Electrification of transport: Challenges and opportunities

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Power systems: Emerging challenges
Smart Grid paradigm shift in providing flexibility: from redundancy in assets to more intelligent operation through incorporation of Distributed Energy Resources in support of real time grid management – smart will save €350bn
Electrification of transport: Challenges and opportunities

• Challenges
  ➢ Driving patterns: disproportionally higher increase in demand peaks than increase in energy demand
  ➢ Low asset utilisation

• BUT…significant flexibility potential
  ➢ Inherent ability to store electrical energy
  ➢ Stationary on average for more that 90% of time, opportunity for smart charging
  ➢ Vehicle to Grid (V2G) capability
  ➢ Smart fast charging of fleet vehicles
  ➢ Second life of EV batteries – grid application: contribution to supply adequacy
Impact of EV charging on aggregate demand

Peak demand week in December

Non-optimized charging

EV Charging coinciding with peak demand periods

Smart charging

EV Charging optimized during low net demand periods
Impact of EV charging strategy on the infrastructure capacity requirements will be very significant.

- Energy increase
- Peak increase BaU
- Peak increase Smart
Whole system assessment of benefits of EV smart charging

Optimised EV operation with wind increase during system peak

Additional cost to supply EV demand (£/EV/year)

- OPEX
- Generation CAPEX
- Transmission CAPEX
- Distribution CAPEX

Generation, Transmission & Distribution Planning

- Years before delivery

Long-term Generation and Storage Scheduling

- Months to days before delivery

Day-ahead Generation, Storage & DSR Scheduling

- One day to one hour before delivery

System Balancing

- Actual delivery: physical generation & consumption
Environmental impacts of alternative charging strategies

- Greater absorption of wind energy
- Reduced utilization of CO2 emitting plants

Comparison with emissions from conventional passenger vehicles (EU):
- Current emission factor (2013): 127 g/km
- Target fleet average for 2021: 95 g/km
DSR flexibility: Driver for low carbon generation

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<th>Installed Capacity (GW)</th>
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<th>50% flex</th>
<th>Full flex</th>
<th>Full flex + add DST</th>
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Key messages

• EV charging strategies have a profound impact on (1) system infrastructure capacity requirements (2) system operational costs and (3) CO2 emissions.

  ➢ Smart charging will eliminate infrastructure investment requirements

• Moving from “silo” approach towards integrated planning and operation of generation and networks is key for the realization of benefits of EV smart charging
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