bang Saphan 2–Surat Thani 2 line in Phuket, which doubled the transmission capacity of the southern region to 1.76 GW. It is part of the larger 255-km transmission system improvement project in the western and southern regions to enhance system security. In 2023, EGAT commissioned the 230 kV Chonburi 2 and 115 kV Mae Moh 2 substations. The Chonburi 2 substation, which is interconnected with the Phan Thong, Ao Phai and Bo Win substations in Chonburi province, supports the growth of investment in the Eastern Economic Corridor (EEC), which includes the Chonburi, Chachoengsao and Rayong provinces. The Mae Moh 2 substation, located in Lampang province, is the first digital substation in the northern region and a part of EGAT's grid modernisation initiative to accommodate renewable energy generation. EGAT also recently completed the improvement of three more digital substations – Trat, Satun and Kantharalak.

Financial and operational performance

During 2022, EGAT earned TBH800.4 billion compared to TBH524.8 billion in 2018, recording a compound annual growth rate (CAGR) of 11.13 per cent. In 2022, over 99 per cent or TBH794,894 million of revenue was from electricity sales while expenditure in the

Figure 1: Installed capacity of EGAT in Thailand as of September 2023 (MW)



Note: Renewable includes solar, wind and geothermal as well as 30 MW of diesel; hydro includes small hydro
Source: EGAT; Global Transmission Report

Table 1: Growth in EGAT's transmission network in Thailand

Voltage	2018	2019	2020	2021	2022	2023*
Transmission lines (circuit km)						
69 kV AC	19	19	19	19	19	19
115 kV AC	13,263	13,998	14,423	14,716	14,388	14,708
132 kV AC	9	9	9	9	9	9
230 kV AC	14,713	15,358	15,698	15,805	15,952	15,729
300 kV DC	23	23	23	23	23	23
500 kV AC	6,527	6,575	6,912	7,269	8,275	8,725
Total	**34,554**	**35,981**	**37,084**	**37,840**	**38,667**	**39,213**
Transformer capacity (MVA)						
115 kV AC	14,833	15,048	15,223	15,511	15,661	15,611
132 kV AC	133	133	133	133	133	133
230 kV AC	62,800	64,700	66,400	69,400	70,900	72,100
300 kV DC	388	388	388	388	388	388
500 kV AC	36,950	40,950	41,950	44,950	48,950	49,950
Total	**1,15,104**	**1,21,219**	**1,24,094**	**1,30,382**	**1,36,032**	**1,38,182**
Substations (number)						
115 kV AC	126	125	126	125	124	125
230 kV AC	82	82	83	84	86	87
500 kV AC	20	22	22	23	25	25
Total	**228**	**229**	**231**	**232**	**235**	**237**

*Note: *As of September 2023*
AC–alternating current; DC–direct current
Source: EGAT; Global Transmission Report

electricity sector was TBH707,905 million (with about 18 per cent or TBH12,599 million incurred on transmission).

During 2022, revenue from electricity sales witnessed a year-on-year growth of 44 per cent predominantly driven by the increase in the volume of electric sales from 190.4 TWh in 2021 to 196.8 TWh due to economic recovery post the COVID-19 pandemic. Another factor was the rise in electricity price from TBH2.91 per kWh in 2021 to TBH4.04 per kWh in 2022, attributable to the rise in the automatic tariff adjustment driven by the escalating price of liquefied natural gas (LNG) since the beginning of 2022. Additionally, the procurement of electricity amidst the global energy crisis and the implementation of the energy pool price mechanism, as announced by the Energy Regulatory Commission (ERC) from April 2022 onwards, played a significant role in shaping the pricing dynamics. Net profit showed a year-on-year increase of about 48 per cent from 2021 to 2022.

Table 2: Key financial indicators of Thailand's EGAT (TBH million)

	2018	2019	2020	2021	2022
Revenue	**5,24,768**	**5,60,446**	**5,10,707**	**5,57,314**	**8,00,403**
–Electricity revenue*	5,21,554	5,57,099	5,07,254	5,53,483	7,94,894
Net profit	**48,809**	**51,496**	**31,311**	**30,682**	**45,387**
Expenditure in electricity	4,37,380	4,78,108	4,40,013	4,72,530	7,07,905
–Expenditure on transmission	11,567	12,332	12,823	12,562	12,599
Debt to equity ratio	1.26	1.12	1.04	1.16	1.41
Net profit margin (%)	9.3	9.2	6.13	5.51	5.67

*Note: Data reflects consolidated financial results for EGAT's entire business and is not specific to transmission unless stated otherwise; *Refers to revenues from electric energy sales.*
Source: EGAT; Global Transmission Report

Looking at operational indicators in 2022, the system average interruption frequency index (SAIFI) was 0.0904 occurrences per delivery point and the system average interruption duration index (SAIDI) was 0.9041 minutes per delivery point. Additionally, service availability was over 99.89 per cent, transmission circuit availability was 99.98 per cent, transformer availability was 99.08 per cent, voltage deviation was 0.0573 parts per million and frequency deviation was zero per cent, over the same period. These metrics imply good reliability, minimal interruption frequency and duration, high service availability, and precise control over voltage and frequency deviations.

Future plans

EGAT is focusing on adding new generation capacity and strengthening and augmenting its domestic networks. The upcoming generation capacity of 8,999 MW includes combined cycle power plants (54 per cent), followed by renewable energy sources (RES) (30 per cent), hydropower (10 per cent) and thermal (7 per cent). On the renewable front, hydro-floating solar hybrid projects are in the pipeline, in line with the country's energy transition plans.

EGAT has also entered into power purchase agreements (PPAs) with IPPs and SPPs, incorporating both cogeneration systems and RES. Furthermore, it has entered into a PPA for Lao PDR's 1,460 MW Luang Prabang hydro project, which is expected to begin commercial operation in January 2030.

In transmission, EGAT has around 20 key approved projects scheduled for completion between 2023 and 2030. Two more projects that are under the approval process plan on linking a 24 MW floating solar plant with a hydropower plant at Ubol Ratana Dam and constructing a 230 kV system for a new power plant replacing the South Bangkok power plant, respectively. Both projects are set to be completed in 2023.

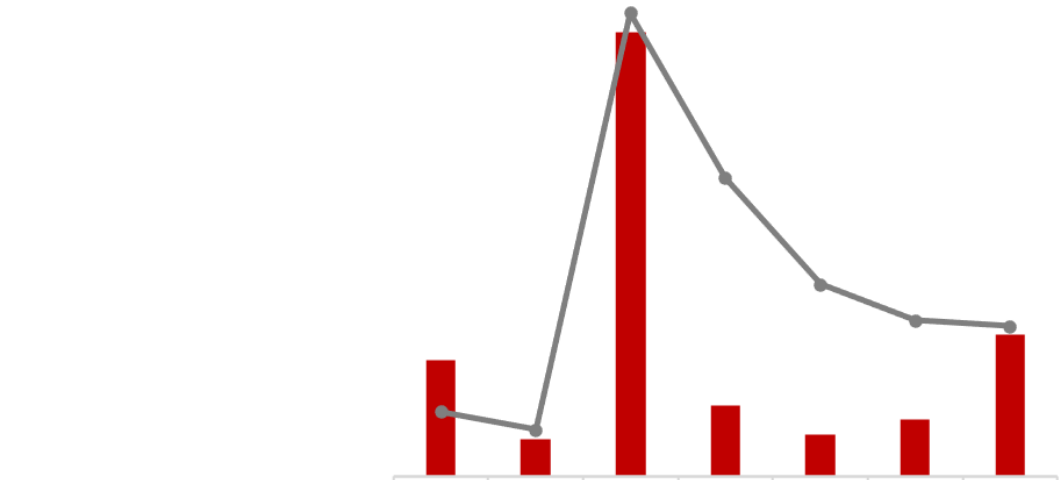
Among the notable approved projects, the biggest is the Transmission System Improvement Project for System Security Enhancement of the Northeast, Lower North, and Central Parts, including the Bangkok Metropolitan (TIEC) project. The TBH94 billion project aims to fortify power system security, accommodate the 25 per cent growth in RES, and contribute to the Association of Southeast Asian Nations (ASEAN) Power Grid (APG) system. As of December 2022, the project had achieved 58 per cent progress. It is slated for completion in 2030.

The TBH63.2 billion Transmission System Improvement Project in the Western and Southern Regions to Enhance System Security (TIWS) entails the construction of 500 kV lines and the enhancement of existing 230 kV lines to ensure long-term electricity supply to southern Thailand. By bolstering the transmission system's capacity from the west and central regions to the south, the project seeks to foster business, industry and tourism expansion in the area, addressing power outage issues. As of December 2022, the project had achieved progress of 72 per cent. It is slated for completion in 2026.

To strengthen its cross-border network, in February 2023, EGAT partnered with Malaysia's Tenaga Nasional Berhad (TNB) to jointly enhance interconnection with Malaysia, contributing to the security of the APG and facilitating regional energy trading during peak demand or crises. The collaborative effort aims to establish itself as the future ASEAN energy trading hub. Over three years, the two entities will conduct a comprehensive study to augment interconnection capacity, design an efficient transmission system, evaluate legal and regulatory considerations, and assess associated costs and risks. This initiative is crucial as the existing Thailand–Malaysia HVDC interconnection, operational since 2002, is set to conclude in 2027.

Recently in August 2023, EGAT entered into a memorandum of understanding (MoU) with Innopower Company Limited for

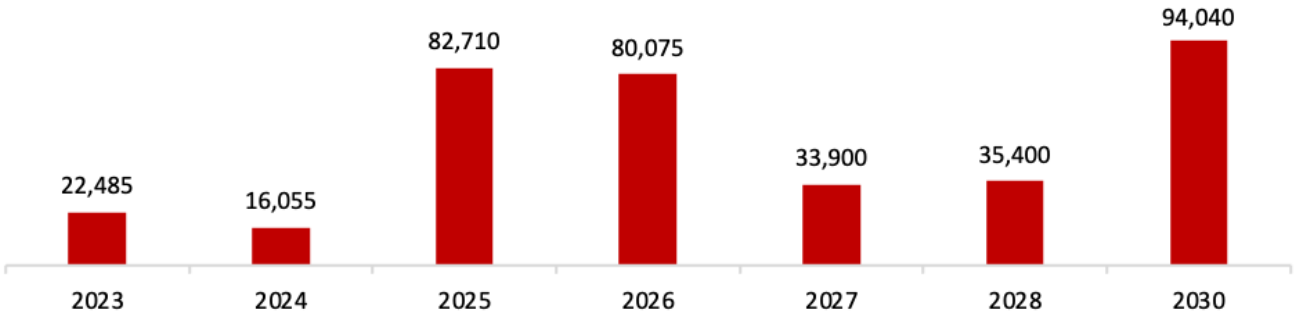
Figure 2: Planned transmission infrastructure of EGAT (2023-30)



	2023	2024	2025	2026	2027	2028	2030
Planned transformer capacity (MVA)	8,200	2,600	31,127	5,000	3,000	4,000	10,000
Planned line length (ckm)	587	426	4,184	2,693	1,737	1,409	1,358

Note: Addition figures have been mentioned for the year in which the project is expected to be completed.
Source: EGAT; Global Transmission Report

Figure 3: Planned investment in transmission, 2023-30 (TBH million)



Total investment =TBH364,665 million

Note: Investment figures have been mentioned for the year in which the project is expected to be completed.

Source: EGAT; Global Transmission Report

Table 2: EGAT's upcoming approved projects in transmission, 2023-30

Project name and details	Project purpose	Line length (ckt km)	Transformer capacity (MVA)	Other components	Cost (TBH million)	Expected year of completion
Transmission System Improvement Project for System Security Enhancement of the Northeast, Lower North, and Central Parts, including Bangkok Metropolitan (TIEC)	Supporting renewable energy projects, enhancing system security, and contributing to the ASEAN Power Grid	1,358	10,000	Expansion of 12 substations	94,040	2030
Transmission System Improvement Project in Western and Southern Regions (TIWS)	Enhancing power system security and promoting business and tourism expansion in the region	2,192	4,000	1 new substation, expansion of 5 substations	63,200	2026
Transmission System Expansion Project, Phase 12 (TS12)	Expansion project to meet growing power needs and strengthen the national transmission network	3,428	26,202	9 new substations, expansion of 124 substations	60,000	2025
Transmission System Improvement Project in Lower Southern Region (TILS)	Strengthening the power system in the lower southern region for long-term security and development	1,409	4,000	2 new substations, expansion of 9 substations	35,400	2028
Transmission System Renovation and Expansion Project, Phase 2 (RTS2)	Expanding and modernising the transmission network for increased capacity and reliability.	1,267	-	Construction/ renovation/ expansion of 19 substations	21,900	2027
Transmission System Improvement Project for the Upper Northern Region (TIPN)	Enhancing transmission infrastructure to accommodate increased electricity demand in the upper northern region	426	2,600	Expansion of 3 substations	12,240	2024
Bulk Power Supply for the Greater Bangkok Area, Phase 3 (GBA3)	Addressing the escalating electricity demand in the Greater Bangkok area	267	2,425	1 new substation, expansion of 6 substations, capacitor bank (384 MVAr)	12,100	2025
Transmission System Development Project in Loei, Nong Bua Lam Phu, and Khon Kaen Provinces (LNKP)	Facilitating power purchase from the Xayaburi hydroelectric plant	497	1,400	2 new substations, expansion of 4 substations	12,060	2023

Project name and details	Project purpose	Line length (ckt km)	Transformer capacity (MVA)	Other components	Cost (TBH million)	Expected year of completion
Transmission System Improvement Project in Eastern Region for System Security Enhancement (TIPE)	Enhancing power system security and supporting regional industrial expansion	470	3,000	3 new substations, expansion of 1 substation	12,000	2027
Main Transmission System Expansion Project for Power Purchase from SPP Cogeneration Power Plants (SPPC)	-	490	2,500	1 new substation, expansion/ improvement of 102 substations	10,610	2025
Transmission System Renovation and Expansion Project, Phase 1: Transmission Line (RLP1)	Overhauling and expanding aged transmission lines for improved efficiency	331	-	Renovation/ expansion of 14 substations	9,850	2026
Bulk Power Supply for the Greater Bangkok Area Project, Phase 2 (GBAS2)	Expanding power infrastructure to meet rising demand and enhance the security of the Greater Bangkok area	89	6,800	1 new substation, expansion of 6 substations, capacitor bank (384 MVAr)	9,170	2023
Transmission System Development Project for Power Purchase from IPPs (IPPP)	Linking power purchase from IPPs to strengthen the eastern and central power grid.	170	1,000	2 new substations, expansion of 6 substations	7,025	2026
Transmission System Renovation and Expansion Project, Phase 1: Substation (RSP1)	Enhancing system reliability by renovating aged substations	-	-	Renovation of 15 substations	3,815	2024
Transmission System Project for South Bangkok Power Plant Replacement, Phase 1 (SBR1)	Supporting a new power plant to replace the decommissioned South Bangkok thermal power plant	1	-	Expansion of 1 substation*	1,090	2023
Transmission System Development Plan for Power Plant of Hin Kong Power Company Limited (THKP)	Enhancing power system security in the western and southern regions by supporting the THKP plant	-	-	-	165	2023
Transmission System Development Project for Power Purchase from Independent Power Producers, Phase 3 (IPP3)	Linking power purchase from IPPs to meet rising demand in the eastern and central regions	-	-	-	-	2023
Transmission System Development Plan for Power Purchase from SPP Firm Cogeneration Power Plants (TSFC)	Accommodating power purchases from SPP firm cogeneration plants to maintain power system stability	-	-	-	-	2025

*Note: ASEAN – Association of Southeast Asian Nations; Table includes project details available from EGAT; *South Bangkok substation*
Source: EGAT; Global Transmission Report

grid modernisation, focusing on unmanned aerial vehicles (UAV), unmanned aircraft systems (UAS) platforms and centres, and an online management system for transformers.

Innopower, a collaboration among leading Thai energy companies – EGAT, Ratch Group Public Company Limited, and Electricity Generating Public Company Limited (EGCO Group) – will contribute technological solutions in drone technology, robotics, augmented reality/virtual reality (AR/VR), smart sensors, Internet of Things (IoT), integrated data centre platforms, and artificial intelligence (AI).

This initiative supports EGAT's integration of modern technologies into the transmission system, ensuring grid resilience in the face of RES uncertainties and the anticipated growth of electric vehicles.

Conclusion

EGAT stands at the forefront of Thailand's power sector, wielding significant influence in electricity transmission. With a commitment to innovation, diverse business ventures, and strategic collaborations with entities, the utility aims to navigate the evolving landscape of RES and grid modernisation.◆

US DOE's TSED Programme

Addresses transmission siting and permitting challenges

The US is focusing on modernising the electric grid through dedicated funding under the Infrastructure Investment and Jobs Act (IIJA) [also known as the Bipartisan Infrastructure Law (BIL)] and the Inflation Reduction Act (IRA). Independent estimates project that there will be a 60 per cent expansion in transmission systems by 2030, potentially tripling by 2050 to meet clean electricity and resiliency demands. The US Department of Energy (DOE), which is the nodal agency for the disbursement of BIL and IRA funds for clean energy programmes, is deploying several strategies to help reduce siting and permitting delays in the construction of new transmission projects needed to maintain reliability, reduce consumer costs, and enable the addition of new clean energy resources. This includes the Transmission Siting and Economic Development (TSED) grant programme *(*established by IRA*)*; the Coordinated Interagency Transmission Authorizations and Permits (CITAP) Program (to improve the efficiency of federal permitting processes) and the National Interest Electric Transmission Corridors (NIETCs) (to unlock additional federal funding and siting and permitting tools). Specifically, IRA provides USD760 million in TSED grants to support states and local communities in the siting and permitting of interstate and offshore electricity transmission lines (*Section 50152)* and another USD100 million to support planning, modelling, analysis and convening stakeholders *(Section 50153). In line with this,* on August 29, 2023, DOE announced a USD300 million funding opportunity announcement (FOA) as the first tranche of the programme. Going forward, two additional application phases will be available in summer 2024 and fall 2025.

Administered by the DOE's Grid Deployment Office (GDO), the TSED grant programme is dedicated to supporting states, tribes and local governments in strengthening and accelerating siting and permitting processes of qualifying or covered projects; as well as the economic development in communities affected by the construction and operation of such projects. Qualifying or covered transmission projects include high-voltage interstate or offshore transmission lines [alternating current (AC) or direct current (DC)] that are proposed to be constructed and to operate at a minimum of 275 kV (for onshore) or 200 kV (for offshore) by an entity that has applied or informed a siting authority of its intent to apply, for regulatory approval. All awardees are required by law to share costs with DOE at least to the extent of 5 per cent.

Siting and permitting activities

The activities eligible for funding include studies and analyses of the impacts of qualifying projects; examination of up to three alternate siting corridors for covered projects; participation by the siting authority in regulatory proceedings or negotiations in another jurisdiction or proceedings at the Federal Energy Regulatory Commission (FERC) or a state regulatory commission (subject to 50 per cent cost share); and other actions that may improve the chances of, and shorten the time required for, approval by the siting authority. The latter actions could include increasing human resources capacity, such as staff or consultants; coordination within the state or with other state, tribal or federal jurisdictions; and robust engagement and communication with stakeholders including impacted communities. All activities except regulatory proceedings involve a cost share of 5 per cent. Authorities receiving funding for siting activities must agree to reach a final decision on an application within two years after the grant is disbursed unless DOE extends the timeline. Unutilised funds must be returned to DOE.

Economic development activities

The eligible TSED award recipients for economic development activities include siting authorities; or any other state, tribal, or local government entity working with communities. Eligible applicants can partner with community organisations such as non-profits. Some of the examples of potential types of projects DOE could consider are sub-grant programmes enabling communities to propose local activities; investments in local energy resilience, such as microgrids or solar; affordable and sustainable housing; community infrastructure such as broadband, public safety facilities, community centres, green spaces or species habitat; job training and apprenticeship programmes; and low-income energy funds to reduce costs for qualifying community members. DOE is flexible and urges communities to propose projects tailored to meet local needs. Under this head, DOE can make an award for economic development activities but cannot disburse the funds until certain milestones are hit in the transmission project development such as obtaining permits or commencement of construction. Awardees are required to contribute 5 per cent of the total costs.

The way forward

Interested applicants must prepare and submit a concept paper, a brief, high-level expression of interest containing approximately four to six pages. It should include seven pieces of information, namely, the basis of eligibility; a description of the proposal and objectives; identification of two to three high-level risks and challenges and possible risk mitigation strategies; schedule for the project including start dates for spending grant funds; identification of the transmission project; identification of qualification, experience and resources of the applicant to help ensure project completion; and requirement of partners if applicable. The deadline for submission of concept papers was November 17, 2023, while DOE is expected to respond to these in early 2024. The complete application deadline is April 5, 2024, with the final selection notification expected in the summer of 2024. DOE expects to make an award of about USD200 million for economic development activities and USD100 million for siting and permitting for up to 40 projects under each category. The period of performance may vary from 24 to 28 months. In October 2023, GDO announced that two additional application phases will be held in summer 2024 and fall 2025. DOE intends to accept a second round of concept papers in August 2024, with full applications due in winter 2024-2025, and a third round of concept papers in fall 2025, with full applications due in winter 2025-2026. Notably, while transmission developers are ineligible for TSED grants, DOE encourages collaboration with these developers to propose innovative solutions that enhance coordination across jurisdictions, streamline permitting processes and resolve bottlenecks. The latest financial aid is expected to facilitate studies, modelling, environmental planning and analysis to expedite decision-making and reduce application processing times. This is essential to address the existing challenges of lengthy siting and permitting processes and expedite the construction of transmission infrastructure to achieve the country's clean energy goals.◆

EU Grid Action Plan

Seeks to address missing links of energy transition

Europe is pursuing one of the world's most ambitious climate and energy goals. To help deliver the objectives of the European Commission's (EC) European Green Deal of carbon neutrality by 2050; REPowerEU Plan to end Russian fossil fuel imports; and the revised Renewable Energy Directive (RED III) of reaching at least 42.5 per cent renewable energy sources (RES) share (but aiming for 45 per cent) by 2030, the European Union (EU) needs to upgrade and strengthen its transmission grid. EU's well-interconnected internal energy markets with one of the world's most extensive and resilient networks spanning 11 million km have played a critical role in ensuring stable supplies during the energy crisis. This has been possible largely due to the EU Trans-European Networks for Energy (TEN-E) Regulation, which has selected over 100 electricity projects of common interest (PCIs) over the last decade and facilitated their permitting and construction including by funding through the Connecting Europe Facility (CEF) funds.

Going forward, EU's electricity consumption is expected to increase by around 60 per cent between now and 2030. Networks will have to accommodate a more digitalised, decentralised and flexible system with millions of rooftop solar panels, heat pumps and local energy communities sharing their resources, more offshore wind (OSW) coming online, more electric vehicles (EVs) to charge, and growing hydrogen production needs. Wind and solar generation capacity alone is expected to increase 2.5 times from 400 GW in 2022 to at least 1,000 GW by 2030, including a large build-up of OSW of up to 317 GW. With RES expected to contribute to around half of the EU's 2030 energy supply, distribution grids, 40 per cent of which are over 40 years old, will need to be transformed substantially in parallel to accommodate this expansion. Further, as per the European Network of Transmission System Operators for Electricity's (ENTSO-E) Ten-Year Network Development Plan (TYNDP), cross-border transmission capacity is expected to double over the next seven years, with an additional 23 GW of capacity being incorporated by 2025 and a further 64 GW by 2030. Consequently, an estimated investment of a whopping EUR584 billion is required in EU transmission and distribution (T&D) grids. Continuing its support to the grid rollout, the EC has put in place a legal framework with the revised TEN-E Regulation (June 2022), RED III (October 2023; which streamlines permitting of networks necessary for RES integration), regulation and proposals for a Net-Zero Industry Act (NZIA; November 2023; which includes grid technologies in its scope) and a reformed electricity market design (EMD; October 2023).

In the latest move, on November 28, 2023, the EC released a communication 'Grids, the missing link: An EU Action Plan for Grids' under the European Wind Power Action Plan presented by it in the previous month. It follows the first High-Level Electricity Grids Forum that the ENTSO-E hosted under the EC's patronage in September 2023. The Action Plan identifies several interlinked measures that can be completed within the next 18 months to provide an adequate investment framework for grids. In addition to the Action Plan, the EC released the sixth list of projects of common interest (PCIs) and the first EU list of PCIs and projects of mutual interest (PMIs; between EU and third countries) established under the revised TEN-E Regulation, to bring the EU's energy infrastructure in line with its climate goals. It is also accompanied by a 'Pact for Engagement' to ensure broad stakeholder engagement in grid development.

Global Transmission Report presents the highlights of EC's recent releases.

EU Action Plan for Grids

The EC's Action Plan for Grids aims to address the missing links of the clean energy transition. It will ensure that EU grids operate more efficiently and are rolled out further and faster. It addresses the main challenges in expanding, digitising and better using EU electricity T&D grids. Specifically, it identifies concrete and tailor-made actions to help unlock the needed investment to accelerate the European electricity grid upgrade. The 14-point action plan to address seven horizontal challenges to accelerate the pace of grid development will make Europe's electricity grids stronger, more interconnected, more digitised and cyber-resilient to make a difference in time to achieve the 2030 objectives.

Accelerating PCI implementation and developing new projects through political steering, reinforced monitoring and new proposals: Going forward, the TEN-E framework will gain further importance in line with the expected growth in cross-border grid needs, to integrate and transmit large amounts of new RES generation across Europe. PCIs will also support EU countries in reaching the 15 per cent electricity interconnection target. Cross-border projects can decrease generation costs by EUR9 billion annually to 2040, while investments needed in cross-border capacity and storage amount to EUR6 billion annually. The timely completion of PCIs, the latest of which was approved on November 28, 2023 (more details covered subsequently), is key to ensuring that they can have an impact within this decade. Avoiding the slippages and delays that hampered PCI completion in the past requires an extra effort to monitor progress and swiftly remove bottlenecks and obstacles to implementation.

The TEN-E's comprehensive EU-wide TYNDP identifies significant additional system needs for 2040 and beyond. These should be matched by new PCIs in the subsequent lists and a robust pipeline of new projects must be developed and included in the updated PCI lists every two years. For the period 2021-2027, CEF for energy has a grant budget of EUR5.84 billion, which is available to new categories of offshore grids, electrolysers, hydrogen infrastructure, energy storage, CO_2 storage and smart gas grids in addition to electricity, gas, smart grids and CO_2 networks. CEF is limited to PCIs and does not cover local distribution system operator (DSO) needs. However, other EU funding possibilities such as the Cohesion Fund, European Regional Development Fund (ERDF), Recovery and Resilience Facility (RRF) or the Modernisation Fund are available for electricity grids, but some are under-utilised. The Recovery and Resilience Plans allocate around EUR13 billion to grids, covering reforms and investments in grid infrastructure, smart energy systems, energy storage facilities and digitisation of distribution and transmission networks.

Improving the long-term planning of grids to accommodate more RES and electrified demand, including hydrogen, in

the energy system by steering the work of system operators (SOs) and national regulatory authorities (NRAs): Building on past experience in pan-European network planning through TYNDP, the revised TEN-E regulation requires ENTSO-E to prepare offshore network development plans (ONDP), the first of which is due in January 2024. This should further be expanded together with onshore and offshore network planning under a common framework through the next TYNDP process. To ensure progressive integrated energy system planning, ENTSO-E should further strengthen the synergies among different energy carriers in the TYNDP, ensuring engagement of the relevant stakeholders for distribution, storage, hydrogen, CO2 and gas sectors as these sectors reach adequate maturity. NRAs should ensure that SOs further assess the flexibility needs of their energy systems when planning transmission networks, including the potential of energy storage as per the upcoming revised EMD legislative framework.

At the distribution level, the EU DSO Entity (the association of DSOs) should, by mid-2024, publish recommendations to improve distribution network planning in close coordination with ENTSO-E and TSOs and network users like RES, electromobility or heating and cooling, considering the uncertainties affecting DSO activities and their heterogenous size. Around 2,560 DSOs in EU cover 10 million km of distribution grids containing a wide spectrum of sizes and disparities in national concentrations. Adequate data sharing through a common platform will support DSOs in planning network needs to shorten grid connection times. EC plans to include grid-related actions in the iterative process with EU countries on their National Energy and Climate Plans (NECPs).

Introducing regulatory incentives through guidance on anticipatory, forward-looking investments and on cross-border cost-sharing for offshore projects: Anticipatory investments can be relevant in cases such as investing in future-proof offshore networks that allow for future expansions of meshed offshore grids; areas with high untapped onshore PV potential; and grid connections to ports for provision of shoreside electricity supply. To support this, the EC, in consultation with the Agency for the Cooperation of Energy Regulators (ACER), ENTSO-E and EU DSO Entity, plans to propose by the first quarter (Q1) of 2025 guidance identifying conditions under which the approval of anticipatory investments should be expected. Offshore networks will be composed of radial and hybrid transmission projects evolving towards a future meshed grid while the connection of energy islands and other large OSW projects will bring large benefits to society. It poses challenges in agreeing on the appropriate cost allocation approach. The EC plans to address this in a guidance aimed at supporting EU countries and NRA in such activities by June 2024.

Incentivising the better usage of grids with enhanced transparency and improved network tariffs for smarter grids, efficiency and innovative technologies and solutions by supporting the cooperation between SOs and recommendations by ACER: ENTSO-E and EU DSO Entity, in cooperation with the EC and NRAs, should work towards harmonised definitions for available grid hosting capacity to be able to provide a pan-EU overview of available grid hosting capacities for new network users to connect by mid-2025. They should also support SOs in digitising and streamlining procedures for grid connection requests. To promote effective utilisation of existing assets, SOs must increasingly deploy available innovative technologies such as dynamic line rating (DLR), high-temperature superconductor (HTS) cables, static synchronous compensators (STATCOM), voltage source converters (VSC) in high voltage direct current (HVDC) systems, HVDC breakers or phase shifting transformers (PST). ACER, in its next tariff report due in January 2025, must recommend best practices for the promotion of smart grids and network efficiency technologies through tariff design, focusing on the consideration of operation expenditure (opex) in addition to capital expenditure (capex) and benefit sharing.

Improving access to finance for grid projects by increasing visibility on opportunities for EU funding programmes, especially for smart grids and modernisation of distribution grids: SOs are faced with an unprecedented increase in the volume of capex. To fill the funding gap, the EC plans to identify tailored financing models and strengthen dialogue to address obstacles to private financing. The EC and the European Investment Bank (EIB) will explore further the need for financing tools and instruments to support grid investments at large, in the context of InvestEU. As mentioned earlier, major funding sources such as ERDF, CF and RRF, including its REPowerEU component, are not fully utilised. Countries must consider the available options to increase allocations for smart grids and modernisation of distribution grids.

Stimulating faster permitting for grid deployment by providing technical support for authorities and guidance on better engaging stakeholders and communities: EU countries could adopt the provisions of the emergency Council Regulation (December 2022) and transpose the revised RED III to accelerate T&D grid development necessary for RES integration. The EC plans to update by Q4 2024 the existing guidance on streamlining environmental impact assessments (EIAs) for PCIs and PMIs and the guidance on energy transmission infrastructure and EU nature legislation to adapt them to the revised legislative frameworks of TEN-E and RED and their streamlining permitting provisions. From 2024, the EC will support the digitisation of permitting procedures for grid projects through the Technical Support Instrument (TSI). To address potential public opposition and ensure the highest standard in stakeholder engagement, the EC launched a Pact for Engagement for early, regular and meaningful stakeholder engagement and the need for adequate regulatory support (more details covered subsequently).

Improving and securing grid supply chains, including by harmonising industry manufacturing requirements for generation and demand connection: While the EU industry is a global leader in manufacturing power systems like HVDC systems, which is critical to delivering EU's offshore ambitions, long and growing lead times for procuring specific grid components due to tight supply or increasing raw material prices remain major concerns for project developers. ENTSO-E and EU DSO Entity must collaborate with technology providers to develop common technology specifications and improve the visibility of grid project pipelines to facilitate investments in manufacturing capacity and secure supply chains. Further, the EC plans to promote common technical requirements for generation and demand connection.

To ensure the effective implementation of the Action Plan, the EC plans to set up a dedicated platform within the Copenhagen Energy Infrastructure Forum (organised by EC annually to discuss

Table 1: Key activities proposed under the EU Action Plan for Grids

Category	Actions	Timeline
Accelerating the implementation of PCIs and developing new projects	EC, member countries and TSOs to strengthen support to PCI and PMI preparation, faster implementation and funding	From 2024
Improving long-term grid planning for a higher RES share and increased electrification	ENTSO-E to enhance top-down planning towards 2050 by integrating the identification of offshore and onshore system needs and further considering hydrogen	From Q1 2024
	EU DSO Entity to support DSO grid planning by mapping the existence and characteristics of distribution development plans	Mid-2024
Introducing regulatory incentives for forward-looking grid build-out	EC to propose guiding principles identifying conditions under which anticipatory investments in grid projects should be granted	Q1 2025
	EC to issue guidance on cross-border cost sharing for offshore projects	Mid-2024
Incentivising better usage of the grids	ENTSO-E and EU DSO Entity to agree on harmonised definitions for available grid hosting capacity for system operators and establish a pan-EU overview	From adoption
	ENTSO-E and EU DSO Entity to promote uptake of smart grid, network efficiency and innovative technologies	Q4 2024
	ACER, in its next tariff report, to recommend best practices for the promotion of smart grids and network efficiency technologies through tariff design	Q1 2025
Improving access to finance	EC to identify tailored financing models and strengthen dialogue to address financing obstacles	From adoption
	EC to increase visibility on opportunities for EU funding programmes for smart grids and modernisation of distribution grids	From Q1 2024
Accelerating deployment through faster permitting and public engagement	EC to support permitting acceleration by providing guidance and technical support on how to implement existing legislative tools and member countries to implement acceleration measures	2024-25
	EC to launch a Pact for Engagement for early and effective stakeholder engagement and regulatory support	From adoption
Strengthening grid supply chains	ENTSO-E and EU DSO Entity to collaborate with technology providers to develop common technology specifications and improve the visibility of grid project pipelines, to facilitate investments in manufacturing capacity and secure supply chains	Q4 2024
	EC to promote common technical requirements for generation and demand connection	By 2025

Source: EU Action Plan for Grids

major issues relating to infrastructure and EU energy policy) to regularly monitor the progress and report on the plan delivery.

Pact for engagement

The EC launched the Pact for Engagement with electricity sector representatives to raise public awareness of the crucial role of grids in accelerating the clean energy transition.

The pact calls on EU countries, NRAs, project developers and civil society to work together towards early and regular public participation in grid development projects, and to the views, ideas or concerns of local communities. It underscores the importance of communication on the role of grids in the clean energy transition; more engagement in the fora such as the established high-level groups focusing on grid acceleration and faster implementation of permit-granting rules; regular dialogue among ministries, NRAs and SOs on engagement activities; and stakeholder engagement activities.

The first signatories of the pact were EC's Director-General for Energy, high-level representatives of ENTSO-E, EU DSO Entity, ACER, and Renewables Grid Initiative (RGI) (a collaboration of non-government organisations and TSOs to promote 100 per cent RES integration into the EU grid).

EU List of PCIs and PMIs

The EC has adopted the sixth EU list including PCIs, and the first list of PCIs and PMIs established under the revised TEN-E Regulation that ensures that EU-supported cross-border energy infrastructure projects help the EU achieve its 2030 and 2050 targets for energy and climate. The EC adopted the list of PCIs and PMIs in the form of a delegated regulation, which will be submitted to the European Parliament and Council, which has two months to decide on the list. Once adopted, the EC will work with project promoters and member countries to support their rapid implementation, in line with the enhanced measures in the EU Action Plan for Grids.

Table 2: Sixth EU list of PCIs for electricity

North-South interconnections in Western Europe (NSI West Electricity)	
Portugal–Spain interconnection	Bearíz–Fontefría (Spain)–Ponte de Lima (Portugal)–Vila Nova de Famalicão (Portugal) Substations at Bearíz, Fontefría and Ponte de Lima
Biscay Gulf (Spain–France)	Gatica (Spain)–Cubnezais country (France)
Celtic interconnector (France–Ireland)	La Martyre (France)–Great Island of Knockraha (Ireland)
Cluster of internal lines in Germany	Emden-East–Osterath (A-Nord)
	Heide/West–Polsum (Corridor B)
	Wilhelmshaven–Uentrop (Corridor B)
SuedLink (internal line in Germany)	Brunsbüttel/Wilster–Großgartach/Grafenrheinfeld
Ultranet (internal line in Germany)	Osterath–Philippsburg
Pyrenean crossing 1 (Spain–France)	Navarra (Spain)–Landes (France)
Pyrenean crossing 2 (Spain–France)	Aragón (Spain)–Atlantic Pyrenees (France)
Lonny–Gramme interconnection (France–Belgium)	Lonny (France)–Gramme (Belgium)
BRABO II + III (internal lines in Belgium)	Zandvliet–Lillo–Liefkenshoek; Liefkenshoek–Mercator Substation at Lillo
SACOI 3	Codrongianos (Italy)–Lucciana (Corsica, France)–Suvereto (Italy)
North-South interconnections in Central Eastern and South Eastern Europe (NSI East Electricity)	
Cluster Austria–Germany	Isar/Altheim/Ottenhofen (Germany)–St Peter (Austria)
	St Peter–Tauern; Westtirol–Zell-Ziller (internal lines in Austria)
	Pleinting (Germany)–St.Peter (Austria)
SuedOstLink (internal line in Germany)	Wolmirstedt–Isar
Cluster of internal lines in Czech Republic	Vernerov–Vitkov– Prestice– Kocin– Mirovka
Würmlach–Somplago interconnector (Austria–Italy)	Würmlach (Austria) –Somplago (Italy)
Cluster of lines between Hungary–Romania	Józsa (Hungary)–Oradea (Romania) (interconnector)
	Urechesti–Targu Jiu–Paroseni–Baru Mare–Hasdat (internal lines in Romania)
EUROASIA interconnector (Israel–Cyprus–Greece)	Hadera (Israel)–Kofinou (Cyprus)–Korakia, Crete (Greece)
Otrokovice–Ladce interconnector (Czech Republic–Slovakia)	Otrokovice (Czech Republic)–Ladce (Slovakia)
Lienz–Veneto interconnector (Austria–Italy)	Lienz (Austria)–Veneto region (Italy)
Baltic Energy Market Interconnection Plan in Electricity (BEMIP Electricity)	
Synchronisation of Baltic countries' electricity system with the continental European network	Tartu (Estonia)–Valmiera (Latvia)
	Lithuania–Poland interconnection (Harmony Link)
	New 330 kV Musa and Darbenai substations (Lithuania)
	Other infrastructure aspects related to synchronisation
	Nine internal lines in Estonia (2 projects), Lithuania (3 projects) and Poland (4 projects)
	Synchronous condensers providing inertia, voltage stability, frequency stability and short-circuit power in Estonia, Latvia and Lithuania
Aurora line (Finland–Sweden)	Keminmaa (Finland)–Messaure (Sweden) (third interconnection)
	Keminmaa–Pyhänselkä (internal line in Finland)
Aurora line 2 (Finland–Sweden)	Finland–Sweden (fourth interconnection)
Estlink 3 (Finland–Estonia)	Inkoo (Finland)– Paldiski (Estonia)
Offshore wind (OSW) interconnections	
	Northern Seas offshore grids (NSOG)
North Sea Wind Power Hub (NSWPH)	One or more hubs in the North Sea with interconnectors to bordering North Sea countries of Denmark, Germany, Netherlands
Triton Link	Belgium–Denmark (Hybrid offshore interconnector)
OSW connection Centre Manche 1 (France)	High voltage offshore substation and connection to Menuel (France)

OSW connection Centre Manche 2 (France)	High voltage offshore substation and connection to Tourbe (France)
BEMIP offshore grids	
ELWIND (Estonia–Latvia)	Latvia–Estonia (hybrid offshore interconnector)
Bornholm energy island (BEI) (Denmark–Germany)	Denmark–Germany (hybrid offshore interconnector)
South and West offshore grids (SW offshore)	
OSW connection Occitanie (France)	–
OSW connection PACA (France)	–
Atlantic offshore grids	
OSW connection South Britanny (France)	–
OSW connection South Atlantic (France)	–

Source: European Commission; Global Transmission Report

Table 3: First EU list of PMIs for electricity

NSI Western Electricity	
ELMED (Italy–Tunisia)	Sicily (Italy)–Tunisia node
Cronos (Belgium–UK)	Zeebrugge area (Belgium)–Kemsley, Kent (UK)
Tarchon (Germany–UK)	Emden areas (Germany)–Corringham, Essex (UK)
NSI East Electricity	
Serbia–Hungary interconnector	Subotica (Serbia)–Sándorfalva (Hungary)
GREGY interconnector (Greece–Egypt)	Mesogeia/St Stefanos (Greece)–Wadi El Natroon (Egypt)
NSOG	
Nautilus (Belgium–UK)	Modular Offshore Grid (MOG) 2 (Belgium)–Leisten (UK) (Multi-purpose interconnector or MPI)
LionLink (UK–Netherlands)	UK–Netherlands (MPI)

Source: European Commission; Global Transmission Report

The latest PCI and PMI list includes 166 energy projects, of which 85 relate to electricity, offshore and smart electricity grid projects, around half of which are expected to be commissioned between 2027 and 2030; 65 are hydrogen and electrolyser projects (included for the first time given that it will play a major role in enabling energy system integration and decarbonising the EU industry); and 14 CO_2 network projects [in line with EU's goals to create a market for carbon capture and storage (CCS)].

Many of the electricity projects included under the sixth PCI list were also part of the previous list. However, the list has expanded from 67 in the previous PCI list. It includes a renewed focus on electricity with 68 projects (including 12 storage projects), 5 smart grid projects and, for the first time, a new category on offshore infrastructure with 12 projects.

The TEN-E Regulation establishes 11 strategic geographical infrastructure priority corridors in the areas of electricity, offshore grids, hydrogen and electrolysers, and three EU-wide infrastructure priority thematic areas for smart electricity grids, smart gas grids and cross-border CO2 network. It also lays down a set of measures to ensure that PCIs and PMIs are implemented in a timely manner. These include strengthened transparency and improved public consultation; an accelerated and streamlined permit-granting procedure including a binding time limit of three-and-a-half-years for this procedure; a single national competent authority acting as a one-stop-shop for permit-granting procedures; a single point of contact for offshore renewable grids; improved regulatory treatment by allocating costs across borders according to the net benefits, and regulatory incentives; and eligibility of applying for financial assistance under CEF in the form of grants.

The way forward

Interconnected and stable energy networks are the backbone of the EU's internal energy market and key to enabling the green transition. Grid modernisation, expansion and smartening are highly needed at both T&D levels to enable the energy transition across all economic sectors.

The grids need to be prepared for the new system needs to integrate RES and flexible demand. The policy guidance and actions at the EC level will give confidence to the sector and industry at large to take the giant leap forward involving a complete transformation of the energy landscape. The key now lies in effective and timely implementation.◆

South Africa: Installed Capacity, Generation and Consumption

South Africa, one of the largest economies in Africa, has been in a deep energy crisis over the past few years. Owing to a shortage of electricity supply, the country has been facing rolling power cuts and blackouts as Eskom, the country's integrated power utility, has struggled to keep the generators on amid repeated malfunctions and maintenance issues.

To resolve the electricity capacity shortage and bring the country out of the deepening power crisis, as well as meet net-zero carbon emissions by 2050, Eskom has begun the implementation of its 'Just Transition Framework' (also known as 2035 Corporate Strategy), which is expected to shift the country from a heavy dependence on coal for energy generation towards renewable energy sources (RES). Eskom also released its Transmission Development Plan (TDP) 2023-32, which provides guidelines to develop the electricity infrastructure over the next decade.

The installed capacity in South Africa was 53,982 MW as of 2022, comprising 89 per cent thermal, 7 per cent hydro, 4 per cent nuclear and less than 1 per cent wind energy. These energy mix figures have remained constant since 2018.

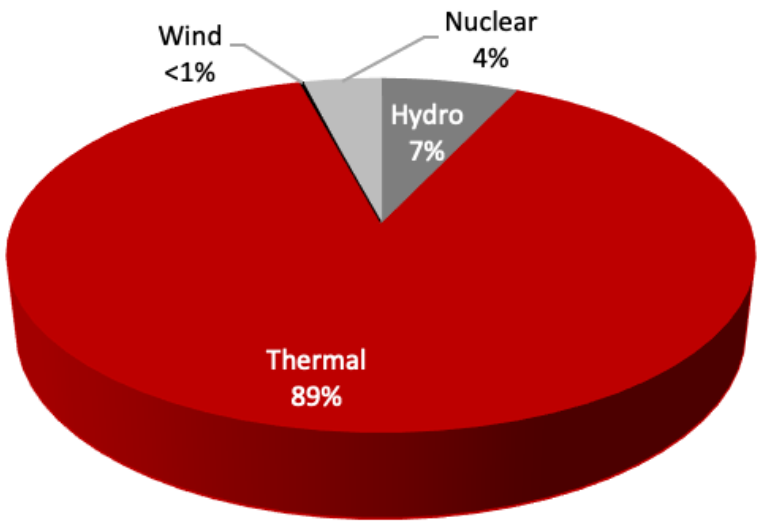
Overall, the installed capacity grew at a compound annual growth rate (CAGR) of 1.40 per cent between 2018 and 2022, from 50,340 MW in 2018 to 53,982 MW in 2022.

Table 1: Growth in South Africa's installed electricity capacity (MW)

	2018	2019	2020	2021	2022
Eskom	45,561	44,172	45,117	46,466	**47,151**
-Hydro	3,324	3,324	3,324	3,324	3,326
-Thermal	40,277	38,888	39,833	41,182	41,865
-Wind	100	100	100	100	100
-Nuclear	1,860	1,860	1,860	1,860	1,860
Independent power producers (IPPs)	4,779	4,981	5,209	6,083	**6,831**
Total	**50,340**	**49,153**	**50,326**	**52,549**	**53,982**

Source: Eskom; Global Transmission Report

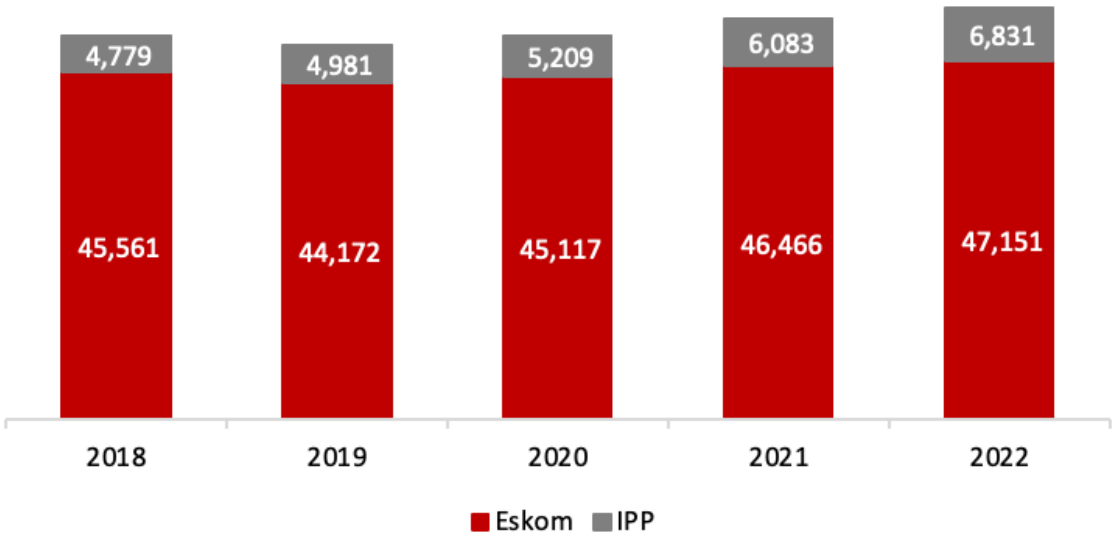
Figure 1: Installed electricity capacity by source, 2022 (%)



Source: Eskom; Global Transmission Report

Eskom's share of the installed capacity fell from 90 per cent in 2018 to 87 per cent in 2022 as the contribution of independent power producers (IPP) increased from 10 per cent to 13 per cent.

Figure 2: Share of Eskom and IPPs in the installed capacity, 2018-2022



Source: Eskom; Global Transmission Report

During the period 2018-2022, the country's generation decreased at a CAGR of 1.5 per cent and consumption decreased by 0.79 per cent.

Table 2: Growth in South Africa's generation and consumption

	2018	2019	2020	2021	2022
Generation	**2,21,936**	**2,18,939**	**2,14,968**	**2,01,400**	**2,05,688**
Annual growth rate (%)	-	(1.4)	(1.8)	(6.3)	2.1
Consumption	**2,35,486**	**2,34,407**	**2,31,356**	**2,19,423**	**2,26,226**
Annual growth rate (%)	-	(0.5)	(1.3)	(5.2)	3.1

Note: Generation data does not include electricity generated by IPPs
Source: Eskom; Global Transmission Report

South Africa: Growth in Electricity Transmission Network

Eskom has confirmed that the legal separation of the transmission business is at an advanced stage, with the National Transmission Company South Africa (NTCSA) SOC Limited receiving approval for the requisite licences from National Energy Regulator of South Africa (NERSA). In 2019 it was announced that Eskom would be separated into three units of generation, transmission and distribution to address the utility's financial crisis and encourage investment in renewables. NTCSA is expected to start operating in the next financial year (starting March 1, 2024) subject to fulfilment of all suspensive conditions.

As of 2022, South Africa's transmission network comprised about 33,191 km of transmission lines at voltage levels of 132 kV to 765 kV alternating current (AC) and 533 kV direct current (DC). Of the total installed line length, 60 per cent was at 400 kV AC, followed by 22 per cent at 275 kV. The transmission line network witnessed a growth of just 0.1 per cent from 2021 to 2022.

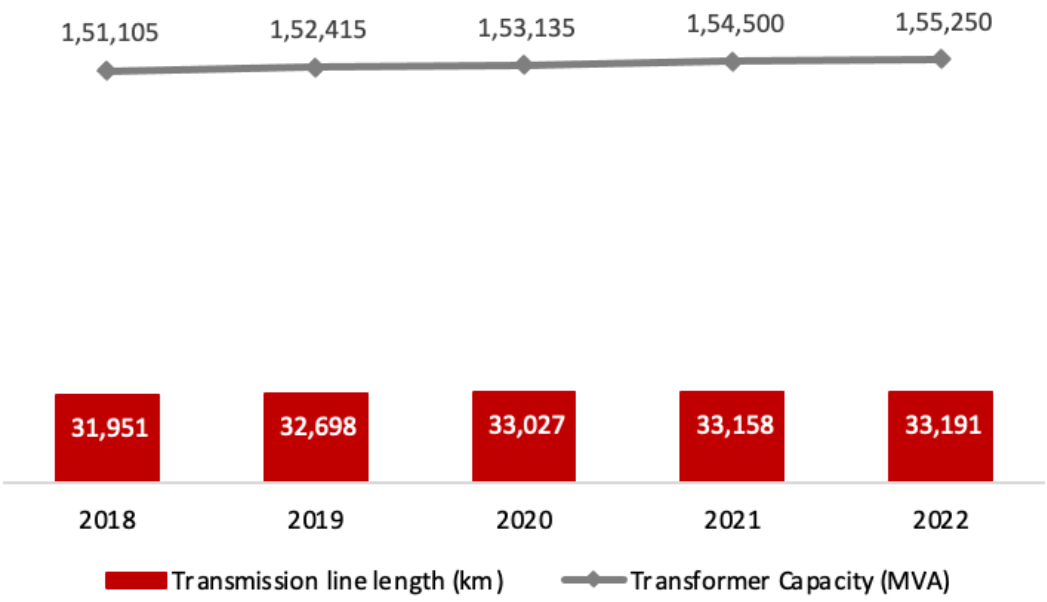
Between 2018 and 2022, the transmission line network grew at a CAGR of 0.76 per cent. The overall CAGR for the transformer capacity was 0.54 per cent from 2018 to 2022.

Table 1: Growth in South Africa' transmission line length (km)

Voltage (kV)	2018	2019	2020	2021	2022
132 kV AC	889	889	889	889	766
220 kV AC	1,221	1,351	1,351	1,351	1,351
275 kV AC	7,218	7,218	7,228	7,342	7,342
400 kV AC	18,804	19,421	19,743	19,760	19,916
533 kV DC (monopolar)	1,035	1,035	1,032	1,032	1,032
765 kV AC	2,784	2,784	2,784	2,784	2,784
Total	**31,951**	**32,698**	**33,027**	**33,158**	**33,191**

Notes: AC- alternating current; DC - direct current
Source: Eskom; Global Transmission Research

Figure 1: Growth in South Africa' transmission network

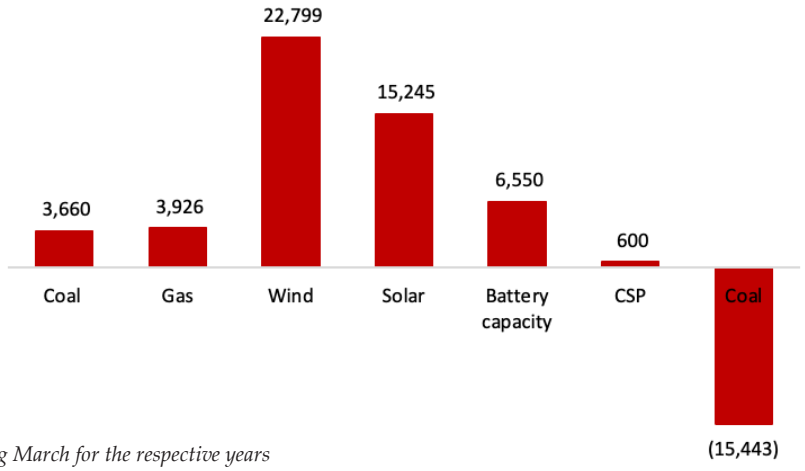


Note: Data for transformer capacity is of transformers of voltage levels 132 kV and above.
Source: Eskom; Global Transmission Research

South Africa: Planned Generation and Transmission Capacity

By the end of 2032, a total of 52,780 MW of generation capacity is expected to be added with plans to decommission 15,443 MW of coal power plants. The maximum generation capacity will be added through wind energy, contributing 43 per cent to the total capacity followed by 28 per cent of solar energy.

Figure 1: Expected generation capacity addition in South Africa during 2023-32 (GW)

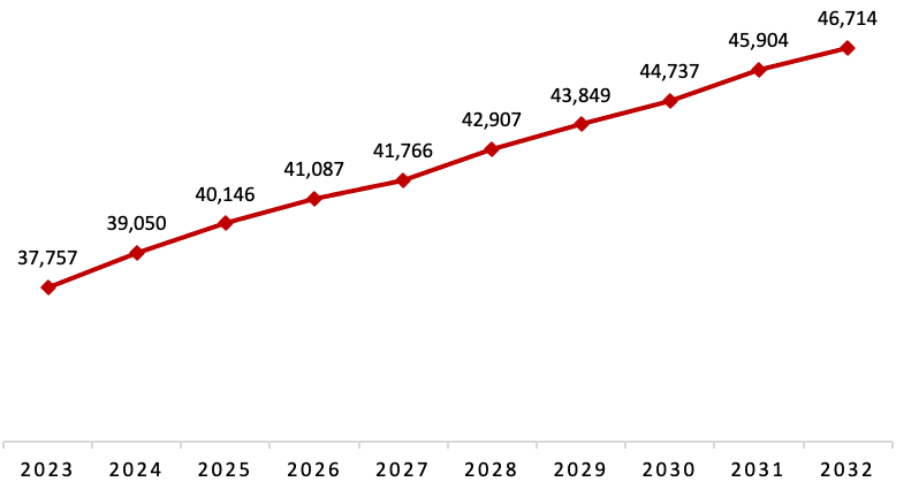


Note: Data is for fiscal year ending March for the respective years
Source: Eskom Transmission Development Plan 2023-32

Electricity demand in South Africa is expected to reach 46,714 MW in 2032 from 37,757 MW in 2023. It is expected to grow at a CAGR of approximately 2.15 per cent during the period 2023-2032.

The majority of the demand increase is expected to come from Gauteng Province at 33 per cent of the total demand followed by 14 per cent from the KwaZulu-Natal Province and 11 per cent from Western Cape Province.

Figure 2: Expected growth in electricity demand in South Africa during 2023-2032 (MW)



Source: Eskom Transmission Development Plan 2023-32

According to the TDP 2023-32, it is expected that 10,427 km of lines will be added in South Africa along with 90,404 MVA of transformation capacity. Among the nine provinces, Northern Cape (2,995 km) and Eastern Cape (2,112 km) will account for about 50 per cent of the total network addition followed by Limpopo (1,271 km), KwaZulu-Natal (1,084 km) and Western Cape (1,053 km). The TDP 2023-32 involves a planned investment of ZAR72.17 billion over the next five years up to 2027. Some of the key projects include the Johannesburg North strengthening phase 2, which includes building a 400 kV Apollo to Lepini line that is scheduled for completion by 2027; the Vaal strengthening phase 2 project, which entails building a 400 kV line from Glockner to Etna and is expected to be completed in 2027; and the Kimberly strengthening phase 3 project, expected to be completed in 2028, which includes the construction of a 400 kV line from Hermes to Mookodi with several other projects in the pipeline.

Table 1: Key planned transmission projects in South Africa under TDP 2023-32

Project	Voltage (kV)	Description	Scheduled completion
Gauteng province			
Johannesburg North strengthening phase 2	400	First 400 kV Apollo–Lepini line	2027
Vaal strengthening phase 2	400	400 kV Glockner–Etna line	2027
Kwazulu-Natal (KZN) province			
KZN 765 kV strengthening: Empangeni integration	400 and 765	Second 400 kV Invubu–Mbewu line 765/400 kV Mbewu switching station, loop-in of 400 kV Athene–Umfolozi 1 and 400 kV Invubu–Umfolozi line into Mbewu substation 765 kV Umfolozi–Mbewu line (extension of 765 kV Majuba–Umfolozi 1 line; to operate at 400 kV)	2028
Limpopo province			
Highveld North-West and Lowveld North reinforcement phase 2	400	400 kV Manogeng–Silimela line 400/132 kV Silimela substation 400 kV Manogeng switching station with loop-in of 400 kV Duvha–Leseding line	2024
Limpopo East corridor strengthening	400	First 110-km-long 400 kV Foskor–Spencer line 400/275 kV Foskor substation (400 MVA transformer) 400/132 kV Spencer substation (400 MVA transformer) Upgrade of the second 275 kV Merensky–Foskor line to 400 kV	2029
Mpumalanga province			
Emkhiweni 400 kV integration	400	400 kV Emkhiweni–Silimela line 400/132 kV Emkhiweni substation (2x500 MVA) with loop-in of Kendal–Arnot line	2026
Wonderkrag 400 kV integration	400	400/132 kV New Wonderkrag substation (5x500 MVA) with 400 kV loop-in of Kriel–Tutuka and Kriel–Zeus lines	2027
North West province			
Kimberley strengthening phase 3	400	400 kV Hermes–Mookodi line	2028
Free State province			
Bloemfontein strengthening phase 2	400	400 kV Beta–Harvard D/C line, Harvard–Merapi line 400/132 kV Harvard and Merapi substations (2x500 MVA each)	2028
Northern Cape province			
Gromis–Oranjemond corridor strengthening	400	400 kV Juno (Western Cape)–Gromis (Northern Cape) Transformer at 400/220 kV Gromis substation	2024
Upington strengthening phase 2 (IPP)	400	400 kV Aries–Upington D/C line 500 MVA transformer at 400/132 kV Upington substation 400 kV Ferrum–Upington line	2026 2027
Aries–Hydra corridor strengthening	400	400 kV Aries–Kornos–Hydra second line	2028
Eastern Cape province			
Greater East London Phase 3	400	400 kV Neptune–Pembroke line First 400/132 kV, 500 MVA and 132/66 kV, 160 MVA transformers at Pembroke substation	2026
Greater East London Phase 4	400	400 kV Poseidon–Pembroke line Second 500 MVA and 160 MVA transformers at Pembroke substation	2028
Western Cape province			
Saldanha Bay network strengthening phase 1	132 and 400	2x400 kV Aurora–Blouwater substation line (operated at 132 kV) Replacement of one of three 250 MVA, 400/132 kV transformers with a 500 MVA transformer as part of refurbishment Strategically acquire a substation site in Saldanha Bay area	2028

Source: Eskom; Global Transmission Report

North America

Dominion Energy and VSU collaborate on battery storage project

Dominion Energy, a US energy company headquartered in Richmond, Virginia, has entered into a strategic partnership with Virginia State University (VSU) to spearhead an innovative battery storage initiative. The proposed pilot project aims to deliver backup power to the VSU Multi-Purpose Center (MPC), a prominent venue on the university campus hosting various events.

As part of a series of projects presented to the Virginia State Corporation Commission in September 2023, the initiative explores three alternatives to traditional lithium-ion batteries, capable of discharging power for extended durations. California-based EnerVenue, a company that builds energy storage, has been selected by Dominion Energy to manufacture a 1.5 MW battery utilising metal-hydrogen technology, with the capacity to discharge energy for up to 10 hours.

In addition to the VSU campus installation, Dominion Energy plans to evaluate two other battery storage technologies at a separate location in Henrico County. One of these technologies is expected to have a discharge capability of up to 100 hours, surpassing current industry standards. Longer-duration batteries enable the storage of renewable energy for extended periods, ensuring availability during peak demand. Additionally, VSU plans to integrate the backup battery into its educational programmes, providing students in the College of Engineering and Technology with hands-on experience. The curriculum will incorporate real-world scenarios, offering valuable insights into the intricacies of battery storage technology.

energyRe raises USD1.2 billion capital to drive clean energy transition

US clean energy developer, energyRe, has successfully raised a USD1.2 billion capital package to propel the expansion of its extensive renewable energy portfolio encompassing utility-scale transmission and storage, onshore wind and solar generation, and offshore wind (OSW) projects. energyRe will also be focusing on hard-to-abate energy load centres through cutting-edge electric grids.

The company's portfolio encompasses a development pipeline spanning seventeen states, featuring over 500 miles (804.6 km) of high voltage direct current (HVDC) transmission, 10.5 GW of solar, wind, and storage projects, and over 155 MW of distributed generation.

The capital raised comprises committed investments from US-based Glentra Capital along with co-investors Novo Holdings, and Denmark-based pension fund PKA. Glentra Capital, leveraging its experience in renewable energy asset development in the US, will support energyRe in expanding its development pipeline and achieving growth targets. A significant milestone includes a firm agreement with Elia Group for the acquisition of a stake in energyRe's subsidiary, energyRe Giga. As a specialist in European transmission, Elia Group will contribute its expertise in offshore transmission infrastructure, HVDC technology, transmission planning, and congestion management to the partnership. The capital package also incorporates a mandated corporate debt facility arranged by Santander and Deutsche Bank, further fortifying energyRe's financial position.

Latin America

Canada's CDPQ acquires Brazil's Intesa for BRL396 million

Canadian pension fund, Caisse de Dépôt et Placement du Québec (CDPQ), has announced an agreement with Equatorial Energia S. A. for the acquisition of Integração Transmissora de Energia S. A. (Intesa), an operator of 695 km power transmission network in the states of Tocantins and Goiás, in the centre of Brazil.

The transaction, worth up to BRL396 million, is the second investment of the CDPQ in the electricity transmission sector in Latin America for 18 months. Earlier in April 2022, CDPQ acquired almost 1,100 km of power lines in Brazil and Uruguay, a network that is now part of its Verene Energia (its power transmission business firm in Brazil).

The deal is scheduled to achieve financial closure in December 2023, subject to customary conditions and necessary consents and approvals.

Reportedly, this deal is a part of CDPQ's plans to double the size of Verene Energia over the next five years. The expansion may involve new projects won at auctions or the acquisition of operational assets.

(BRL1=USD0.20)

Colombia's EPM forms alliance with India's KPIL

Colombia-based Empresas Públicas de Medellín (EPM) has announced a strategic alliance with Kalpataru Projects International Limited (KPIL) [formerly known as Kalpataru Projects Transmission Limited (KPTL)], an India-based engineering, procurement and construction (EPC) company in the field of power transmission infrastructure, for the development of electrical energy infrastructure in Colombia.

The collaboration is set to span five years, and EPM aims to bolster the growth of its energy transmission and distribution (T&D) businesses through this partnership. The alliance with KPIL is anticipated to provide firm prices and enhance agility in both offer preparation and project execution. Due to this collaboration, the cost of future project construction is expected to be covered through tariffs.

EPM emphasised that the competitiveness of their potential joint offers and bids for projects from the Colombian mining and energy planning unit, Unidad de Planeación Minero Energética (UPME), will contribute to lowering energy rates for users. EPM and KPIL aim to execute EPC works through turnkey solutions, streamlining the process of contracting and implementing transmission line and electrical substation projects.

To identify the ideal partner for this venture, EPM conducted a thorough selection process, initially identifying 37 companies based on their experience, effectiveness, and technical and financial capacities. Following a series of evaluations, KPIL emerged as the chosen collaborator, aligning with EPM's strategic objectives in the energy sector.

Colombian GEB issues sustainable bonds to fund grid projects

Colombia's Grupo Energía Bogotá (GEB) recently issued sustainable bonds in the international capital markets, amounting to USD400 million to finance energy transmission infrastructure essential for the energy transition in Colombia. This makes GEB the first company in the country to launch a sustainable bond of this nature. The bond issuance was authorised by the Ministerio de Hacienda y Crédito Público or Ministry of Finance and Public Credit. The ministry aims to partially fund the company's 2023-2027 investment plan, which will lead to an increase in debt by USD81 million, constituting 4 per cent of GEB's overall debt as of June 2023. GEB intends to allocate an equivalent amount of net proceeds from the issuance to support green and social projects, specifically, renewable energy transmission in Colombia.

The bond offer experienced an oversubscription of 2.8 times the value offered and 96 orders from international investors. The bond is governed by GEB's Sustainable Financing Framework, aligned with international market principles and taxonomies. The issuance was structured in collaboration with investment banks – JP Morgan Securities LLC, Santander US Capital Markets LLC, and Scotia Capital (USA) Inc. Legal advice was provided by Winston & Strawn LLP, Clifford Chance, Cuatrecasas, and Garrigues.

Asia Pacific

Kyrgyzstan secures new World Bank funding for CASA-1000 project

Kyrgyzstan has secured USD18.3 million in additional financing from the World Bank for the ongoing Central Asia South Asia Electricity Transmission and Trade (CASA-1000) project.

CASA-1000 aims to facilitate the trade of 1,300 MW of electricity among four countries — Tajikistan, the Kyrgyz Republic, Afghanistan and Pakistan, involving surplus energy from hydroelectric power projects in the former two countries, to the power-deficit Pakistan (1,000 MW) and Afghanistan (300 MW). Afghanistan's Da Afghanistan Breshna Sherkat (DABS), Joint Stock Company National Electric Grid of Kyrgyzstan (NEGK), National Transmission and Despatch Company (NTDC) Limited of Pakistan and Open Joint Stock Holding Company Barki Tajik of Tajikistan, are the developers of this project.

This additional financing complements the initial funding to the original CASA-1000 Project, which was supported by several donors and international financial institutions as approved in March 2014 and effective from January 2018.

In Kyrgyzstan, NEGK is developing the project, which involves the construction of approximately 456 km of 500 kV high voltage alternating current (HVAC) transmission lines across 1,243 transmission towers. It is currently at an advanced stage of implementation, 100 per cent of the transmission towers installed and 287 km of stringing works (or 63 per cent) completed. The additional financing will address the financing gap caused by various factors, including increased prices for goods and transportation as a result of the COVID-19 pandemic and the overall economic crisis.

The latest funding is provided through the International Development Association (IDA), the World Bank's concessional lending arm, in the form of a zero-interest credit, with repayments spread out over 50 years and a 10-year grace period. NEGK has received total funding of USD216 million for the project from European Investment Bank (EIB) (USD85 million), Islamic Development Bank (IsDB) (USD63 million), and the World Bank and Multi-Donor Trust Fund (USD68 million).

The project is expected to be completed in March 2025.

Kazakhstan's KEGOC's shares oversubscribed by 50 per cent in SPO

Kazakhstan's state-owned Samruk-Kazyna National Welfare Fund Joint Stock Company (JSC), which is the holding company for the management of public assets, including JSC Kazakhstan Electricity Grid Operating Company (KEGOC), announced that the shares of KEGOC were oversubscribed by 50 per cent as part of the secondary public offering (SPO).

The acceptance of applications from investors for participation in the SPO, which was held on the Kazakhstan Stock Exchange (KASE) and the Astana International Exchange (AIX) of the Astana International Financial Centre (AIFC), ended on November 2, 2023. The application period began on October 16, 2023.

As part of the SPO, KEGOC offered 15,294,118 ordinary shares priced at KZT1,482 each. The distribution of shares to investors concluded on November 7, 2023, while secondary trading on the AIX platform commenced on November 10, 2023. JSC KEGOC went public in 2014 by offering 10 per cent of its shares on the KASE.

KEGOC operates Kazakhstan's energy system and is the owner of the country's transmission infrastructure spanning around 27,000 km in length, along with 82 electrical substations across 220 kV to 1,150 kV voltages. JSC Samruk-Kazyna National Wealth Fund is the major shareholder in KEGOC with a 90 per cent stake, while the Unified Accumulative Pension Fund owns a 7.25 per cent stake.

(KZT1=USD0.0021)

Europe

TotalEnergies acquires stake in Xlinks Morocco–UK project

French multinational TotalEnergies SE has invested GBP20 million to acquire a minority in Xlinks First Limited, a UK-based company. This move marks its entry into the Xlinks Morocco–UK power project, joining existing investors Octopus Energy and Abu Dhabi National Energy Company (TAQA).

The Xlinks Morocco–UK power project comprises a new 11.5 GW solar-plus-wind generation facility, along with a 22.5 GWh/5 GW battery storage facility to be located in Morocco's renewable energy-rich region of Guelmim Oued Noun.

Of the generated amount, 3.6 GW of renewable energy will be supplied for an average of 19+ hours a day to the UK via 3,800-km-long, twin 1.8 GW high-voltage direct current (HVDC) subsea cable systems that will run from the Moroccan site to Alverdiscott, North Devon in the UK. Once complete, the project will provide low-cost, clean power to over 7 million British homes from the end of the decade, contributing to 8 per cent of UK's electricity needs.

In October 2023, the UK government classified the Xlinks project as a Nationally Significant Infrastructure Project (NSIP). The latter will now require a Development Consent Order (DCO) from the Department for Energy Security and Net Zero (DESNZ), replacing the need for local authority planning permission.

TotalEnergies' investment aligns with its goal to achieve net zero emissions by 2050. The company aims to build a cost-competitive portfolio integrating renewables (solar, onshore and offshore wind) and flexible assets (combined cycle gas turbine, storage) to deliver clean, reliable power.

In 2022, TotalEnergies generated over 33 TWh of electricity and had a gross renewable electricity generation installed capacity of 17 GW, with plans to expand its total power generation to over 100 TWh by 2030.

(GBP1=USD1.26)

Japan's JBIC signs loan agreement with Triton Knoll OFTO Limited

The Japan Bank for International Cooperation (JBIC) has signed a loan agreement with Triton Knoll OFTO Limited, a UK-based company owned by TEPCO Power Grid UK Limited (a subsidiary of TEPCO Power Grid Incorporated) and Equitix Investment Management Limited (a London-based infrastructure investor). The consortium of the two companies was selected in 2021 as the winner by the UK's energy regulator Office of Gas and Electricity Markets (Ofgem) of the tender for the Offshore Transmission Owner (OFTO) for the 857 MW Triton Knoll offshore wind farm (OWF) located 32 km off the Lincolnshire Coast in the UK.

JBIC will provide project financing amounting to up to approximately GBP259 million (JBIC portion) to the OFTO. The loan is co-financed with Sumitomo Mitsui Banking Corporation, Societe Generale, Barclays Bank PLC, and Aviva Life & Pensions UK Limited, bringing the total co-financing amount to approximately GBP523 million.

The know-how gained from the electricity transmission service for the OWF is expected to be utilised in future projects in Japan and other countries, in addition to the UK.

Triton Knoll OFTO Limited will own and operate facilities for offshore electricity transmission associated with the Triton Knoll OWF and will transmit the electricity generated by the OWF to the UK's transmission system operator (TSO), National Grid, for 23 years.

(GBP1=USD1.26)

Germany acquires minority stake in TransnetBW through KfW

German energy company, Energie Baden-Wurttemberg AG (EnBW), has concluded the sale of a minority stake in its subsidiary TransnetBW, which is one of the four German TSOs. The German federal government has taken over a 24.95 per cent stake in TransnetBW, through Germany's development bank, Kreditanstalt für Wiederaufbau (KfW). In 2022, EnBW had put up for sale two different minority holdings in TransnetBW totalling 24.95 per cent, with a pre-emptive right to buy stakes held by the state-lender KfW. In May 2023, EnBW sold a 24.95 per cent minority stake in TransnetBW, to Südwest Konsortium Holding GmbH. The consortium is led by SV SparkassenVersicherung and consists of more than 30 banks, insurance companies, and corporations from BadenWürttemberg. With the signing of the transaction with KfW, EnBW has now closed the partial sale process of TransnetBW. The investment would help the German federal government to achieve the climate targets set for 2030. Reportedly, the implementation of the energy transition requires an investment of up to EUR600 billion. According to the results of a progress report on the energy transition published in February 2023, EUR126 billion of this will be accounted for by new power lines and power line modernisation alone.

(EUR1=USD1.09)

Grant agreement signed for ELMED interconnection

A grant agreement has been officially signed between Italy's TSO Terna and its Tunisian counterpart Société Tunisienne de l'Electricité et du Gaz (STEG), with the European Commission (EC) for the ELMED interconnection between the two countries. The signing of the agreement was ratified in August 2023, which initiated the EUR307 million financing from the EC for the undersea power line between Italy and Tunisia.

The interconnector was included in the European Union's 5th list of projects of common interest (PCI) in January 2022. It is the first time that Connecting Europe Facility (CEF) funds have been allocated to an infrastructure project developed by an EU member country and a third country.

The World Bank has also extended USD268.4 million in financing to Tunisia, supporting the construction of the converter substation (part of the CEF-funded scope) and internal grid enhancements vital for the interconnection's operation.

The high voltage energy bridge that will connect Europe and Africa will be approximately 220 km long, of which about 200 km will be undersea. It will have a capacity of 600 MW and would entail an investment of EUR850 million. In Italy, the underground link will start from the landing point at Castelvetrano in the province of Trapani, and then follow existing roads for 18 km to reach Partanna, where the new electrical conversion station will be constructed near the existing one. It will also contribute to the integration of electricity markets and energy supply security through diversification of sources. The interconnection will help in reducing climate-altering emissions, contributing to Italian and European energy and climate goals set by the Integrated National Energy and Climate Plan (PNIEC) and the Green New Deal.

(EUR1=USD1.09)◆

North America

SunZia Southwest Transmission Project, US

Developer: SunZia Transmission LLC (Pattern Energy Group LP)

Project details and status: The SunZia Southwest transmission project entails the construction of an over 550-mile (885-km) bi-directional ±525 kV high voltage direct current (HVDC) transmission line from the SunZia East converter station near Corona, New Mexico, to the SunZia West converter station in Pinal County, Arizona, along with the installation of two HVDC voltage source converter (VSC) stations; two new 0.75-mile, 500 kV lines from the SunZia West converter station to the 500 kV Pinal Central substation; and two 1,500 MW thyristor-controlled breaking resistors (AC choppers) integrated with the SunZia East converter station in New Mexico.

The SunZia project originates in Torrance County in east-central New Mexico, traverses 353 miles (568 km) southwest into the Valencia, Socorro, Sierra, Grant, Luna and Hidalgo counties before continuing through Arizona. In Arizona, it traverses over 199 miles (320 km) in five counties, namely, Greenlee, Graham, Cochise, Pima and Pinal, before interconnecting with the Western Interconnection southeast of Phoenix. The New Mexico portion of the line is being developed in partnership with the New Mexico Renewable Energy Transmission Authority (RETA), which facilitates the development of electric transmission and storage projects. The SunZia wind project has a capacity of 3,515 MW and is located in the Lincoln, Torrance and San Miguel counties in New Mexico. Together, the SunZia wind and southwest transmission projects are the largest renewable energy infrastructure projects in US history.

Though the Bureau of Land Management (BLM) released the first draft environmental impact statement (EIS) for the project in September 2012 and finalised it in June 2013, the project faced issues due to its route, which was proposed to pass close to the White Sands Missile Range (WSMR). The biggest concerns include the project's impact on the San Pedro area [through habitat fragmentation, collision of birds with the power lines, and the ability of non-native invasive plants to grow in the power line right-of-way (RoW)].

In November 2016, the project received approval from the New Mexico Public Regulation Commission (NMPRC), securing all the required approvals. In 2016, the Arizona Corporation Commission (ACC) approved the certificate of environmental compatibility (CEC) for SunZia to construct the project.

In September 2017, the Federal Energy Regulatory Commission (FERC) allowed SunZia Transmission LLC to modify its authority to charge negotiated rates for the transmission capacity of the project.

In January 2018, SunZia Transmission signed an agreement with the Western Area Power Administration (WAPA) to allow the latter to participate in the development of the project. This followed an advanced funding agreement signed between SunZia and WAPA's Transmission Infrastructure Program in 2015 for development support and technical assistance. Key contractors for the project include the software company Coreworx, selected to provide information management solutions, and South Korea's Taihan Electric Wire Company, which was selected to install a 53-km underground 500 kV power cable in the southwest US on a turnkey basis.

In April 2018, the developers submitted an application to NMPRC for location control and RoW width approvals, which was accepted in August 2018. However, in September 2018, the PRC denied its permit for the project, stating that the filing lacked specific information on the actual location of the route. PRC allowed the developers to submit a new proposal to acquire the necessary permits.

Between October 2018 and April 2019, the developer submitted various updates on project routes to ACC and New Mexico regulators.

As of June 2021, BLM published a notice of its intent to develop an EIS ahead of granting a permit for the project following which they announced that they were moving forward with the project.

In May 2022, BLM issued a draft EIS, which was open for public comments until August 1, 2022. Meanwhile, FERC approved an agreement granting Pattern Energy 1,500 MW capacity on the first line. In a pending request, SunZia Transmission and Pattern Energy had asked FERC to approve the results of a second solicitation process that would give Pattern Energy another 1,500 MW on the same line, which would be expanded by switching to HVDC technology from an AC line. Together, the wind and transmission projects involve an investment of USD8 million.

In July 2022, SunZia Transmission awarded the full 3,000 MW of capacity on the transmission line to Pattern Energy. Further, Pattern Energy Group announced that it had acquired the first phase of the project from SouthWestern Power Group. The transmission line will combine with the company's existing plans to develop wind power in the region. SouthWestern Power Group will continue to develop the second phase of the project involving the 500 kV HVAC El Rio Sol Transmission line. It will maintain the ownership of this line. The schedule for the second line will depend on the timing of the financing and construction of the first line as well as regional demand for transmission capacity. SunZia Transmission and Pattern Energy partnered with the New Mexico RETA on the development of the transmission project.

In November 2022, ACC voted to approve a modification to the CEC for the project it had previously approved in 2016. However, the decision was challenged in the Superior Court and then the Arizona Court of Appeals, both of which upheld ACC's decision.

In February 2023, BLM released its final EIS and resource management plan amendment for the SunZia Southwest Transmission Project planned to serve central New Mexico, Arizona and California.

In May 2023, Pattern Energy selected Quanta Services (Quanta) and Hitachi Energy to build the SunZia transmission and wind projects. Quanta will provide a turnkey solution for the transmission line while Blattner Company, a Quanta operating company, will provide turnkey solutions for the SunZia wind facility and associated switchyard, which entails the installation of over 900 wind turbines, 10 substations, several facilities for operations and maintenance, and wind generation transmission lines spanning over 100 miles (160.9 km). Hitachi Energy will supply the HVDC

converter stations and use its HVDC Light technology and Modular Advanced Control for HVDC (MACH) digital control platform for the project. In the same month, BLM approved the RoW for the transmission project while Pattern obtained long-term power purchase agreements from Shell Energy North America (US) LP and the Regents of the University of California for a portion of the SunZia wind resources.

In July 2023, Pattern Energy chose Stantec, a renowned global leader in sustainable design and engineering, to take on the role of owner's engineer (OE) for the project. This entails offering expertise in electrical, civil, structural, building and mechanical engineering services related to the HVDC converter stations and AC choppers. It will conduct design reviews, manage interfaces among different components, witness factory acceptance tests for major equipment, and offer commissioning assistance.

In September 2023, Pattern Energy commenced the construction of the project after BLM issued the notice to proceed for the project. The ground-breaking ceremony for the project took place at the SunZia East converter station in Corona, New Mexico.

In November 2023, SunZia encountered a setback, as construction work along a 50-mile (80.5 km) stretch was halted due to concerns raised by Arizona indigenous groups (particularly leaders of the Tohono O'odham Nation – a collective government body of the Tohono O'odham tribe in the US) regarding the preservation of cultural sites. Tohono O'odham Nation expressed dissatisfaction with the BLM's incomplete and flawed inventory of historic properties in the San Pedro Valley, highlighting the potential risk of damage to these sites. In response, BLM ordered the suspension of construction and intended to engage in government-to-government discussions with the group to address the issues. However, later in the same month, the federal land managers, in a letter sent to Pattern Energy, indicated that the timing of information provided by the tribes did not support pausing work. BLM lifted the temporary suspension and construction resumed, with a meeting between the agency and tribal leaders scheduled for December 11, 2023.

The transmission project is expected to begin commercial operations in 2025, while the wind project's operations are planned for 2026.

Propel Alternate Solution 5 Project, US

Developer: Propel NY, a partnership between the New York Power Authority (NYPA) and New York Transco (owned by affiliates of Con Edison, National Grid, Avangrid, Inc. and CH Energy Group)

Project details and status: The USD3.26 billion project has been proposed to transmit at least 3,000 MW of offshore wind (OSW) energy and provide operational flexibility under various conditions. It entails the installation of three new underground cables to connect Long Island with the rest of New York, along with a 345 kV transmission backbone across the western and central parts of the island.

The project entails the construction of several new 345 kV underground transmission lines: Barrett to East Garden City - 9 miles (14.5 km); East Garden City to Tremont - 23 miles (37 km); East Garden City to Shore Road - 10 miles (16.1 km); Ruland Road to Shore Road - 18 miles (29 km); and Shore Road to Sprain Brook - 19.5 miles (31.4 km). An approximately 11-mile (17.7-km), 138 kV transmission line will also be built between Syosset and Shore Road. Additionally, new stations will come up at Barrett, Ruland Road, Shore Road and New Rochelle.

In June 2023, the project was chosen by New York Independent System Operator (NYISO) to fulfil the grid enhancement requirements identified by the Long Island OSW Export Public Policy Transmission Need (Long Island Need) study, which was initiated by the New York State Public Service Commission (NYPSC) in March 2021 and resulted in the beginning of a multi-year, joint effort by NYISO's team of experts, the New York PSC, developers and stakeholders to address transmission needs in and around Long Island driven by the Climate Leadership and Community Protection Act (CLCPA).

In November 2023, New York Transco successfully obtained the required permits from NYSPSC for developing the transmission project. NYPSC approved USD1.4 billion in financing for the project.

The project is required to be operational by May 2030.

Smart Path Connect Transmission Project, US

Developers: NYPA and National Grid New York

Project details and status: The proposed project is part of a comprehensive portfolio of transmission upgrades being undertaken across New York State to support its clean energy goals to enable the flow of an additional 1,000 MW of renewable energy across the state.

Smart Path Connect involves rebuilding approximately 100 miles (161 km) of transmission lines in the North Country (which comprises Clinton, Essex, Franklin, Hamilton, St. Lawrence, Jefferson and Lewis counties) and Mohawk Valley, and runs east to west from Clinton to Massena and north to south from Croghan to Marcy.

The project will replace the old wood H-frames installed in the 1950s with steel poles and replace or upgrade around 10 substations along the path of the transmission lines. When complete, the two segments of Smart Path Connect will join the Smart Path project, creating one continuous upgraded transmission line from Clinton to Marcy.

Following a competitive bidding process, Michels Power was granted a six-year USD276 million contracts for the construction of Smart Path Connect's transmission lines, and an additional five-year USD104 million contracts in May 2022 for the construction of the substations under the project.

In August 2022, NYPSC approved the project.

In December 2022, the developers commenced construction of the Smart Path Connect project.

In November 2023, over half of the project's upgraded transmission lines, encompassing 36 miles (57.9 km) in Mohawk Valley and 38 miles (61.2 km) in North Country, were energised.

The line is expected to come online by 2025.

345 kV Fairport to Denny to Iowa/Missouri State Border Transmission Project

Developers: Ameren Transmission Company of Illinois (ATXI), a subsidiary of Ameren Corporation; Missouri Electric Commission

Project details and status: This USD84 million transmission project is in northwest Missouri. This is the second competitively bid project from the LRTP Tranche 1 portfolio approved by Midcontinent Independent System Operator's (MISO) Board of Directors in 2022.

It entails two 345 kV lines and a new Denny substation near the existing Fairport substation. The first line spans 42 miles (67.6 km), from Denny to the Missouri/Iowa state border, and the second 345 kV line will connect the Denny substation to the Fairport substation.

In December 2022, MISO issued a request for proposal (RfP) for the project. Developers had until May 19, 2023, to complete submissions. In November 2023, MISO selected ATXI along with Missouri Electric Commission for developing the project. Ameren will now move forward on executing the Selected Developer Agreement. The project is expected to be in service by 2030.

Western Wisconsin Transmission Connection (WWTC) Project, US

Developer: Xcel Energy

Project details and status: This USD500 million transmission line in western Wisconsin has been proposed to enhance grid reliability amid the transition away from coal-fired power plants and increased integration of wind power from Minnesota and the Dakotas. The project is anticipated to start at an existing substation near the City of Blair in Trempealeau County, connecting with another transmission line near the City of Owen in Clark County or the Village of Sheldon in Rusk County. The project includes the replacement of single-circuit (S/C) transmission lines with new double-circuit (D/C) poles, incorporating both existing and new transmission lines.

The company is exploring potential route options, with most following existing corridors such as transmission lines or along roadways and state highways, to minimise the impact on landowners and communities.

Two main route options are under consideration: Route 1 will be 96-100 miles (154.5-160.9 km) long, estimated to cost USD398 million to USD407 million; and Route 2 will be 80-82 miles (128.7-131.9 km) long, estimated to cost USD263 million to USD280 million. Both routes largely follow existing utility lines to minimise impact.

In October 2023, Xcel Energy sent letters to landowners within 1,000 feet of the proposed transmission line routes. Public open house sessions took place between October 9 and October 12, 2023, across locations such as Eau Claire, Blair, Chippewa Falls, Stanley and Holcombe to gather input from the community.

However, in November 2023, plans for the WWTC project raised concerns among Chippewa County residents regarding potential impacts on the environment, residences and tourism due to the transmission lines. A letter from the town of Anson opposed Route 1, citing its potential impact on the Old Abe State Trail and the town's development objectives, to which Xcel Energy has replied, emphasising the common practice of reusing existing infrastructure corridors to reduce the impact on landowners and communities.

The company plans to file a certificate of convenience and public necessity (CCPN) with the Public Service Commission (PSC) of Wisconsin in mid-2024. The final route will be determined after the PSC's review, with a decision expected in mid- to late-2025. Construction, if approved, is projected to commence around 2026 and take approximately two years.

St Clair Transmission Line Project, Canada

Developer: Hydro One Inc.

Project details and status: Hydro One has proposed the project to meet the growing power demand in Ontario.

Under the project, a new 230 kV, 60-km transmission line will be constructed between the Lambton transformer station in Lambton County and the Chatham switching station in the Municipality of Chatham Kent, utilising about 80 per cent of existing corridors while updating an existing transmission line. In addition, it will include the expansion of the Lambton and Wallaceburg transformer stations, and the Chatham switching station, as well as an upgrade of the Wallaceburg transformer station from 115 kV to 230 kV.

In February 2022, Hydro One initiated a Class Environmental Assessment (EA) under Ontario's Environmental Assessment Act to build the project. Through the Class EA process, it evaluated five route alternatives by collecting environmental and technical information, as well as input from indigenous communities, community members, elected officials, interest groups and businesses. Based on information gathered and feedback received, in June 2023, the developer selected Route Alternative 2 as the preferred route for the project. The chosen route will replace an existing 115 kV line with a 230 kV line and involves the construction of new 230 kV lines to connect the Lambton transformer station and the Chatham switching station. In the same month, the developer also sought public comments on the preferred route of the project.

In November 2023, Hydro One unveiled the draft Environmental Study Report (ESR) for the project. The draft ESR encapsulates the outcomes of the Class EA initiated in February 2022, and delineates the route selection process and potential impacts on both natural and socio-economic environments. Hydro One sought comments on the draft ESR till December 7, 2023. During the same month, the Chatham-Kent council announced that it would be taking steps to safeguard local water wells, particularly in areas like North Kent, during the construction of the proposed St. Clair transmission line. In response to the concerns raised by Water Wells First, a community group that is trying to stop the black water crisis in Chatham-Kent, Hydro One's commitments include ensuring tower foundations do not interact with the aquifer and remain between 33 feet to 100 feet, depending on the depth of the soil, above the top of the aquifer layer; not using pile driving to install tower foundations; and using helical screw piles due to their simpler installation process and minimal noise and vibration levels.

The transmission line is expected to be operational by the end of 2028, with construction starting in the spring of 2027.

Latin America

Engenheiro Lechuga–Equador–Boa Vista Transmission Line Project, Brazil

Developer: Transnorte Energia S.A, a consortium between Brazil-based energy firms Centrais Elétricas do Norte do Brasil S.A. (Eletrobras Eletronorte) (49 per cent) and Alupar Investimento S.A. (51 per cent)

Project details and status: The project aims to connect the Brazilian state of Roraima with the country's national electrical power grid. Presently, Roraima gets 70 per cent of its power from Venezuela's Guri hydroelectric dam. Therefore, the project is crucial to reduce the country's dependence on dispatches by Venezuela-based power company Corporación Electrica Nacional, S.A. (CORPOELEC).

The project was awarded as Lot A during Auction 004/2011 of Brazil's national electricity agency, Agência Nacional de Energia Elétrica (ANEEL), held in September 2011.

The project entails the construction of the 400-km-long Engenheiro Lechuga–Equador line; the 315-km Equador–Boa Vista line; the 500 kV Equador switching substation; and the 800 MVA, 500/230 kV Bora Vista substation. About 125 km of the line will pass through the Waimiri-Atroari indigenous reserve in the states of Amazonas and Roraima.

In December 2015, Fundação Nacional do Índio, or National Indian Foundation (Funai), gave its approval to environmental agency Ibama for the construction of the transmission line between Manaus in Amazonas and Boa Vista in Roraima.

In May 2018, the Ministry of Mines and Energy (MME) declared the construction of the project to be of strategic interest, which would allow initiating its construction without the permission of local indigenous inhabitants, including the Waimiri-Atroari.

In March 2019, it was announced that construction of the 500/230 kV Engenheiro Lechuga–Boa Vista line project would likely begin by end June 2019.

In May 2019, the Brazilian government put forward its plan to issue a decree that would guarantee high revenues for the developers, who argued that the project would only be feasible with an annual revenue of BRL396 million, compared to the revenue of BRL121 million per year that the firms had accepted during the bidding.

In August 2019, the project developers announced that they expected to get the environmental licence by the end of the month.

In November 2019, the Brazilian government ratified the construction the project.

As of June 2020, Transnorte was facing difficulties in obtaining the licence for the project as the 715-km-long line will cross around 122 km of land occupied by the Waimiri-Atroari clan.

In the same month, Eletrobras announced that the works for the transmission line from Roraima to the country's grid network were stalled due to the outbreak of the COVID-19 pandemic.

Initially, the government planned to release the project's environmental licence in April 2020, which would have enabled work to begin on the transmission line. However, the licence approval process has also been delayed due to the pandemic.

In March 2021, the Federal Court accepted Transnorte's request to annul the contract for the construction of the transmission line between Manaus, Amazonas, and Boa Vista, Roraima, as the consortium's request for an environmental licence for the line was rejected. This will allow the Brazilian government to re-tender the project after almost 10 years, despite it being first awarded in September 2011.

In September 2021, Eletronorte signed the first addendum to the concession contract between the federal government and Transnorte, for the construction and operation of the transmission line. The addendum pertained to the change in commercial operations of the project – of 36 months after the environmental installation licence is issued, and an increase in the annual revenue allowed to BRL329 million.

In the same month, Brazil's environmental enforcement agency Ibama issued a licence to the transmission line for the developers to initiate construction works on the project.

In September 2022, the MME closed the public civil actions related to environmental licensing for the construction of the project. During the same month, the Conselho Nacional de Política Energética (CNPE) or National Energy Policy Council (CNPE) of Brazil published Resolution 07, which recognises the strategic interest of the project.

In November 2023, Pró Amazônia Legal, the Steering Committee of the Structural Cost Reduction Program for Energy Generation in the Legal Amazon and Navigability of the Madeira River and the Tocantins River, under the MME, sanctioned the allocation of funds for the reimbursement of amounts related to Waimiri Atroari indigenous land.

The allocated funds constitute part of the heritage compensation for socio-environmental impacts on the Waimiri-Atroari indigenous land due to the proposed project. This approval authorises the disbursement of over BRL20 million by the federal government, distributed in three instalments to the developer.

(BRL1=USD0.20)

500 kV Panama–Colombia Interconnection Project

Developer: Interconexión Eléctrica Colombia-Panamá, S.A. (ICP), a joint venture of Empresa de Transmision Electrica S.A. (ETESA) of Panama and ISA of Colombia

Project details and status: The project, which was announced in 2008, entails the construction of a 500 kV, 500-km, HVDC line connecting the power grids of Colombia and Panama. Since its announcement, the project has been facing various environmental and cost-related issues, due to which the president of Panama halted the project in 2012. After that, both countries tried to revive its development multiple times, but several issues related to its cost, the environment, delayed decisions, etc. prevented its resumption.

In September 2022, after a delay of almost 15 years, the developer defined the line route under the EIS of the project, which is likely to be completed soon. Following this, the project will be open for bidding. The USD500 million project is being funded by

the Inter-American Development Bank (IaDB) and will cover 220 km in Panama and 280 km across Colombia, from a substation in Panama City to the Cerromatoso substation in Colombia. It will have the capacity to transport up to 300 MW of electric power in either direction.

The line route has been divided into three sections: a 220-km land section on the Panamanian side; a 130-km underwater section; and a 150-km land section on the Colombian side. The design and technical structure for the underwater section, which runs from Guna Yala in Panama to Cerro Matoso in Colombia, are already in place. The cross-border link will eventually be interconnected with a regional grid project called Sistema de Interconexion Electrica de los Paises America Central (SIEPAC)—a 230 kV, 1,796-km-long transmission line linking Panama, Costa Rica, Honduras, Nicaragua and El Salvador.

In March 2023, ETESA submitted the EIS for the 300 kV Panama II substation as part of the 500 kV project. Also, Panama and Colombia agreed to work together on the project. In November 2023, ETESA provided an update on the progress of the project. The project is currently in the feasibility phase, with technical and environmental studies nearing completion. The project's EIS for Colombia is 90 per cent advanced, while Panama has received approval for EIS. However, challenges have arisen due to significant complaints from communities affected by the project, such as in the Wargandí and Guna Yala regions. The construction of the line is expected to begin by the end of 2023 or early 2024.

Fourth Line Project, Panama

Developer: Yet to be selected

Project details and status: The project will provide the national interconnected system with an unrestricted connection to power generation in the west and enable the transfer of electricity from this region to the load centre in the east.

The Chiriqui Grande–Panama III transmission line, also known as the Fourth Line project, will be implemented in two phases. Phase I involves the construction of a 300-km-long, 500 kV transmission line proposed to connect the 500/230 kV Chiriqui Grande substation to the Panama III substation, and the expansion of the latter. At this stage, the line will operate at 230 kV and will allow transmission of 589 MVA under normal operating conditions and 797 MVA under emergency conditions.

Phase II will include the energisation of the line at 500 kV, for which the 500 kV yards of the Chiriqui Grande and Panama III substations will be constructed so that the line transmits 1,280 MVA under normal operating conditions and 1,856 MVA under emergency conditions.

Panama's state transmission company ETESA plans to develop the project through a competitive bid process. The selected company will be awarded a build, operate and transfer (BOT) contract and will be responsible for the financing, design, construction, operation and maintenance of the Fourth Line for 35 years.

In May 2018, the Cabinet Council of the Republic of Panama approved the prequalification criteria for the companies planning to participate in the tender to design and construct this project, following which the prequalification documents for the contractor selection were published. According to the criteria, the company or consortium that won the tender would also be responsible for obtaining the necessary funds to develop the work, estimated at PAB500 million. Later, in July 2018, the council extended the prequalification criteria and the deadline to submit the offer from July 12, 2018, to July 27, 2018. Following this, ETESA announced the prequalified bidders for the project.

Between December 2018 and March 2019, the due date of the tender was postponed several times. In April 2019, ISA and China Electric Power and Technology submitted the final bids for the project. However, in May 2019, ETESA negated the tender for the project as none of the bidders had met the minimum requirements of the tender. In August 2019, Panama's regulators put forward their plans to review the pending initiatives for the project, under which several aspects of the design were to be re-evaluated. In June 2020, Autoridad Nacional de los Servicios Publicos (ASEP) accepted the appeal filed by ETESA for the inclusion of the project in the Plan de Expansión del Sistema Interconectado Nacional (PESIN) 2019-33 or Expansion Plan of the National Interconnected System 2019-33. Previously, ASEP did not include the project in PESIN 2019-33 due to its complexity and high cost and had called for a re-evaluation of its technical parameters.

In September 2020, ETESA pushed the completion deadline of the project from the first half of 2023 to July 2024. Later in December 2020, ETESA and other associations involved in the development of the social and environmental studies of the project decided to reactivate the study process. In April 2021, ETESA launched a tender to conduct the EIS for the project, which will pass through three ecological reserves. The analysis, preliminary study and consulting service for the project's EIS will cost USD4.2 million. In August 2021, ETESA received five bids to prepare the EIS for the project. However, in October 2021, ETESA announced the tender for preparing the EIS of the Fourth Line as void, post re-evaluation.

In December 2021, ETESA relaunched the tender for conducting the EIS of the project wherein it received four bids. The bidders for the new tender for the USD4.2 million, 365-day contract were Consorcio Proyeco Diceasa Socioambiental; Consultores Ambientales y Multiservicios, S.A. (CAMSA); Tecnica y Proyectos SA (TYPSA) Group; and URS Holdings Inc. In February 2022, Panama's General Directorate of Public Contracting partially annulled the evaluation report of the tender process for drafting the EIS for the line, following complaints from some of the bidders.

In March 2022, ETESA awarded the contract for drafting the EIS of the line to CAMSA. It offered approximately USD2.9 million for the new tender of this contract. In May 2022, ETESA submitted the pre-feasibility study of the line to the Asociaciones Público-Privadas (APP) or the Public-Private Partnership (PPP) Regulatory Entity, for it to be built from Chiriqui Grande to Bocas del Toro to Panama III substations, in the province of Panama. This is the first investment project of ETESA to be carried out under the PPP modality and the second of the current government to be submitted for evaluation as a PPP, based on Law 93 of September 19, 2019.

In June 2022, ETESA launched the tender for easement studies for the line. The easement works entail conducting commercial appraisal of land along the route of the line. In July 2022, eight groups showed interest in ETESA's tender to carry out the easement

studies. The potential bidders are LAC Legal, Consorcio Avalúos T4, Colliers Internacional, Consulting & Solution, Cía. Nacional de Avalúos, ISES, Manhattan Panamá and Abco Energy.

The process of awarding the easement works was suspended by Dirección General de Contrataciones Públicas (DGCP) or General Directorate of Public Procurement in August 2022, after one of the potential bidders—LAC Legal—objected to some of the points of the bidding specifications such as the requirement to be registered for more than 10 years with the Autoridad Nacional de Administración de Tierras (Anati) or National Land Administration Authority.

With regard to this, DGCP ordered ETESA to take corrective actions wherever required. In August 2022, Panama's public services regulator, ASEP, postponed the approval of the Fourth Line project for the future PESIN. In October 2022, ETESA published the updated terms of reference and resumed the contracting process. The bids were due on October 31, 2022. In December 2022, ETESA awarded a contract to carry out an easement study for the project to Consorcio Conavsa & Cwork LT4/Compañía Nacional de Avalúos y Obras Civiles for USD3.5 million.

As of May 2023, ETESA has been progressing with the preparatory works of the project, aimed at increasing the country's electricity transmission capacity.

In June 2023, several environmental and indigenous organisations such as Movement for the Defense of Territories and Ecosystems of Bocas del Toro, Center for International Environmental Law and Alliance for Conservation and Development raised concerns with respect to transparency, indigenous participation and citizen consultation, over the project.

ETESA has assured compliance with environmental regulations and laws. It will soon release the definitive technical report of the project, including the feasibility report, bidding documents and the PPP contract. In July 2023, ETESA clarified its position on the Fourth Line project, stating that it will not involve the privatisation of ETESA. Instead, the development and construction of the line will be carried out under the PPP scheme.

The specifics of this PPP scheme have been thoroughly presented and explained to various business associations, and ETESA has highlighted that the project will not follow the BOT scheme that was used in previous administrations.

As of November 2023, ETESA was working in coordination with the Secretaría Nacional de APP (SnAPP) or National PPP Secretariat and preparing the Informe Técnico Final (ITF) or Final Technical Report of the project, which includes the feasibility study, the bidding documents and the PPP contract, which is expected to be presented to the Governing Body of the sector by December 2023.

ETESA is planning to issue the tender for the project in January 2024, to ensure that the infrastructure becomes operational between 2027 and 2028. If the tender is delayed further, ETESA is considering a backup plan involving the repowering of existing transmission lines to temporarily boost capacity. However, this solution is deemed insufficient in the long term, emphasising the critical need for the Fourth Line project.

(PAB1=USD1)

Asia Pacific

400/220 kV Narendra–Koppal Transmission Scheme, India

Developer: Indian renewable energy company ReNew Power Private Limited

Project details and status: The Narendra–Koppal project, involving the evacuation of 2.5 GW from wind energy zones in Karnataka, is part of the first of three phases of the planned interstate-based evacuation infrastructure Koppal transmission scheme. The latter will create 66.5 GW of renewable energy zones (REZs) in the Indian states of Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat, Rajasthan, Maharashtra and Madhya Pradesh. The Narendra–Koppal project includes:

- A 5×500 MVA, 400/220 kV pooling station near Munirabad or any other suitable location in the Koppal district of Karnataka
- Nine-line bays of 220 kV for the interconnection of wind projects
- A 400 kV double-circuit line from the proposed Munirabad pooling station to Power Grid Corporation of India Limited's (POWERGRID's) Narendra (new) substation in Dharwad district, Karnataka
- Two line bays of 400 kV at the aforementioned Narendra substation
- 2×125 MVAr, 400 kV bus reactor at the proposed Munirabad pooling station

In April 2022, GE's Grid Solutions business received a contract from ReNew Power to build two 400 kV substations in the southwest state of Karnataka, India. It includes a 400/220 kV air-insulated switchgear (AIS) substation in Koppal, and a 400 kV gas-insulated switchgear (GIS) substation in Narendra. The contract also includes the supply of two 125 MVAr, 400 kV reactors for each substation.

In November 2023, ReNew announced that it has commissioned the project, which will help in the transmission of 1,500 MW of renewable energy in the Koppal area of Karnataka state.

The remaining transmission for 3,500 MW is expected to be completed by June 2024.

400 kV Hetauda–Dhalkebar–Inaruwa project, Nepal

Developer: State-owned utility, Nepal Electricity Authority (NEA)

Project details and status: The 400 kV project is part of the larger Nepal–India Electricity Transmission and Trade Project, which aims to establish about 1,000 MW of cross-border transmission capacity between India and Nepal to facilitate electricity trade between the two countries and to increase the supply of electricity in Nepal by the sustainable import of at least 100 MW.

The 400 kV project includes the construction of the 288-km, double-circuit Hetauda–Dhalkebar–Inaruwa transmission line; and three 400 kV AIS substations at Hetauda, Dhalkebar and Inaruwa. The Dhalkebar substation (commissioned in August 2016) is connected to the Muzaffarpur (India) substation via the 400 kV Dhalkebar–Muzaffarpur cross-border transmission line, which will

also be connected to the Hetauda and Inaruwa substations via the Hetauda–Dhalkebar–Inaruwa transmission line. These works also involve the installation of 220/132 kV, 2×160 MVA transformers and the associated bay at the Dhalkebar substation; 220/132 kV, 2×160 MVA and 132/11 kV, 10 MVA transformers and the associated bays at the Hetauda substation; and 220/132 kV, 2×160 MVA and 220/33 kV, 2×63 MVA transformers and the associated bay at the Inaruwa substation.

In January 2019, construction works were halted after a former minister filed a writ petition to change the route of the project and to stop the ongoing work at Padariya of Lahan Municipality, as the project required RoW on forest and private land. After this, the Supreme Court also issued an interim order halting the development of eight towers of the project.

In November 2021, due to the prolonged delay, the key financier, the World Bank, discontinued its funding for the project. Now the project cost, estimated at USD170 million, is being entirely financed by the Government of Nepal.

In July 2022, the Supreme Court scrapped the petition of the former minister and allowed NEA to carry on with the construction of the project, after paying due compensation to the locals. The Supreme Court verdict paved the way for other NEA projects facing similar issues.

As of March 2023, the transmission line, which has been stalled for five years now, continues to face delays in the Jiajor area of Lalbandi Municipality in Sarlahi as well as Wards 15, 16 and 17 of Hetauda Sub-Metropolitan City in Makwanpur. The development of 14 towers in the Hatia neighbourhood, two towers in Thanabha Yang, which is in Ward 11 of the Hetauda sub-metropolitan area, and eight towers in the Jiajor neighbourhood has been put on hold.

Delays have been caused due to several reasons, including the local residents demanding a change in the route of the line; procedural complications in forest area land use and deforestation approvals; and poor performance by the contractor. Due to the delay, power from the 456 MW Upper Tamakoshi hydropower project cannot be transmitted to the west from the Dhalkebar substation due to a lack of line capacity.

In September 2023, India and Nepal reached an understanding on increasing the volume of power traded through the 400 kV Dhalkebar (Nepal)–Muzaffarpur (India) interconnection beyond 800 MW up to 1,000 MW, which is possible only once the Hetauda–Dhalkebar–Inaruwa project is commissioned in Nepal.

In November 2023, the Minister for Energy, Water Resources and Irrigation (MoEWRI) directed NEA to complete the construction of the line immediately by taking necessary measures, such as help from local security personnel and administration.

NEA is under pressure to complete the construction of the line within the next four months.

Koshi Corridor 220 kV Transmission Line Project, Nepal

Developer: NEA

Project details and status: The project aims to evacuate power from hydropower projects proposed to be developed in the Koshi and Mechi zones over the next 15 years. Through the entire Koshi Corridor project, about 1,000 MW of electricity can be transmitted from Tumlingtar to Basantapur and from Dhungesanghu to Basantapur, while about 2,000 MW can be transmitted from Basantapur to Inaruwa. The corridor is Nepal's longest 220 kV transmission line so far.

The first section of the project entailed the construction of the 106-km-long, 220 kV double-circuit transmission line passing from Inaruwa (Sunsari District) to Basantapur (Terhathum District) to Khandbari (Sankhuwasabha District) as well as construction of 220 kV substations in Inaruwa, Basantapur, Vaneshwar and Tumlingtar at an estimated cost of USD60.8 million. The second section of project will involve the construction of a 35-km transmission line between Basantapur and Dhungesanghu in the Taplejung district.

In June 2018, Indian company Larson & Toubro (L&T) was awarded a contract worth USD26.01 million to build the Inaruwa, Tumlingtar and Baneshwar substations. In August 2021, the first phase of the project was completed. In October 2021, the first phase was energised by India's Kalpataru Power Transmission Limited (KPTL) and handed over to NEA. In July 2022, 200 kV substations constructed in Inaruwa of Sunsari district, and Tumlingtar and Baneshwar of Sankhuwasabha district, were put into operation.

In August 2022, NEA put three 220 kV substations under the project – one each in Inaruwa, Tumlingtar and Baneshwar – into operation. The operation of these substations resulted in the charging up of the 220 kV Inaruwa–Tumlingtar transmission line. In November 2023, NEA put the 220/132/33 kV Basantapur substation in Dharmadevi municipality into operation. Built at a height of 2,450 metres above sea level, the substation will transmit electricity coming from Tumlingtar (in Sankhuwasabha district) and Dhungesanghu in the Taplejung district. This is important for the electrification of the eastern part of the corridor.

Currently, the last section of the project—the 34-km-long, 220 kV Basantapur–Dhungesanghu D/C line—is under construction, in addition to the 132 kV substation at Dhungesanghu. Of the 128 towers on this line, only six remain to be constructed. Further, construction of the Dhungesanghu substation is about 95 per cent complete. Works are underway to complete the S/C, 26-km line by January 2024. The contract for the construction of the second circuit has been signed and the work has started with a target to complete it by February 2024.

The transmission corridor, which is being constructed with financial support from the Government of Nepal, NEA and a concessional loan from Exim Bank of India, will evacuate the energy generated by the hydropower projects that are under construction in Bhojpur, Terahathum, Sankhuwasabha and Taplejung of Province 1, to the national grid.

220 kV Nam Sum (Laos)–Nong Cong (Vietnam) Transmission Line project

Developer: Vietnam Electricity National Power Transmission Corporation (EVNNPT), a subsidiary of state utility Vietnam Electricity (EVN)

Project details and status: The 220 kV interconnection between Laos and Vietnam is an urgent project under development for importing electricity from the Nam Sum hydropower plant cluster

(Laos) to Vietnam to meet the increasing demand of the Northern region. The project is being managed by EVNNPT's unit, Northern Vietnam Power Projects Management Board (NPMB).

The Nam Sum–Nong Cong line is about 130 km long, with two circuits from the connection point G1 (at the Vietnam–Laos border) to the 220 kV Nong Cong substation, 299 column foundation positions and 99 anchorages. The route passes through the Que Phong and Quy Chau districts of Nghe An province spanning 77.31 km, and the Nhu Xuan, Nhu Thanh and Nong Cong districts of Thanh Hoa province spanning 52.64 km. The entire route has up to 234 column foundation locations affected by forests. In December 2021, the construction of the project commenced. In November 2023, EVNNPT established a Steering Committee and promulgated its working regulations for the construction of the line in Vietnamese territory. The committee is responsible for directing, inspecting and advancing the construction to ensure its timely completion with the required quality and compliance with regulations.

The project is behind schedule due to issues with forest use conversion and site clearance. It is expected to be completed in January 2024.

500 kV Quang Trach–Pho Noi Project, Vietnam

Developer: EVNNPT, a subsidiary of state utility EVN

Project details and status: The 500 kV transmission line is part of the Power Development Plan VIII (PDP VIII) approved in May 2023. It aims to boost interregional connections and help ensure power supply for the northern region of Vietnam.

It is a 513-km project, comprising four sections, namely, Quang Trach–Quynh Luu (226 km), Quynh Luu–Thanh Hoa (91 km), Thanh Hoa–Nam Dinh 1 (73 km) and Nam Dinh 1–Pho Noi (123 km). As of August 2023, EVNNPT announced that it was working with Vietcombank and Asia Commercial Bank (ACB) to arrange capital for the transmission line, which requires a loan of VND16 trillion. EVNNPT was also in talks with the Bank of China, Bank for Investment and Development of Vietnam (BIDV), Vietinbank and Vietnam International Bank (VIB) for funding the project.

In October 2023, Vietnam's deputy prime minister (PM) approved the investment and implementation plan of the 500 kV, 74.4-km Nam Dinh I thermal power plant–Thanh Hoa transmission line section of the project at an investment of VND3.09 trillion, besides approving EVNNPT as the investor of the project. EVNNPT will contribute VND925.83 billion for project development, while over VND2.16 trillion will be funded by commercial bank loans.

The deputy PM also directed EVNNPT to start the construction of the remaining three sections of the 500 kV Quang Trach–Pho Noi transmission line project [Quang Trach–Quynh Luu (226 km), Quynh Luu–Thanh Hoa (91 km) and Nam Dinh 1–Pho Noi (123 km)] in the following months. The line is considered vital to meet the expected consumption in northern Vietnam during the peak period of 2024 and the following years to ensure energy security.

The Ministry of Natural Resources and Environment and Ministry of Construction have also increased their efforts to help EVNNPT start construction works of the 500 kV Nam Dinh I–Thanh Hoa section of the project by December 2023.

In November 2023, EVNNPT announced that the People's Committee in Vietnam's northern Nam Dinh province has approved an additional land use plan for the implementation of the Nam Dinh 1–Thanh Hoa and Nam Dinh 1–Pho Noi sections. For the Quynh Luu–Thanh Hoa and Quang Trach–Quynh Luu sections, the Ministry of Industry and Trade (MOIT) will prepare a plan to implement the project's steps and need to send this to the PM by December 30, 2023.

(VND1=USD0.000041)

North–South Expressway Power Project, Vietnam

Developer: Power Transmission Company 3 (PTC 3) [a unit of EVN subsidiary EVNNPT]

Project details and status: The project is divided into three parts – Quang Ngai–Hoai Nhon, Hoai Nhon–Quy Nhon and Quy Nhon–Chi Thanh – with a total length of about 118.8 km (passing through eight districts, towns and cities with 30 communes and wards in the Binh Dinh province). It has 11 intersections with 220 kV transmission lines managed by Binh Dinh Power Transmission (under PTC 3).

As of November 2023, PTC 3 is working to accelerate the progress of the project. Binh Dinh Power Transmission has coordinated with relevant parties to complete temporary line connections for seven of the 11 intersection points. Further, the renovation and relocation of two intersections of the 220 kV Quy Nhon–Tuy Hoa line and the Phu My–Phuoc An line with the North–South Expressway have been completed. To overcome difficulties and carry out the relocation of intersection points on schedule, Binh Dinh Power Transmission has increased the allocation of human, material and vehicle resources. It will continue to coordinate closely with the Provincial Land Clearance Board and relevant parties to participate in monitoring activities, and for landowners' acceptance of renovation and relocation of the remaining intersection points.

Marinus Link, Australia

Developer: Marinus Link Pty Limited, a subsidiary of Tasmania's transmission network developer TasNetworks

Project details and status: The second Bass Strait interconnector, widely known as the Marinus Link, is a proposed 1,500 MW undersea power link connecting Tasmania and Victoria, with supporting transmission infrastructure. The project is being developed by TasNetworks and will operate in addition to the existing Basslink interconnector.

The first stage of the project involves building a 750 MW HVDC link between Burnie in Tasmania and Hazelwood in Victoria, with support network augmentations in Tasmania. In the second stage, a second 750 MW HVDC cable will be installed. The project entails around 250 km of undersea cables, 90 km of underground cables, as well as converter stations at both ends.

Project Marinus began in 2017. The first phase of the project was the feasibility and business case assessment phase, which was completed in late 2019. Now that the project has reached the design and approvals phase, the utility will be mapping out route options, conducting surveys of the local area and analysing costs.

In December 2021, TasNetworks awarded an AUD5.5 million contract for works under the project. The Australian company MMA Offshore won the contract to carry out critical engineering surveys, known as the Marine Engineering Geotechnical Site Investigation (MEGSI). MMA Offshore further contracted Melbourne-based TEK Ocean Group to provide marine services for the survey in Bass Strait. As part of the works under the awarded contract, the expert crew of the 87-metre survey ship, named TEK Ocean Spirit, will be based in Burnie for the duration of the 39-day survey programme. The crew members are from Tasmania, Victoria and Western Australia.

In February 2022, TasNetworks launched a major marine engineering survey to establish a path for burying the project's undersea HVDC cable by building on results from previous investigations and analyses. The survey will be the third for the project and the largest so far. TEK Ocean Group announced that TEK Ocean Spirit had sailed from a port in Burnie and was headed south to commence the survey.

The survey will encompass an estimated 255 km between Heybridge in northwest Tasmania and Waratah Bay in South Gippsland, Victoria, and could take between four to six weeks to complete. Those on board the vessel will investigate approximately 110 sites across the Bass Strait, in sea depths of up to 80 metres. As of August 2023, AER started public consultation on the Stage 1-Part A early works application for the Marinus Link. As part of its application, Marinus Link Pty Limited has sought to recover AUD128.9 million in revenue to deliver the proposed early works.

Marinus Link will later submit a Stage 1-Part B application for construction and implementation costs after finalising the cost estimate and completing AEMO's Integrated System Plan (ISP) feedback loop process. This staged approach aims to reduce project uncertainty and identify risks.

The Tasmanian government has raised concerns about the escalating costs of Marinus Link and is in discussions with the federal government and Victoria to find a feasible solution. The former seeks to renegotiate the deal and explore alternative funding options as the rising costs of the project have raised concerns about its economic viability and the burden on Tasmanians. In September 2023, the Australian government and the government of Tasmania announced a new deal to continue with one 750 MW cable of the Marinus Link project. Under the deal, the federal government has increased its equity share to 49 per cent, with the share of Tasmania falling to 17.7 per cent and that of Victoria remaining at 33.3 per cent as agreed in October 2022. The project will also be reduced to one 750 MW cable in the first stage, which is expected to deliver two-thirds of the project's economic benefits. The cost for this stage is estimated at AUD3 billion to AUD3.3 billion. Further negotiations will continue for the second 750 MW cable. The revised deal between the governments also involves an increase in concessional debt financing via the Australian government's Clean Energy Finance Corporation (CEFC).

In the same month, Marinus Link entered into a capacity reservation agreement with Prysmian Powerlink, securing production and offshore installation capacity for the first 750 MW cable. In November 2023, TasNetworks announced that its North West Transmission Developments (NWTD) project would be built in two stages, with only 60 per cent of the original project included in the first stage. The first stage involves the construction of the Palmerston–Sheffield–Heybridge link, as well as the Stowport–Burnie link, which is required for the operation of the first Marinus Link cable. In the second stage, the Staverton–Hampshire Hills–Burnie section will be constructed in alignment with the second Marinus Link cable.

A final investment decision on the project is targeted by the end of 2024. Construction on the first stage of the NWTD project is expected to begin in 2025. Construction of the second stage will only take place if the state government decides to build a second Marinus connection. The first cable of the Marinus Link is expected to be commissioned by 2028.

(AUD1=USD0.64)

CASA-1000 Project, Tajikistan–Afghanistan–Pakistan–Kyrgyz Republic

Developers: Da Afghanistan Breshna Sherkat (DABS) of Afghanistan; Joint Stock Company National Electric Grid of Kyrgyzstan (NEGK); National Transmission and Despatch Company (NTDC) Limited of Pakistan; and Open Joint Stock Holding Company Barki Tajik of Tajikistan

Project details and status: The transmission project aims to facilitate the trade of 1,300 MW of electricity among four countries—Tajikistan, the Kyrgyz Republic, Afghanistan and Pakistan. The project will help transport surplus energy from hydroelectric power projects in Kyrgyzstan and Tajikistan to the power deficit countries of Pakistan (1,000 MW) and Afghanistan (300 MW).

The scope of the project entails construction of a 475-km-long, 500 kV high voltage alternating current (HVAC) line from Datka (Kyrgyz Republic) to Khudjand (Tajikistan); a 1,300 MW HVDC converter station each at Sangtuda (Tajikistan) and Nowshera (Pakistan); and an 800-km, ±500 kV HVDC transmission line connecting Sangtuda and Nowshera via Afghanistan. Almost three-fourths of the line passes through Afghanistan.

In 2013, agreements were signed between the four countries, pertaining to the structure and commercial principles of the project. In April 2015, the project received approval from Pakistan's Central Development Working Party (CDWP), part of the Planning and Development Division of Pakistan's Planning Commission. Additionally, core project agreements, including a power purchase agreement, were signed between the energy ministers of Tajikistan, Kyrgyzstan, Afghanistan and Pakistan. Under the agreement, the transmission tariff was set at 2.98 cents/kWh, the energy tariff at 5.15 cents/kWh and the Afghan transit fee at 1.25 cents/kWh.

The energy ministers of the four countries signed a final agreement for project implementation in November 2015 and work on the project commenced in Tajikistan in May 2016. In March 2017, Kyrgyz Republic sought the assistance of the Saudi Fund for Development (SFD) to implement the project.

In December 2017, DABS awarded three major contracts worth USD235.16 million associated with the implementation of project works in Afghanistan. A contract worth USD76.9 million was signed with India-based engineering, procurement and

construction (EPC) major KPTL and two contracts worth USD72.83 million and USD85.43 million, respectively, were signed with KEC International Limited.

In September 2018, Switzerland-based ABB in consortium with Spain-based Cobra Gestión De Infraestructuras, S.A secured a USD330 million contract for the supply of HVDC converter stations, along with the installation and construction of associated substations in Tajikistan and Pakistan. Under the contract, ABB will supply 1,300 MW HVDC converter stations at Sangtuda in Tajikistan and Nowshera in Pakistan, while Cobra will be responsible for the construction and installation of the associated substations.

In February 2019, the World Bank awarded two contracts for the project. The first contract, worth USD647.6 million, was awarded to Iran-based Monenco Iran Consulting Engineers Company to provide construction supervision services for the design, supply and installation of HVDC transmission lines and associated substations in Tajikistan. The second contract, worth USD2,113 million, was awarded to India's Water and Power Consultancy Services (WAPCOS) Limited to provide consulting services for the construction and installation of HVDC lines, terminals and converter stations in Pakistan and Tajikistan.

In June 2019, International Development Association (IDA) approved a loan of USD65 million for the additional financing required to complete Pakistan's infrastructure component of the project. Later in November 2019, Pakistan signed a loan agreement with the World Bank, worth USD65 million, for the project.

In December 2019, DABS invited Expressions of Interest (EoI) for providing consultancy services to prepare a grid stability study for the existing 220 kV line from Tajikistan for Afghanistan's share in the CASA-1000 project. The grid stability study is being funded by the World Bank.

In February 2020 DABS officially commenced construction work on the CASA-1000.

In July 2020, the Ministry of Energy and Water Resources, Tajikistan, announced that it expects the construction of the Tajikistan section of the CASA 1000 power project to be completed by 2021. As of July 2020, about 30 per cent of the necessary construction equipment had been delivered to the country. Negotiations between the India's KPTL—responsible for the construction of the Tajikistan section of CASA-1000—and the cable manufacturing company Nokili Talco Limited culminated in the procurement of a 1,780-km cable for TJS9.7 million.

In January 2021, Pakistan's NTDC commenced construction work on the 113-km-long, ±500 kV Nowshera–Torkham portion of the CASA-1000. In April 2021, NTDC started construction work on the Nowshera HVDC convertor station for the CASA-1000 project. Both the line and the converter station are expected to be completed by 2024.

In May 2021, the Intergovernmental Council Secretariat, on behalf of the governments of the Islamic Republic of Afghanistan, the Kyrgyz Republic, the Islamic Republic of Pakistan and the Republic of Tajikistan, invited EOIs for undertaking consulting services for the World Bank-funded CASA-1000. The secretariat has invited prospective consulting firms to manage the procurement for and support mobilisation of a DC operator to operate and maintain the HVDC power transmission system. The scope of work under the contract will entail preparation of a scope of services and O&M Agreement for the DC operator in accordance with the CASA Technical Code and other ancillary documents, regulations as per the respective countries, international industry standards/benchmarks, and other requirements pertaining to the project. It will also include planning and executing the DC operator procurement; support mobilisation of the DC operator through system commissioning and commercial operations date, and deployment of key/non-key personnel including HVDC technical experts, commercial experts, legal advisors, project management specialists and translators.

In October 2021, work on the longest stretches of the project was suspended due to ongoing political upheaval in Afghanistan. The World Bank, which is a main stakeholder, also expressed its inability to maintain financial terms with the new Kabul administration.

In August 2022, construction of the project was announced to be under progress in Kyrgyzstan. The 455.6-km-long transmission line will connect the 500 kV Datka substation in Jalal-Abad and the Tajikistan border, passing through the Osh and Batken regions.

In December 2022, Kyrgyzstan announced that construction of access roads to the construction sites for 1,217 utility poles had been completed. To mobilise specialists for the construction of infrastructure facilities in the Batken, Jalal-Abad and Osh regions, six construction bases were established. The project has been experiencing delays due to the law-and-order situation as well as financing challenges in Afghanistan and land acquisition issues in Pakistan.

In November 2023, Kyrgyzstan secured USD18.3 million in additional financing from the World Bank for the project. This funding will be provided through the IDA, the World Bank's concessional lending arm, in the form of a zero-interest credit, with repayments spread out over 50 years and a 10-year grace period. The project is expected to be completed in March 2025.

Europe

Celtic Interconnector Project, Ireland–France

Developers: Ireland's state-owned electric power transmission operator EirGrid and France's transmission system operator (TSO) Réseau de Transport d'Électricité (RTE)

Project details and status: The 700 MW project aims to increase electricity trade within Europe by connecting the north coast of Brittany (in France) to the south coast of Ireland. It will create a direct HVDC link between the French and Irish markets and increase renewable energy integration, especially wind, in Ireland. The interconnector will be about 575 km long. This includes the subsea (500 km) and the onshore cable to the converter station. The subsea connection will link the coast of Cork and the Ceinture Dorée (Gold Belt) coast in Brittany, passing to the west of the Isles of Scilly.

In June 2017, the European Union (EU), under its Connecting Europe Facility (CEF), allocated EUR4 million for the project. The funding was for a study that covered the project's detailed design, a public consultation, and preparation for its construction.

In May 2019, both the Irish and French regulators—Ireland's Commission for Regulation of Utilities (CRU) and France's Commission de Regulation de l'Energie—approved construction of the project and jointly recommended that it receive at least 60 per cent of the total cost of EUR930 million from EU grant support. This falls in line with the EU rules that allow for up to 75 per cent of a project's cost to be covered by grants from the bloc, especially if the project provides a high degree of regional or union-wide security of supply or strengthens the solidarity of the EU.

In June 2019, the Irish TSO conducted an eight-week public consultation on the project. It was seeking feedback on three possible landfall locations on the coast of East Cork (Ireland) for the cable, and on a shortlist of six proposed locations for a converter station in East Cork.

In October 2019, the European Commission (EC) approved EUR530 million in funding for the project. The funding follows from the application signed by both developers in June 2019 to receive EC funding for the project, under the EC's CEF Energy Programme 2019.

In April 2020, RTE issued bids seeking survey services for the project. The scope of work covered the provision of a nearshore geophysical survey, including unexploded explosive ordnance (UXO), and geotechnical services at the French landfall site of the Celtic Interconnector, mainly in water depths ranging between 0 and approximately 30 metre LAT.

In November 2021, the project was included in the fifth list of project of common interests (PCIs) as a priority offshore grid interconnection. The GBP1 billion project had already received GBP530.7 million of support from the EC in 2019. In December 2021, the project entered into the public enquiry phase. Additionally, a foreshore licence application was submitted for the offshore elements of the project in Ireland. A marine licence is also required from the UK Marine Management Organisation.

In May 2022, Ireland's national independent planning body, An Bord Pleanála, granted approval for the interconnector.

In September 2022, the TSOs had informed the Irish and French energy regulators that the project cost would be EUR1,623 million (including a provision of EUR141 million for contingency), which is 75 per cent more than the initial cost.

In November 2022, Ireland's CRU and France's Commission de Regulation de l'Energie confirmed that the Celtic Interconnector project would go ahead and should be completed by 2027, despite a substantial re-evaluation of the project's costs. According to the latest decision by the regulators, the project's estimated investment cost of EUR1,178 million will be borne by EirGrid and RTE in the same ratio as agreed before, with EirGrid bearing 65 per cent of the costs and RTE responsible for the rest. However, the cost overruns—the additional EUR445 million—will be shared equally between the TSOs. This cross-border allocation is based on an equal sharing of the project's operation and maintenance costs and of the project's revenues from congestion rents, the difference between payments made by loads and exports and the revenues received by generators and imports.

In November 2023, construction works on the cable route from Knockraha in east Cork in Ireland had commenced for the interconnector. French cable manufacturer Nexans will design and install the entire cable between the two countries, while Siemens Energy will deliver the converter station at Ballyadam, as well as other high-voltage transmission technology required at the network connection point at Knockraha.

The interconnector is scheduled to be energised by 2026.

(GBP1=USD1.26; EUR1=USD1.08)

Hansa PowerBridge Interconnector, Sweden–Germany

Developers: Sweden's TSO Svenska Kraftnät and Germany's TSO 50Hertz Transmission GmbH.

Project details and status: The Hansa PowerBridge is an onshore/offshore cable connection between Germany and Sweden, which will run from the Gustrow substation in Mecklenburg-Western Pomerania over Fischland (Germany), and through the Baltic Sea to Sweden. The project was announced in March 2014 with the signing of a memorandum of understanding (MoU) between Svenska Kraftnät and 50Hertz. In November 2015, both developers signed the cooperation agreement for setting up the project.

The project comprises two 700 MW cross-linked polyethylene (XLPE) cables along a 300-km route. The cable route includes a 175-km HVDC submarine cable, a 70-km DC underground cable (landfall to converter station) and a 2-km underground AC cable (converter station to substation) on the German side, and a 60-km DC underground cable on the Swedish side. The two converter stations will be located at Lüssow (Güstrow) and Hurva, in Germany and Sweden respectively.

On January 19, 2017, 50Hertz and Svenska Kraftnät signed a cooperation agreement on the interconnector, which lays down substantial details regarding the planning and construction of the interconnector, such as the time schedule, technical design and cost allocation. In January 2022, the TSOs announced a tender for a 300 kV HVDC submarine cable for the Hansa PowerBridge. The scope of work includes an underground cable system in Germany and Sweden, the submarine cable system, the underground fibre optic cable system in Germany, the submarine fibre optic cable system, the optical shed in Sweden, and the service agreement.

In end-February 2022, the Federal Maritime and Hydrographic Agency of Germany (BSH or Bundesamtes für Seeschifffahrt und Hydrographie) initiated the final approval procedures for the construction and operation of the interconnector. The procedure initially relates to the section crossing the German continental shelf in the Baltic Sea. As part of the procedure, BSH is accepting submissions from public interest representatives.

The interconnector entails an investment of EUR600 million, which will be equally shared by 50Hertz and Svenska Kraftnät.

In November 2023, the Ministry for Economic Affairs, Infrastructure, Tourism and Labour of Mecklenburg-West Pomerania, Germany, granted approval to the interconnector for the sections on land and in Germany's territorial sea. The application for planning approval for the interconnector was submitted by 50Hertz in May 2021.

The next step will be to obtain approval for the construction of the section within the German exclusive economic zone (EEZ) from

the German BSH. The tenders for the production and installation of the cables, and for the converters and the associated construction work, will be finalised once this permit has been received, allowing work to begin in 2024.

The cable installation works are scheduled to begin in 2025 with commissioning expected in 2026.

(EUR1=USD1.08)

EuroAsia Interconnector Project, Greece–Cyprus–Israel

Developer: Greek independent power transmission operator (IPTO) Anexartitos Diacheiristis Metaforas Ilektrikis Energeias (ADMIE) [formerly proposed by EuroAsia Interconnector Limited (EIL), a subsidiary of Cyprus-based Quantum Energy Limited]

Project details and status: The project proposes to link the power grids of Israel, Cyprus and continental Greece (via Crete) through a ±400 kV or more HVDC submarine cable and onshore stations in each country/location. It will have a capacity of 2,000 MW.

The project will create an energy bridge between Europe and Asia. The 1,208-km-long subsea interconnector (Israel–Cyprus 310 km; Cyprus–Greece 898 km) will provide a reliable alternative corridor for transferring electricity between the two continents. The first stage entails the construction of a ±500 kV, 1,000 MW submarine cable and eight HVDC onshore stations. The second stage will upgrade the electricity interconnector to 2,000 MW.

In July 2016, EIL, with the participation of Greece's Public Power Corporation (PPC) S.A., announced four global consultancy tenders for undertaking various studies and providing services for the EuroAsia interconnector project. The first tender entails undertaking a detailed geophysical and geotechnical route study, the second tender is for conducting a power system cable installation study, the third tender involves carrying out territorial civil work studies and the fourth tender is for providing technical, engineering and analysis services.

In April 2017, the EC's Innovation and Networks Executive Agency (INEA) signed a grant agreement for undertaking project studies. For this, EUR29 million in funding was extended under the second 2016 CEF energy call for proposals as it is listed among the EU PCI. In January 2018, Elia Grid International (EGI), a unit of Belgium's grid developer Elia, entered into an agreement for the development and implementation of the interconnector as a strategic partner.

In April 2018, EIL issued tenders for the design, manufacturing, testing, supply, installation and commissioning of four HVDC VSCs and four sea electrodes, and for HVDC submarine cables for the Israel–Cyprus link, including the supply of HVDC, MVDC and HVAC land cables in Israel.

In November 2019, EIL issued a EUR1.7 billion tender for engineering, procurement, construction and installation (EPCI) of an HVDC cable system for the project. The published tender was divided into four lots, wherein Lot I entailed EPCI of the submarine HVDC cable system, including all required offshore and onshore joints for Pole 1 of Link 1 (Israel–Cyprus); and Lot II entailed EPCI of the submarine HVDC cable system, including all required offshore and onshore joints for Pole 2 of Link 1. Additionally, Lot III entailed EPCI of the HVDC cable system, including all required offshore and onshore joints for Pole 1 of Link 2 (Cyprus–Crete); and Lot IV entailed EPCI of the HVDC submarine cable system, including all required offshore and onshore joints for Pole 2 of Link 2.

However, EIL made small budgetary changes and reissued the tender in January 2020.

In March 2020, EIL selected Germany-based Siemens AG as the preferred bidder for the construction of the VSC stations associated with the interconnector.

In February 2021, EIL again tendered a EUR1,246 million contract for EPCI of the HVDC cable systems for the Cyprus–Greece (Crete) link of the EuroAsia interconnector. In April 2021, the company announced the receipt of binding offers from Nexans Norway AS and Prysmian Powerlink s.r.l. for the award of the EPCI contracts.

In September 2021, EIL published a EUR30 million tender for provision of project management and owner's engineer services for the interconnector. The submission deadline of this tender was December 6, 2021.

In 2021, Greece's IPTO, ADMIE, became the technical consultant for the interconnector.

In January 2022, the EU approved EUR657 million under its CEF for the interconnector. The total cost of the project is estimated at EUR1,037 billion.

In July 2022, EIL announced that French cable manufacturer Nexans had emerged as the preferred bidder for the supply and installation of 500 kV HVDC mass-impregnated (MI) cables for the 1,000 MW Cyprus–Greece interconnection.

In October 2022, EIL commenced construction on the first phase of the project.

In December 2022, EIL invited competitive bids for owner's engineer services for the Cyprus–Greece (Crete) section of the EuroAsia interconnector. The consultant's scope of work includes providing EIL with the specialised technical engineering support necessary for the project's execution through the phases of procurement, design, production, construction, installation and commissioning. The total estimated value of the contract is EUR5 million.

In June 2023, ADMIE entered into a strategic agreement with EIL for the acquisition of a 25 per cent stake in the interconnector. IPTO's contribution to the interconnector's capital meets the EC Directorate General for Energy requirement for the equity participation of a TSO as a guarantor of the electricity supply security of the three countries of the eastern Mediterranean.

In July 2023, EIL awarded a EUR1.43 billion cable contract to Nexans, which was selected as the preferred bidder earlier in July 2022. Nexans will supply subsea HVDC MI cables for the interconnector. The cables will be manufactured in Nexans' facilities in Halden, Norway, and Futtsu, Japan, and will be installed by the cable-laying vessels Nexans Aurora and Nexans Skagerrak.

In October 2023, it was announced that EIL would exit the EuroAsia interconnector project. Following this development, in November 2023, it was reported that ADMIE had become the

project promoter for the interconnector. EIL is reportedly in the process of transferring all the EU grants to IPTO. The designation of ADMIE as a project promoter will ensure the technical and financial adequacy of the project and lay the foundations for its timely completion.

In November 2023, it was announced that ADMIE intends to form a special purpose vehicle (SPV) for the EuroAsia Interconnector. The SPV formation will facilitate the potential entry of Cyprus and other investors into the project.

The interconnector will soon be moving into the construction phase and is expected to be completed in 2027. When completed, the interconnector between Greece and Cyprus will be the longest and the deepest HVDC subsea cable project ever, with bi-pole cables of 2×900 km and a water depth of 3,000 metres.

(EUR1=USD1.08)

Trans-Balkan Electricity Corridor, Serbia, Montenegro and Bosnia and Herzegovina

Developers: Serbia's state-owned TSO, Elektromreza Srbije (EMS); Montenegro's TSO Crnogorski Elektroprenosni Sistem (CGES); and Bosnia's TSO Elektroprenos BiH

Project details and status: The Trans-Balkan corridor entails the construction of a 400 kV transmission network connecting Montenegro, Bosnia and Herzegovina and Serbia and their connection to neighbouring countries such as Croatia, Hungary, Romania and Italy to allow for better mutual energy trade and further integration of the region's electricity markets.

The project is divided into four phases. The first phase of the bigger project entailed the construction of the 400 kV double-circuit line stretching from Pancevo to the Romanian border within Serbian territory. This phase was finished in December 2017 in Serbia, while Romania deployed its section of the corridor in May 2018.

The EUR29.6 million second phase, which was completed in 2022, included the construction of a 400 kV line linking Kragujevac 2 and Kraljevo 3, the upgrade of the Kraljevo 3 substation to 400 kV, as well as equipping one 400 kV feeder bay in the 400/110 kV Kragujevac 2 substation.

Under the first two phases, 120 km of the corridor have already been built on Serbian territory from Pancevo to the border with Romania, and from Kragujevac to Kraljevo in Serbia.

The third phase entails the construction of a 109-km-long, 400 kV line from Bajina Basta to Obrenovac, the upgrade of the Bajina Basta substation's capacity to 400 kV, and the overhaul of the Obrenovac substation. The fourth phase will include the construction of the 400 kV Bajina Bašta (Serbia)–Višegrad (Bosnia and Herzegovina)–Pljevlja (Montenegro) line, which will span 84 km.

In July 2016, Germany's development bank Kreditanstalt für Wiederaufbau (KfW) Bank signed a EUR25 million grant agreement with Montenegro's Economy Ministry and CGES for Montenegro's section of the Trans-Balkan electricity corridor.

In March 2020, EMS signed a contract with the consortium of local Koda Elektromontaža doo, Elektromontaža doo, and Elnos BL for the construction of the 60-km second phase line. Subsequently, in July 2020, EMS commenced construction of the 400 kV second phase line linking the Kragujevac 2 and Kraljevo 3 substations. In September 2020, EMS signed a EUR6.5 million contract with a consortium of local companies Energotehnika Juzna Backa, Elektromontaza Kraljevo and Elnos BL, for the Lot 2 works of the second phase. The scope of work included the construction of a 400 kV switchyard and a 400/220 kV transformer in the Kraljevo 3 substation, and equipping a 400 kV feeder bay in the 400/110 kV Kragujevac 2 substation.

In January 2023, the EUR40.8 million fourth phase of the corridor project achieved financial closure. KfW announced a grant of EUR8.5 million to Serbia for this phase. The EU donation amounts to EUR10.6 million, the national contribution is about EUR2.4 million while the remaining amount will be provided by KfW as a loan. Construction of this phase will begin in 2026 after the completion of the third section connecting Obrenovac to Bajina Basta between 2024 and 2026. In November 2023, CGES and EMS signed an agreement to build the fourth phase of the corridor. The construction of the 84-km, 400 kV Bajina Basta (Serbia)–Višegrad (Bosnia and Herzegovina)–Pljevlja (Montenegro) line is the fourth and the final phase of the large energy corridor. This phase is expected to be completed in early 2025 at an investment of EUR58.95 million. Following this, construction of the last section is scheduled to begin and will be completed in 2027.

(EUR1=USD1.08)

Middle East Africa

North–South Oman Interconnector Project (RABT) Phase I

Developer: Oman Electricity Transmission Company (OETC)

Project details and status: In line with the Omani government's drive to switch to renewable energy (RE), the North–South Oman Interconnector Project (also known as the Rabt project) is expected to play a vital role in achieving the government's ambitions to produce 15 per cent of the country's energy from renewable energy sources by 2025 by connecting the planned solar energy stations and wind farms in the Governorate of Al Wusta.

The USD966 million Rabt project will provide electricity to the special economic zone (SEZ) in Duqm, as it will connect the Duqm electricity network with the 400 kV national grid and ensure that the factories and large companies in Duqm are provided with reliable electricity. In October 2020, OETC awarded contracts to four EPC companies—L&T; KEC International Limited; Bahwan Engineering Company; and Zawawi Powertech Engineering LLC—for the implementation of Phase 1 of the project.

The first phase of the project comprises 660 km of 400 kV overhead lines, and five main grid stations (GSs) in Nuhaida, Barik, Suwayhat, Duqm and Mahut. The phase is divided into the following five sub-projects:

400 kV GSs at Barik and Suwayhat: The project has been awarded to Oman-based Zawawi Powertech Engineering and is valued at OMR39 million. Both the GSs will be equipped with twelve 400

kV GIS bays, and two 500 MVA, 132/400 kV transformers (at each substation). Works at the Barik GS will also involve the installation of ten 132 kV GIS bays, four shunt reactors, control and relay panels and communication instruments, in addition to associated construction works. At the Suwayhat GS, works will also involve the installation of six shunt reactors, control and relay panels, and communication instruments. The project will be implemented over 24 months with six weeks for mobilisation.

400 kV Barik– Suwayhat–Nuhaida overhead transmission line (OHTL): The total cost of the project is OMR45 million and involves the construction of 400 kV OHTLs connecting the Barik and Suwayhat GSs (129-km-long) and Barik and Nuhaida GSs (195-km-long). It includes construction of overhead line towers, insulators and associated construction works. It will be implemented over 28 months, in addition to six weeks for mobilisation.

400 kV GSs at Duqm and Mahout: Valued at OMR38 million, the Duqm GS will be equipped with twelve 400 kV GIS bays; 2×500 MVA, 132/400 kV transformers; eight 132 kV GIS bays; 4×125 MVA, 132/33 kV transformers; 42 units of 33 kV GIS bays; and six shunt reactors, control and relay panels, and communication instruments. The Mahout GS will be equipped with nine 400 kV GIS bays; 2×125 MVA, 400/33 kV transformers; 21×33 kV GIS bays; three shunt reactors, control and relay panels, and communication instruments. The project will be implemented over 24 months, in addition to six weeks for mobilisation.

400 kV Suwayhat–Duqm and Duqm–Mahout OHTLs: The OMR45 billion contract has been awarded to India-based KEC International and involves the construction of 400 kV lines between the Suwayhat and Duqm GSs (191-km-long) and between the Duqm and Mahout GSs (152-km). It will be implemented over 28 months, in addition to six weeks for mobilisation.

Nuhaida 132/400 kV GS: The OMR17 million GS will be equipped with 14×400 kV GIS bays; 2×500 MVA, 132/400 kV transformers; eight 132 kV GIS; control and relay panels; and communication and associated construction works. It also involves the diversion of the 400 kV transmission line linking the Izki and Ibri GSs via the Nuhaida GS. The project will be implemented over 24 months, in addition to six weeks for mobilisation. As of April 2023, 93 per cent of the works under Phase I had been completed.

In August 2023, OETC completed the Barik and Suwayhat GSs at an investment of OMR45 million and OMR19 million respectively. This facilitated the completion of the OHTL between Barik and Suwayhat GSs. In November 2023, OETC completed Phase 1 of the project at an investment of approximately OMR372 million, compared to the initial estimate of OMR183 million. The completion of Phase 1 sets the stage for the second phase, scheduled to launch in 2023.

(OMR1=USD2.60)

Jordan–Iraq Power Transmission Project (JIPT)

Developers: Jordan's National Electric Power Company (NEPCO) and Iraq's General Electricity Transmission Company – Central Region

Project details and status: The project entails the construction of a 300-km-long, 400 kV transmission line connecting the Al-Risha substation in Jordan with the Al-Qaim electrical transformation station in Iraq. It also includes the commissioning of switchgear at the 400/132/33 kV Risha substation.

In September 2020, the two governments signed a contract to link their electricity networks and trade electricity. In the first phase of the project, Jordan will provide Iraq with 1,000 GWh per year, after completing the network link between the two countries, followed by a second phase that will allow the two sides to increase the capacity of electricity exchange.

Subsequently, the project implementation mechanism for the interconnector was signed by NEPCO and Iraq's General Electricity Transmission Company- Central Region.

In August 2020, Iraq's Ministry of Electricity signed a USD727 million agreement with GE Renewable Energy's Grid Solutions business to reinforce Iraq's transmission network, enhancing grid stability and interconnection with Jordan's electricity grid.

In November 2021, NEPCO invited international bids for the supply and commissioning of switchgear and ancillary equipment for the 400/132/33 kV Risha substation. The scope of work for the contractor includes the design, engineering, manufacture, inspection and testing at the factory of all switchgear and ancillary equipment packing for export and supply at Aqaba Port, Jordan and locally manufactured materials to be delivered at NEPCO warehouse or at site, and supervision of erection and commissioning works at site.

In December 2021, UAE's Ducab Group won the contract for supplying turnkey solutions to GE Renewable Energy's Grid Solutions business' electrification project in Iraq. The scope of work entails the design, supply, installation, testing and commissioning of the 400 kV, 288-km overhead line connecting Jordan and Qaim, a border town located in Iraq, as well as supplying overhead conductors for the project.

In April 2022, NEPCO began construction works on the project. Meanwhile, Ducab Group in Iraq commenced work on the project by checking the power transmission line routes, connection stations and soil.

In October 2022, the groundwork for the project was completed with the Iraqi prime minister and his Jordanian counterpart laying the cornerstone for the interconnection project aimed at tackling power shortages in Iraq. It was reported that the first phase of the project will be completed by June 2023, supplying 400 MW of power to Iraq. In April 2023, Jordan agreed to supply 150 MW of electricity to Iraq via this interconnection.

In August 2023, Iraq completed the construction of a 132/33 kV extra-high voltage substation in Al-Rutba district, Anbar governorate. With this, the technical aspects of the interconnection have been concluded from the Iraqi side. In November 2023, it was announced that the first phase of the project had been completed, providing Iraq with around 50 MW of electricity particularly to Rutba town in Al Anbar province, which has been facing a power crisis for several years.

Iraq will also receive an additional power supply of 350 MW after the completion of the second phase. The third phase of the project includes the completion of the electrical connection between Iraq, Jordan and Egypt.◆

Latin America

Hitachi Energy bags Garabi converter station upgradation contract in Brazil

Brazil's electric power transmission company, Transmissora Alianca de Energia Eletrica SA (TAESA), has awarded the tender to supply comprehensive upgrades to Hitachi Energy, a global energy solutions provider.

The focus of the project is the upgradation of Garabi high voltage direct current (HVDC) converter station, a critical component enabling energy exchange between Argentina and Brazil.

The converter station, operational since 2000, facilitates the transmission of up to 2,200 MW of electricity while overcoming the challenge of different operating frequencies of Argentina (at 50 Hz) and Brazil (at 60 Hz). As part of the contract, Hitachi Energy will employ its latest MACH technology to upgrade the control and protection system, ensuring enhanced performance and reliability.

The investment for this project would be backed by contributions from international entities such as the Inter-American Development Bank (IaDB), Agence Française de Développement (AFD) and European Investment Bank (EIB).

The upgraded HVDC system is expected to contribute to the decarbonisation of the system by facilitating operational reconfiguration, eliminating fossil generation, and enabling the evacuation of renewable energy to the Sistema Interligado Nacional (SIN) or National Interconnected System.

Asia Pacific

Hitachi bags order for Japan's next-generation load dispatching system

Japan's Transmission and Distribution IT & OT Systems LLC, a joint venture established in September 2023 by ten general power transmission and distribution (T&D) companies, has awarded an order for a complete set of the next-generation nationwide load dispatching system, to Hitachi Limited.

The ten T&D companies are Hokkaido Electric Power Network, Inc., Tohoku Electric Power Network Company, Inc., TEPCO Power Grid, Inc., Chubu Electric Power Grid Company, Inc., Hokuriku Electric Power Transmission & Distribution Company, Kansai Transmission and Distribution, Inc., Chugoku Electric Power Transmission & Distribution Company, Inc, Shikoku Electric Power Transmission & Distribution Company, Inc., Kyushu Electric Power Transmission and Distribution Company, Inc., and The Okinawa Electric Power Company, Inc.

Hitachi will build the next-generation system to standardise the load dispatching system under the jurisdiction of each of the nine general T&D companies (excluding the Okinawa area). It will utilise the know-how developed in Japan and Hitachi Energy's global package, Network Manager. The new system will perform a wide-area load frequency control (LFC) function that will be introduced for the first time in Japan, as well as optimisation calculations for nationwide generator start-stop planning, and supply and demand control through security-constrained unit commitment/security-constrained economic dispatch (SCUC/SCED) functions.

Until now, the load dispatching system, which serves to balance demand and supply, had been developed by the T&D companies in each area. With increasing complexity and variances in the operation of the grid, and the promotion of merit orders (where the cheapest power gets scheduled first) in nationwide areas, there is now a need to develop a platform that is scalable, flexible and transparent for future regulation changes, and can be commonly used by all operators to achieve improved resilience and social cost reduction. Notably, the current load dispatching system was also built by Hitachi.

Canadian Solar's e-STORAGE to deliver BESS to Australian project

Copenhagen Infrastructure Partners (CIP) has selected e-STORAGE, which is part of Canadian Solar Inc.'s majority-owned subsidiary CSI Solar Company Limited (CSI Solar), as the preferred supplier for engineering, procurement and construction (EPC) and operations and maintenance (O&M) to deliver its Summerfield battery energy storage system (BESS) project in the Murraylands region to the east of Adelaide in South Australia.

The project is a two-hour 240 MW (480 MWh) direct current (DC) BESS solution and will incorporate e-STORAGE's SolBank battery technology, which is based on lithium-iron-phosphate (LFP) chemistry. Summerfield is the first of multiple large-scale BESS projects spearheaded by CIP in Australia. The project is scheduled to become operational in 2025.

Afghanistan's DABS awards contracts to Afghan Invest Private Company

Da Afghanistan Breshna Sherkat (DABS) has awarded two contracts to Afghan Invest Private Company for the completion works of the 500 kV Sheberghan–Dasht Alwan transmission line and developmental works at the Dasht Alwan substation. These projects will streamline the transmission of cost-effective, high-quality electricity from Turkmenistan to Afghanistan, significantly alleviating the country's electricity shortage.

Under the contract, Afghan Invest will be responsible for completing the remaining 23.7 per cent of the 500 kV power line from Sheberghan to Dasht Alwan, covering a distance of 305.17 km, in addition to concluding the remaining development works at the 500 kV substation in Alwan Desert. The contractor has to completed the projects in two years at a total cost of USD36.2 billion. DABS will closely monitor and evaluate the implementation, technical and financial affairs of the projects according to the monitoring and evaluation standards based on the agreement.

DABS has been taking steps to complete several other unfinished high-capacity transmission projects at its own cost. It has completed the Kajki–Kandahar line, Balkh Chamtal substation, and Arghandai–Maidan power line projects at a low cost, while it is currently working on completing the transmission line to Ghazni, Zabul and Kandahar, as well as on the Torghundi–Herat line and Noorul-Jihad substation projects in Herat.

EUROPE

French Nexans signs capacity reservation agreement with UK's SSEN

The UK's SSE Networks Transmission (SSEN Transmission), the transmission business of Scottish and Southern Energy (SSE), has entered into a capacity reservation agreement with French cable manufacturer Nexans to supply around 100 km of 220 kV high voltage subsea and land cables for the Orkney transmission link.

SSEN Transmission's strategic sourcing approach of reserving capacity for key transmission equipment in the early stages of project development will allow suppliers to better manage their manufacturing capacity in the long term.

The proposed 200 MW Orkney connection project aims to provide a new transmission connection between Orkney and mainland Scotland, and the associated onshore infrastructure required to support renewable energy projects.

The GBP260 million link will include a single 220 kV subsea cable, followed by a second similar cable, once further generation has been committed, and if it is labelled as economical.

The project received approval from the UK's energy regulator, Office of Gas and Electricity Markets (Ofgem), in July 2023.

With all planning consents in place for the point-to-point connection, work is underway to plan the infrastructure required to connect and transmit Orkney's renewable energy generation to the Finstown substation on the island, before onward transmission to demand centres in the north of Scotland and beyond.

The project is scheduled for completion in 2028.

(GBP1=USD1.26)

Italy's Prysmian wins 525 kV HVDC submarine cable contract for EGL1

The UK's SP Transmission (SPT) – a subsidiary of SP Energy Networks, which manages a portion of Scotland's transmission grid, along with National Grid Electricity Transmission (NGET), has selected Italian cable manufacturing company, Prysmian Group, to supply a 525 kV HVDC cross-linked polyethylene (XLPE) submarine cable system for the Eastern Green Link 1 (EGL1) project. The contract is valued at EUR850 million.

Prysmian will design, manufacture, install, test and commission the required HVDC cable system, delivering nearly 400 km of power cable needed for the 194-km route between the two countries.

The majority 176-km portion of the route will be installed offshore in the North Sea with onshore sections of around 8 km and 10 km in Scotland and England respectively.

Prysmian will provide high voltage alternating current (HVAC) cable systems to connect the converter station at Torness with the grid substation near Branxton, requiring 30 km of 400 kV XLPE insulated cable, while the respective HVDC and HVAC cable systems will be completed with fibre optic cable and monitoring systems.

Prysmian plans to manufacture the submarine cables at its centres of excellence in Pikkala in Finland, as well as Gron and Montereau, both located in France (for onshore cables).

The first 2 GW HVDC electricity superhighway, EGL1, will be constructed between Torness in East Lothian, Scotland to Hawthorn Pit in County Durham, England. The 525 kV HVDC cable system spans around 190 km with converter stations at both ends to integrate it into the existing transmission network.

EGL1 is part of a major grid overhaul in the UK, requiring a multi-billion-dollar investment in new electricity transmission projects, including three additional subsea links between Scotland and England to support the move toward net zero emissions.

The project is scheduled for commissioning in 2028.

(EUR1=USD1.08)

Siemens and Aker Solutions secure HVDC system contract for UK OWFs

Swedish utility Vattenfall AB has signed a contract with Siemens Energy and Aker Solutions for the supply of a HVDC transmission system for the Norfolk Vanguard East and Norfolk Vanguard West offshore wind farms (OWFs).

Siemens Energy and Aker Solutions will be responsible for the engineering, procurement, construction and installation (EPCI) of the onshore and offshore converter stations for both OWFs.

Earlier in October 2022, the utility had awarded the consortium the HVDC system contract for the Norfolk Boreas OWF – the first phase of Vattenfall's two OWFs under development in the Norfolk offshore wind zone. The second phase comprises the 1.8 GW Norfolk Vanguard OWF, which is expected to be completed between 2027 and 2028.

Vattenfall's Norfolk offshore wind zone, which is located 47 km off the coast of Norfolk, will produce clean energy for more than four million households and save about six million tonnes of carbon dioxide.

Balfour Beatty signs MoU with Taihan Cable for UK's onshore T&D projects

British multi-national infrastructure company, Balfour Beatty, has signed a memorandum of understanding (MoU) with South Korean company Hoban Group, under which it will work directly with Taihan Cable & Solution, a specialist cabling subsidiary of Hoban Group, on potential large-scale onshore power T&D projects across the UK. The partnership will focus on delivering sustainable, low-carbon solutions, prioritising modern methods of construction, and building information modelling to drive efficiencies and productivity throughout future projects.

As an initial outcome of the MoU, Taihan Cable secured a power grid project worth KRW36 billion. The project involves replacing overhead lines (OHLs) with underground cables (UGCs) in the North Wessex Downs area for the improvement of natural landscapes. Taihan Cable will provide the 400 kV power grid and carry out electrical work for the project, led by the UK's transmission system operator (TSO), National Grid. Balfour Beatty

will handle the EPC tasks. The two companies are already working together on National Grid's London Power Tunnels 2 project.

By 2030, the South Korean company will participate in various T&D projects, totalling more than GBP220 million.

(GBP1=USD1.26; KRW1=USD0.00077)

Canadian Solar's e-STORAGE to deliver two BESS projects in UK

e-STORAGE, which is part of Canadian Solar Inc.'s majority-owned subsidiary CSI Solar Company Limited (CSI Solar), will deliver two energy storage projects, each with a capacity of 56.5 MW/113 MWh DC in Cathkin and Broxburn, Scotland, UK, for French multinational utility company ENGIE.

e-STORAGE has signed an engineering, procurement and construction (EPC) agreement with ENGIE for the construction of both sites, which will be connected to the 33 kV network and are scheduled to reach grid connection in early 2025.

The Cathkin and Broxburn energy storage projects will employ SolBank – a proprietary containerised energy storage solution using high-cycle capacity lithium-iron-phosphate (LFP) cells; and an active balancing battery management system (BMS) and efficient thermal management system (TMS).

The two BESS projects will support more than 40,000 homes and play a significant role in facilitating the UK's transition to net zero emissions by 2050.

Swedish Vattenfall signs multi-year framework agreement with Dutch TKF

Swedish utility Vattenfall AB has signed a multi-year framework with Dutch cable manufacturer BV Twentsche Kabelfabriek (TKF) for the supply of 66 kV inter-array cable systems for the former's upcoming OWFs across Europe.

The contract will initially be signed for three years and can be extended for another five years. TKF has made specific commitments that will help reduce CO2 emissions and increase the circularity of cables, such as the use of low-carbon aluminium and recycled copper for the cables' conductive material.

The first project covered by the new collaboration is the German Nordlicht cluster, which includes the 980 MW Nordlicht I OWF off the island of Borkum in the North Sea.

Nordlicht I is planned to be built in a surface area of 52.63 square km about 96 km from shore and at water depths of between 37-39 metres. The project is expected to be completed by the end of 2027.

In the past, Vattenfall has collaborated with TKF for its Hollandse Kust Zuid I and II OWFs off the Dutch coast.

Spain's Iberdrola signs deal with Masdar for Baltic Eagle OFW

Spanish power utility Iberdrola has concluded a EUR1.6 billion deal with Abu-Dhabi-based major renewable energy group Masdar to co-invest in the 476 MW Baltic Eagle OWF located in the German Baltic Sea. Following confirmation that all the necessary regulatory approvals have been received, Iberdrola will have a majority stake of 51 per cent in the project, which will help to accelerate energy independence in Europe. Iberdrola will control and manage the assets, providing operation and maintenance services and other corporate services.

The Baltic Eagle OWF, located 30 km to the northeast of Rügen Island off the coast of Pomerania (Germany) in the Baltic Sea, will be operational by end-2024, supplying renewable energy to 475,000 households.

The OWF is part of Iberdrola's Baltic Hub, which together with the 350 MW Wikinger OWF and the planned 300 MW Windanker OWF, will have an installed capacity of more than 1.1 GW by 2026.

The evacuation of electricity, estimated at 1.9 TWh per year to the grid, will be carried out via two existing submarine cables covering a distance of 90 km to Lubmin, where the connection point to the grid operated by the German TSO, 50Hertz Transmission GmbH, is located.

Iberdrola had reported the completion of the offshore substation (OSS) topside of the OWF in February 2023.

(EUR1=USD1.08)

Hellenic Cables wins contract for Denmark–Sweden interconnection

The TSO of Denmark, Energinet, has awarded a contract to Hellenic Cables—the cables segment of Cenergy Holdings, for a cable system for the 400 kV Denmark–Sweden interconnection. Hellenic Cables will be responsible for the supply of the cable system, supervision of the installation and testing, and the jointing and termination works of the interconnection.

The company will design, manufacture, and deliver 30 km of submarine cable and 12 km of underground 400 kV single-core cables.

These will be produced at the company's manufacturing facilities in Greece.

The production of cables is scheduled to commence in December 2023, with delivery expected in the first half of 2024.

Caverion bags power line projects from Finland's Fingrid

Finland's TSO, Fingrid Oyj, has awarded three power line projects worth EUR8.5 million to Finnish engineering company, Caverion. The scope of work includes power line alterations in the Hepokorvi district of Espoo, where three landscape electricity pylons will be built, and the installation of an optical ground wire (OPGW) between the Espoo and Tammisto substations.

In addition, Caverion will build 2×110 kV power lines between Kopula and Hankasalo, and implement power line alterations in Nurmijärvi.

The projects are significant for electricity transmission and security of supply in the Helsinki metropolitan area, and will contribute to achieving Espoo's climate objectives.

(EUR1=USD1.08)

Linxon wins 400 kV turnkey AIS order from Sweden's SvK

Sweden's TSO, Svenska Kraftnat (SvK), has awarded a turnkey 400 kV air-insulated substation (AIS) contract to Linxon, a joint venture (JV) between SNC-Lavalin and Hitachi Energy.

The contract has been awarded for the Messaure substation in Jokkmokk, northern Sweden and forms part of the 400 kV Aurora Line, an interconnector between Sweden and Finland. Linxon will start work on the Messaure substation in April 2024.

The Aurora Line will run from Pyhänselkä in Muhos via Keminmaa in Finland to Messaure in northern Sweden. In Sweden, the project involves the construction of the Messaure–Dockasberg–Risudden (Finnish border) section.

Aurora Line is expected to be completed in 2025 and will increase the transmission capacity between Sweden and Finland by 700 MW on completion.

Middle East and Africa

Saudi Arabia's Keir secures contracts from state-owned SEC

The Saudi Arabian state-owned vertically integrated power company, Saudi Electricity Company (SEC), has awarded three contracts to Saudi-based Keir International Company Limited (Keir). The first two contracts are for the replacement of a 132 kV underground electrical cable and conversion project at its station in Riyadh and are worth SAR59 million. The first contract involves the replacement of a cable circuit with a new one at a station in Riyadh city, which is valued at SAR34.1 million. The scope of the work for the second contract includes re-routing of the existing 132 kV UGC from a substation to the central station, and installing a new cable along with associated communication work.

The third contract worth SAR26.43 million involves the implementation of a high-voltage inter-tie project in the city of Al Khobar in the Eastern Province. This contract was awarded on November 19, 2023, while the signing date is expected to be December 19, 2023.

So far in 2023, SEC has awarded contracts worth SAR165.94 million to Keir.

(SAR1=USD0.27)

South Korea's Hyundai secures contract from Saudi's SEC

South Korean Hyundai Engineering & Construction (Hyundai) has secured a contract from SEC for 380 kV high voltage circuit breakers and reactors. The value of the contract stands at KRW82.2 billion. The circuit breakers and reactors will be supplied for four new substations that are being constructed by SEC in the eastern and central regions of Saudi Arabia, with completion scheduled for September 2025.

(KRW1=USD0.00076)

ACTOM Energy Namibia secures substation contract from NamPower

South African electrical equipment and services company, ACTOM Energy Namibia (AEN), has clinched a substantial ZAR100 million contract from Namibia's national power utility, Namibia Power Corporation (NamPower).

The contract entails designing, manufacturing, supplying, installing, and commissioning hybrid compact switchgear called HYpact and substation protection and automation systems. This infrastructure is destined for a new indoor 132/66/33 kV substation planned by NamPower in Swakopmund, Namibia.

The forthcoming Sekelduin substation, slated for completion in early 2025, is a strategic response to the escalating demand for power attributed to the rapid growth of Swakopmund and its surrounding areas. It is also poised to accommodate future expansion in the region.

ACTOM group divisions and business units, including ACTOM High Voltage Equipment, ACTOM MV Switchgear, and ACTOM Protection and Control, will supply all substation equipment except transformers.

The substation's unique features include a hybrid switchgear unit from GE Grid, combining AIS and gas-insulated switchgear (GIS) to enhance compactness.

A total of 11 HyPact switchgear units will be provided by GE Grid for the project.

Furthermore, the 33 kV switchgear will feature a four-panel switchboard type, GHA single busbar GIS switchgear from Schneider Electric – ACTOM MV Switchgear's international technology partner, known for its widespread use in South Africa and other African countries.

ACTOM Protection and Control will supply the protection, automation and control scheme, utilising products and services from Schweitzer Engineering Laboratories.

The scheme, aligned with the IEC61850-9-2 international standard, has been operational in NamPower substations since 2009.

The comprehensive contract also involves Metal Fabricators of Zambia—ACTOM's associate, responsible for manufacturing and supplying all control cabling for the project.

Megatron Engineering Namibia, a Windhoek-based EPC management contractor, will spearhead the installation and commissioning of the substation equipment under ACTOM's supervision.

This contract marks a historic milestone for AEN, being the largest awarded since its establishment in 2013.

The project aligns with Namibia's commitment to meeting energy demands in the face of urban expansion and future regional growth.

(ZAR1=USD0.053)◆

Europe

Construction of 110 kV Prijedor substation

Country: Bosnia and Herzegovina
Organisation: Elektroprenos BiH
Description/Scope of work: International competitive bids are invited for undertaking the procurement of construction works and equipment for the 110 kV Prijedor 1 substation.
Closing date: December 21, 2023
Contact: Elektroprenos BiH,
Banja Luka St Wilson Promenade 15, 71000 Sarajevo,
Bosnia and Herzegovina
Phone: +387 0 51 246 551
Fax: +387 0 51 246 550
Email: jnprotokol@elprenos.ba
Website: www.elprenos.ba

Construction of 110 kV Sarajevo 12 TS

Country: Bosnia and Herzegovina
Organisation: Elektroprenos BiH
Description/Scope of work: International competitive bids are invited for undertaking the procurement of the construction of the 110 kV Sarajevo 12 transformer station (TS) which includes, preparation of project documentation, consents/approvals/ permits, preparation of the removal project and removal of the existing facility 35/10 kV Grbavica TS, procurement of equipment and materials (excluding power transformers, which were procured through another public procurement procedure), execution of electrical and construction works, functional testing and commissioning,
The contract is a Government Procurement Agreement (GPA).
Closing date: January 16, 2024
Contact: Elektroprenos BiH,
Banja Luka St Wilson Promenade 15,
71000 Sarajevo, Bosnia and Herzegovina
Phone: +387 0 51 246 551
Fax: +387 0 51 246 550
Email: jnprotokol@elprenos.ba
Website: www.elprenos.ba

Construction of 110 kV GIS plant

Country: Croatia
Organisation: Hrvatski Operator Prijenosnog Sustava d.o.o. (HOPS)
Description/Scope of work: International competitive bids are invited for the reconstruction of Velebit pumped storage power plant which will include the delivery and installation of 110 kV gas-insulated switchgear (GIS) and the installation of a 400 MVA network transformer.
Closing date: December 18, 2023
Contact: HOPS, Kupska 4, Zagreb 10000, Croatia
Phone: +385 14545301
Email: JN-3000-V-5/23@hops.hr
Website: www.hops.hr

Reconstruction of 110 kV Kantkula substation

Country: Estonia
Organisation: Elering AS
Description/Scope of work: International competitive bids are invited for the reconstruction of the 110 kV Kantkula substation with a 110 kV connection.
Closing date: December 19, 2023
Contact: Laura Frolov, Elering AS,
Kadaka tee 42,
Tallinn, 12915, Estonia
Website: www.elering.ee

Construction of 110 kV Olavinlinna GIS substation

Country: Finland
Organisation: Fingrid Oyj
Description/Scope of work: International competitive bids are invited for the construction of the 110 kV Olavinlinna GIS substation.
Closing date: October 27, 2024
Contact: Joona Kinnunen, Fingrid,
Lakkisepantie 21, Helsinki, 00620,
Finland
Phone: +358 303955000
Email: joona.kinnunen@fingrid.fi
Website: www.fingrid.fi

Maintenance at Lansisalmi transformer station

Country: Finland
Organisation: Fingrid Oyj
Description/Scope of work: International competitive bids are invited for the basic maintenance of one 400 kV, 400 MVA transformer at the Lansisalmi transformer station and its equipping to operational condition and commissioning.
Closing date: November 13, 2024
Contact: Jami Lehtinen, Fingrid, Lakkisepantie 21,
Helsinki, 00620, Finland
Phone: +358 303955000
Email: jami.lehtinen@fingrid.fi
Website: www.fingrid.fi

Call for tenders for MPAs for HVDC converter stations

Country: France
Organisation: Réseau de Transport d'Électricité (RTE)
Description/Scope of work: Tenders are invited to enter into multi-party agreements (MPAs) for high voltage direct current (HVDC) voltage source converter (VSC) onshore converter stations and offshore substations as part of 1.2 GW HVDC links at DC operating voltage 320 kV and 2 GW HVDC links at DC operating voltage 525 kV connecting offshore wind farms (OWFs) to the French grid.
Closing date: December 20, 2023
Contact: Magalie Augros, RTE, Immeuble Window, 7C Place du Dome, Paris La Défense, 92073, France
Phone: +33 762482392
Email: magalie.augros@rte-france.com
Website: www.rte-france.com

Construction of 132 kV Buj–Nyírbogdány transmission line

Country: Hungary
Organisation: Opus Titász Electricity Network Private Limited Company
Description/Scope of work: International competitive bids are invited for the construction of 132 kV Buj–Nyírbogdány transmission line from the 400/132 kV Buj substation to 132/22 kV Nyírbogdány substation spanning a length of 16.5 km. The scope of the work also includes the placement of pole No. 20 of the 132 kV transmission lines Kisvárda OVIT–Nyírbogdány and Nyírbogdány–Nyíregyháza Kelet running on a common line of poles from the area of the 132/22 kV substation Nyírbogdány and establishment of an optical ground wire connection (OPGW) on the new transmission line between column 71/1 and 132/22 kV Nyírbogdány substations.
Closing date: November 15, 2024
Contact: Orosz-Szabo Lilla, Opus Titász,
Kossuth Utca 41., Debrecen, 4024,
Hungary
Phone: +36 301811681
Fax: +36 52511221
Email: orosz-szabo.lilla@opustitasz.hu
Website: www.opustitasz.hu

Modernisation of 220/110 kV Leszno Gronowo substation

Country: Poland
Organisation: Polskie Sieci Elektroenergetyczne SA (PSE) S.A.
Description/Scope of work: International competitive bids are invited for the modernisation of the 220/110 kV Leszno Gronowo power station. The scope of work includes construction of a technological building for PSE S.A., construction of a new 220 kV switchgear with a new station autotransformer (AT2), construction of new AT1 and AT2 bays in the 110 kV switchgear, reconstruction of the entry and exit of 220 kV overhead lines from Polkowice substation to Plewiska substation, and dismantling the existing 220 kV switchyard.
Closing date: December 18, 2023
Contact: PSE, 165 Warszawska Street, Konstancin-Jezorna 05-520, Poland
Phone: +48 661708472
Email: marcin.jamroszczyk@pse.pl
Website: www.pse.pl

Expansion of 400 kV Gdańsk Przyjaźń station and Żydowo Kierzkowo station

Country: Poland
Organisation: PSE SA
Description/Scope of work: Competitive bids are invited for the expansion of the 400 kV Gdańsk Przyjaźń station and the 400(220)/110 kV Żydowo Kierzkowo station along with the installation of reactive power compensation devices and adaptation of the 400/220/110 kV Gdańsk I station for switching of the 400 kV Dunowo–Żydowo Kierzkowo–Gdańsk I and Piła Krzewina–Żydowo Kierzkowo line track for 400 kV voltage.
Closing date: December 18, 2023
Contact: 165 Warszawska Street,
Konstancin-Jezorna 05-520,
Poland
Phone: +48 223213101
Email: magdalena.kurzynoga@pse.pl
Website: www.pse.pl

Voltage upgradation of line to 400 kV

Country: Romania
Organisation: Transelectrica S.A.
Description/Scope of work: International competitive bids are invited for the voltage upgradation of the Portile de Fier–Reșita–Timișoara–Săcălaz–Arad to 400 kV level for the Stage II: 400 kV Reșița–Timișoara–Săcălaz line project.
Closing date: December 18, 2023
Contact: Ioana Cristina Oprisa,
RO321 Bucuresti, 200581,
Romania
Phone: +40 213035912
Fax: +40 213035670
Email: cristina.oprisa@transelectrica.ro
Website: www.transelectrica.ro

Procurement of transformers

Country: Romania
Organisation: SPEEH Hidroelectrica SA
Description/Scope of work: International competitive bids are invited for the procurement of the following:
Lot 1: 25 MVA 123/6.3 kV power transformer.;
Lot 2: 16 MVA 110/6.3 kV power transformer.;
Lot 3: 16 MVA 20.5/6.3 kV power transformer.;
Lot 4: 25 MVA 121/10.5 kV power transformer.
Closing date: December 21, 2023
Contact: Mihaela Dulau,
SPEEH Hidroelectrica SA,
Sucursala Hidrocentrale Cluj, str.Taberei no.1,
Bucharest, 400383, Romania
Phone: +40 233207141
Fax: +40 233213830
Email: mihaela.dulau@hidroelectrica.ro
Website: www.hidroelectrica.ro

Renovation of 220 kV Botterens substation

Country: Switzerland
Organisation: Swissgrid AG
Description/Scope of work: International competitive bids are invited for the technical renovation of the 220 kV Botterens substation. The scope of work includes renovation of the 220 kV primary technology (air-insulated switchgear or AIS).
Closing date: January 2, 2024
Contact: Yolanda Ferrández, SwissGrid AG,
Bleichemattstrasse 31, 5000 Aarau,
Switzerland

Email: yolanda.ferrandez@swissgrid.ch
Website: www.swissgrid.ch

Construction of 110 kV GIS substation switchboard in Ballylumford

Country: UK
Organisation: Northern Ireland Electricity Networks Limited (NIENL)
Description/Scope of work: Competitive bids are invited for the design, engineering, procurement, delivery, construction, installation, testing and commissioning of a new 110 kV Ballylumford GIS substation.
The scope of the work includes the installation of new 110 kV GIS, construction of 110 kV cable circuits between new GIS and existing circuit connections, undertaking construction of associated high voltage (HV) substations, along with protection and controls (P&C), communications, civil and structural, and HV cables works. The tender also includes construction of a building for GIS, and provide remote end protection and control works.
Closing date: December 20, 2023
Contact: Angela Hutton, NIENL,
120 Malone Road, Belfast,
BT9 5HT, UK
Email: Angela.Hutton@nienetworks.co.uk
Website: www.nienetworks.co.uk

Middle East and Africa

Supply of 400 kV ground wire device

Country: Kuwait
Organisation: Ministry of Electricity, Water and Renewable Energy
Description/Scope of work: International competitive bids are invited for the supply of 400 kV ground wire devices.
Closing date: December 17, 2023
Contact: Ministry of Electricity,
Water and Renewable Energy,
South Al Sourra (Shuada),
Ministries Zone, Kuwait,
Safat 13001
Phone: +965-25371000
Fax: +965-25371420
Email: info@mew.gov.kw; GeneralRegistry@mew.gov.kw
Website: www.mew.gov.kw

Supply of 400 kV conductors

Country: Kuwait
Organisation: Ministry of Electricity, Water and Renewable Energy
Description/Scope of work: International competitive bids are invited for the supply of 400 kV conductors.
Closing date: December 19, 2023
Contact: Ministry of Electricity,
Water and Renewable Energy,
South Al Sourra (Shuada),
Ministries Zone, Kuwait, Safat 13001
Phone: +965-25371000
Fax: +965-25371420
Email: info@mew.gov.kw
Website: www.mew.gov.kw

Supply of 132 kV and 300 kV conductors

Country: Kuwait
Organisation: Ministry of Electricity, Water and Renewable Energy
Description/Scope of work: International competitive bids are invited for the supply of 132 kV and 300 kV conductors.
Closing date: January 7, 2024
Contact: Ministry of Electricity,
Water and Renewable Energy,
South Al Sourra (Shuada),
Ministries Zone, Kuwait, Safat 13001
Phone: +965-25371000
Fax: +965-25371420
Email: info@mew.gov.kw
Website: www.mew.gov.kw

Deviation of sections of 150 kV Taraprura–Sidi Mansour line

Country: Tunisia
Organisation: Société Tunisienne de l'Electricité et du Gaz (STEG)
Description/Scope of work: International competitive bids are invited for the deviation work of sections of the underground cable of the 150 kV Taparura–Sidi Mansour line.
Closing date: December 19, 2023
Contact: Fadoua Charaabi Khlifi, 38,
rue Kemal Atatürk – 1021 Tunis,
G 3rd floor building.,
Tunisia
Website: www.sncft.com.tn

Expansion of transmission system

Country: Qatar
Organisation: Qatar General Electricity & Water Corporation (KAHRAMAA)
Description/Scope of work: International competitive bids are invited for the substations and cables. The project is divided into several packages as described below:
Substations package S1: New 132 kV substations and upgrade of existing substation.
Package S2: New 132 kV and 66 kV substations.
Package S3: New 220 kV substation, and upgrade of existing 400 kV and 220 kV substations.
Cables package C1 & C3: 132 kV Cables.
Package C2: 220 kV cables package overhead line (OHL): Modifications of existing OHLs to connect new cables.
Closing date: December 21, 2023
Contact: KAHRAMAA, Building Number 2,
15th Floor, Dafna Area,
Doha, Qatar
Email: info@km.qa
Website: www.km.qa◆

Global Transmission Report

Information and analysis on the global electricity transmission industry

The mission of **Global Transmission** is simple and modest – to provide you with comprehensive and up-to-date information and analysis on the global electricity transmission industry.

Global Transmission will keep you informed on all the key developments, trends and issues. It will track major projects, contracts and investments. It will profile leading transmission system operators. It will report on regulatory initiatives and examine their implementation. It will provide the latest data and statistics. It will also feature the views and perspectives of top industry experts and players.

Our service package consists of three elements – **Global Transmission Report** (a monthly newsletter), **Global Transmission Weekly** (a weekly update) and **www.globaltransmission.info** (an information-packed website).

Global Transmission Weekly, published every Monday, provides you with a summary of key developments in the transmission sector from across the world, events that took place during the previous week.

The **Global Transmission Report**, a monthly newsletter, has ten distinct sections:

- **Features:** Analytical, insightful and topical write-ups on major trends and developments
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- **Policy Review:** An examination of recent policy and regulatory initiatives
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- **Data & Statistics:** Tables and charts with relevant and latest information
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- **Company News:** News on transmission equipment and service providers
- **Tenders & Contracts:** Key information on open tenders and contracts

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