Efficient integration of EV's with windpower production

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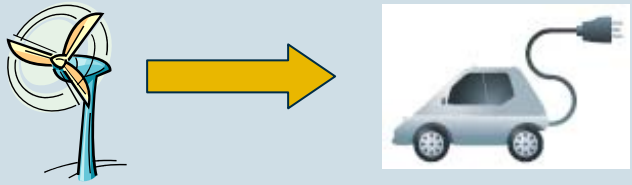


Analysis of a power system with 50% windpower and 30% EV's (of the light vehicle fleet)

Issues investigated:

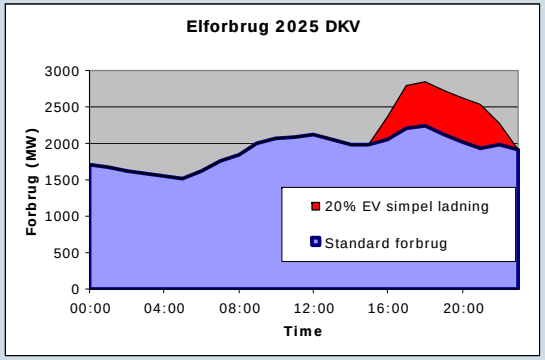
- Feeding the windpower into the EV's
- Efficient use of power infrastructure/net (distribution)
- Ancillary services from the EV's

A need for intelligent integration !

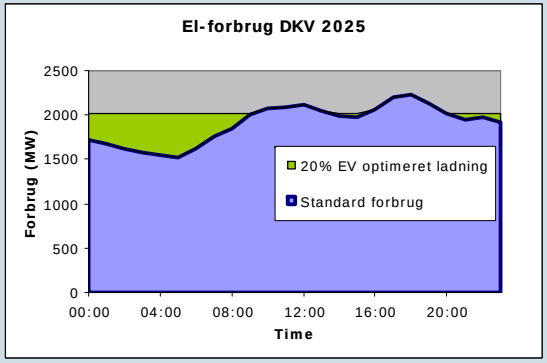
Power System ⇔ EV

Different concepts for EV integration analysed

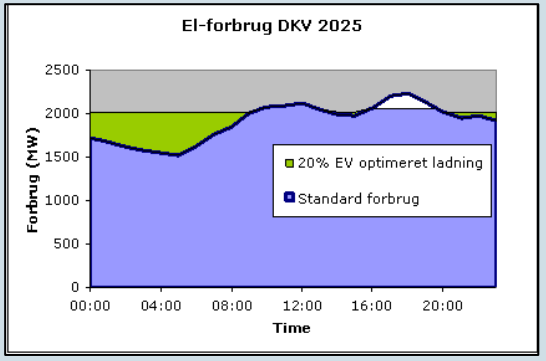
- **Model 1: Simple charging (worst case)**



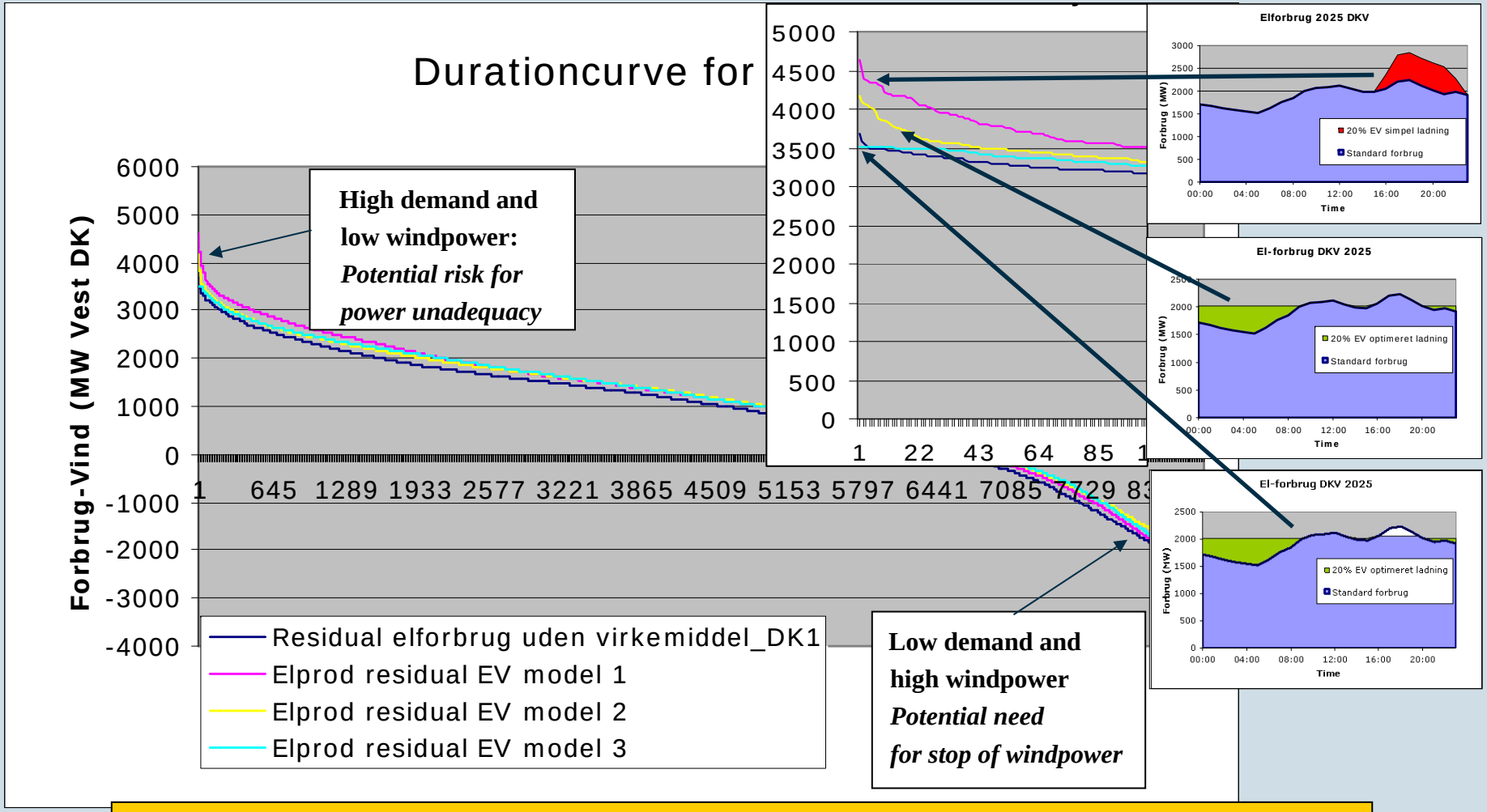
- **Model 2: Day-ahead marked integration**
  - Optimized to day-ahead market and intraday (24 hour)



- **Model 3: System integrated EV**
  - Day-ahead and intraday market
  - Ancillary services
  - Optimization to grid situation (capacity)
  - Delivery of power to network (V2G)

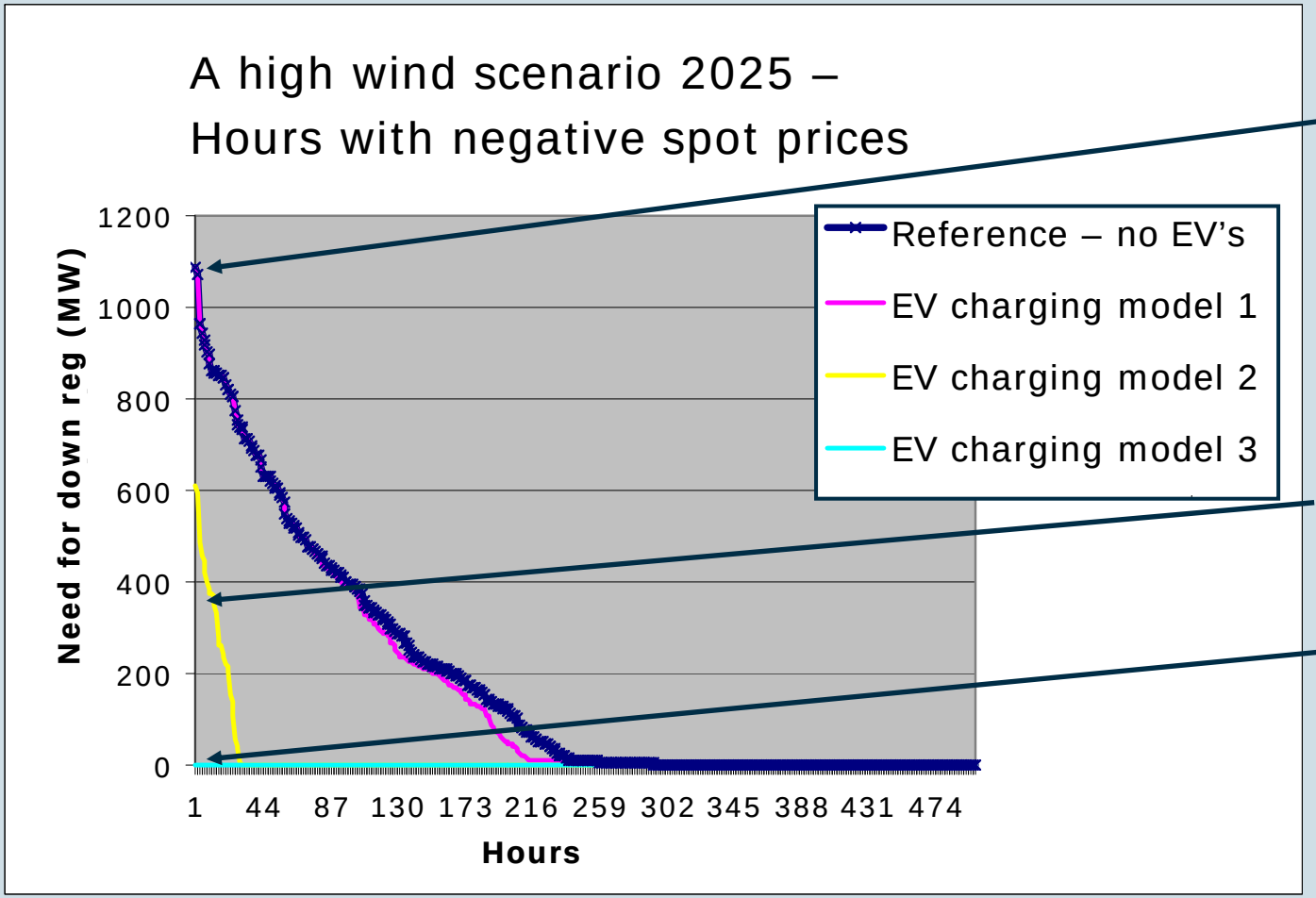


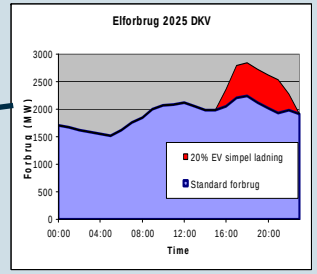
Charging model impact on needed power demand (Demand minus windpower production)

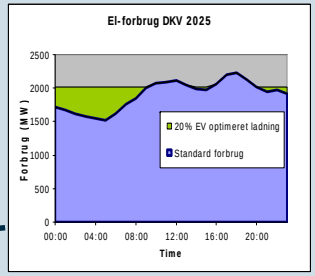


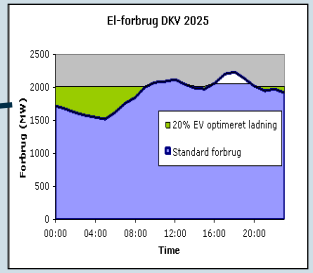
Intelligent charging has a high impact on the demand for peak load capacity

EV charging impact on efficient use of windpower







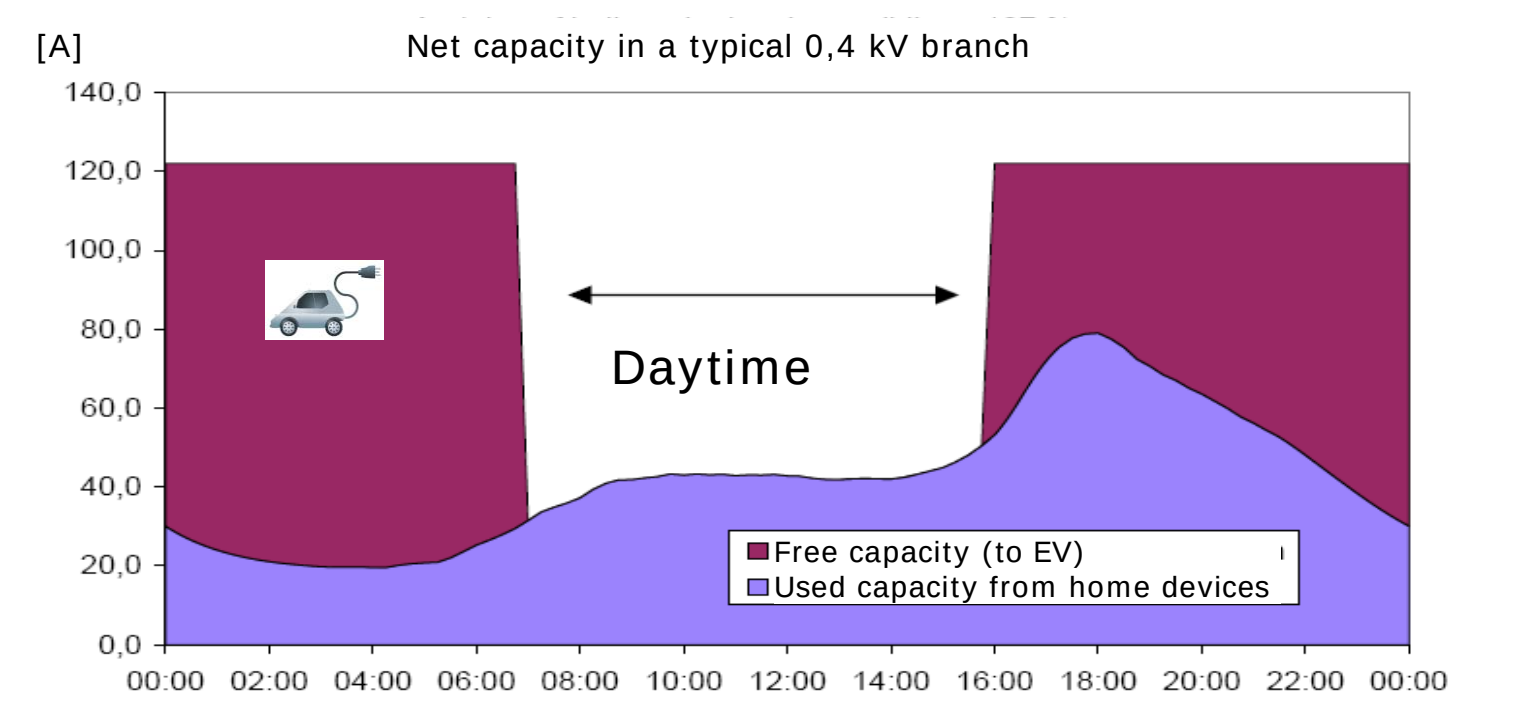


Intelligent charging has a high impact on the integration of windpower!

Capacity in the distribution net to EV charging

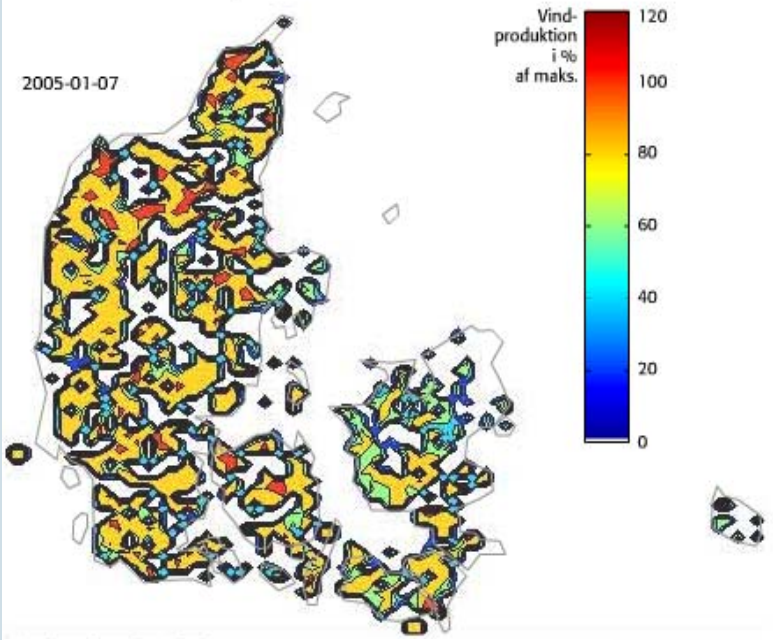
Case study in a typical low voltage distribution net (0,4 kV in DK)

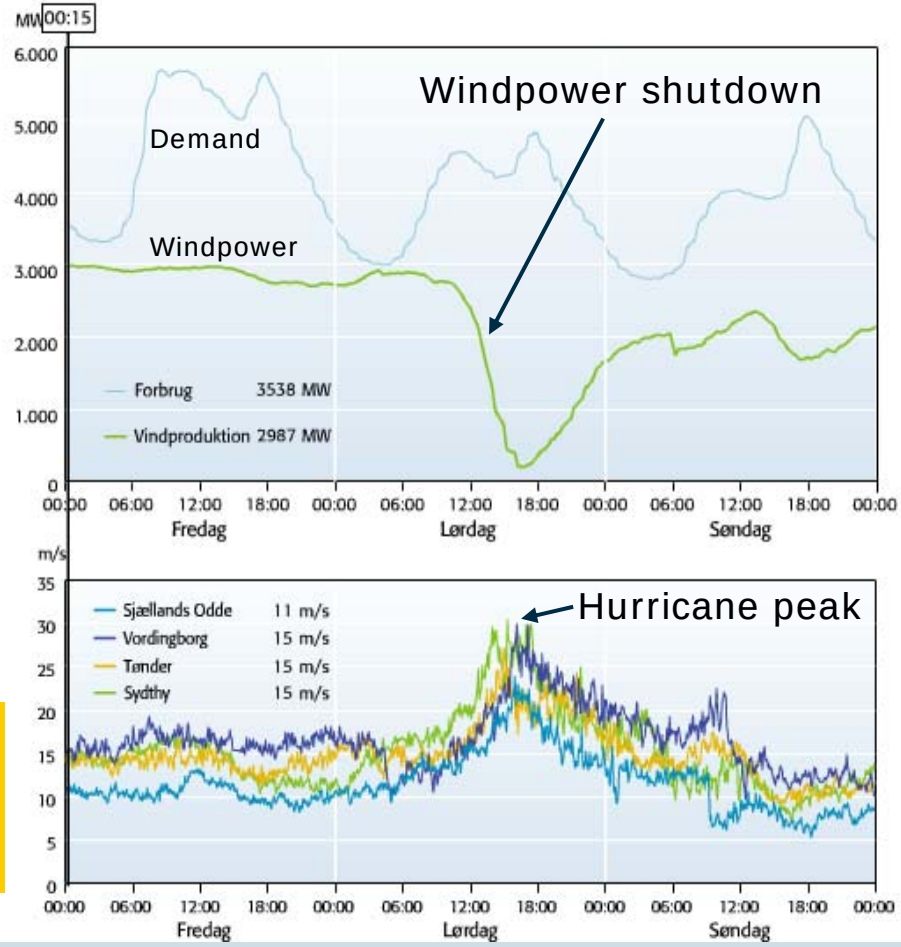
- Energy capacity to 1,4 EV for each house!
  (more than 2 EV's per house if daytime used as well)
- However: Below 10% can charge at same time during peakload (17.00-19.00) => A need for intelligence (smartgrid)



Ancillery services:
Windpower challenges – how can we use the EV ?

Hurricane 2005-01-08

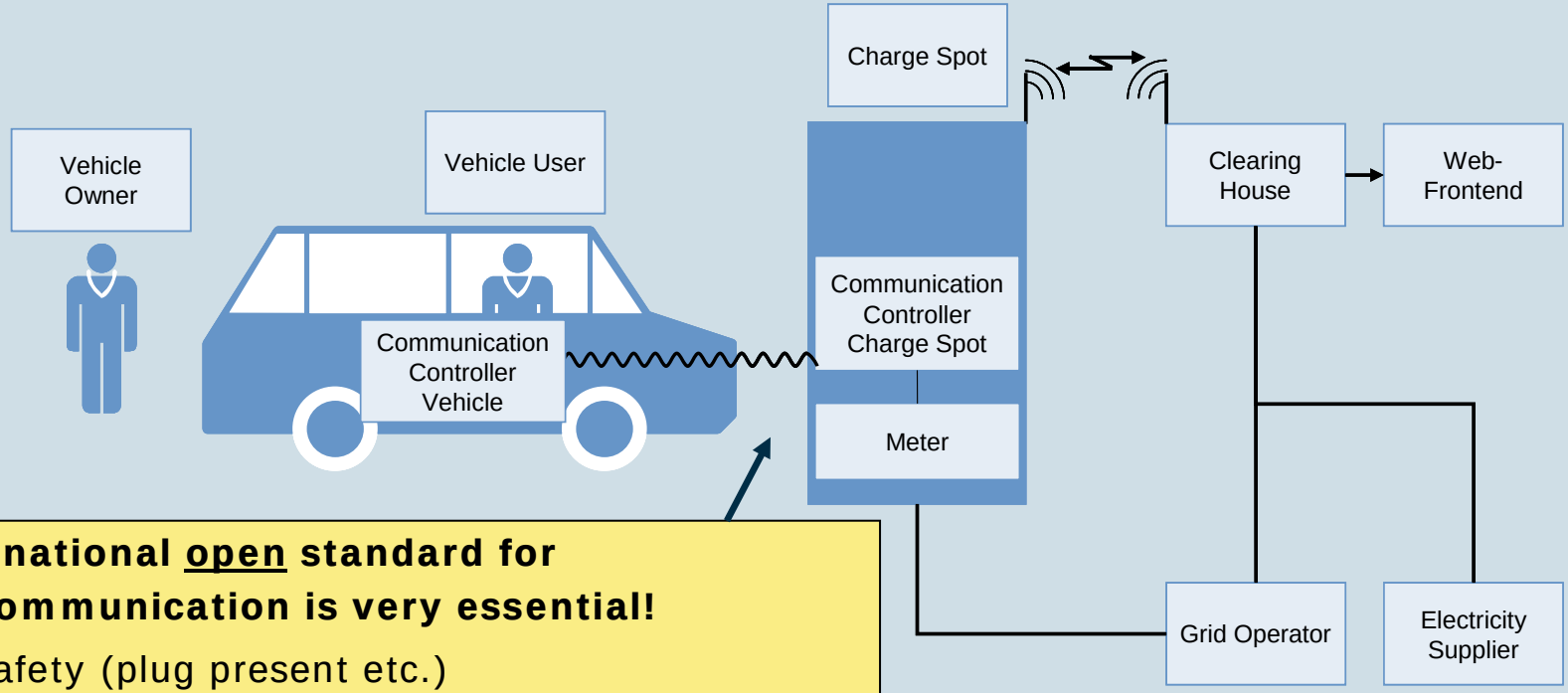




The EV can contribute to combat these type of windpower challenges !

International standardisation:
Joint Working Group V2G CI (Communication Interface)

E-mobility use cases, draft proposal, actors definition:



International <u>open</u> standard for Communication is very essential!

- Safety (plug present etc.)
- ID (contract information)
- Grid parameters (phys. limits etc.)
- Tarif parameters (energy price, local tarif etc.)

Conclusions

- Grid connected vehicles (PHEV/EV) is a key to an efficient integration of windpower in the transport sector
- But:
  An intelligent integration of the electrical vehicle with the power system is needed to obtain an efficient integration with the windpower production
- International standardization work is a key to successful smart integration
- A good cooperation between car industry and power sector is needed to obtain an efficient integration