IRENA
International Renewable Energy Agency

12 April 2018

**INTERNATIONAL RENEWABLE ENERGY AGENCY**
Fifteenth meeting of the Council
Abu Dhabi, 8 – 9 May 2018

# Note of the Director-General
# Transforming power systems: emerging innovation trends

1. Over the last two years, the world has seen dramatic falls in the cost of renewable power to the extent that all currently commercially available renewable power generation technologies will be competitive with fossil fuels by 2020. In parallel, we are starting to see dramatic shifts in the way energy systems operate, driven by trends such as the increased digitalisation of systems, the decentralisation of electricity generation, and the electrification of other sectors. The transformation of the power sector is well underway, opening new opportunities for the use of this low-cost renewable power and for a design of a system fit for the large share of renewables.

2. This new energy reality is reshaping the way energy is produced, distributed and consumed around the world. With growing renewables generation at both the large-scale and small-scale distributed level, the so-called "Energy 3D" – decarbonisation, decentralisation and digitalisation – is altering the entire paradigm of the power sector. The increasing digitalisation of the power system, with the growing relevance of Artificial Intelligence (AI) and machine learning, is leading us to a more intelligent, efficient, and low-carbon grid. Decentralised generation is providing effective alternatives to the 19th-century approach to electrification that relies primarily on expanding the grid. These changes are not only disrupting the energy sector, they are reshaping economies and creating new opportunities that seemed out of reach only a few years ago.

3. While numerous start-ups have already realised the business opportunities in this new paradigm, utilities have largely been late entrants. However, the industry has begun to understand the role they can play in shaping the emerging energy system and in many cases accelerating distributed renewables uptake. In Europe, more than twenty energy firms like EDF, Endesa, Eneco, Engie, Enel, E.ON, Iberdrola, Vattenfall and RWE are engaged in a peer-to-peer energy trading platform based on blockchain technology. China State Grid has now deployed 350 million smart meters. The energy transformation also brings many opportunities for additional value streams beyond selling kilowatt-hours.

4. These innovative business models are not limited to just mechanisms and technology to ensure overall system flexibility. They also comprise new services that empower consumers to take more control over their consumption and production, turning them into active market participants. Facilitated by renewable power technologies, 3 million energy users in Europe are now estimated to be generating at least some of their power. Fast moving utilities can now leverage new services for retail customers through distributed renewable generation, capturing customer relationships while branding and positioning themselves as a utility of the future. In the Netherlands, for example, the utility Eneco has evolved from a company operating in a centralised electricity system to now supporting customers with distributed generation, storage and the exchange of this energy via local networks. Siemens and RWE announced they would jointly build the IT backbone of a mass-market virtual power plant to coordinate hundreds of megawatts worth of distributed energy projects from wind and solar farms.

5. Digitalisation is enabling business models that allow customers to pay directly for the electricity they require at a rate they are able and willing to pay, such as Pay-As-You-Go (PAYG). These models are beneficial for emerging and developing regions where customers' access to financing is limited, and are currently being implemented in regions in Africa (e.g. M-Kopa) and India (e.g. Simpa Networks). Solar home systems (SHS) and renewables-based mini-grids are an increasingly deployed energy solution in remote areas. AI is starting to be used in these off-grid systems to monitor weather conditions and customer electricity consumption patterns to optimise their operation reducing costs for users and increasing reliability of electricity supply (e.g. Azuri Technologies).

6. In the end-use sectors, electrification through low-cost renewable power is opening a portfolio of options for new business opportunities while decarbonising the energy sector. Today, this is particularly the case for the transport sector, as more utilities engage in electric vehicles (EV) services that are transforming our cities. ENEL is deploying mobile apps for smart charging of EVs, and Innogy is running a pilot program with blockchain technology to authenticate and manage the billing process for autonomous EV charging stations.

7. There are many more emerging examples around the world on how innovations in enabling infrastructure and sector coupling, information technology, regulations and business models can drive the renewable power deployment. Sharing knowledge and experiences around these cutting-edge innovations will equip countries with new instruments to accelerate the transformation of power systems aligned with national policy objectives.

**Objective of the session**

8. The *Innovation Landscape study* and *IRENA Innovation Week* are among the Agency's knowledge and dialogue platforms, that help to enable the sharing and implementation of good practices to accelerate the power sector transformation through innovation. This session will present and obtain input from Member representatives on the ongoing preparation of the *Innovation Landscape report*, as well as the programme for the second IRENA Innovation Week, to be held in September 2018.

**Guiding questions**

- What should innovation efforts focus on to accelerate transformation of the power sector?
- How should countries deal with and benefit from a rapidly increasing decentralisation and digitisation of the power system?
- What are the best practices in innovative enabling infrastructure and business models to transform the power sector?
- How can IRENA's platforms be used for peer-to-peer collaboration in innovation (e.g. Innovation Week, Ministerial Discussions)?