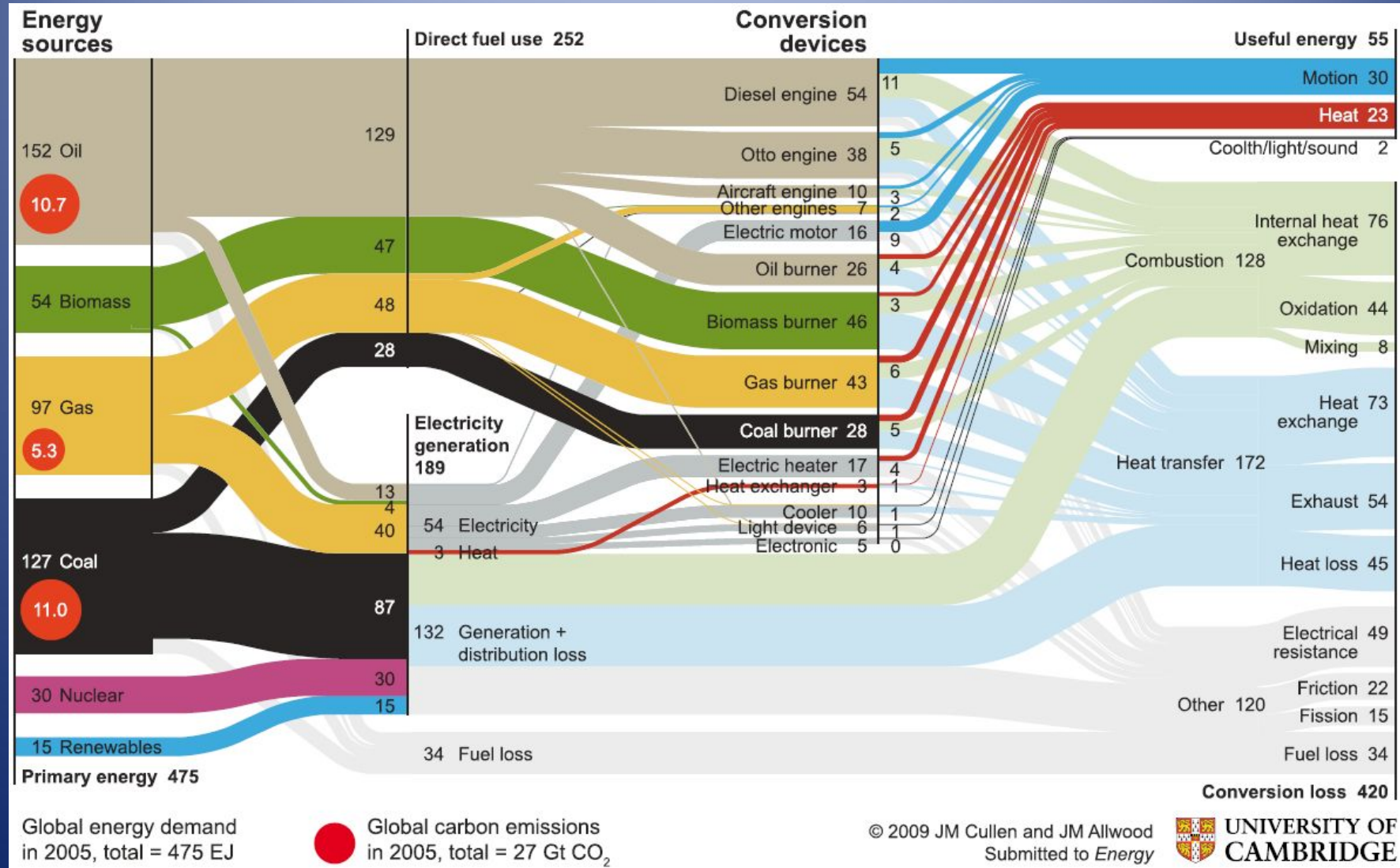


Technological Shift to a Low-Carbon Market

What will it look like –
and how to get there

Jørgen K. Kjems
Senior R&D Consultant
WEC Denmark Member Committee Chairman

ANNUAL GLOBAL FLOW OF ENERGY – we waste a lot

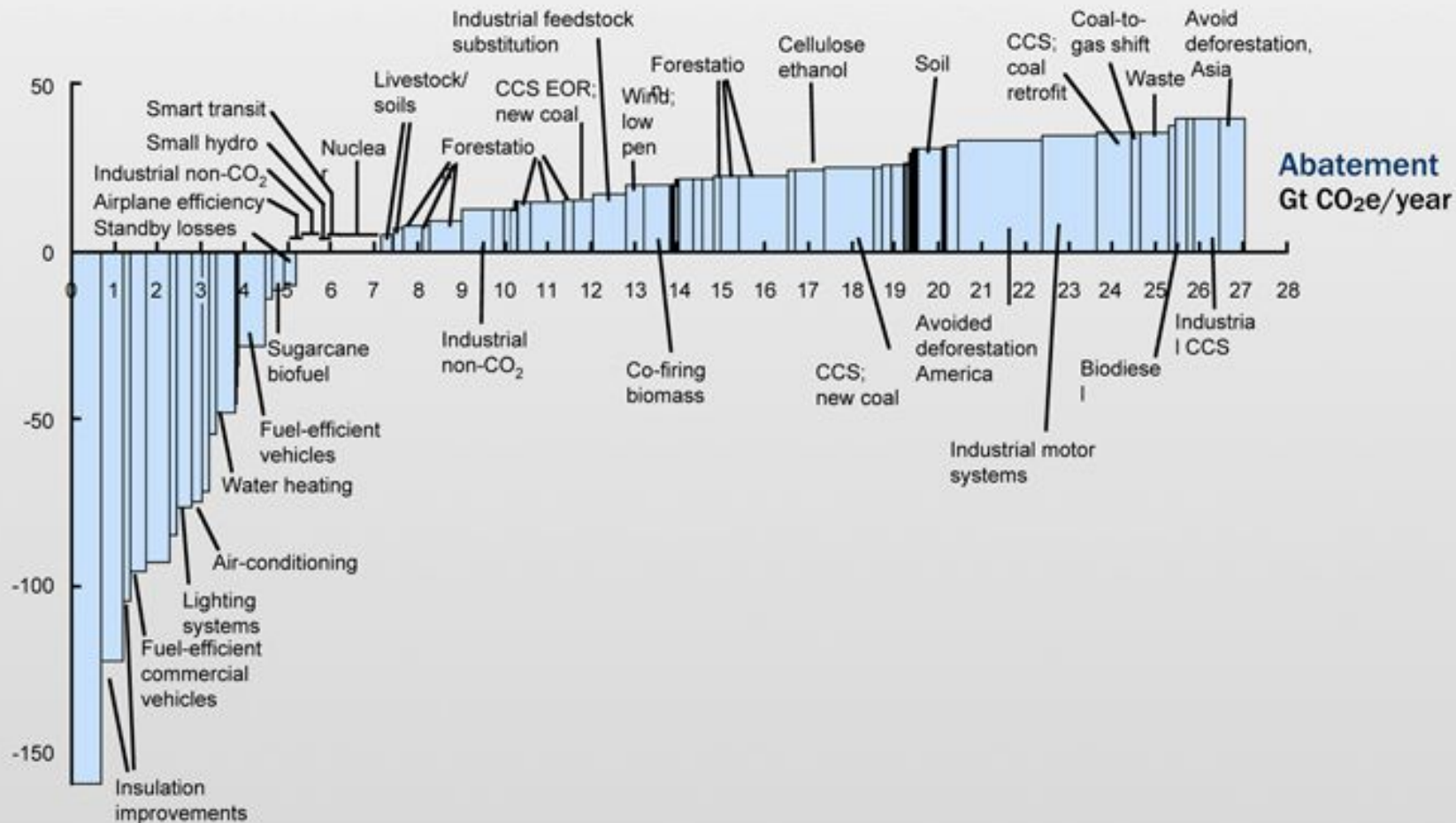


Source: J.M. Alwood and J.M. Cullen, University of Cambridge

Lots of opportunities for improvement – at a cost

THE COST CURVE PROVIDES A “MAP” OF ABATEMENT OPPORTUNITIES

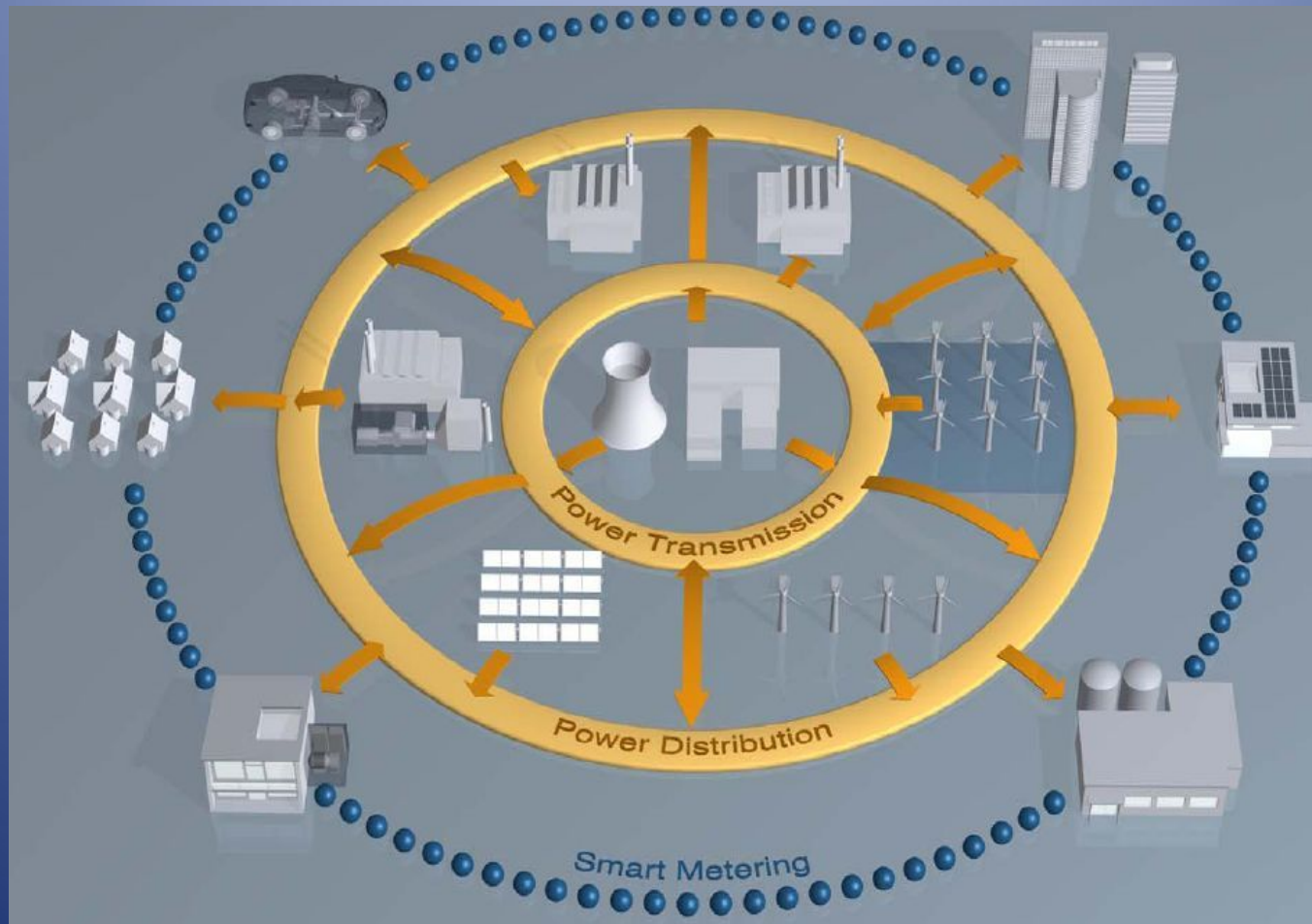
Cost of abatement, 2030, €/tCO₂e*



* Cubic feet of carbon equivalents.

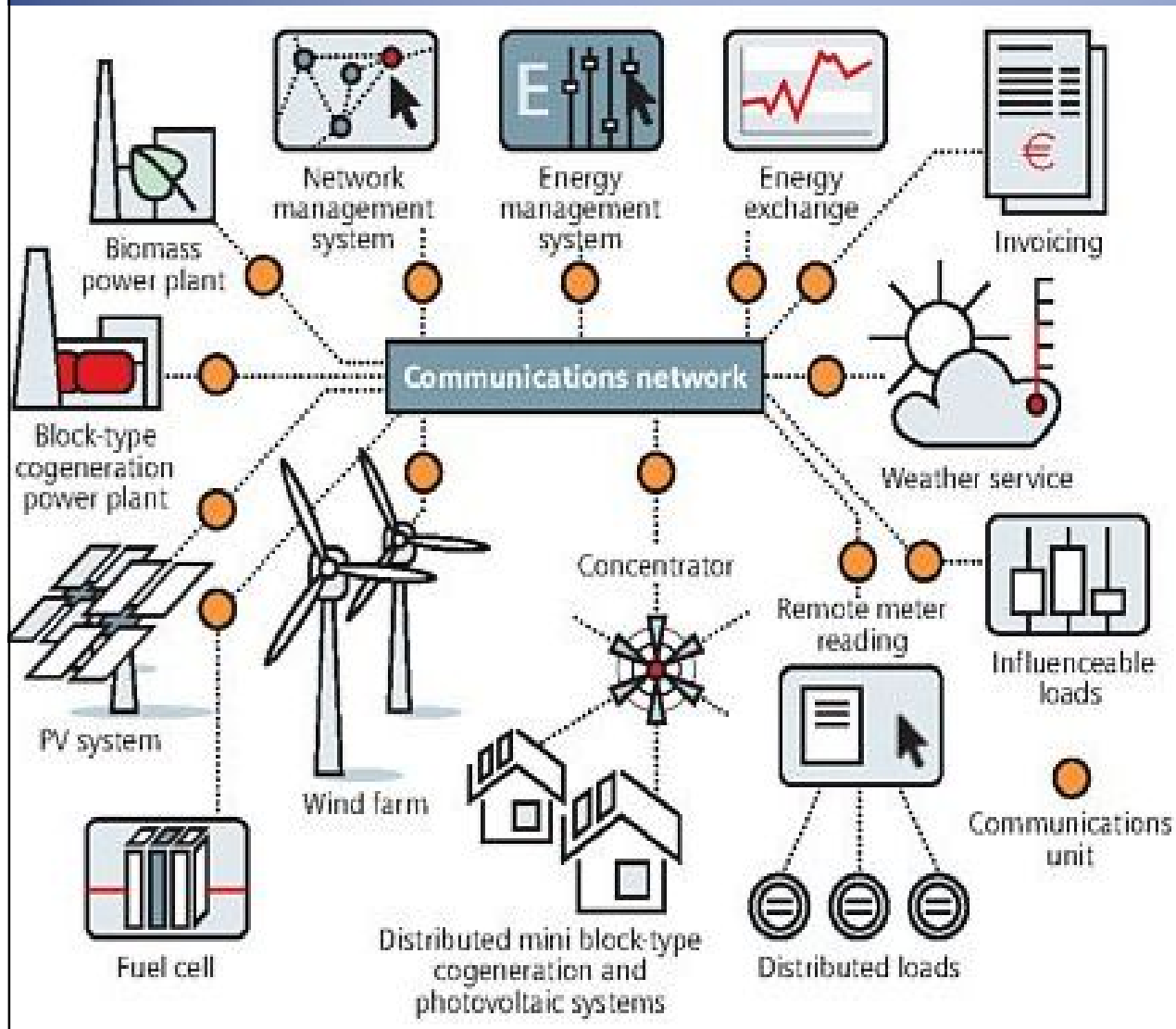
Source: McKinsey and Vattenfall analysis

Re-invention of a low-carbon energy system to increase efficiency and reduce cost



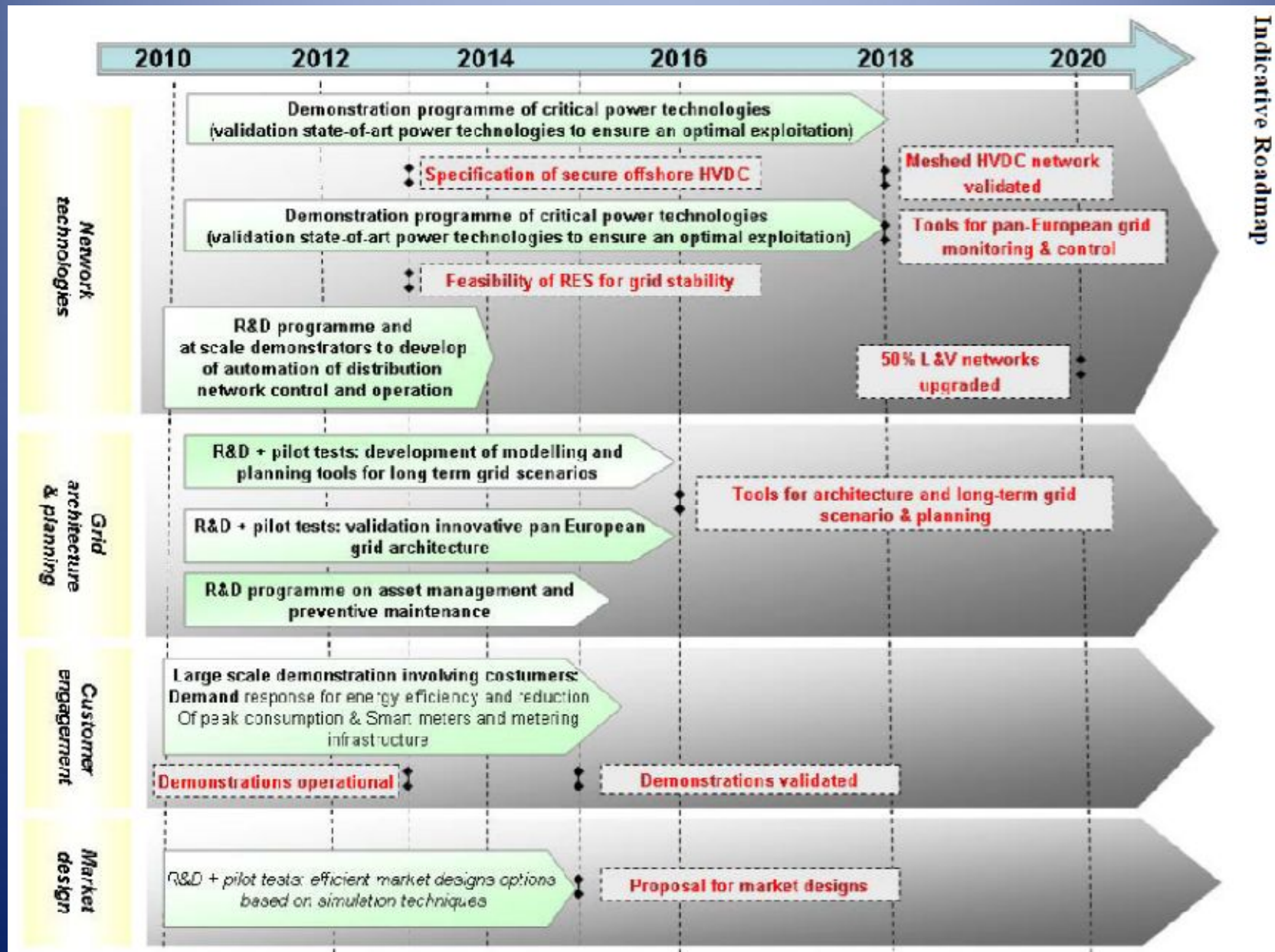
New electricity scenario – *Eldorado*

Communication over-layer

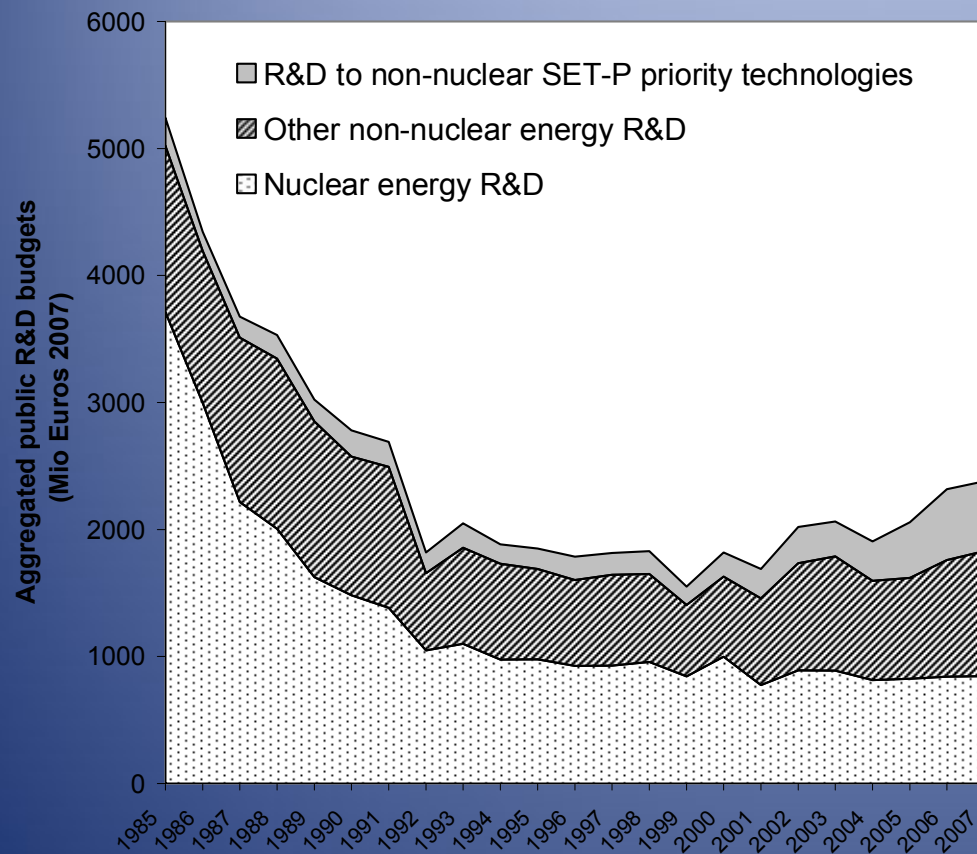


- Robust grids
- Renewables
- Decentralized
- Two way traffic
- New control systems
- New business models
- Shifting loads
- Storage
- Transport

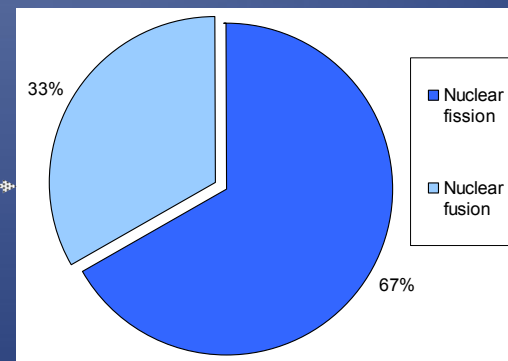
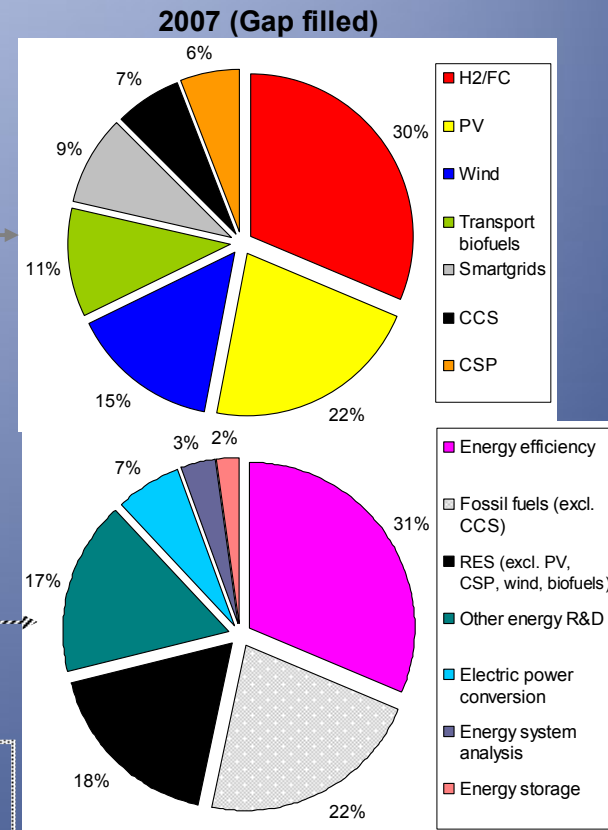
R&D boost needed, SET plan: Energy grid, roadmap



BUT: EU investment trends ...



Source data: IEA



Conclusion:

Prospect to get a global price on carbon emissions are dim . Other drivers are needed for the low-carbon technology roll-out:

- **investment goals for low carbon technologies**
- **goals for energy intensity in national economies**
- **goals for renewable energy learning curves**
(price reduction as volumes grow)

This would spur and give better guidance to **different R&DDD instruments and different roll-out policies for different technologies**

BUT: Time is of essence and we need the transition to a sustainable society for our grand children.