

Twelfth session of the Assembly  
Abu Dhabi, 15-16 January 2022

## Background Note

### **Ministerial Meeting on Flexible Grids for Smart Electrification: pathways for energy system integration and end-use decarbonisation**

1. IRENA's World Energy Transitions Outlook shows that over 90% of the solutions shaping a successful decarbonisation of the energy sector by 2050 involve renewable energy through direct supply, electrification, energy efficiency, green hydrogen and bioenergy combined with carbon capture and storage (BECCS). By 2050, electricity will be the main energy carrier, increasing from a 21% share of total final energy consumption in 2018 to over 50% in 2050. Sectoral boundaries are shifting, with the direct electrification of end-use applications in transport, buildings, and industry sectors.
2. Today, flexibility should not only be harnessed on the generation side but also on the demand-side, energy storage and sector coupling (e.g., electric vehicles, power-to-heat, and power-to-gas). All the different options should be considered in energy planning to ensure a cost-effective energy transition. This has been discussed in a previous IRENA Ministerial and it was agreed that solutions already exist today and operating high renewable power systems is already possible.
3. Direct use of renewable electricity in place of fossil fuels in end-use applications requires a large and rapid uptake of technologies including electric vehicles and heat pumps. As this shift occurs, the annual growth rate of renewable technologies in the power sector will see an eightfold increase.
4. Electricity is expected to play a large role in decarbonising transport including two and three wheelers, passenger cars, light duty vehicles, buses, and commercial trucks. Global sales of electric vehicles in 2020 grew by 43% compared to 2019, to reach 3.2 million units, accounting for 4.2% of global vehicle sales. Meanwhile, global public charging connectors reached 1.36 million, a 48% increase compared to 2019. IRENA's WETO scenario indicated that EV stock must increase from around 10 million globally today to close to 400 million by 2030 and 1.8 billion by 2050. That includes hundreds of billion investments per annum in charging infrastructure as well.
5. At the Ministerial Roundtable on 'Innovation for the Energy Transformation: E-mobility' held during the eighth session of the IRENA Assembly in 2018, Ministers already agreed that electro-mobility was a key pathway to decarbonise the transport sector as renewable electricity becomes the most competitive option for power generation. At present, the discussion has progressed to the implementation of electro-mobility solutions tailored to country contexts.

6. Electricity will also be the key energy carrier in buildings, with its share of final energy use increasing from 32% in 2018 to 56% by 2030 and 73% by 2050. Such a rise implies a doubling of electricity demand in the sector by 2050 compared to the 2018 level, driven by significant electrification of space and water heating, growth in cooling and refrigeration demand and electric cooking. Heat pumps are a key and efficient technology and will grow eight-fold by 2050, increasing the number of units installed from less than 40 million in 2018 to close to 200 million in 2030 and 400 million by 2050.
7. Indirect use of renewable electricity in end-use applications, in the form of green hydrogen and its derivatives, would account for 8% of final energy use by 2050. Green hydrogen will play an important role in hard-to-decarbonise, energy-intensive sectors like steel, chemicals, long-haul transport, shipping, and aviation. Hydrogen will also help balance renewable electricity supply and demand and serve as long-term seasonal storage. Approximately 5,000 GW of electrolyser capacity will be needed by 2050, up from 0.3 GW today.
8. The COP26 in Glasgow acknowledged renewable electricity as the key clean energy carrier for the transition, as demonstrated in the pledges to replace coal with renewables for electricity generation, with more than 23 countries committing to phasing out coal power, as well as the non-binding COP26 pledge to accelerate e-mobility that was signed by 33 countries, several cities and car manufacturers. Those signals are encouraging to nurture the global EV markets but planning to avoid negative impacts in the power sector is crucial.
9. By 2030, renewable power should reach 10,700 GW globally, almost quadrupling the current capacity. Rapid scale-up deployment in the coming decade is necessary to set the stage for decarbonisation of the power system and electrification of end-uses by 2050. Such a massive growth in renewable electricity generation must go hand-in-hand with a fast scale-up in infrastructure investments to avoid bottlenecks in the transition towards an electrified energy system.
10. For a successful electrification of end-uses, policies and technologies need to address how to manage those additional power loads with the objective of minimising their impact on peak demand and grid congestion, linked to additional infrastructure investments.
11. Flexibility is key for reliability. In the past few years, the world has seen power blackouts and major load shedding events in different parts of the world, which were partially related to a lack of power system flexibility. Starting with South Australia in 2016, United Kingdom during Summer 2019, California during the heat wave in Summer 2020, Texas during a winter storm early this year and finally Spain after losing the interconnection with France in Summer this year.
12. Flexibility is key for affordability. In Q4 2021, many countries are seeing a steep rise in energy prices, driven by high gas demand for power, industry and heating. In the power sector, gas generators are being required to start-up to cover electricity demand in periods where renewable availability is low, or not enough to cover demand. High gas prices lead to high electricity marginal prices, which is causing high wholesale electricity prices. Reducing the number of hours when gas is generating through a more flexible system, coupled with electrified end-uses could reduce electricity prices.
13. As it is clear that electrification with renewables is a key pathway towards the transformation of the energy sector, efforts must focus on effective implementation strategies. Smart electrification, unlocked by technology, digitalisation, innovative regulation, business models and system operation, is crucial to manage the extra load for the power sector and to avoid unnecessary investments. This requires attention and proper planning now for a successful roll-out in the following decade.

## Objectives of the session

14. The goal of this session is to discuss the strategies to smartly electrify end-use energy sectors considering the implications on additional renewable energy generation capacity needs, together with the infrastructure and strategies required to ensure a flexible operation of the power system. Ministers will discuss recent developments on the subject in their respective countries and exchange lessons learnt with others. The Ministerial meeting will also have contributions from the private sector on emerging innovations for smart grids enabling a smart electrification of transport, buildings and industry sectors and a flexible operation of the power system with this new, additional electricity demand.

## Guiding questions

- What are the latest developments in your country in technology, market design, system operation and business models to smartly electrify road transport, heat supply and green hydrogen production?
- What are the best practices in planning, designing, and implementing cross-sectoral strategies that couple a flexible, high-renewable power sector with electrified end-use sectors (transport, buildings, and industry)?
- How to value demand-side flexibility to make new electricity loads become a source of power system flexibility and facilitate the decarbonisation of the power sector?
- What are the most efficient short-term and long-term measures to cope with the rise of electricity prices that several countries have seen in the last months? Which countries are less affected thanks to renewables and flexibility?
- What are the best strategies to plan, mobilise investments and roll out the required infrastructure for an electrified future, including electrical and digital infrastructure?
- What is the role of consumers and how to engage them to shape effective electrification strategies?
- What is the role of international collaboration and how to foster it to accelerate a successful electrification of end-use sectors in all geographies, with an emphasis on developing economies, and tailored to country context leaving no one behind?
- What should be the focus of IRENA's work in the context of the next Work Programme to support Members in planning and implementing flexible smart grids and electrification strategies for end-use sectors? How to engage country experts and stakeholders in IRENA's work in the field to tailor its work to country needs?

## Associated Publications

1. [World Energy Transitions Outlook](#) (2021)
2. [Sector Coupling in Cities](#) (2021)
3. [Reaching Zero with Renewables](#) (2020)
4. [Electricity Storage Valuation Framework](#) (2020)
5. [Innovation landscape for a renewable-powered future](#) (2019)
6. [Electrification with Renewables](#) (2019)
7. [Innovation Outlook: Smart Charging for electric vehicles](#) (2019)
8. [3rd IRENA Innovation Week \(IVIW2020\) – Summary Report](#) (2020)
9. [Demand-side flexibility for power sector transformation](#) (2019)
10. [Power system flexibility for the energy transition](#) (2018)