

ELECTRIFICATION TRACK

ELECTRIFICATION OF TRANSPORT

Session overview

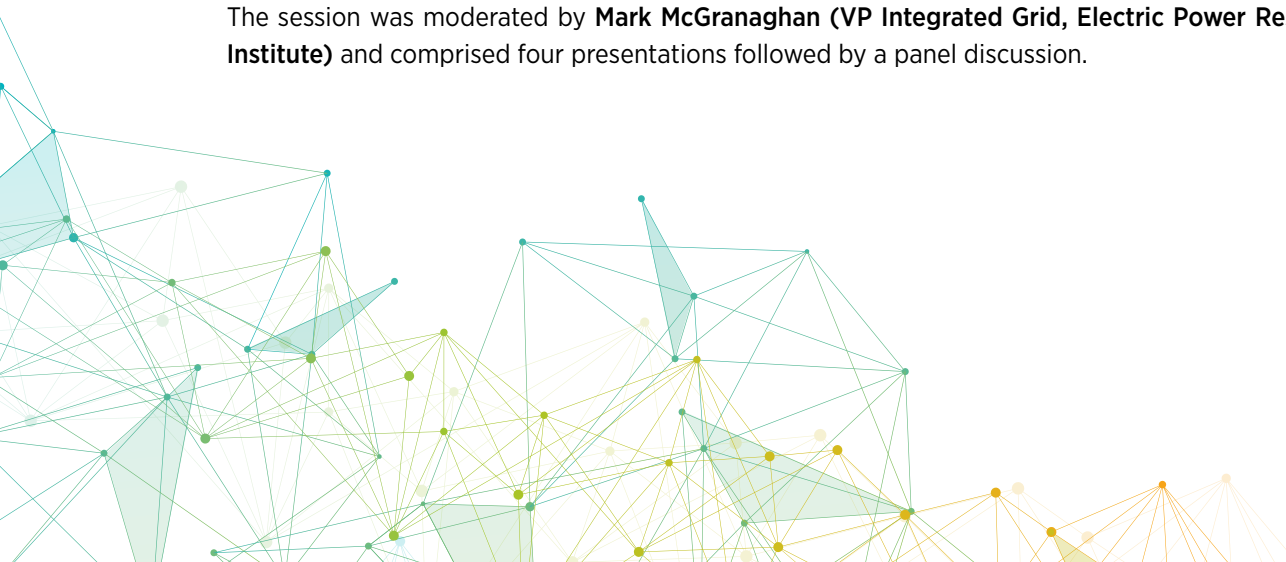
The cost reductions in renewable energy power generation makes electricity an attractive low-cost fuel for the transport sector, particularly if charging is done at times of peak production from renewable sources such as solar photovoltaics (PV) and wind.

However, the shift to electric mobility has important consequences for both charging stations and grid infrastructure requirements. If charging needs are not properly managed, the accelerating penetration of electric vehicles (EVs) can increase stress and congestion on public grids.

In the last few years the transport sector has adopted a more holistic approach to energy management, particularly with the development of smart-charging technologies. Nowadays, “smart charging is the reality and it is an asset to use in vehicle-to-grid integration ... it is ready and exists today”, highlighted Sergey Kiselv, Head of European Operations at ENEL X. Smart charging enables EVs to act as a flexibility solution and to provide other grid services that can foster higher integration of variable renewable energy (VRE) technologies. The ability to control EV charging times and rates would allow network operators to use existing networks more efficiently and reduce the need to install additional infrastructure. A more efficient network is cheaper to run, requires less generation and provides longer asset lifetimes.

This session explored the links between the electrification of the transport sector and the integration of high shares of renewables in power systems. It highlighted how the synergy between the two can help the world meet international climate goals. Progress and innovations in transport sector technologies (EVs, vehicle-to-grid and smart-charging) were discussed, along with how these innovations can transform the electricity system and play a key role in the integration of VRE sources into the grid.

The session was moderated by **Mark McGranaghan (VP Integrated Grid, Electric Power Research Institute)** and comprised four presentations followed by a panel discussion.



Presentation 1:

The role of transport sector electrification in enabling higher variable renewable power shares

Mark McGranaghan (VP Integrated Grid, EPRI) presented on how electrification of transport can be used to provide flexibility to the grid. Key points included:

- » The best ways to expose market signals for flexibility down the value chain are still unknown.
- » EV charging can contribute to valley filling, peak shaving and ramping requirements.
- » Nearly half of new cars sold in California are EVs. By 2025 EV batteries could make a potential contribution to the grid of up to 5 gigawatts equivalent, depending on the application.

Presentation 2:

Integration of EVs into (distribution) grids

Claas Matrose (Asset Strategy Engineer, Westnetz GmbH) provided insights into specific challenges with integrating EVs into distribution grids and electric systems. Key points included:

- » The charging power and location determine the type and costs of connection – for example, low power at low-voltage charging stations, medium power at commercial stations and high power on motorways; motorways are likely least suited to provide flexibility.
- » Possible options for an effective and efficient integration of EVs and their benefits and drawbacks were discussed.
- » From a distribution system operator's perspective, there is a strong motivation to enable integration for increasing power flow and revenue.

Presentation 3:

e-Mobility revolution – smart charging as important enabler

Sergey Kisely (Vice President Europe, ENEL) presented on industry experience in providing smart charging and smart grid solutions as well as energy services that adapt to regional energy systems and customers' needs. Key points included:

- » The previous deployment of e-mobility solutions was driven by subsidies and geo-politics, but now economics is taking over as the primary driver.
- » The timing of charging with VRE generation will see a parallel expansion of renewable energy capacity (e.g., self-consumption of distributed solar).
- » Bi-directional (vehicle-to-grid) charging can facilitate the operation of aggregation platforms.

Presentation 4:

Chinese experiences in wireless power transmission serving electric vehicles

Haiyan Zheng (State Grid Jiangsu Electric Power Co., Ltd) presented a demonstration project integrating driverless vehicles on roads with solar energy and wireless charging technologies. The project's key features include:

- » PV roads and driverless cars with level 4 and wireless power transmitting
- » The electronic/PV road, totalling 600 metres in length and 240 kilowatts (kW) peak
- » A static/dynamic wireless charging system with transmitting power of 30 kW and efficiency near 90%.
- » Bi-directional power flow circuit in the design, allowing the system to play a role in peak shaving and valley filling.

Panel discussion

In addition to the presenters mentioned above, the panel included:

- » Ulf Schulte, Chief Operating Officer, Allego
- » Monica Araya, Founder, Costa Rica Limpia

Highlights from the discussion:

- » **Clear potential exists.** There is a major opportunity in exploring the synergies between EV deployment and renewable energy to deliver increased system flexibility and lower overall investment in system capacity (both transmission and generation).
- » **Economic performance is improving.**
 - The economics of e-mobility is improving, leading to accelerated adoption of EVs.
 - In Costa Rica, where nearly 100% of the electricity is renewable, the alliance between the government, businesses, experts and consumer groups is moving electric mobility forward. This means that, it is not a “price” driving the renewable agenda, but politics and the commitment to make this happen by both top-down and bottom-up stakeholders. Those involved believe that this approach has made a big difference, especially when compared to other countries with much lower prices (but less political commitment) that are not seeing e-mobility move forward.
 - At this stage, almost all players have a positive business case. Utilities and system operators see a lifeline in the face of decentralisation and demand reduction, and even see private investment in long-term ownership of charging infrastructure.

» **The focus now is on use/operation.**

- With the increasing adoption of e-mobility, innovation in smart charging needs to be accelerated to ensure that electrification also delivers flexibility.
- Smart-charging platforms have been successfully piloted in several cases and are able to be rolled out today (e.g., a pilot in Denmark with over 50% of EV charge time bid to contribute flexibility to grid).
- A flexibility market platform in Ireland is using the “demand clearing house” concept where charging and distribution operators manage exchange and smart charging, as well as technology demonstrations to overcome behavioural biases.

» **Key questions and challenges remain in the co-ordination and efficiency of transition.**

- Charging occurs in a highly complex landscape, with different scales, times and types of consumer behaviours. How does flexibility provision fit in this picture, can it be optimised, and can market signals be integrated?
- To avoid a chaotic rollout of e-mobility, need co-ordination among a wide range of players, and debate continues over who gets to control charging, whether emergency powers can be provided to certain players, and how new uses fit with existing regulation and tariffs (e.g., of over 800 distribution system operators and four household meters in Germany).



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