

**ELECTRICITY SECURITY ADVISORY PANEL**

**Workshop VI: INTEGRATING NEW TECHNOLOGIES  
WHILE MAINTAINING RESOURCE ADEQUACY**

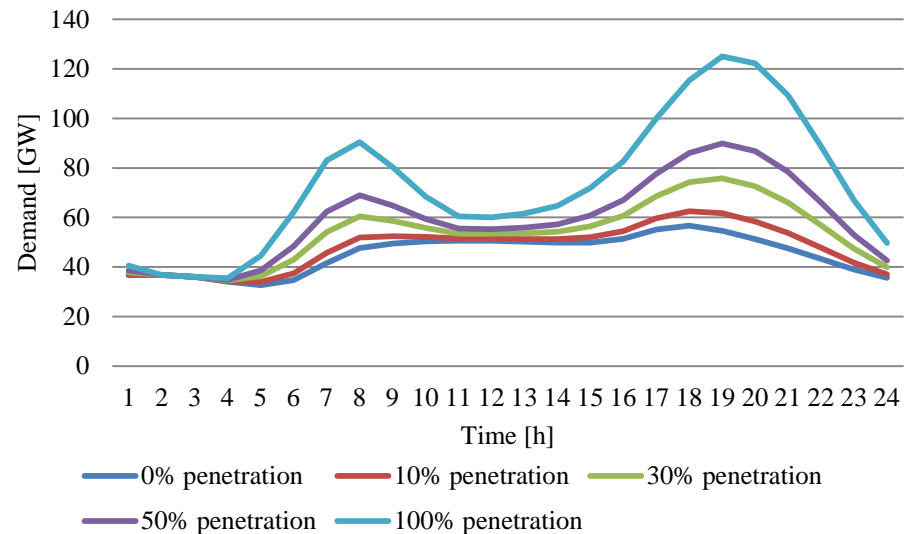
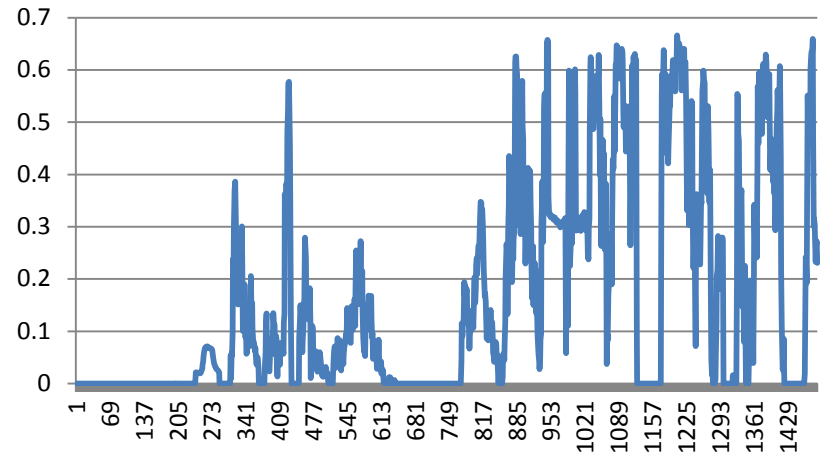
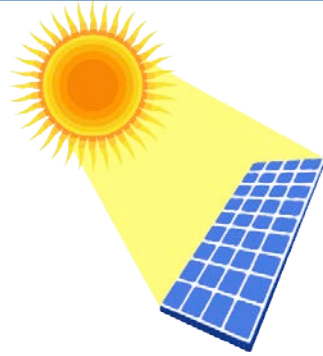
*Electrification of transport:  
Challenges and opportunities*

Professor Goran Strbac

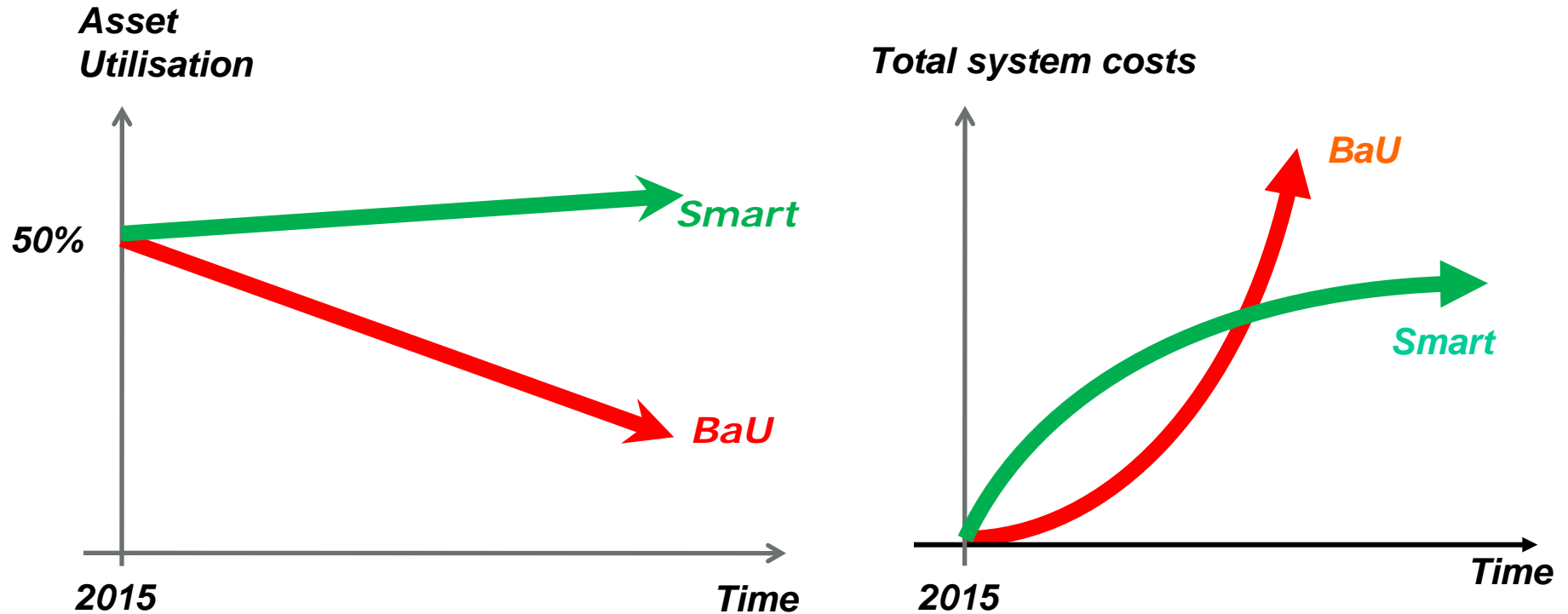
Dr Dimitrios Papadaskalopoulos

Paris, 28/09/2015

# Power systems: Emerging challenges



# Smart Grid paradigm



*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: disproportionately higher increase in demand peaks than increase in energy demand
- Low asset utilisation

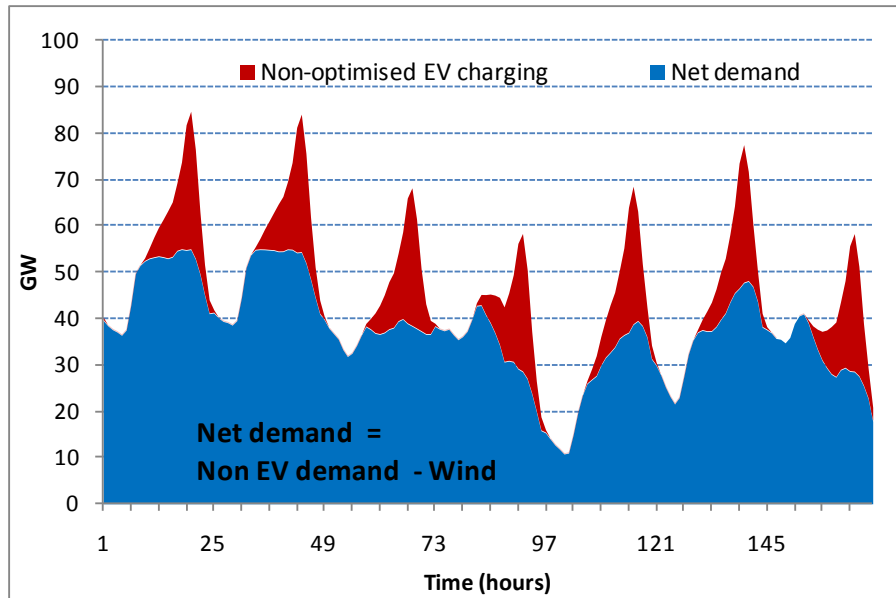
- **BUT...significant flexibility potential**

- Inherent ability to store electrical energy
- Stationary on average for more than 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

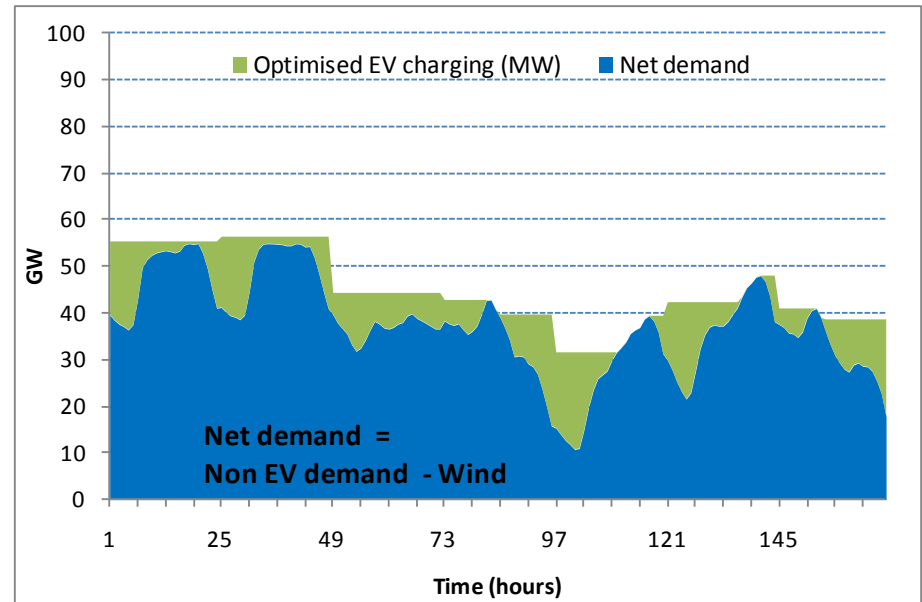
*Peak demand week in December*

## Non-optimized charging



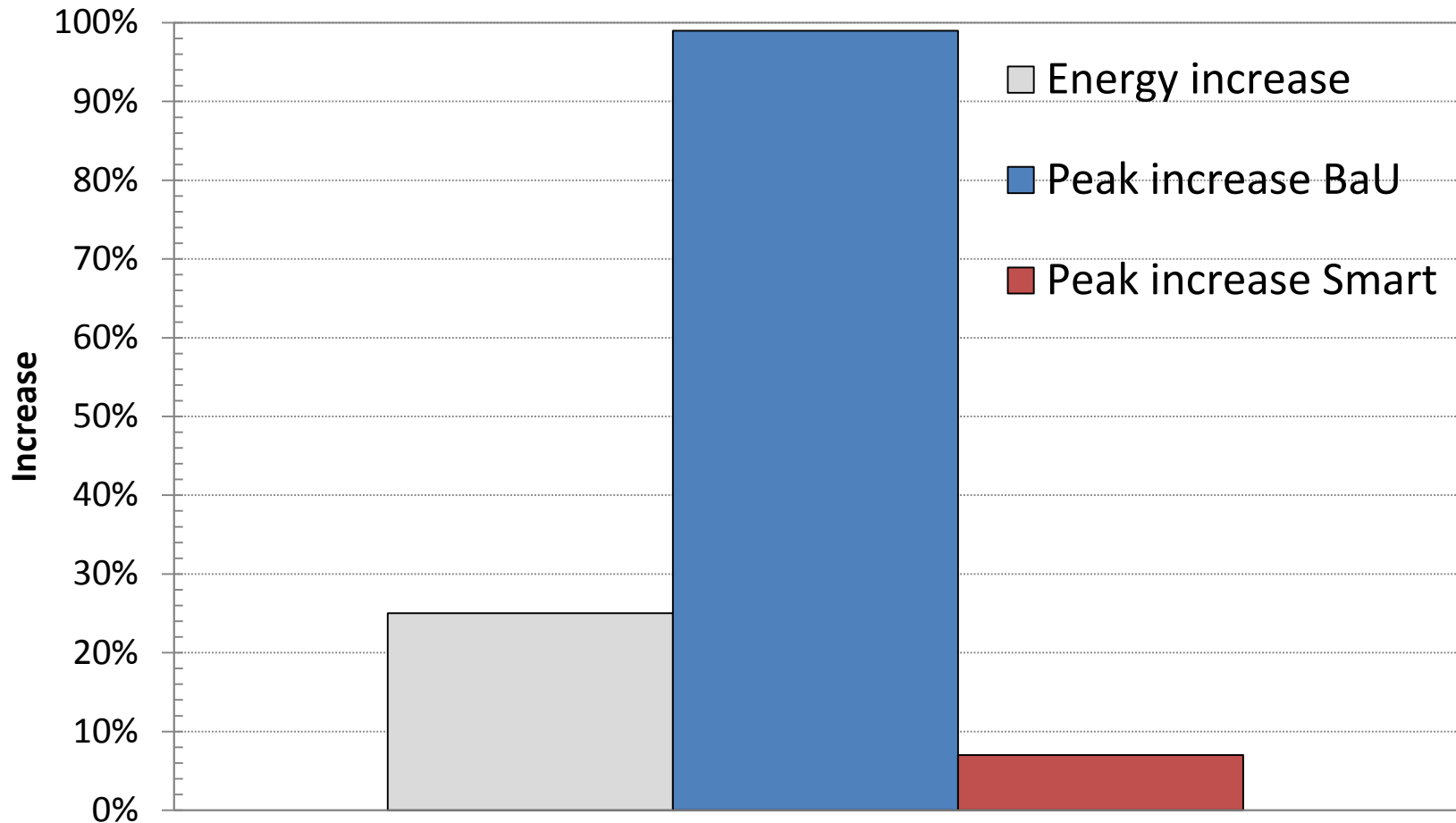
EV Charging coinciding with peak demand periods

## Smart charging



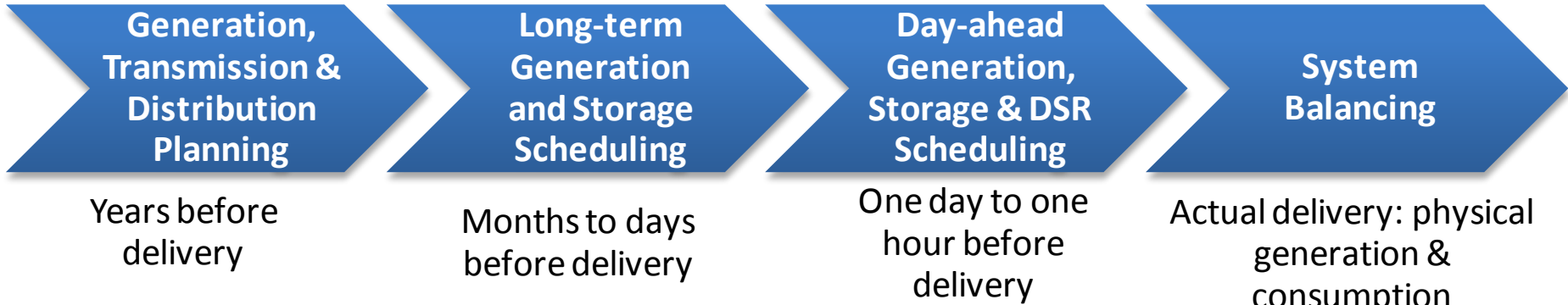
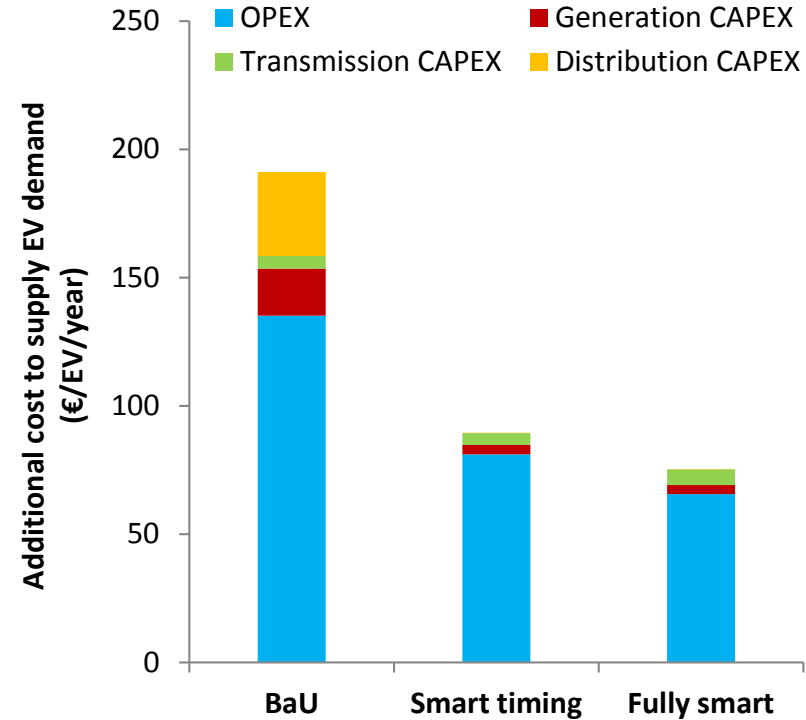
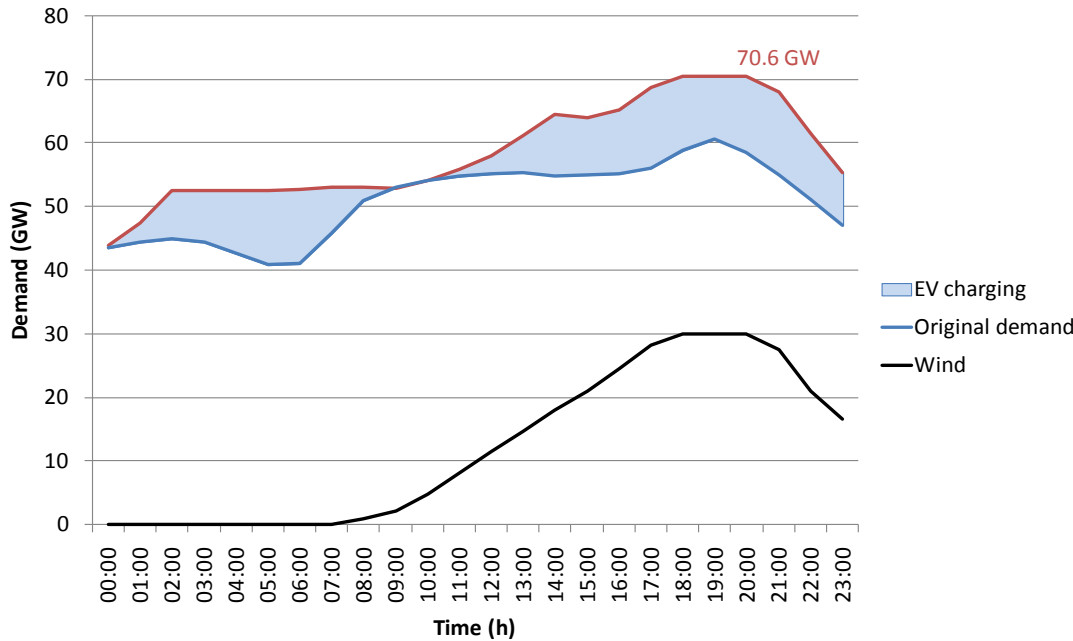
EV Charging optimized during low net demand periods

# Impact of EV charging strategy on the infrastructure capacity requirements will be very significant

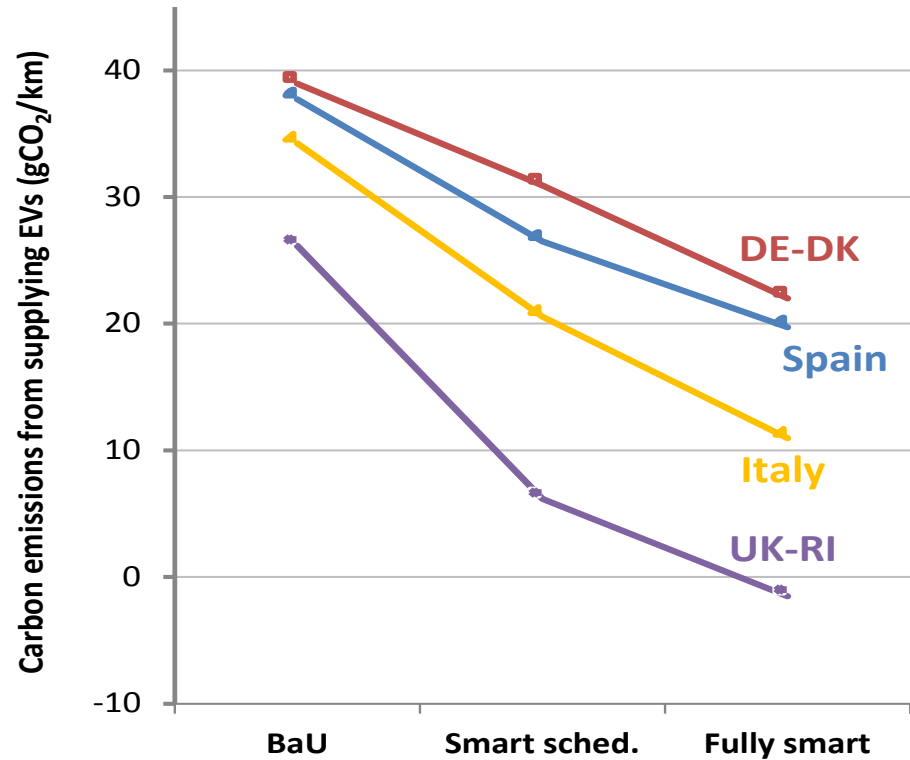
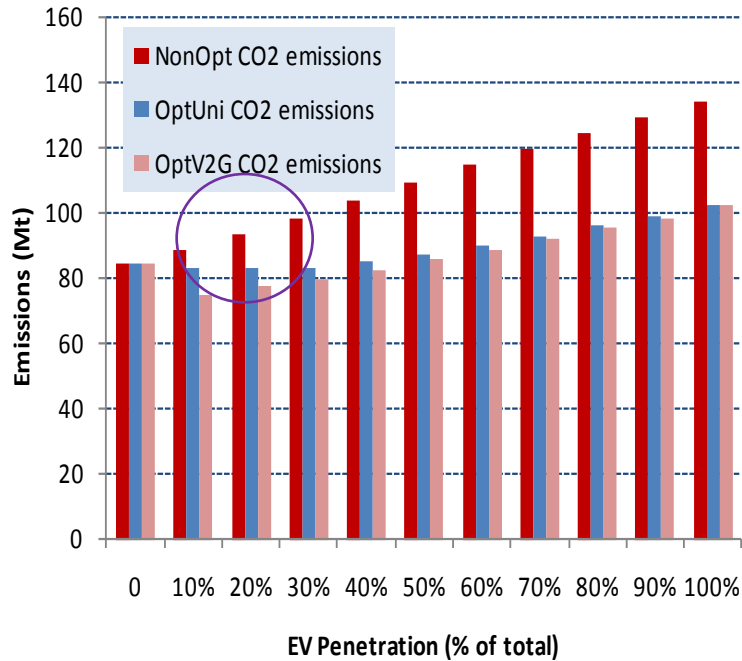


# Whole system assessment of benefits of EV smart charging

Optimised EV operation with wind increase during system peak



# Environmental impacts of alternative charging strategies



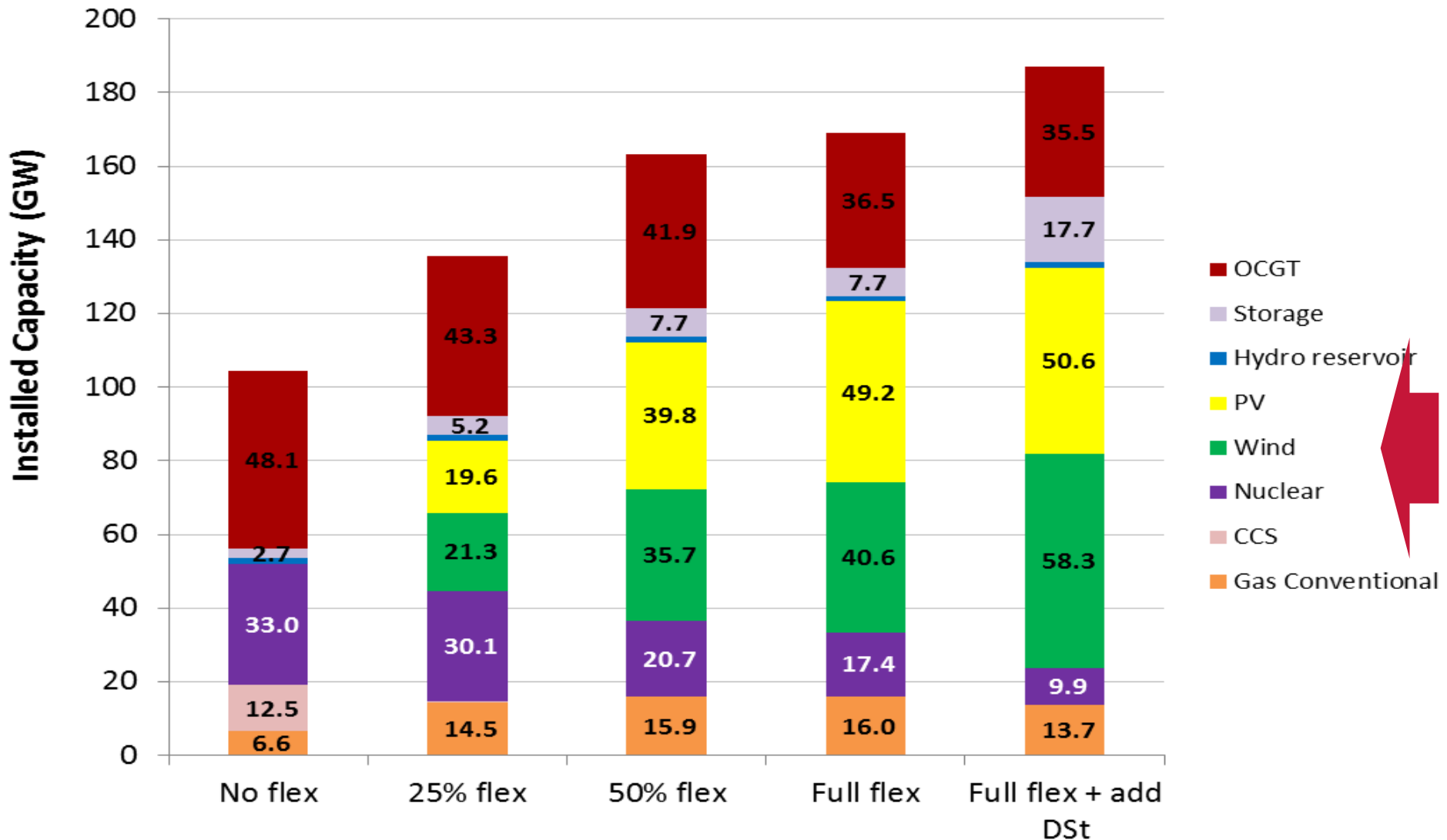
- Greater absorption of wind energy
- Reduced utilization of CO2 emitting plants

*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



# 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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