

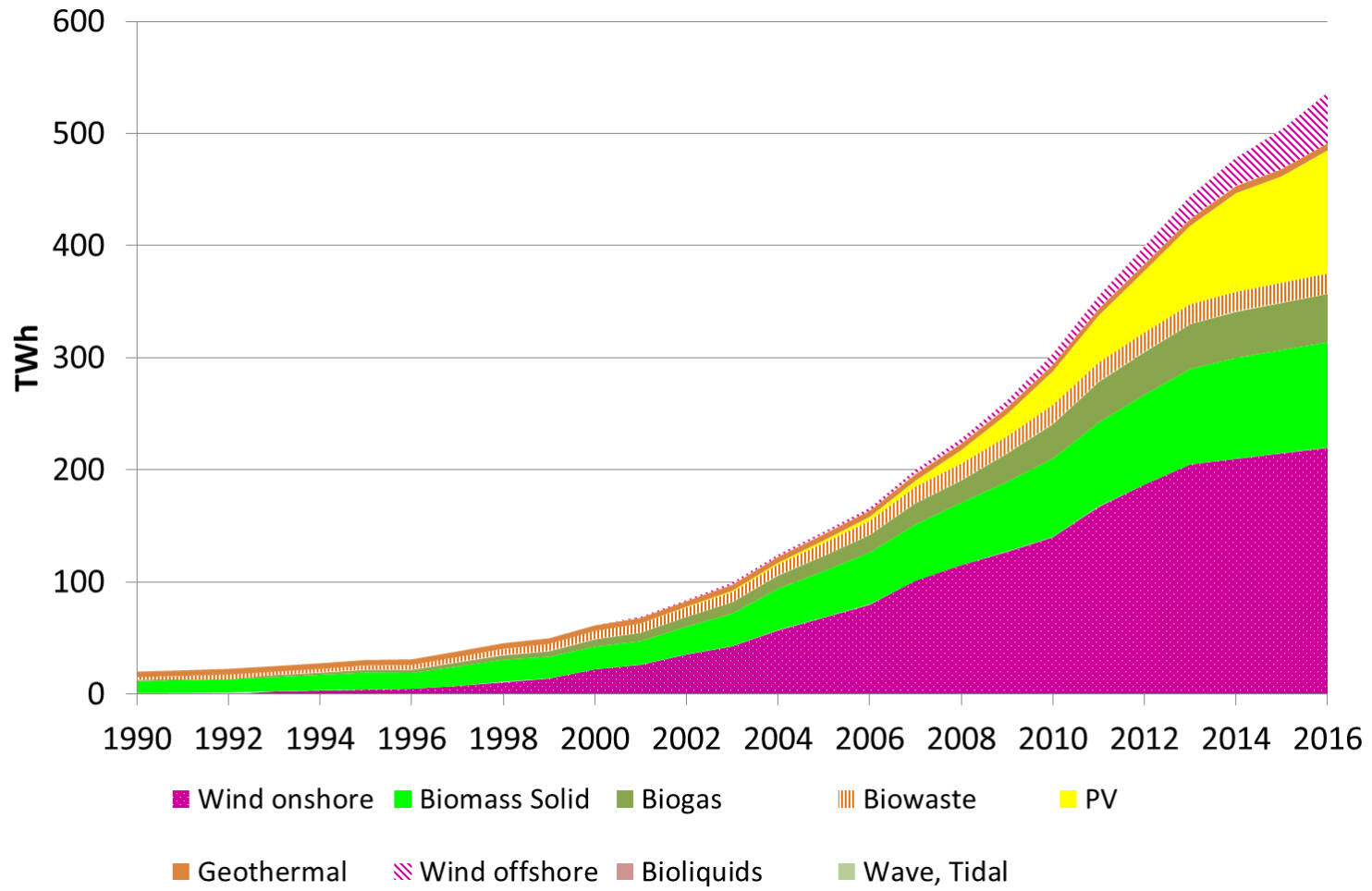
Prospects for sector coupling between electricity and transport by means of producing hydrogen

Amela Ajanovic
Institute of Energy Systems and Electrical Drives
Energy Economics Group (EEG)
TU Wien

*15th IAEE European Conference
Vienna, 4th September 2017*

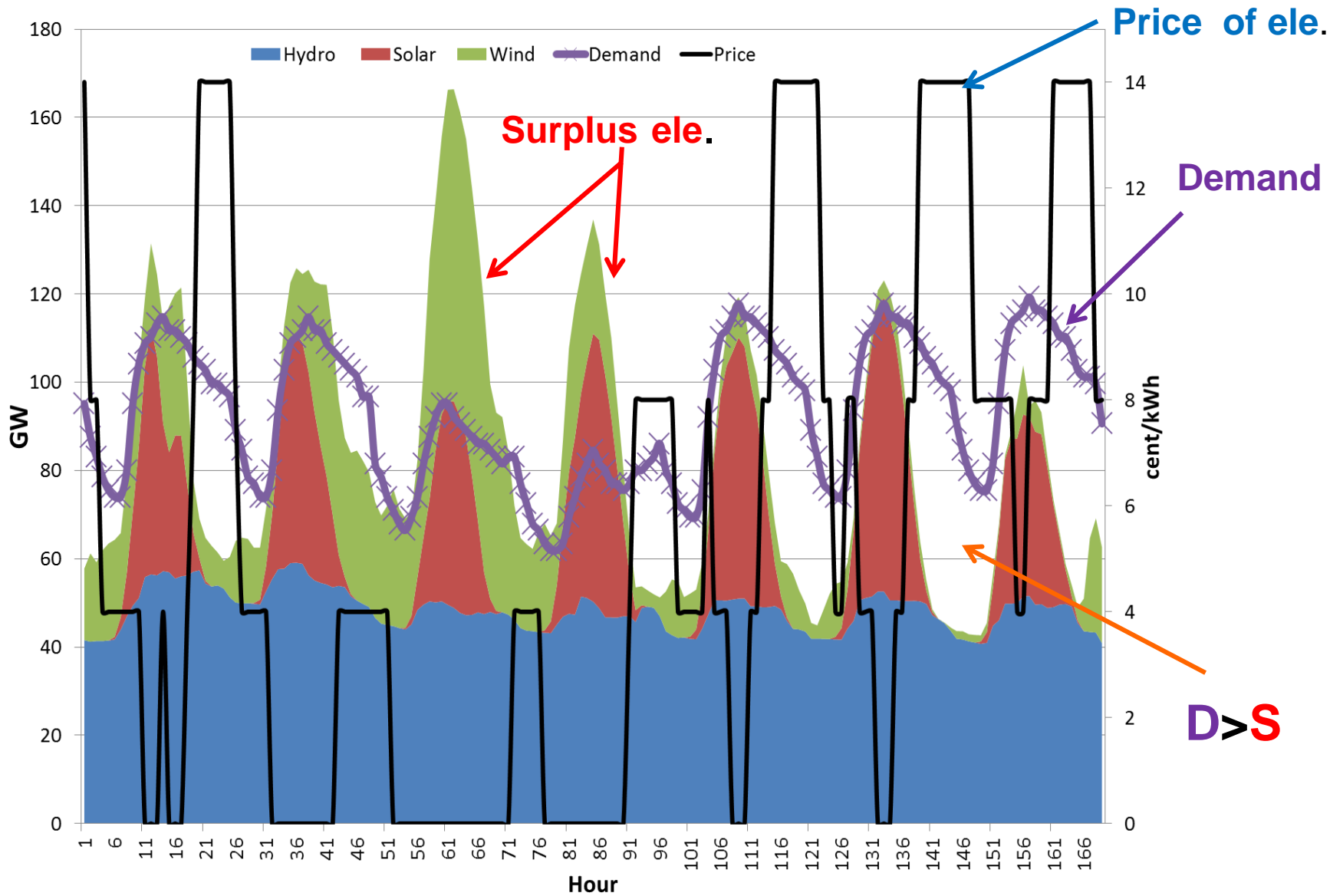
1. Introduction
2. Demand for long term storage options
3. Challenges of the transport sector
4. Storage options and costs
5. Use of hydrogen and methane in the transport sector
6. Conclusions

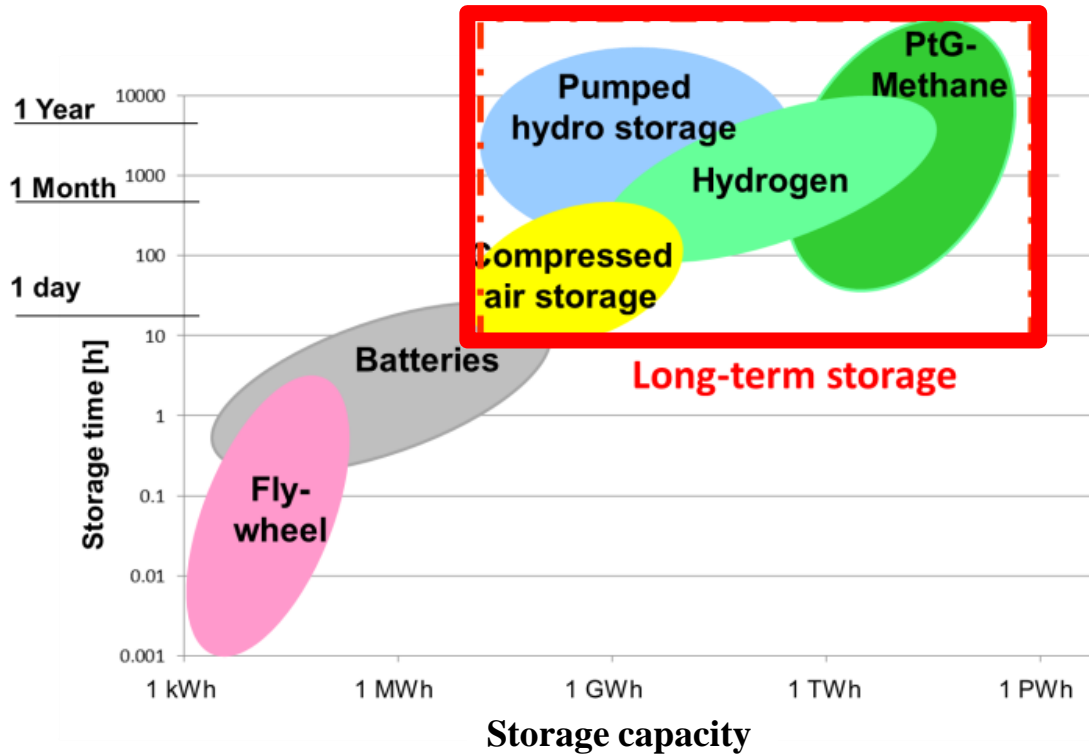
- The global energy system faces currently two major challenges:
 - sufficient and secure energy supply
 - reduction of energy-related greenhouse gas emissions
- ✓ increase the use of renewable energy sources
- ❖ how to cope with excess electricity from RES



EU-28: Electricity generation from „new“ RES

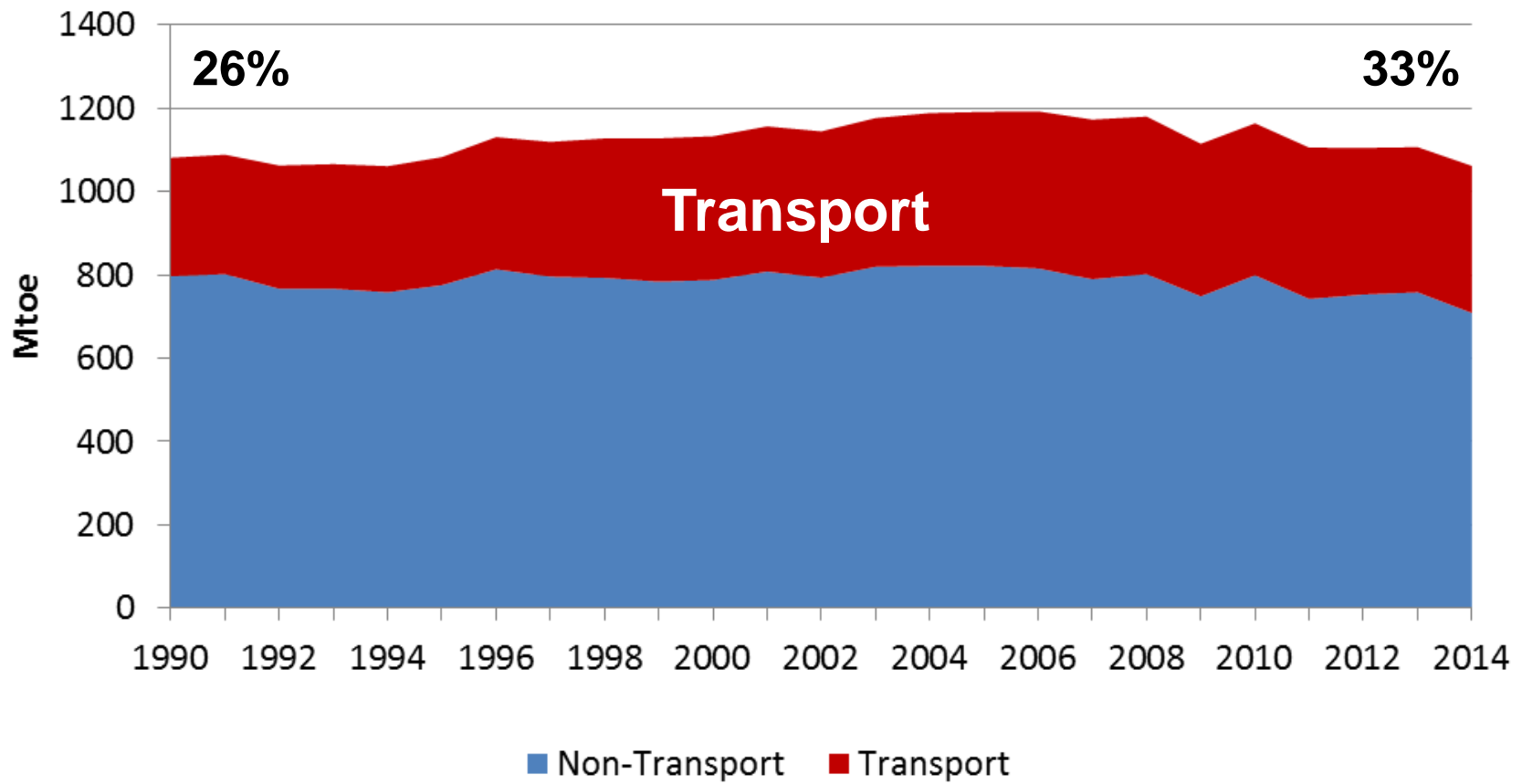
Integrating large shares of renewable electricity





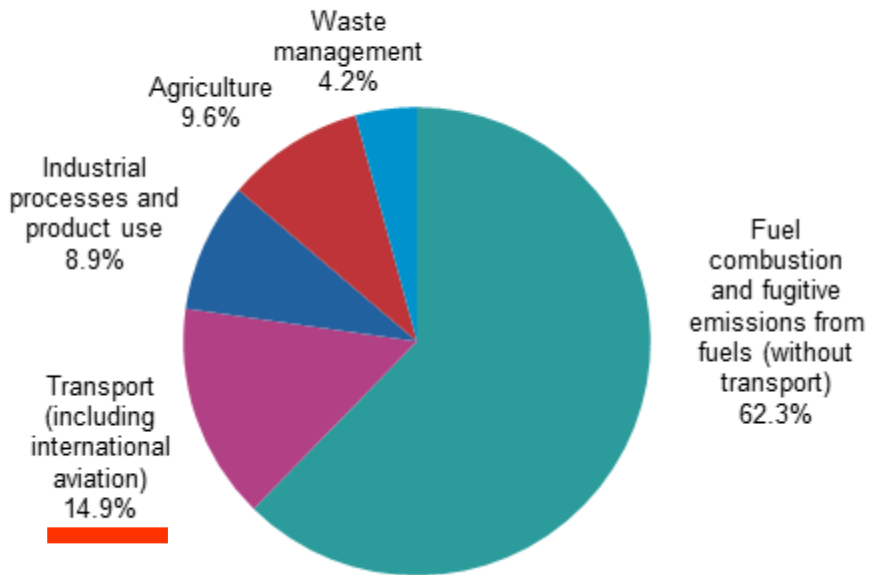
Typical storage times of various storage technologies as a function of installed storage capacity

EU-28: Final energy consumption

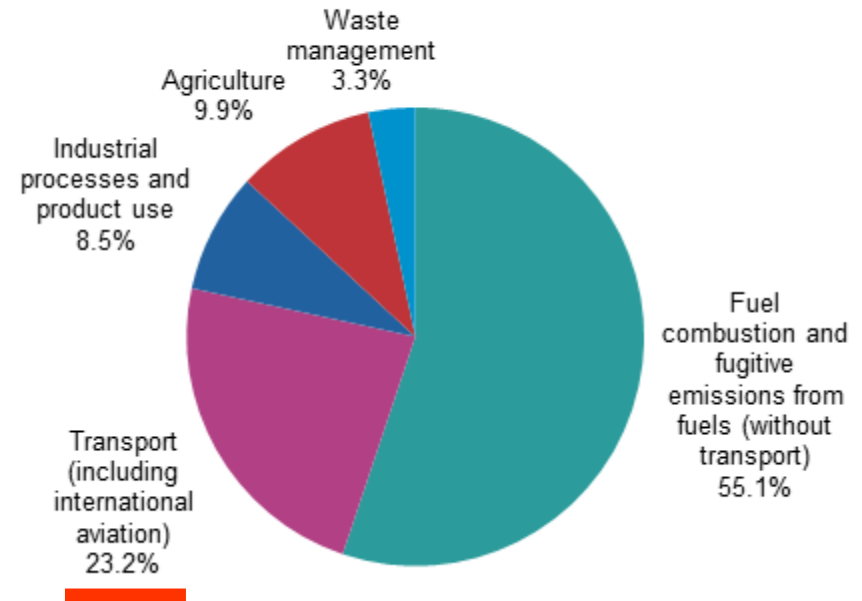


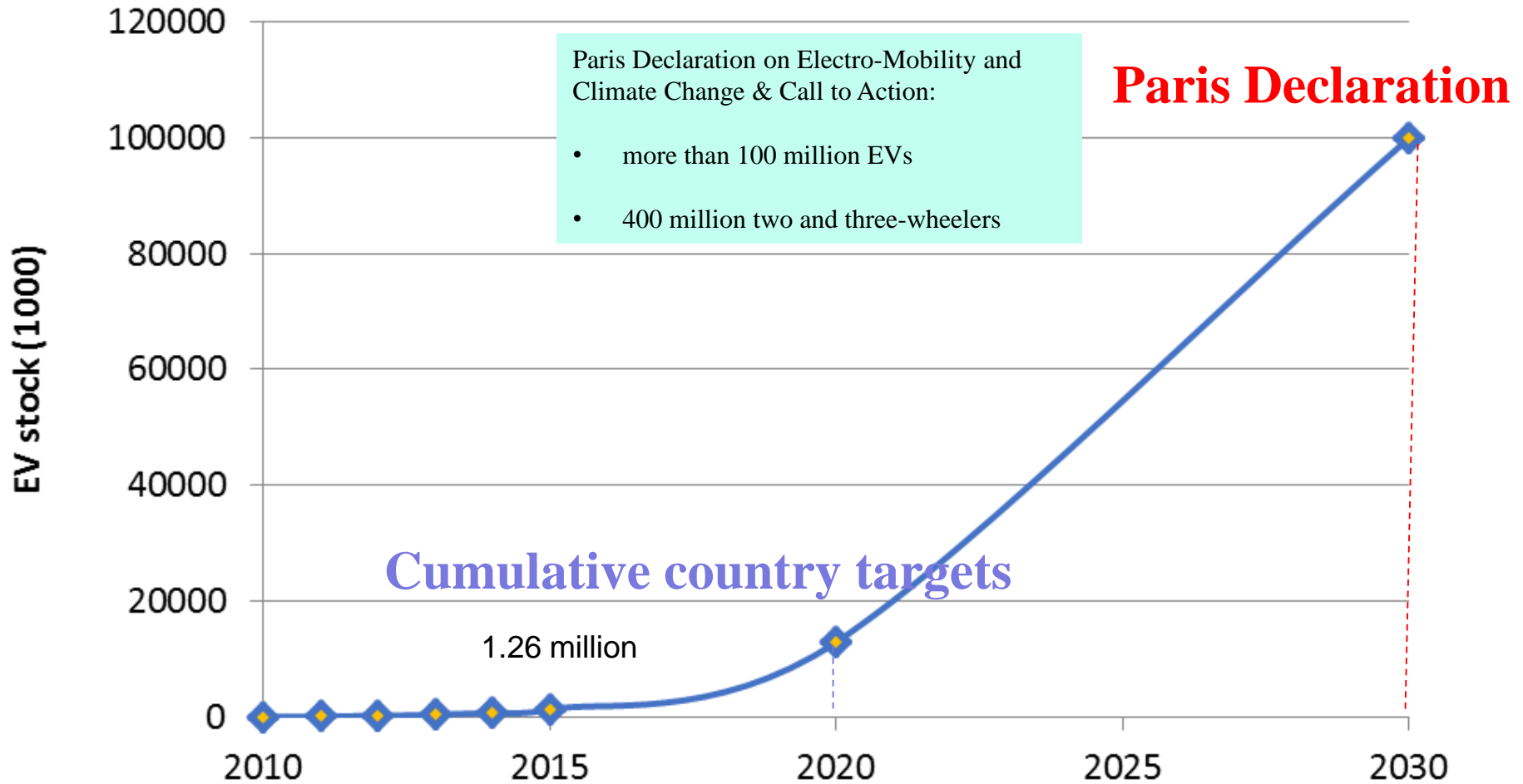
GHG emissions by sectors: EU-28

1990

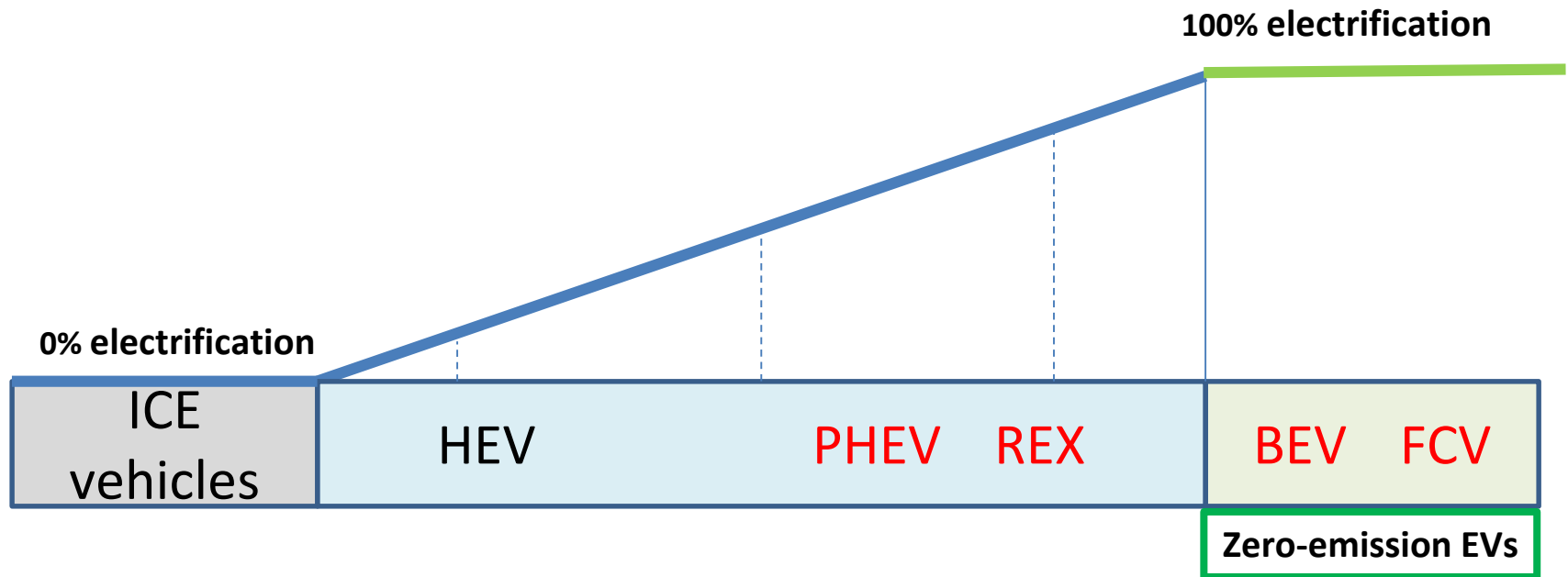


2014

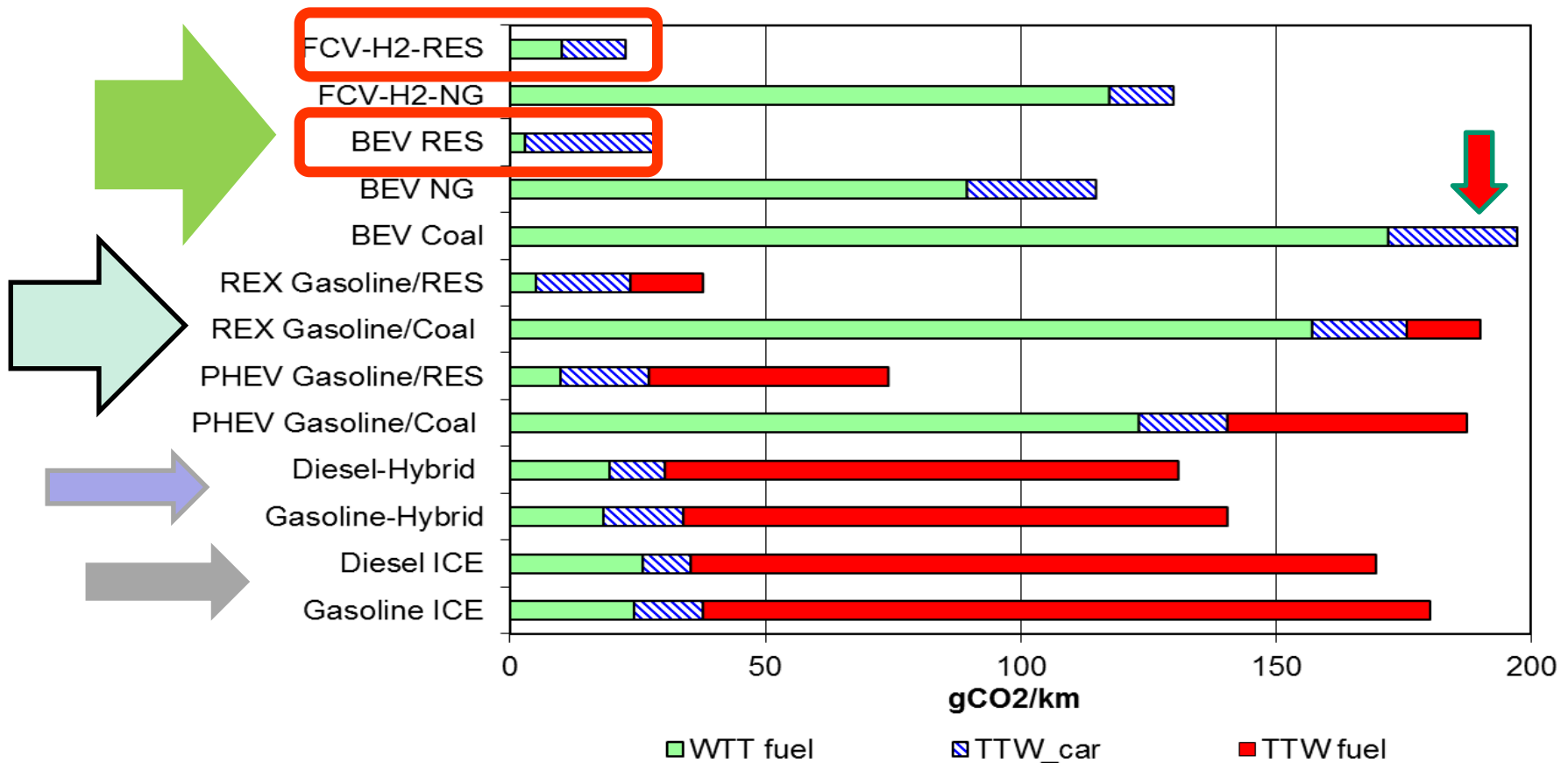




Development of the global stock of EVs

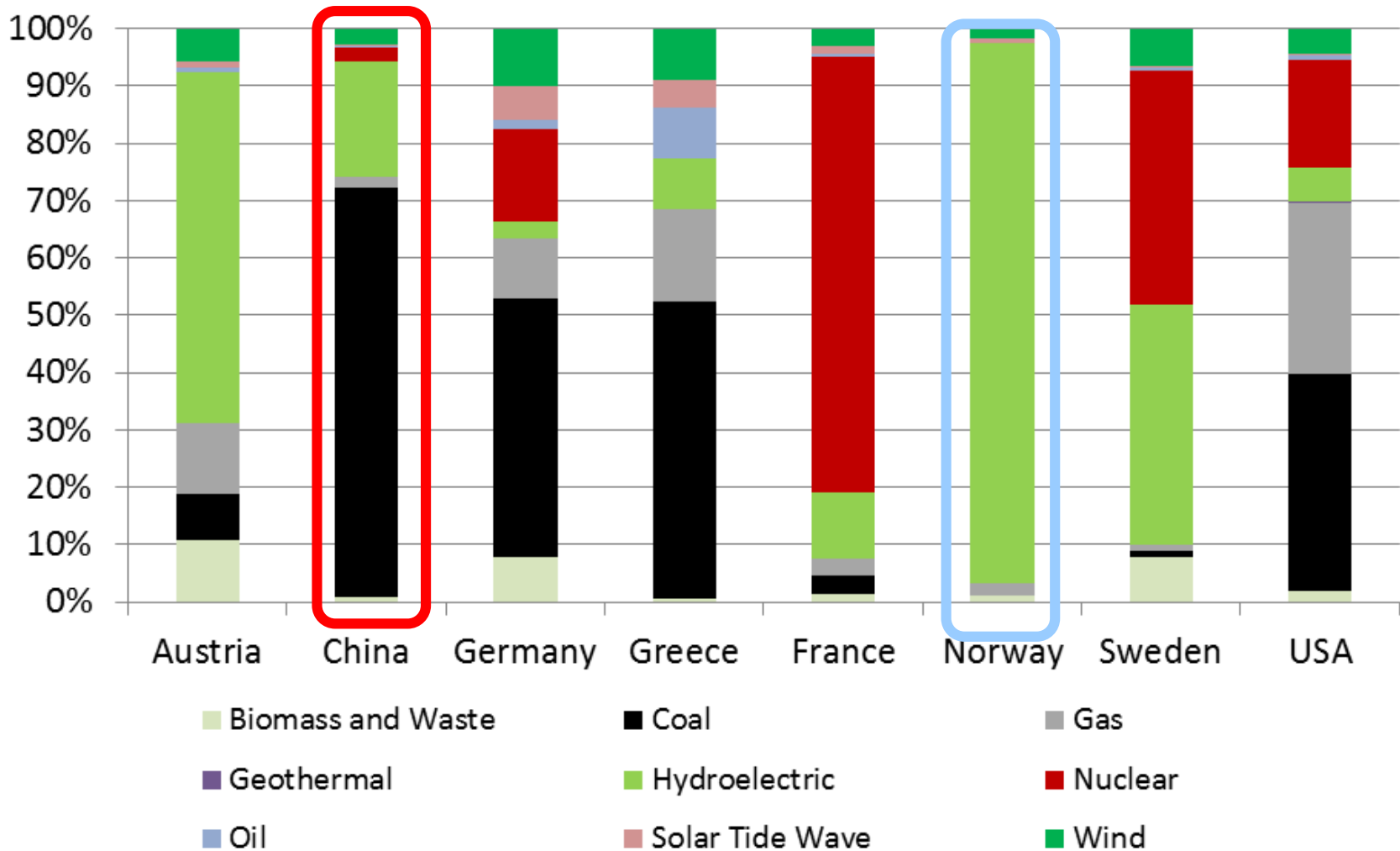


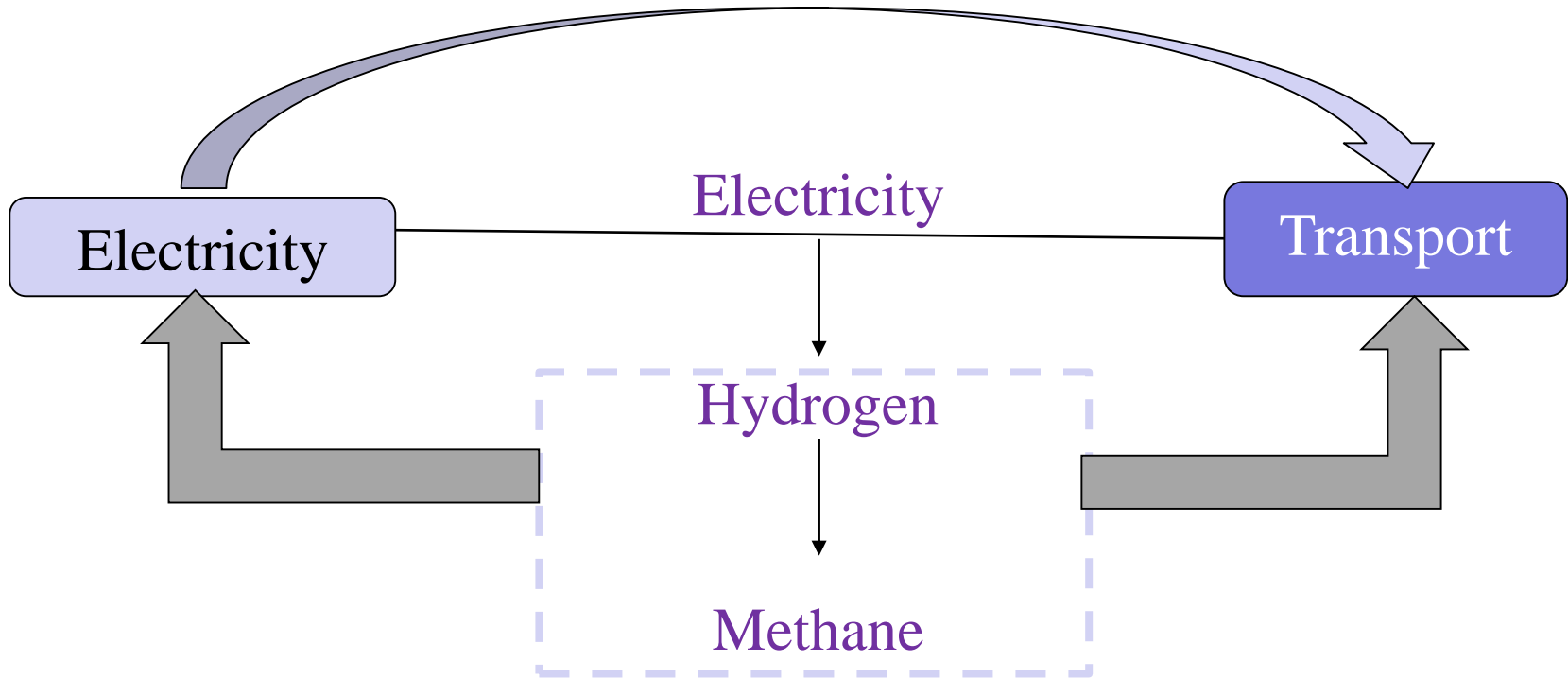
Level of electrification of electric vehicles



CO₂ emissions per km driven for various types of EV in comparison to conventional cars (power of car: 80kW)

Electricity mix (2014)





$$C = \frac{\frac{IC \cdot \alpha + C_{OM}}{T} + C_E}{\eta_{STO}} \left[\frac{EUR}{kWh} \right]$$

C ... Storage costs (EUR per kWh)

C_E ... Energy costs (EUR per kWh)

C_{OM} ... O&M costs (cent per kWh)

IC ... Investment costs (EUR/kW)

α ... Capital recovery factor

T ... Full-load-hours (hours per year)

η_{STO} ... Efficiency of storage

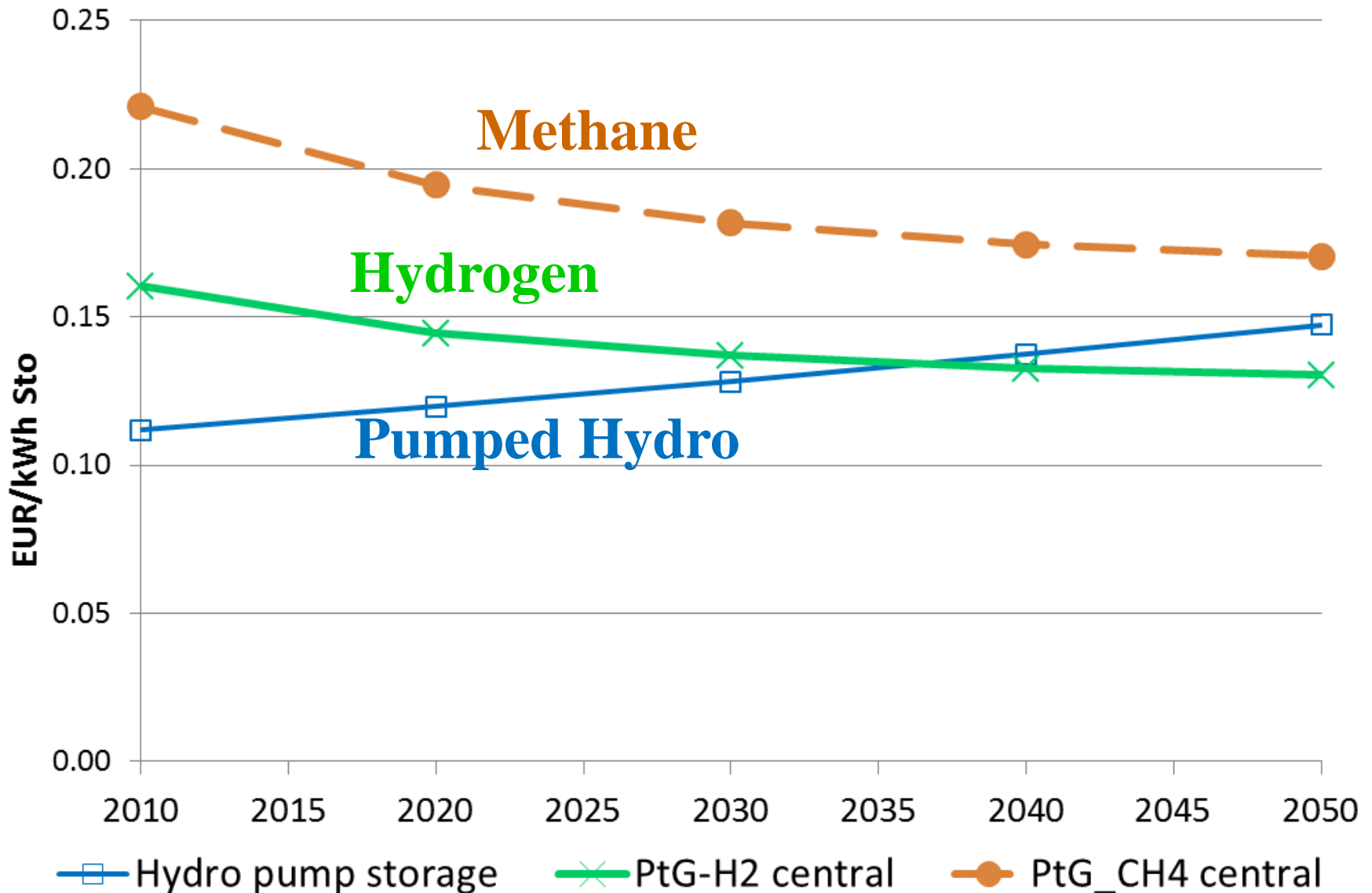
Key factors:

➤ **T (Full-load-hours)**

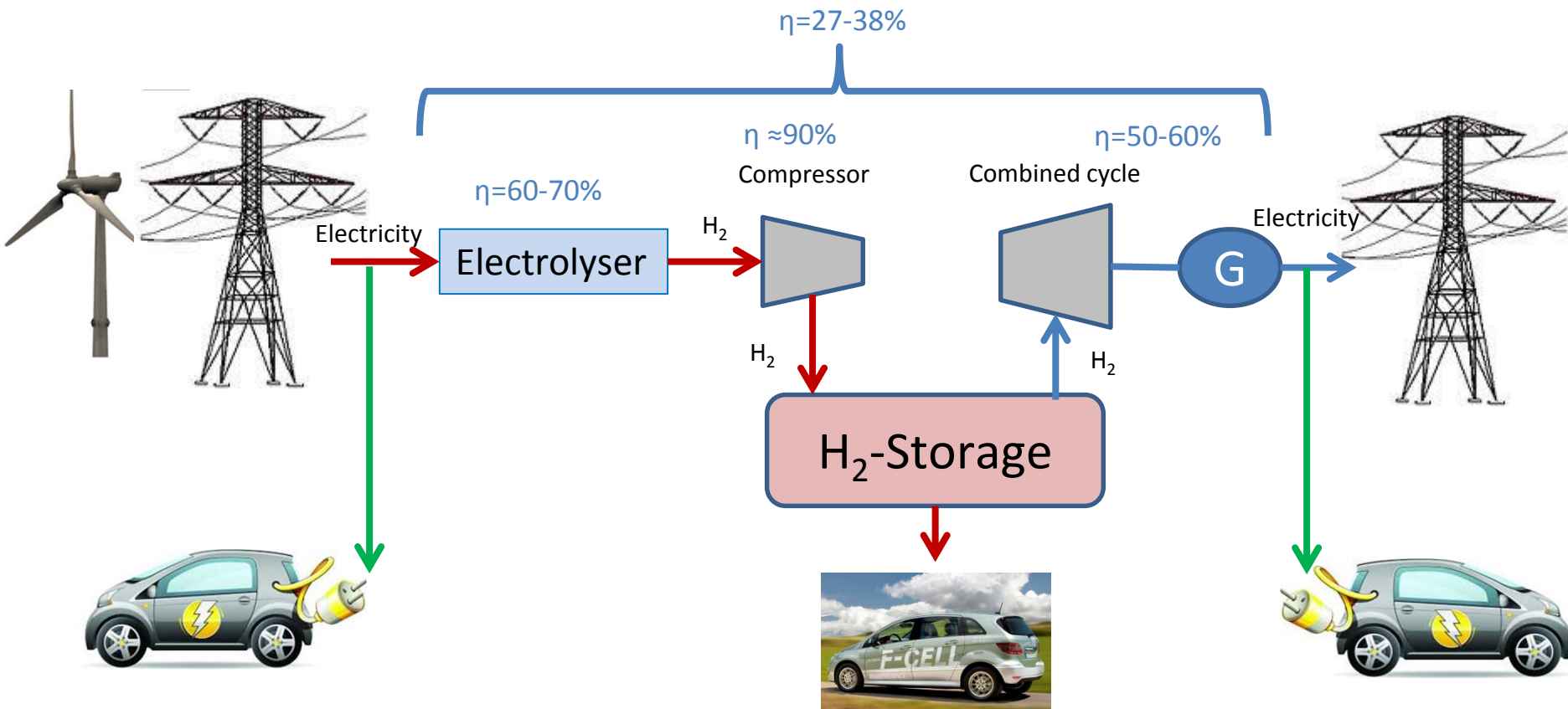
➤ **C_E (electricity price)**

Storage costs optimistic 2010 - 2050

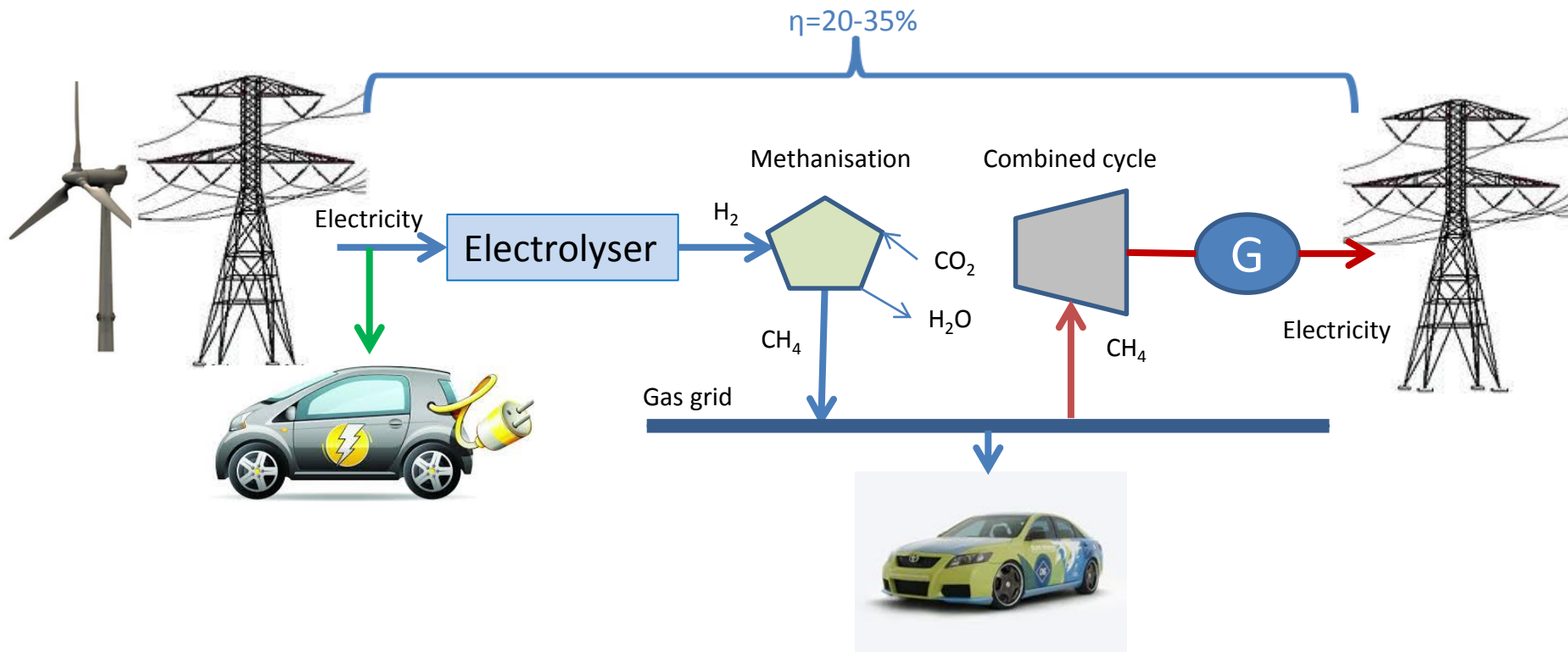
(Electricity costs = 0, T=1800 hours/year)

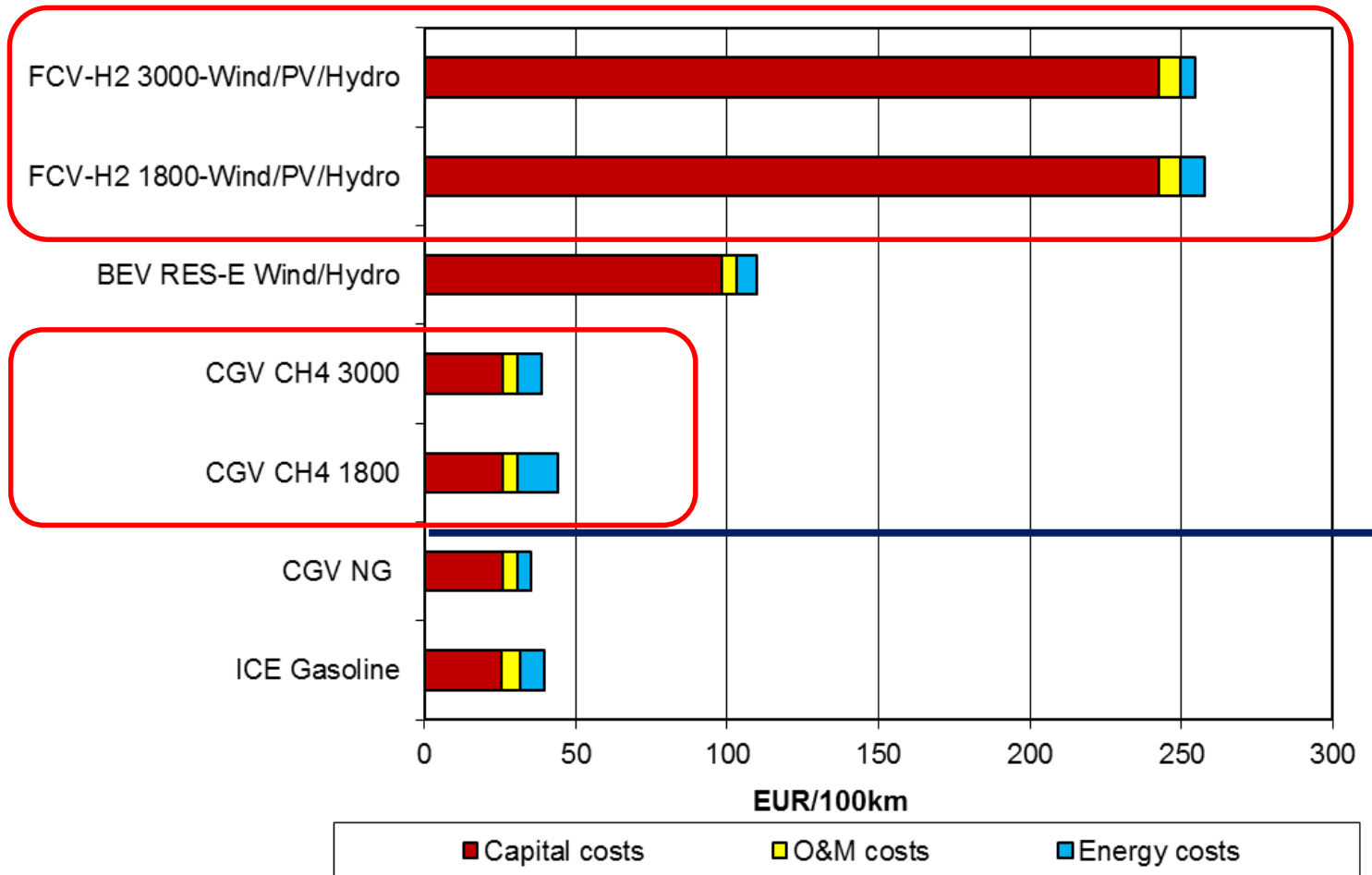


Very low roundtrip efficiency for electricity!



Energy supply chains: Storage and/or use of RES for mobility





Total specific costs per 100 km depending on full-load hours of the electrolysis for hydrogen production

- Increasing electricity generation from variable RES
→ need for new long-term storage options
- Problem of all storage options: low full-load hours
- PtG as electricity storage: low round trip efficiency
- In transport: Need for environmentally friendly technologies
- Proper mix of policies, intensified R&D, and cost reduction

ajanovic@eeg.tuwien.ac.at