

IRENA INNOVATION WEEK 2020

SUMMARY OF KEY INSIGHTS FROM THE SESSION 2: SMART ELECTRIFICATION OF END-USE SECTORS – IMPLICATIONS FOR THE POWER SYSTEM

ORGANISED IN PARTNERSHIP WITH EPRI



SESSION OVERVIEW

The 3rd Innovation week took place online between 5-8 October 2020 under the theme '**Renewable solutions for transport and industry**'. **Electrification of end-use sectors with renewables** will be a major component of plans to decarbonize industry and transport. At the same time, electrifying with renewables is an emerging strategy to maintain value and avoid curtailment of abundant and low-cost variable renewable electricity. Session 2 explored the **implications for the power system** of massive electrification of the transport, buildings and industry sectors, and which smart strategies are key to harness the benefits of coupling these sectors.

4 Panels

12 Expert speakers

579 Participants

SUMMARY OF KEY INSIGHTS

- Electrification is a key pathway to decarbonise end-use sectors, but it must go hand-in-hand with massive deployment of renewables and energy efficiency
- Smart electrification, unlocked by digitalisation, innovative regulation, business models and system operation, is crucial to manage the extra load for the power sector and avoid unnecessary investments
- Despite the implementation of smart electrification approaches, significant investments in electrification technology and infrastructure will be needed. This requires attention and proper planning now for a successful rollout in the next decade
- The preferences and role of consumers will shape the effectiveness of electrification strategies. Consumers need to be informed and engaged in a way that is attractive to them
- Monetising demand-side flexibility through new market designs is currently one of the main challenges for unlocking this flexibility source.
- Deep electrification, increasing dependency on power systems, calls for highly resilient systems
- Regulation is key in this transformation.



Scene Setting

Francisco Boshell from IRENA opened the session by introducing the agency's work and how the Innovation Week fits in that. The findings and key messages from this years' Innovation Week will feed into the next Innovation Landscape report, focused on electrification of end-use sectors.

Electrification is the key vector to decarbonise end-use sectors, namely transport, industry and buildings. While today only 20% of global energy demand is met by electricity, it is expected that by the mid of the century the share will increase to close to 50%, propelled by a mass deployment of technologies such as electric vehicles, heat pumps and electrolyzers for hydrogen production. This will result in investments of 27 trillion USD cumulative between now and 2050, or 800 billion USD per year.

The importance of smart electrification strategies was emphasised, as the most cost-effective way to couple the sectors and manage the extra load in the power system.

Panel I: Global Experience

The first panel offered a global perspective on electrification strategies, brought by leading experts from three different regions: US, Europe and Asia (represented by Japan). **Francisco Boshell**, Energy Analyst at IRENA Innovation and Technology Center, moderated this panel with the following panellists:

- **Robert Chapman**, Vice President of Electrification & Sustainable Energy Strategy, Electrical Power Research Institute (EPRI)
- **Kristian Ruby**, Secretary General, EURELECTRIC
- **Dr Koshichi Nemoto**, Vice President, Central Research Institute of Elec. Power Industry (CIEPRI)

Highlights from the discussion:

- In US, the focus currently lies on electrifying the transport sector. With the total cost of operation of EVs being now equal to the one of internal combustion engine vehicles, the technical and economic potential of EVs is now clear. Consumers preference is important for mass EVs adoption. Dynamic pricing is key to enabling smart electrification and driving customer demand.
- In Europe, doubling down on decarbonization means doubling down on electrification. Electrification of transport is considered to be the biggest challenge and opportunity. There is a need for policy support for infrastructure development needed. Buildings electrification is closely connected to building renovation trend, which is set to double or triple across Europe. Increasing dialogue among electricity industry, transport and industry, is of a great importance in this transition.
- On the other side, in Japan electrification rate is already high. Adoption of heat pumps for residential sector is very high, but there is still a large opportunity to increase electrification in transport sector. Dr Nemoto emphasised on the importance of energy efficiency in this transformation, and that is should go hand-in-hand with renewable energy.



Panel II: Smart Electrification at DSO Level

This panel discussed the impact of electrification application on the low- and medium voltage grid. Distribution System Operators (DSOs) in Germany and US shared their experience with increased electrification and engaged in a discussion with demand-side flexibility technology providers, especially from tapping into the storage capacity of electrical cars and heat pumps. The panel was moderated by Kristian Ruby, Secretary General of EURELECTRIC, and the following panellists joined the discussion:

- **Bastian Pfarrherr**, Head of Innovation Management, Stromnetz Hamburg
- **Katie Sloan**, Director of eMobility and Building Electrification, Southern California Edison
- **Gregory Poilasne**, Co-Founder and CEO, Nuvve
- **Sandra Trittin**, Co-Founder and CSO, Tiko Energy Solutions

Highlights from the discussion:

- **Digitalisation and EV smart charging are deferring the need for investments in grid reinforcement for the DSO in Hamburg.** Bastian Pfarrherr mentioned that it is expected that the peak load in the distribution network, currently at 1.8 GW, will rise by 40% in the next 20 years, driven mainly by the rise in the number of EVs (it is expected that 100,000 out of 700,000 vehicles will be electric in Hamburg). The intermediate solution is to decrease the simultaneity factor of EV charging by using digital technologies. However, in long term, it is expected that grids will need to be reinforced to accommodate the new load from electrification.
- **California's DSO is looking to accommodate 26 million of EVs by 2040, planning for massive investments to build EV infrastructure.** In California, there is clear policy that states that all new passenger cars need to be zero-emission by 2035, and heavy-duty vehicles by 2040. Such clear policy must be expanded to other states. However, drivers and companies need to be reassured that the utility is providing the electricity and reliability they expect.
- **Key success factors for EV integration in power systems are reliability, dispatchability, and monetisability.** This means that utilities should be able to access the storage capacity of electric vehicles, they must have control over discharge and charge, while EVs owners are remunerated. The challenge lies in the complexity of the ecosystem, with charging infrastructure manufacturers, regulators, utilities, system operators, and drivers; and fleets look most promising due to the simple ownership structure.
- **Challenges for unlocking demand-side flexibility are not on the technical side, but on monetising this flexibility.** The lack of markets at the distribution level, and the fact that the actual value of demand-side flexibility is unclear, makes it difficult to monetise it. However, grid reinforcement solution should be replaced by digital solutions and smart management of these assets.
- **Widening the price gap in the tariff structure** between electricity at peak loads and off-peak electricity is a very effective solution for better demand-side management.



Panel III: Smart Electrification at TSO Level

This panel discussed the impact of electrification application on the high voltage grid. The TSO in Denmark and Vertically Integrated Utility in Uruguay shared their experience and plans with regards to increased electrification, while demand-side applications, such as industry demand and green hydrogen production, presented their challenges and successes in supporting the grid and providing flexibility for higher shares of renewable integration.

The panel was moderated by **Norela Constantinescu** from ENTSO-E and the following panellists joined the discussion:

- **Anders Bavnø Hansen**, Chief Engineer, Energinet (TSO, Denmark)
- **Pablo Mosto**, Planning & Environment Manager, UTE National Electric Utility of Uruguay (vertically integrated utility, Uruguay)
- **Christopher Greiner**, Chief Technology Officer, EnergyNest
- **Adele Lidderdale**, Hydrogen Project Manager, EMEC & Big Hit project

Highlights from the discussion:

- **For Denmark, offshore wind resources in North Sea are a great opportunity for further electrification.** Besides direct electrification strategies (EVs, Heat pumps), Denmark is looking at electrifying more end-use sectors, considering also green hydrogen to fuel e.g. aircrafts, ships and for ammonia production
- **Electrification of industrial process steam is important since it accounts for 10% of global final electricity consumption.** Christopher Greiner presents the novel energy storage called thermal batteries, which convert electricity to heat, being able to provide fast response and provide grid flexibility.
- **Thermal batteries and hydrogen are not competitors, but complementors.** Hydrogen strategy in EU focuses on very high temperatures (above 600 degrees Celsius), while thermal batteries focuses on "moderate" temperatures (150-350 degrees C). Hydrogen therefore is not seen as a competitor at the consumer level.
- **Big Hit Hydrogen project aims at looking at how hydrogen can reduce wind curtailment, balancing the grid, while demonstrating different demand uses of hydrogen, such as decarbonising ferries between islands**

Panel IV: New Power Sector Dynamics with Smart Electrification

This panel brought together all power sector actors, DSOs and TSOs, to discuss how the increased electrification changes the dynamics in the power system, on how regulation needs to adapt to increasingly renewable-based, decentralised systems. Also, TSO-DSO cooperation was explored, together with a debate on how to share flexibility resources most efficiently.

The panel was moderated by **Robert Chapman** from EPRI and the following panellists joined the discussion:

- **Anders Bavnø Hansen**, Chief Engineer, Energinet (TSO, Denmark)
- **Pablo Mosto**, Planning & Environment Manager, UTE National Electric Utility of Uruguay (vertically integrated utility, Uruguay)
- **Katie Sloan**, Director of eMobility and Building Electrification, Southern California Edison
- **Bastian Pfarrherr**, Head of Innovation Management, Stromnetz Hamburg

Highlights from the discussion:

- **TSO-DSO integration is key.** With increased decentralisation, Bastian explained that DSO becomes more flexible, being closer to the end-consumer. Increased communication between TSO and DSO and between them and the customers is needed to keep the entire system in balance in the most efficient way. Smart meters are helping, and digitalization is likely an important solution.
- **Regulation is key in this transformation.** Regulation needs to enable flexibility sharing between DSOs and TSO, to enable sector coupling (electricity and hydrogen), while keeping the system resilient and prepare the grid for climate vulnerabilities, as are today seen in California. Regulation needs to take into account all the impacts of the transformation towards a decarbonized economy/society
- **The challenge of net-zero marginal cost in a renewable-based system** was brought into attention by Pablo. As a vertical integrated, state-owned utility, UTE is in the optimal position to lead this transformation. With 98% of the electricity coming from renewable sources, the marginal costs of the system is zero, but that does not mean that the overall cost of the system is zero. Therefore, a close relationship between the utility and the regulator is needed to maintain affordability of the entire system.

Closing Remarks

Robert Chapman from EPRI summarized the discussion presenting the key messages around 5Ds of the energy transition:

- **Decarbonise** power sector and use the clean electricity in other sector will require deep electrification of end-use sectors
- **Decentralisation** results in more opportunities for customers and end users to also support the electricity system
- **Digitalisation** helps capture data and, by using analytics, manage systems efficiently and smartly optimising systems integrating different sectors – power, transport, buildings, industry
- **Dependency** – electrification leads to greater dependence on electricity and it is imperative to ensure reliability and resiliency for customers
- **Diversity** from a technology perspective (the more technological options, the more affordable and sustainable is the transition), but also from a socio-economical perspective (assuring that no one is left behind or unfairly burden the most vulnerable customers)