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Luxembourg"s energy system is characterised by high import dependence and reliance on fossil fuels. In 2018, 95% of its energy supply (100% of oil, natural gas and biofuels and 86% of electricity) were imported. It had the fourth-highest share of fossils fuels in TPES (78%) and the highest share of oil in TPES (60%) among IEA member countries. Oil is by far the dominant energy source, covering most transportation demand, but also notable shares of heating demand in the residential and commercial sectors. Natural gas is the second-largest energy source, covering large shares of industrial, residential and commercial demand.

In 2018, renewable energy covered 7.5% of TPES and came primarily from imported biofuels used in transport and biomass used in combined heat and power plants, along with small but growing contributions from electricity generated by wind and solar photovoltaics (PV). Hydropower contributes to the renewable energy share, but is not expected to grow. District heating is mainly limited to the commercial sector, but could play a more important role in meeting heating demand in the growing residential sector. Coal use has been almost eliminated with just a small share of non-energy use in industry.

European Union (EU) directives are a key driver of Luxembourg"s energy sector targets and policy. The government is also committed to international climate targets of the Kyoto Protocol and the Paris Climate Agreement. Luxembourg is pushing for a more aggressive approach on energy transition at the EU level and in some cases has adopted national targets that exceed the requirements of EU directives.

Luxembourg has numerous support schemes to achieve its energy sector targets and long-term energy sector goals. The government currently provides support for renewables through a feed-in tariff and premium tariff for electricity generated from renewables, as well as investment subsidies supporting deployment of renewable energy projects. In 2018, Luxembourg introduced a tender system for PV projects and prepared legislation to support self-consumption of renewable electricity and encourage consumers to be active market participants (prosumers). Under the new law, which is supposed to enter into force in early 2020, electricity from renewable energy directly consumed at the generation site will be exempt from grid fees.

Prime House is Luxembourg"s main scheme to support energy efficiency renovations and building integrated renewable energy. In January 2017, the government reformed the scheme to provide more generous investment subsidies and also established the Climate Bank programme, which provides low-rate climate loans to encourage residents and companies to undertake energy efficiency renovations.

In 2015, Luxembourg introduced an energy efficiency obligation scheme, which requires electricity and gas suppliers to realise cumulative annual energy savings of 1.5% for endusers through 2020. To encourage energy efficiency in the transport sector, annual vehicle registration fees are higher for less efficient vehicles. The Climate Pact programme, created in 2012, provides technical advice and funding to help municipalities implement measures on climate, renewables and energy efficiency. Municipalities receive certifications based

on the number of measures they implement. The pact has been signed by all 102 municipalities and as of 2018, 88 had received certifications.

Luxembourg has embraced an e-mobility initiative aimed at electrification of the transport sector to reduce GHG emissions and fuel imports. The draft NECP contains a goal for 49% of all vehicles registered in Luxembourg to be electric vehicles (EVs) by 2030. Luxembourg is supporting e-mobility with subsidies for purchasing EVs, investment in a national EV charging network and by encouraging a shift from private vehicles to electrified public transportation. The Modu 2.0 Sustainable Mobility Strategy includes a goal to increase the use of public transportation by 50% from 2017 to 2025 and defines measures to improve the quality of electrified public transportation, including investment in park and ride centres linked to a major reworking of bus and train infrastructure.

The government should examine relevant planning processes and regulations to synchronise grid infrastructure construction with renewables deployment and electricity demand growth. Building early-stage consensus between the different ministries, involved parties, local authorities and the public would enable fast and co-ordinated deployment of renewables and supporting infrastructure. Infrastructure plans and processes should also facilitate the deployment of smart grid technologies such as demand-side response, batteries and other energy storage options.

Luxembourg has targets for at least 95% of all electricity meters to be smart meters by the end of 2019 and at least 90% of all gas meters to be smart meters by the end of 2020. One key objective of the smart meter deployment is to allow consumers to become active market participants (prosumers) through self-generation and self-consumption of electricity. A draft law presented in 2019 aims to establish a national energy data platform with the objective to simplify, standardise and manage market processes, including market communication, and to improve the management of electricity generation from renewable energy sources.

Luxembourg"s smart meter deployment and the development of a national database for smart meter data lays the groundwork for time-of-use pricing, a wide range of demand-side response measures and energy services that could support VRE integration, smart EV charging and system flexibility. Luxembourg is planning to investigate options for time-of-use pricing once the smart meter deployment is completed. The regulations for smart meter data collection and management should establish a clear legal framework ensuring fair and transparent data access that supports innovation and creation of new energy sector services while ensuring data privacy.

Under the European Union Emissions Trading System (ETS), non-ETS sectors include agriculture, residential, commercial, waste, non-energy intensive industry and transport excluding aviation within the European Economic Area.

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