

On the market prospects of long-term- electricity storages

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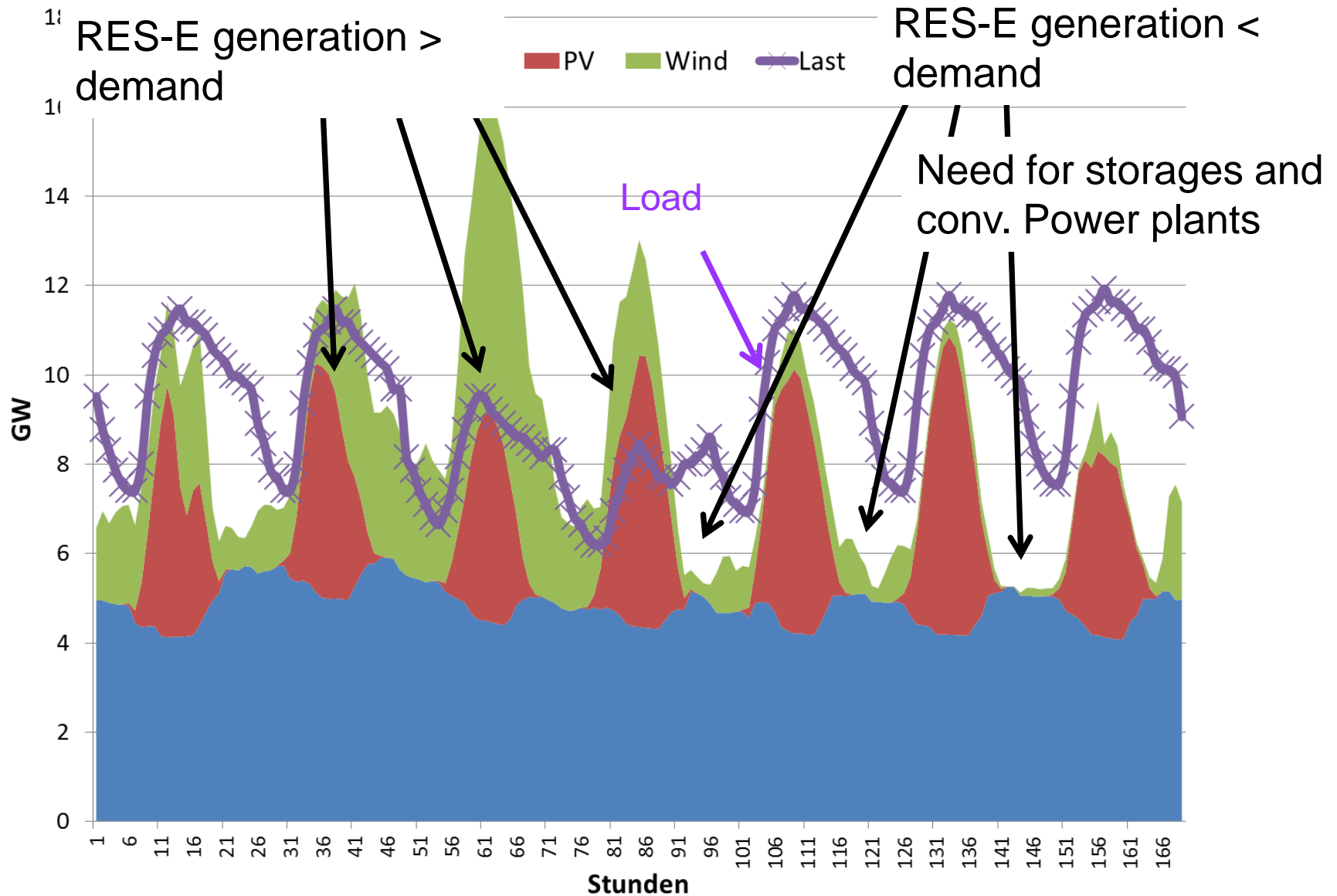
1. Introduction
2. Integrating large shares of RES
3. The problem of storages
4. Costs scenarios for long-term storage technologies
5. Using hydrogen and methane in transport
6. Conclusions

- Major challenges of global energy system:
 - sufficient and secure energy supply
 - reduction of energy-related greenhouse gas emissions

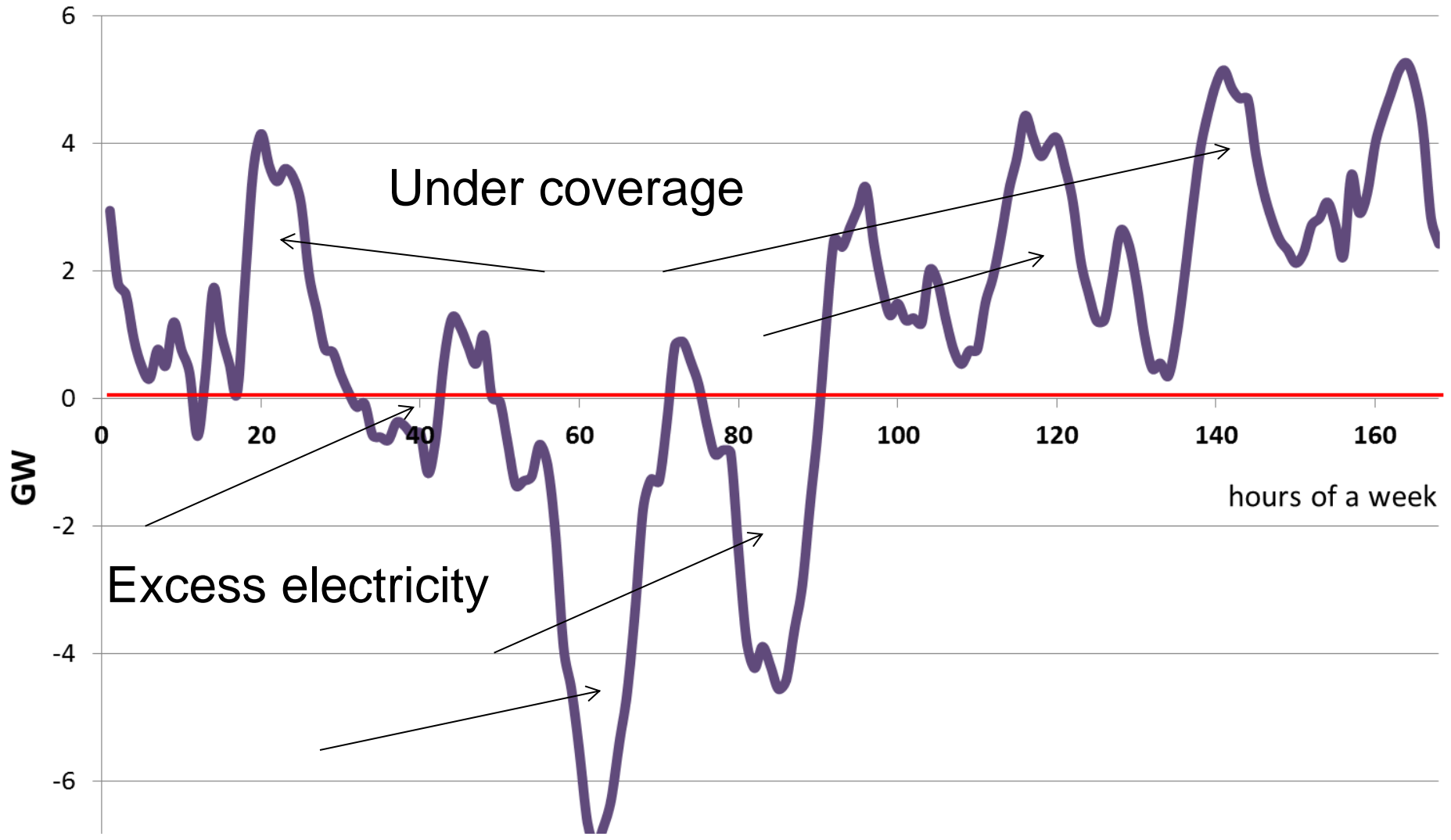
- Approach: increase use of renewable energy sources (RES)

- In electricity: How to cope with excess electricity from RES

2. Integrating large shares of renewable electricity

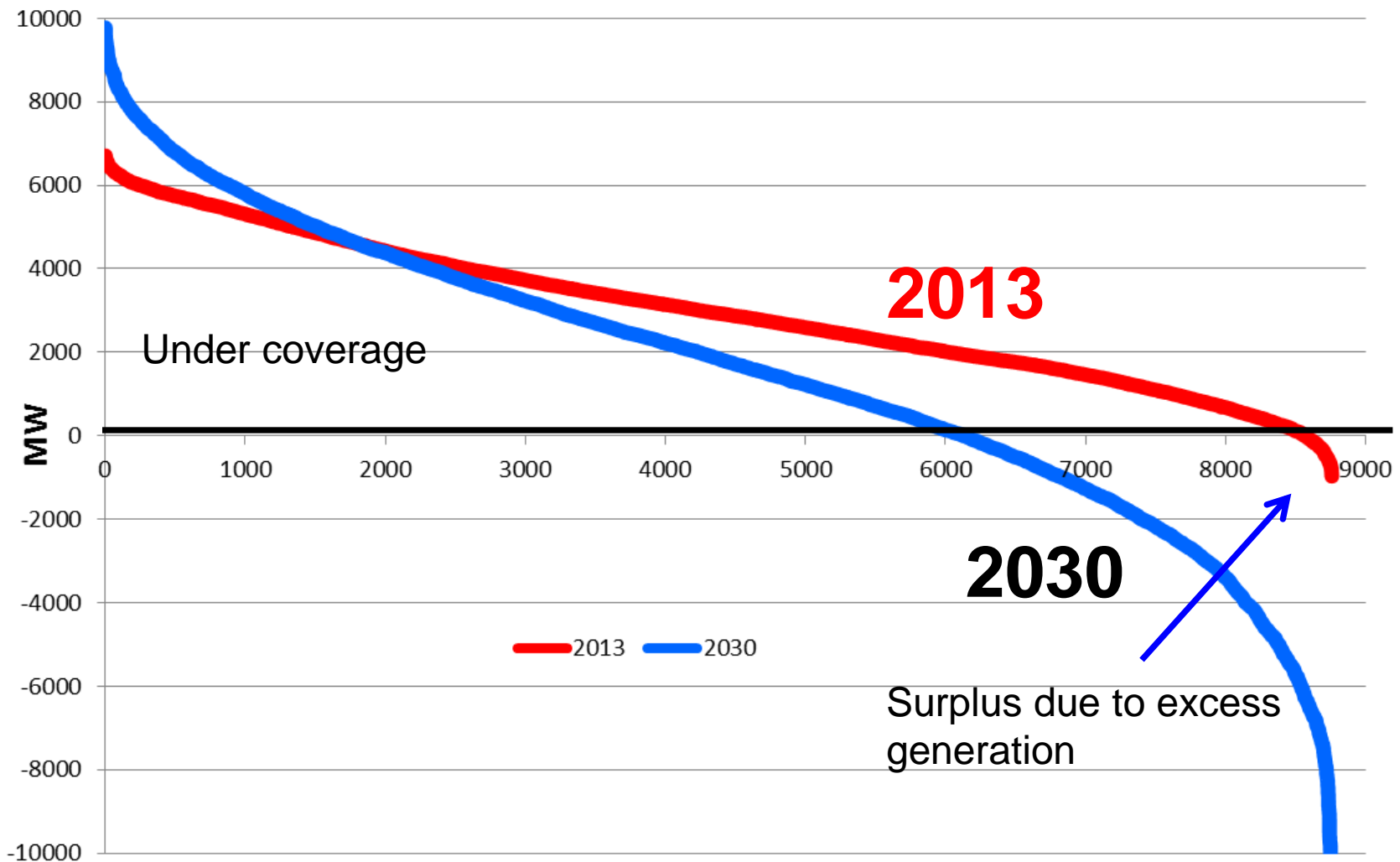


Residual load



Residual load = Load – non-flexible generation

Classified residual load



3. The problem of storages

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

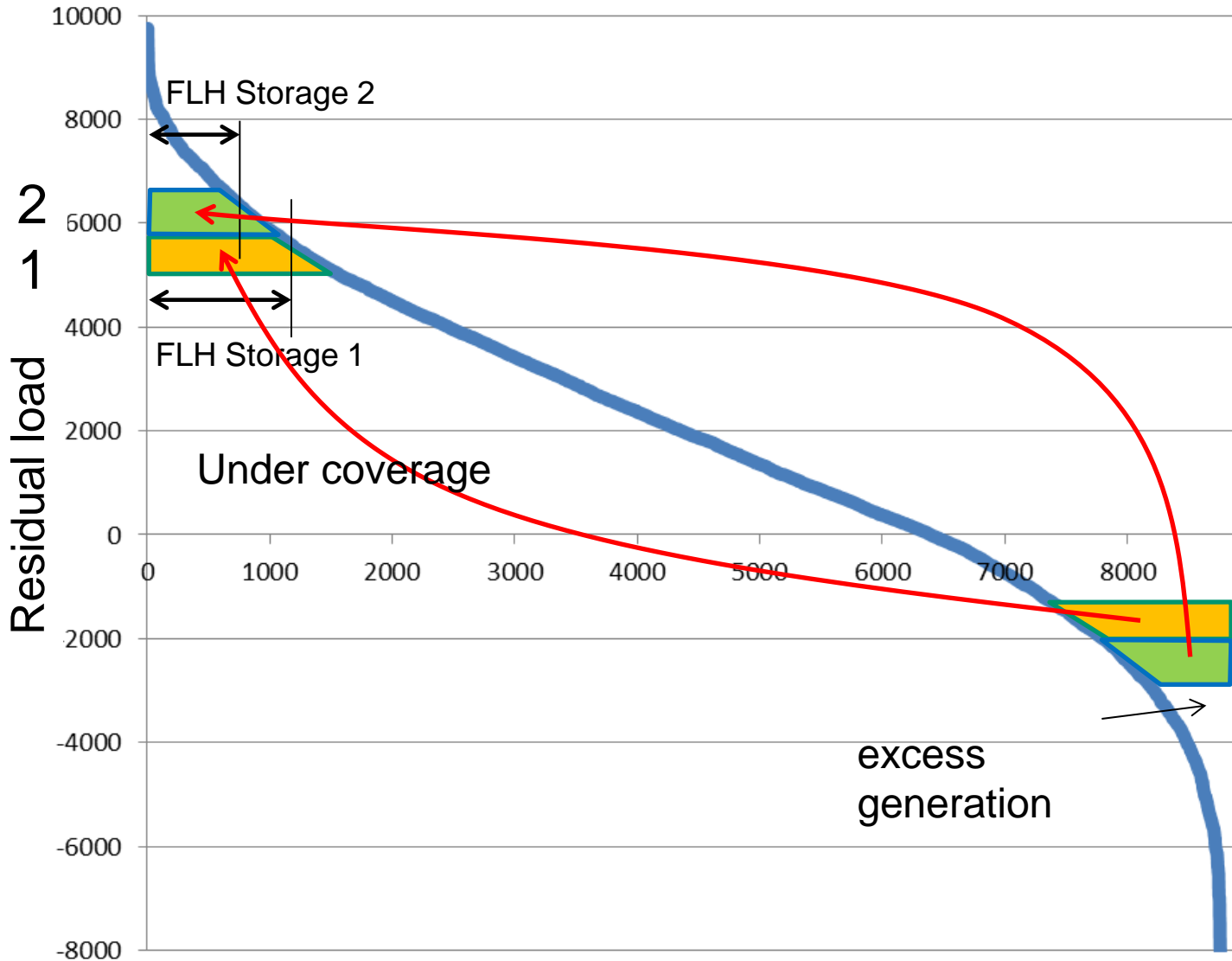
- C ... Storage costs (EUR per kWh)
 C_E ... Energy costs (EUR per kWh)
 C_{OM} ... O&M costs (cent per kWh)
 IC ... Investitionskosten (EUR/kW)
 α ... Capital Recovery factor
 T ... Fullloadhours (hours per year)
 η_{SP} ... Efficiency of storage

Key factors:

- T (Fullloadhours)!
- C_E (electricity price)

Decreasing full-load hours of storages

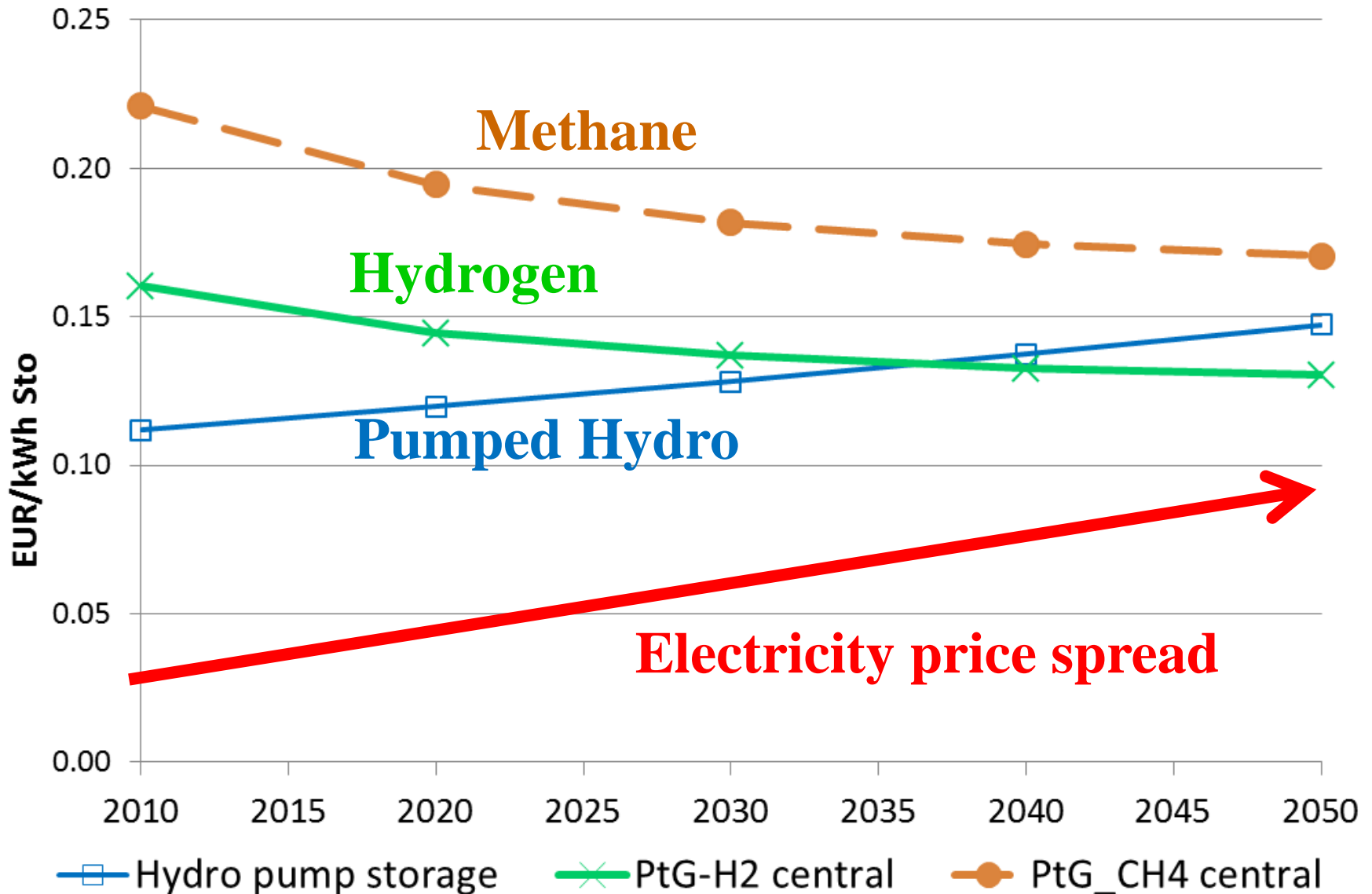
Storage 2
Storage 1



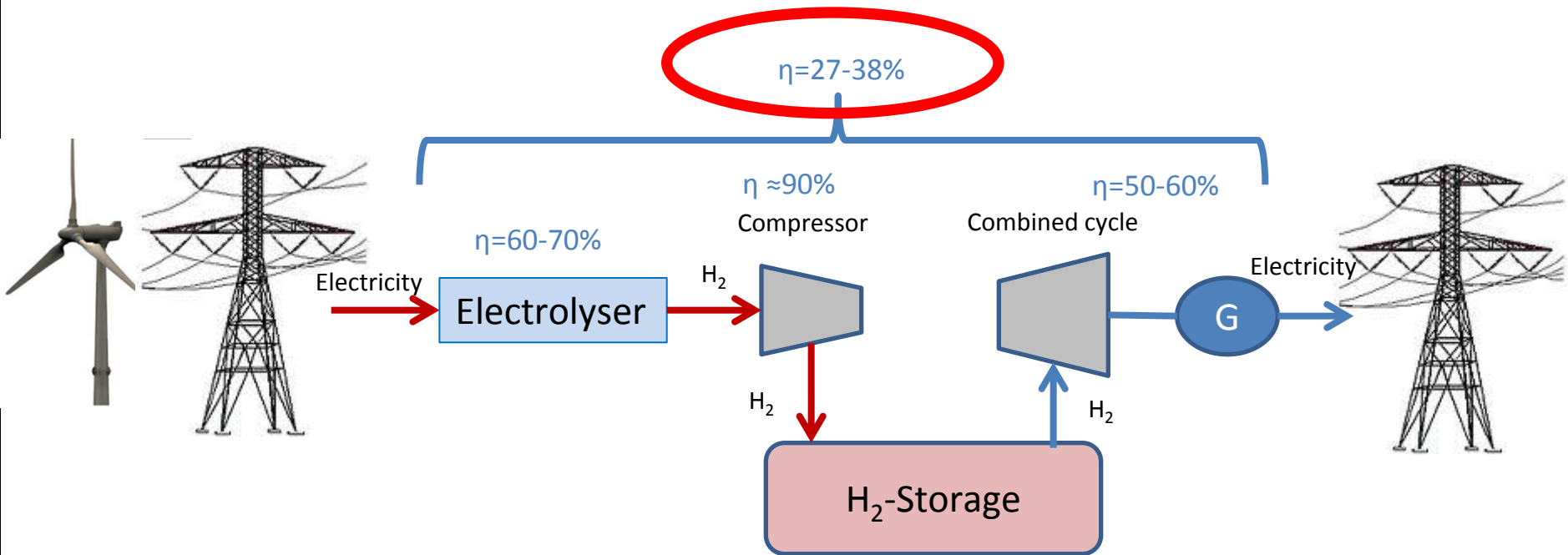
4. Costs scenarios for long-term storage technologies

Storage costs optimistic 2010 - 2050

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

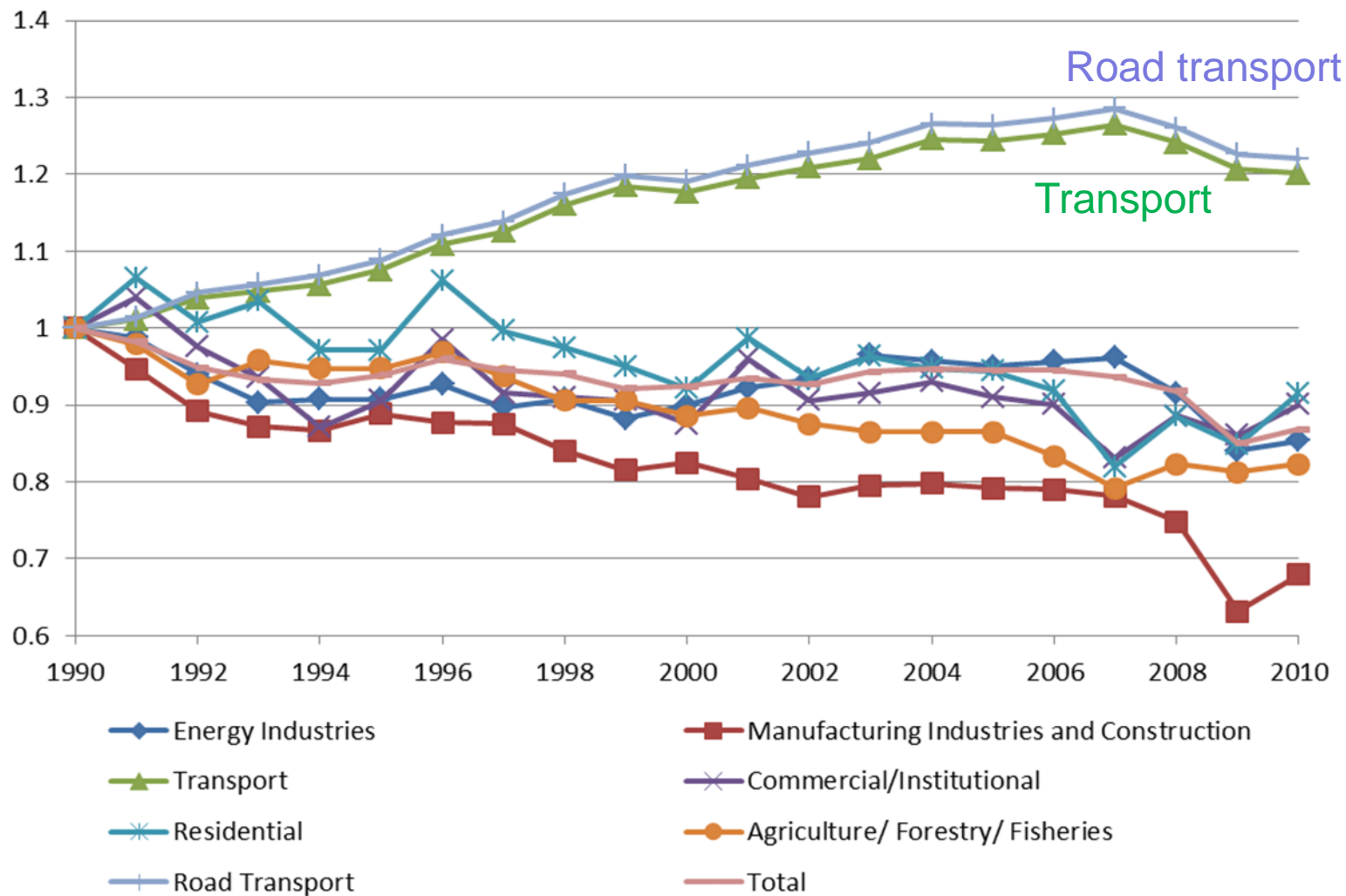


Very low roundtrip efficiency for electricity!

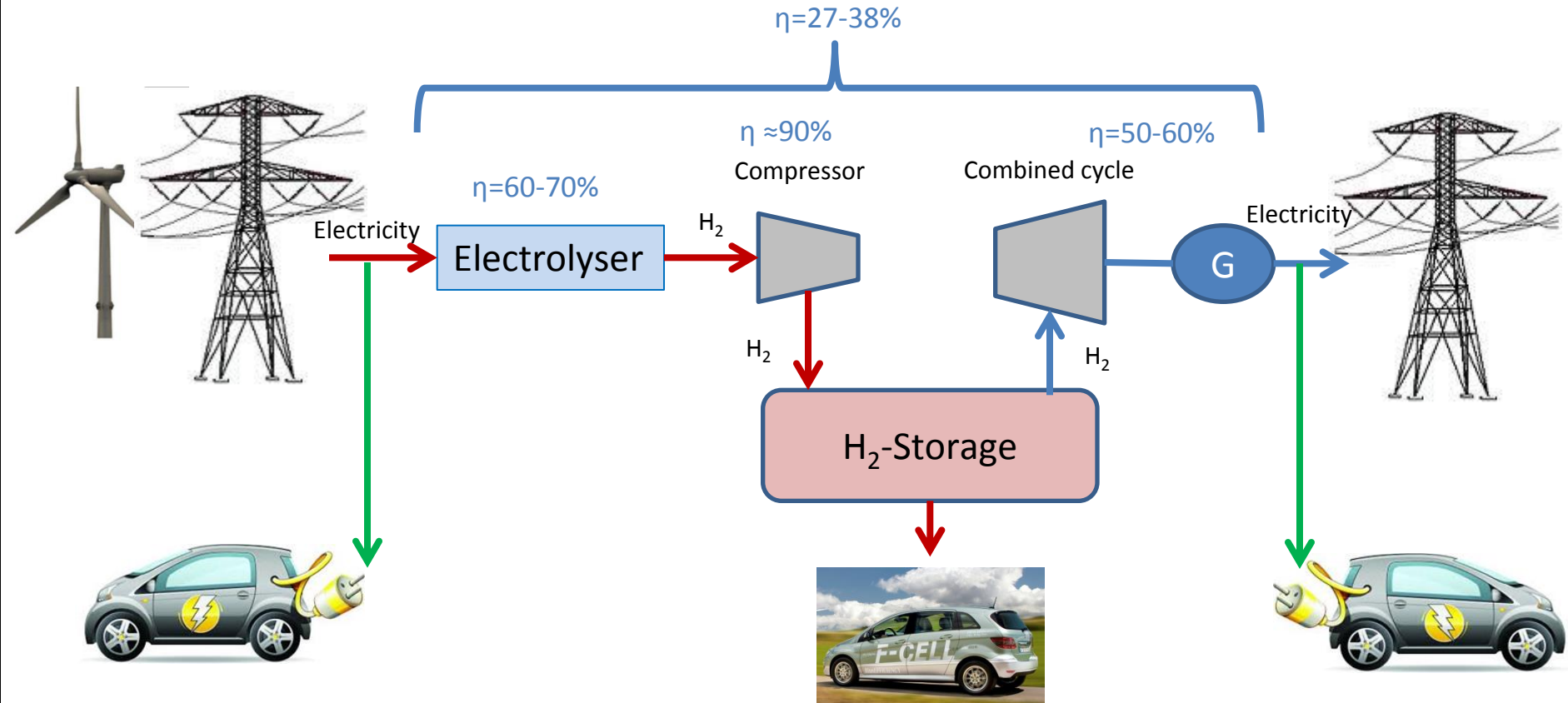


5. Using hydrogen and methane in transport

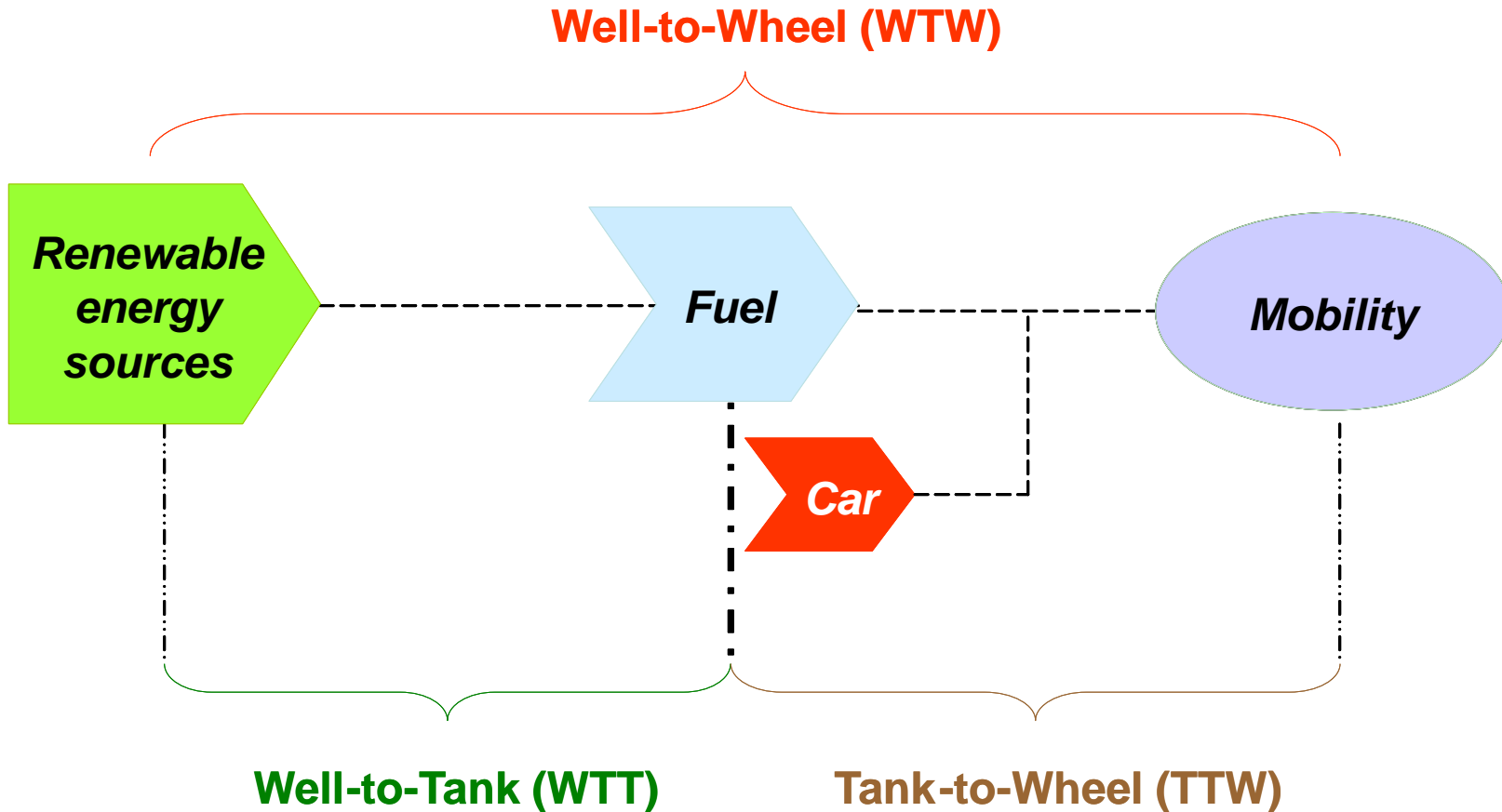
The problem of GHG emissions in transport



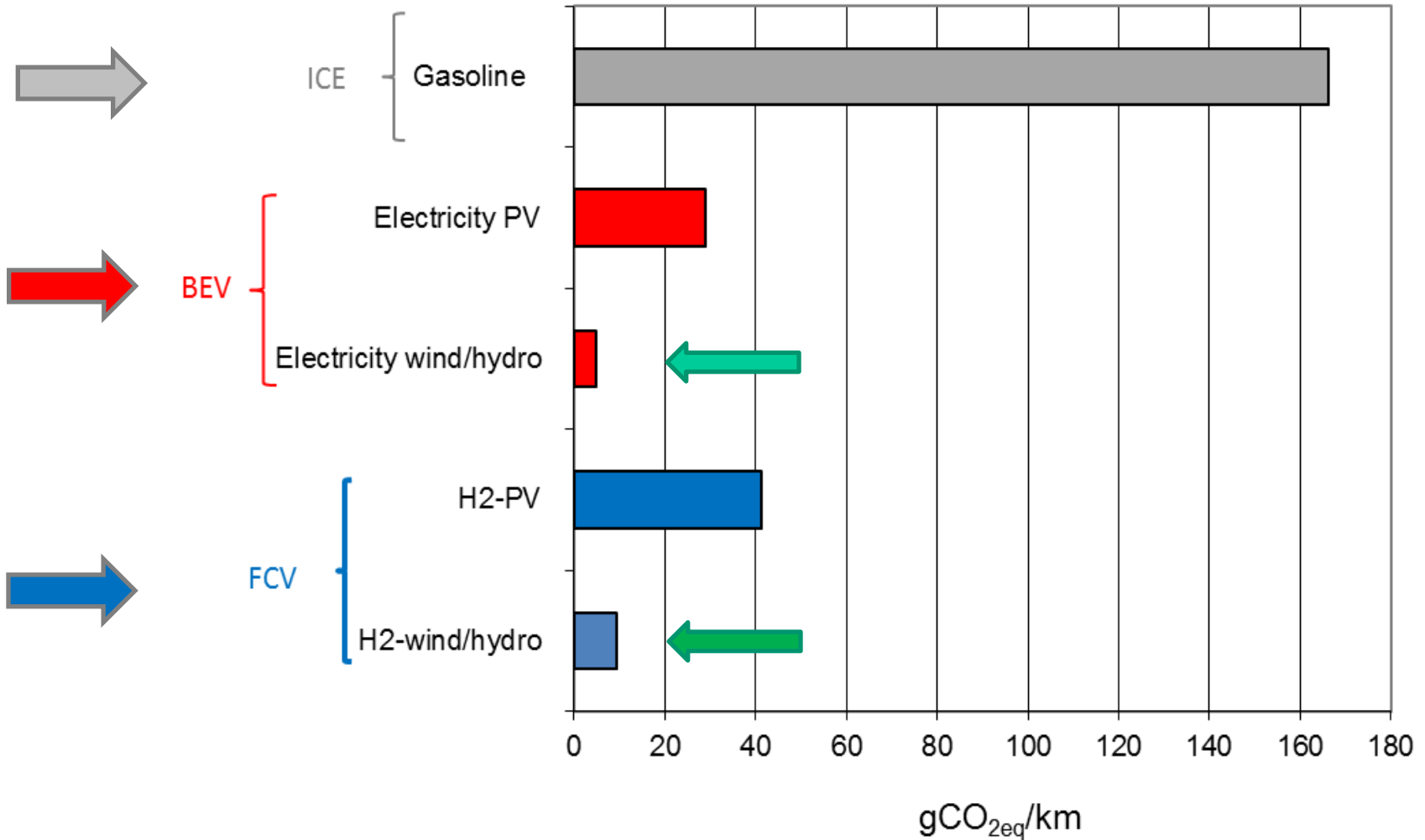
Hydrogen: storage and fuel

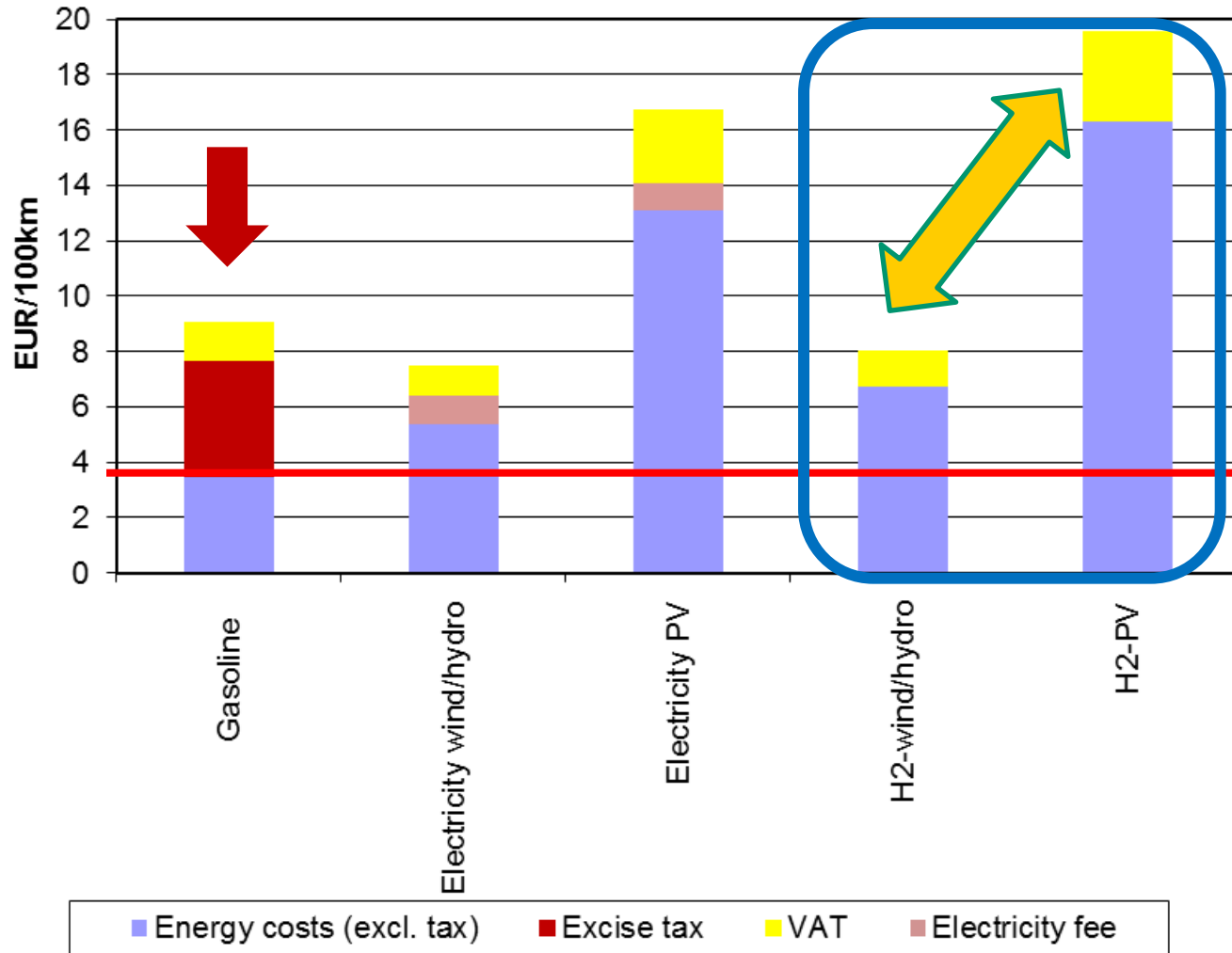


Energy supply chains: Storage and/or use of RES for mobility

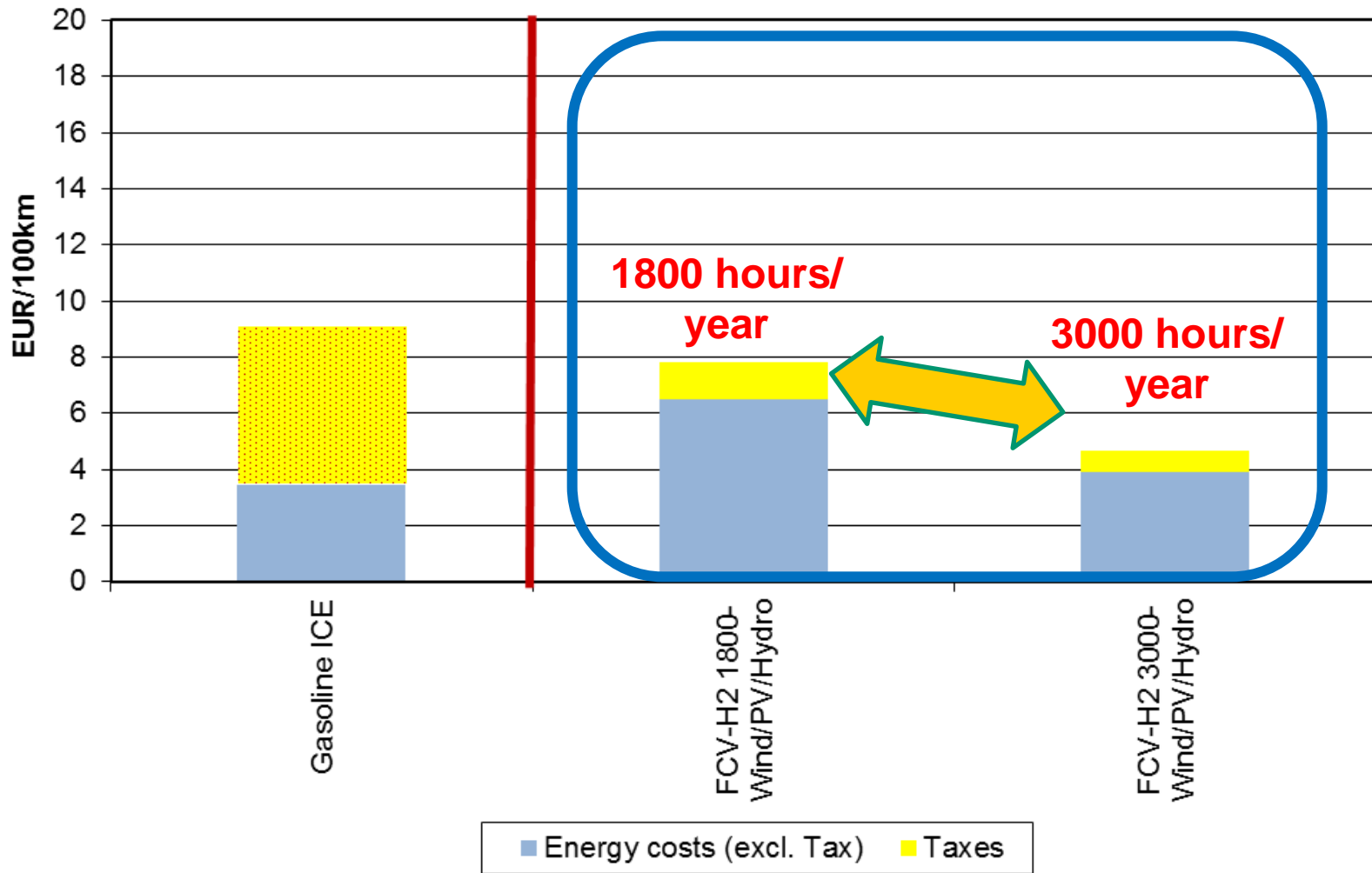


Environmental assessment: WTW GHG-emissions in 2010



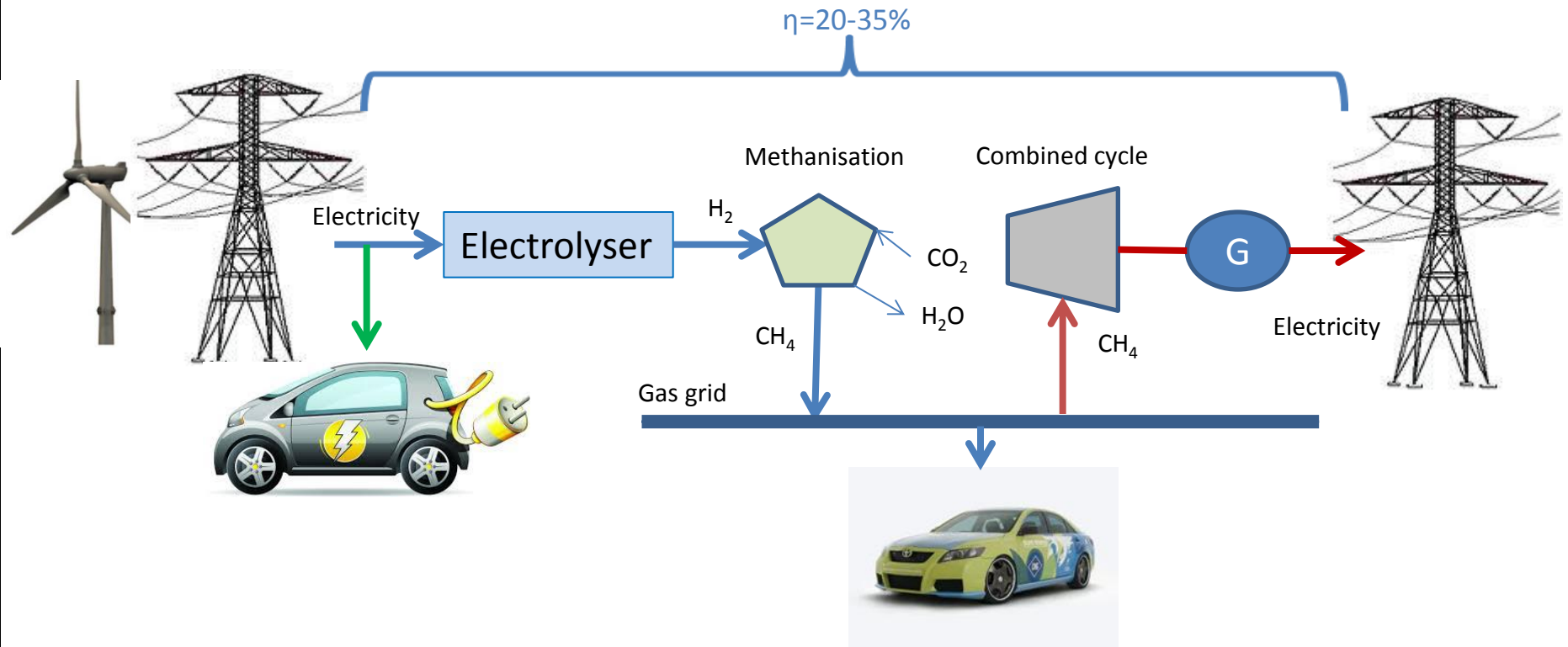


Energy costs of mobility per 100 km based on average of EU-15 countries in 2010

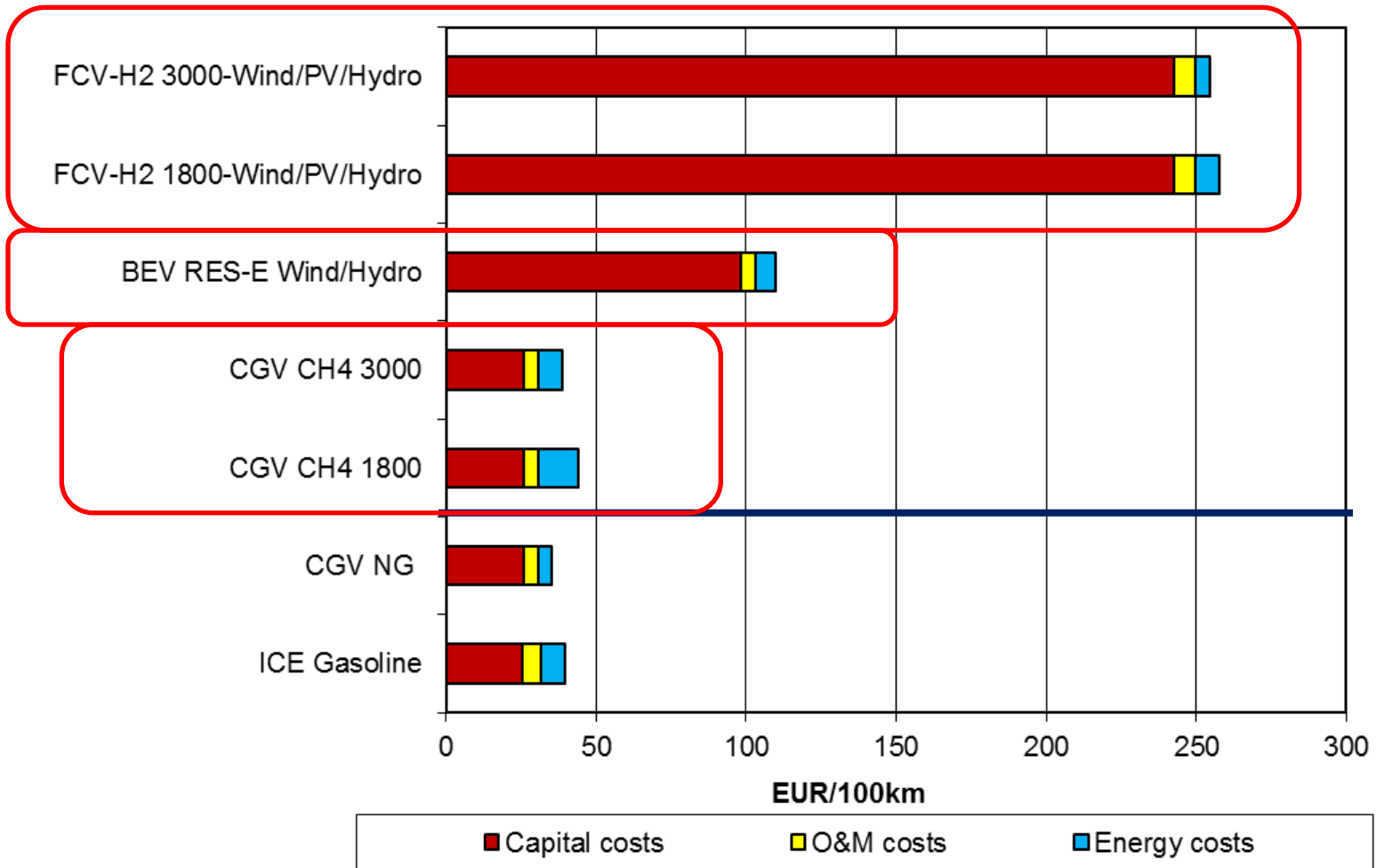


Based on average of EU-15 countries depending on full-load hours of the electrolysis for hydrogen production

Methanisation of hydrogen



Energy supply chains: Methane for mobility



Total specific costs per 100 km in 2010 depending on full-load hours of the electrolysis for hydrogen production

6. Conclusions

- 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 → ZEV
- Proper mix of policies, intensified R&D, and cost reduction

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