Brussels distributed energy systems

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The federal government"s electricity policy is focused on increasing the share of renewable generation, increasing cross-border interconnection capacity, ensuring security of electricity supply, lowering electricity costs and increasing the competitiveness of electricity markets. In addition, regional electricity policy focuses on distribution system flexibility and the participation of consumers through smart meters, demand response measures, energy storage and distributed renewables (including self-consumption).

The Belgian electricity sector will undergo major changes in the next decade. The share of renewables in the electricity generation mix is expected to almost double, from an estimated 20.9% in 2020 to more than 37% in 2030. Belgium"s federal Law of 31 January 2003 requires the phase-out of all nuclear electricity generation in the country. In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to amend the law to extend 2 GW of nuclear capacity by ten years.

Belgium has a well-developed and highly interconnected electricity system serving domestic demand and supporting the European electricity market. Belgium"s electricity network is one of just a few networks in the world to make extensive use of dynamic line rating (DLR), which uses distributed sensors to provide real-time monitoring of high-voltage electricity lines. DLR allows the transmission system operator (TSO) to better determine actual line capacity and improve overall system performance. In 2020, the TSO was using DLR on 28 high-voltage lines and estimated it had increased import and export capacity by around 10%, resolved congestions issues, reduced redispatching costs and aided the development of renewable generation.

Network: transmission and distribution

The private company Elia is Belgium"s electricity TSO. It is owned by the Elia Group, which also owns German TSO 50Hertz. Around 48% of the shares of the Elia Group are held by two public holding companies (Publi-T and Publipart), which are owned by Belgium"s municipalities.

Elia operates the high-voltage electricity transmission network (30-380kilovolts [kV]) that supports transmission of electricity across Belgium and electricity trading via the cross-border interconnectors. The part of the network from 70 kV to 380 kV is regulated by the Commission for Electricity and Gas Regulation and the federal government. The part of the network from 30 kV to 70 kV is regulated by the regional regulators and governments. Most of the electricity supplied by the high-voltage transmission network is delivered via transformer substations to Belgium"s electricity distribution networks, which serve the majority of consumers. However, the transmission system also directly supplies a large number of heavy industrial consumers.

Belgium"s distribution system is composed of medium- and low-voltage networks (below 30kV) and serves the majority of electricity consumers, with 4825659 connection points in2020. Belgium"s municipalities have a legal monopoly on electricity and gas distribution and own the electricity and gas distribution networks.

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Nearly all municipalities have transferred responsibility for electricity and gas distribution to inter-municipal companies, which are the distribution system operators (DSOs) for the assigned section of the network. In 2019, there were 16electricity DSOs in Belgium, 10 in Flanders, 5 in Wallonia and 1 (Sibelga) in the Brussels-Capital Region.

In 2020, Belgium had interconnections to France, Luxembourg and the Netherlands via 12high-voltage alternating current (AC) lines; with the United Kingdom via the Nemo Link HVDC subsea cable; and with Germany via the Aachen Li?ge Electricity Grid Overlay (ALEGrO) HVDC underground cable. Belgium"s maximum technical interconnection capacity was 6.5GW in 2020. Projects under development will expand Belgium"s interconnection capacity with the Netherlands and increase maximum technical interconnection capacity to 8.4 GW.

Under EU rules, Belgium has binding targets for cross-border electricity interconnection capacity, and Elia operates interconnections with connected countries. Targets are based on the ratio of interconnection import capacity and domestic generation capacity. Belgium met its 2020 target of 24% and has a 2030 target of 33%.

Belgium"s pumped hydro storage (1.31 GW in 2020) plays an important role in system balancing. Belgium has limited battery storage capacity. There are no official consolidated data on battery storage, as this is not yet part of the mandatory energy statistics. A first unverified compilation of operational battery projects used for grid balancing was conducted in September 2021 and estimated capacity around 32.5MW/30MWh. However, the government indicated that this estimate is likely well below the actual capacity of operational battery storage. Belgium"s battery storage capacity is expected to increase, as a 25MW/100MWh system is planned for 2022.

In addition to the EU Risk Preparedness Regulation, the core national legal framework for electricity crisis management in Belgium consists of two key documents:

The Federal Grid Code creates a legal basis for the Ministerial Decree of 3 June 2005 on the establishment of the load-shedding plan, which is embedded in the System Defence Plan developed by Elia. To ensure a level of risk preparedness at the level of the TSO, the federal Minister for Energy is granted approval authority concerning the TSO"s System Defence Plan, the Restoration Plan and the Test Plan, pursuant to the Federal Grid Code.