Electricity generation without nuclear and coal in Germany and the EU:

Climate friendly, secure, affordable

Dr. Christian Hey

Sachverständigenrat für Umweltfragen, Berlin

The German Advisory Council on the Environment:

40 years of independent scientific policy advice

- independent, inter-disciplinary scientific council nominated by the Federal Cabinet
- 7 professors, natural science, engineering, economics, law, political science
- Broad mandate to provide early warning of negative trends and new ideas for furthering environmental policy and inform the wider public
- SRU is an active member of the European Environment and Sustainable Development Advisory Councils (EEAC)

Overview

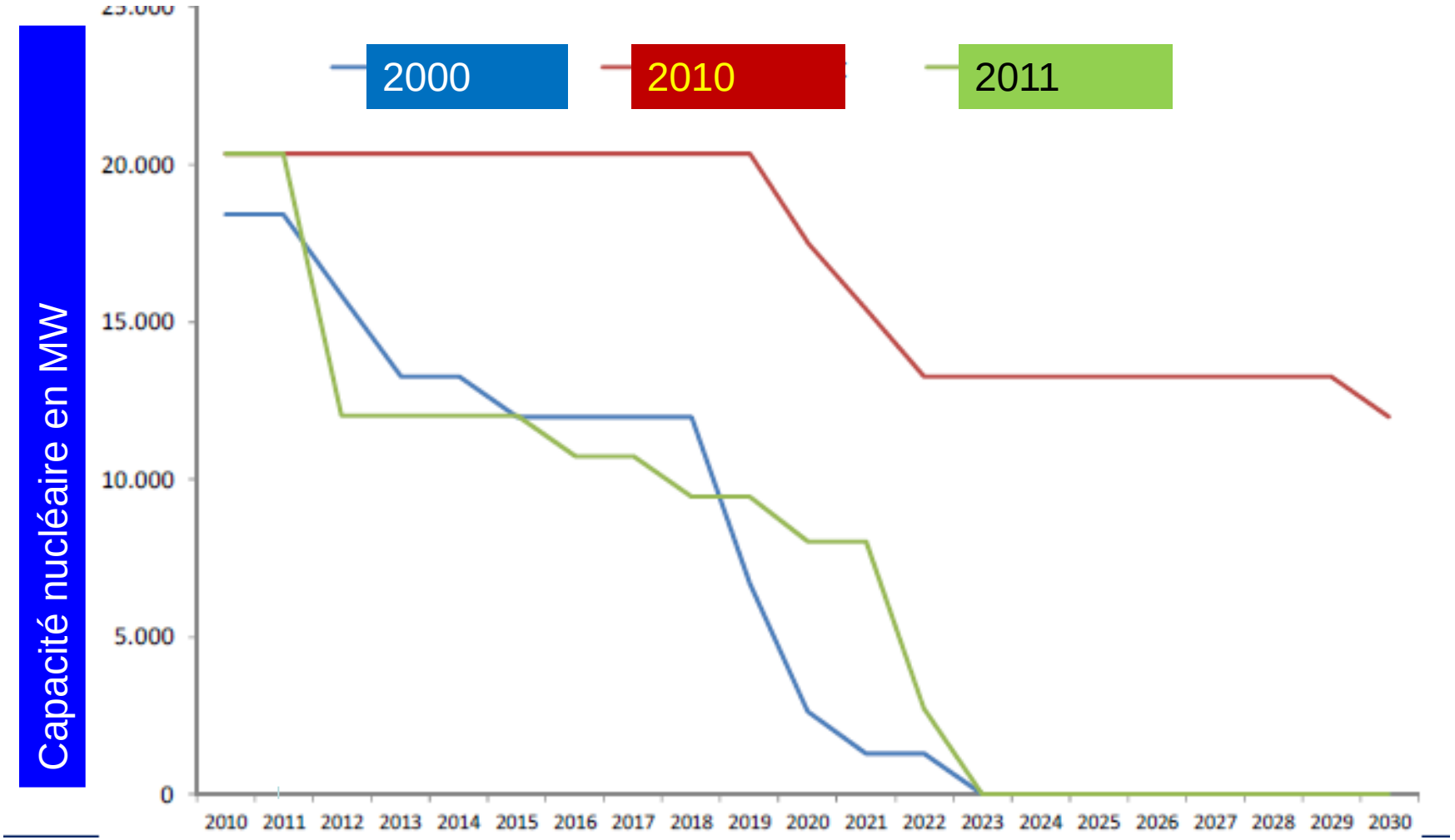
- **The "Energiewende": a role model?**
- **Perspective 2050: 100% renewable electricity: possible, safe and affordable – insights from scenario analysis**
- **The “reality”: Main issues in the national debate**
- **EU Dimension: a bottom-up strategy**

The « Energiewende»:Targets for 2050

Germany's main energy policy goals

	Climate	Renewable Energy		Efficiency				
	Greenhouse Gas Emissions (vs. 1990)	Share Elec-tricity	Share total	Primary Energy	Elec-tricity	Energy productivity	Transport	Heat Demand in Buildings
2020	- 40 %	35%	18%	- 20%	-10%	Increase by 2.1% per year compared to final energy consump-tion	-10 %	Reduc-tions of 20% by 2020, while primary energy demand is to fall by 80% by 2050
2030	- 55 %	50%	30%	▼	▼			
2040	- 70 %	65%	45%					
2050	- 80-95 %	80%	60%	- 50%	-25%		- 40 %	

The « Energiewende»:Nuclear Phase-out 2011

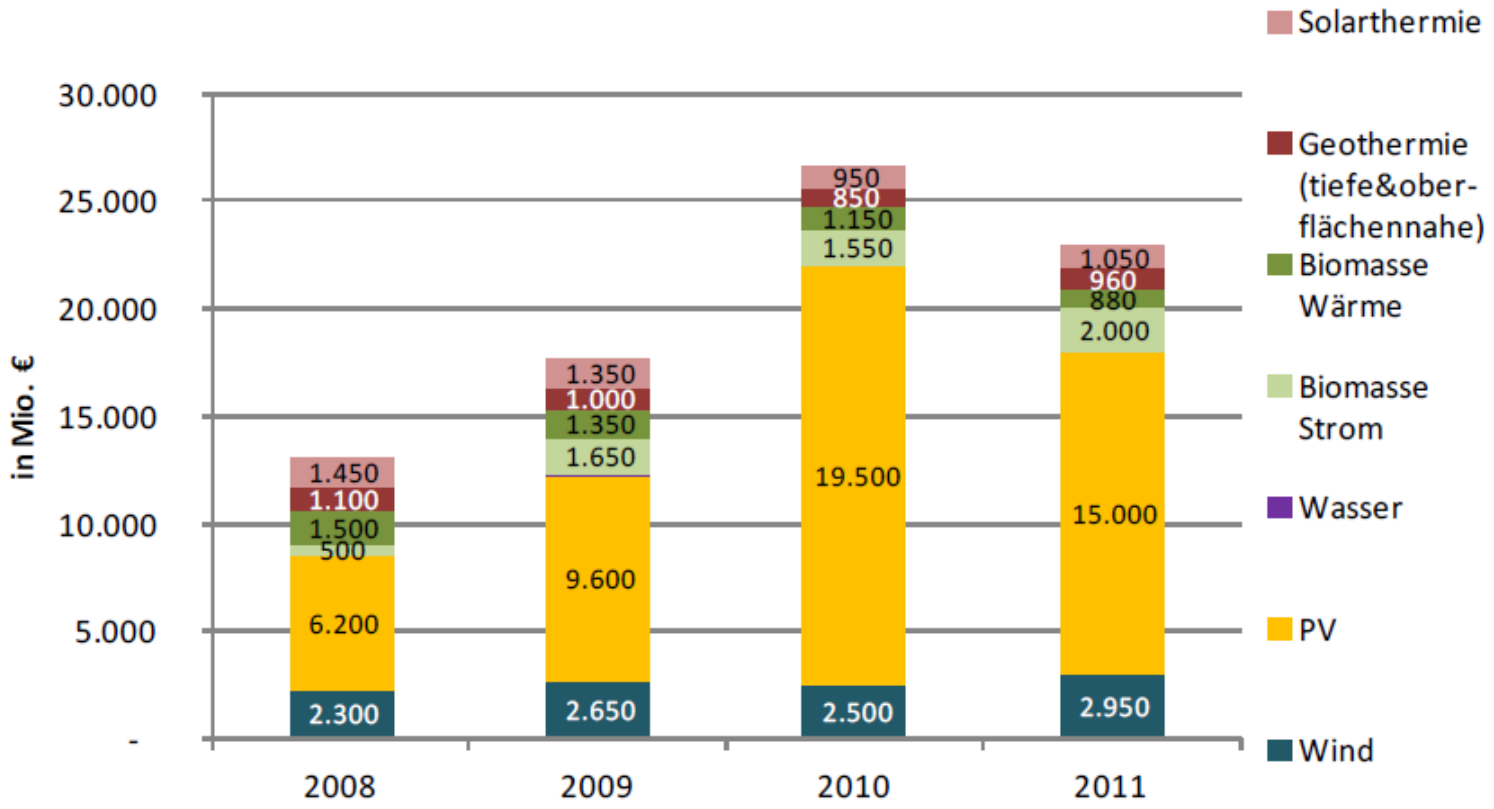


Key Benefits of the "Energiewende"

- Decarbonization
- Less Import Dependency
- Green Growth (Investment, Employment)
- Technological Innovation
- Political Consensus
- Global Role Model

381 000 Jobs by RES Investment of 20 Bill. € in 2011

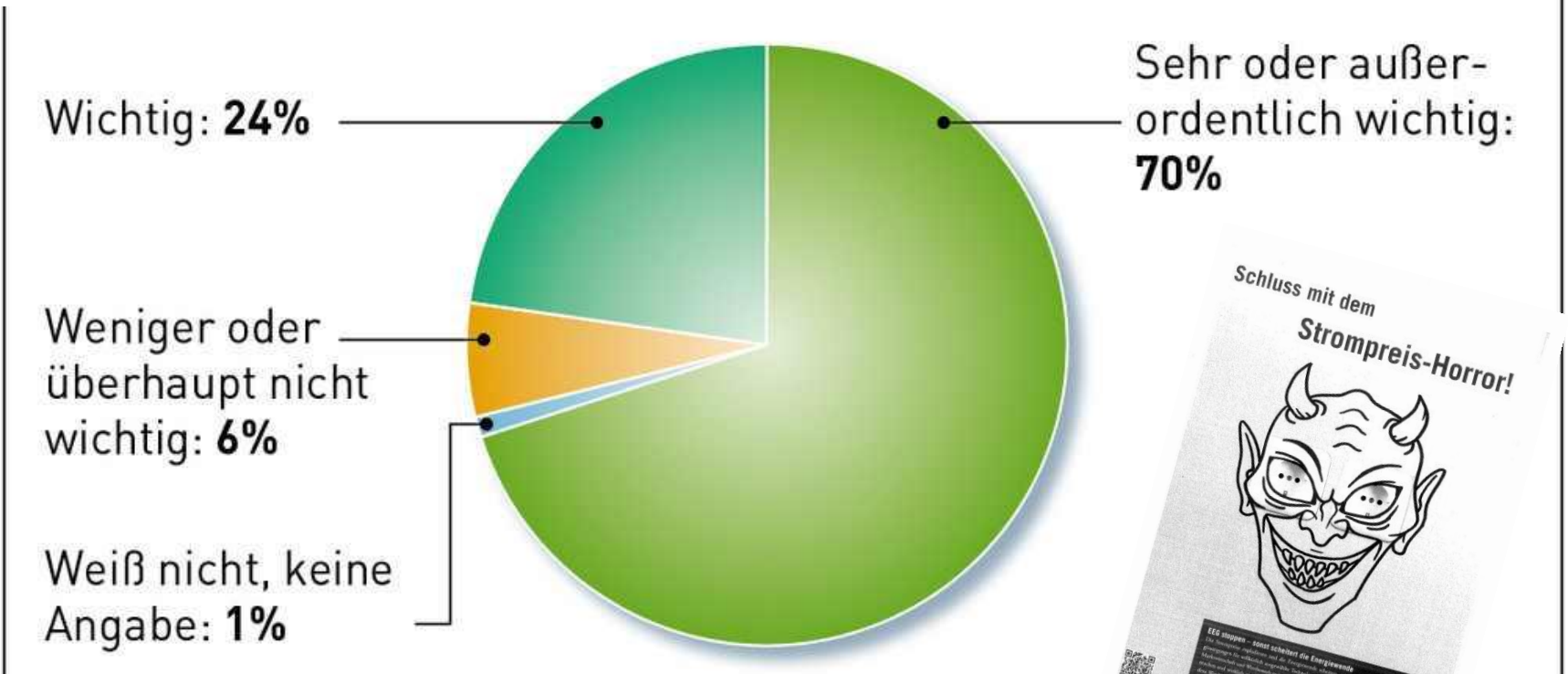
Investment in RES (Heat and Electricity) in Mio.€



FH-ISI, 2012

A Broad Societal Consensus

93% of Germans support RES Growth



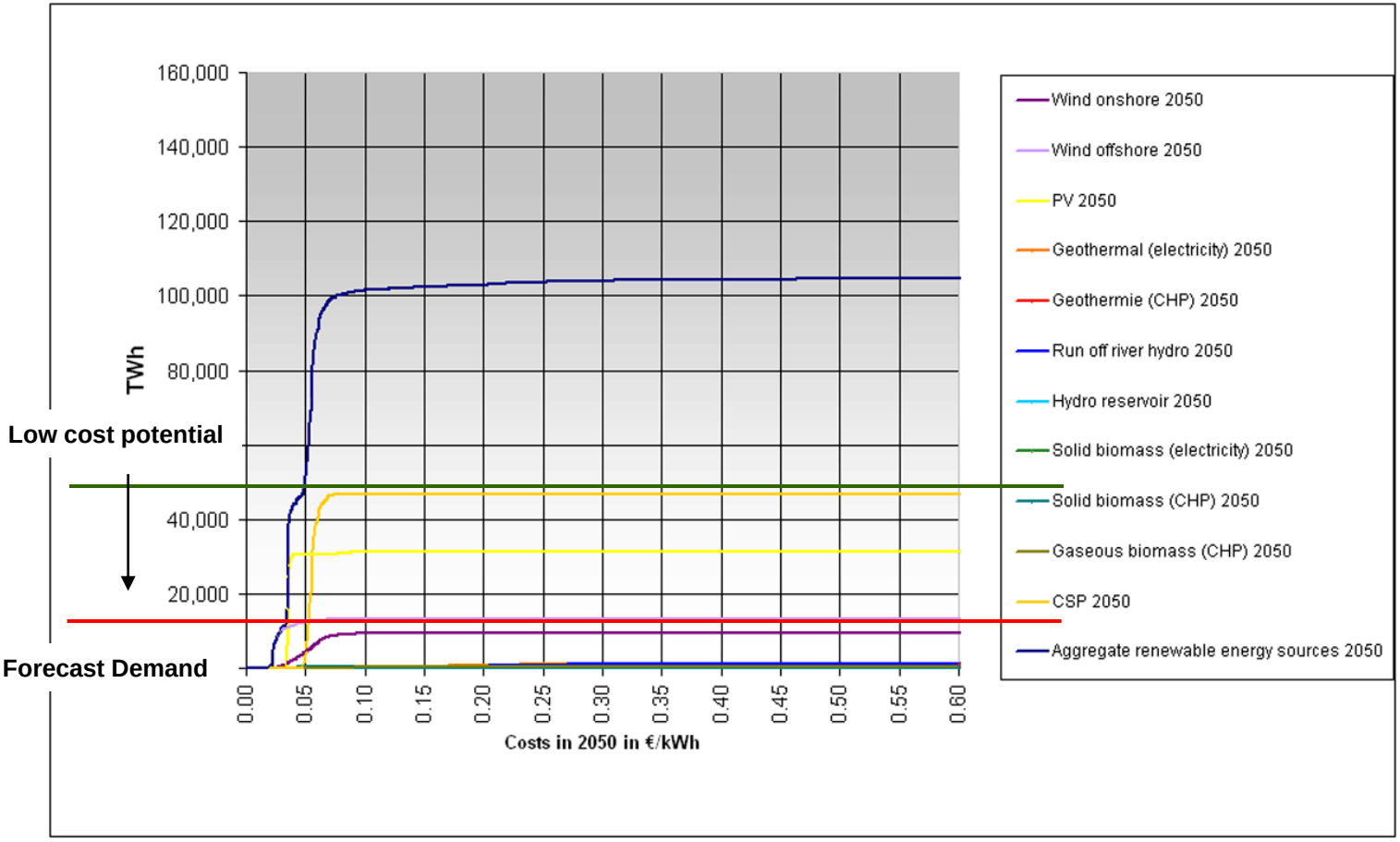
Quelle: Umfrage von TNS Infratest 2012, 3.798 Befragte, im Auftrag der Agentur für Erneuerbare Energien. Stand: 10/2012

2050: Key Scenario Results

- 100% renewable electricity is achievable by 2050
- Security of supply can be assured at a competitive cost
- Initial higher costs (compared to conventional energies) is an investment in the transition to a least cost solution
- (Offshore) wind energy will be the most important single and least cost source
- Efficiency reduces cost
- EU cooperation is crucial for balancing supply and demand
- An energy transition without new coal plants or extended nuclear running is possible
- There is enough flexible conventional power for residual load during the transition

100%-Renewable Electricity is realistic I

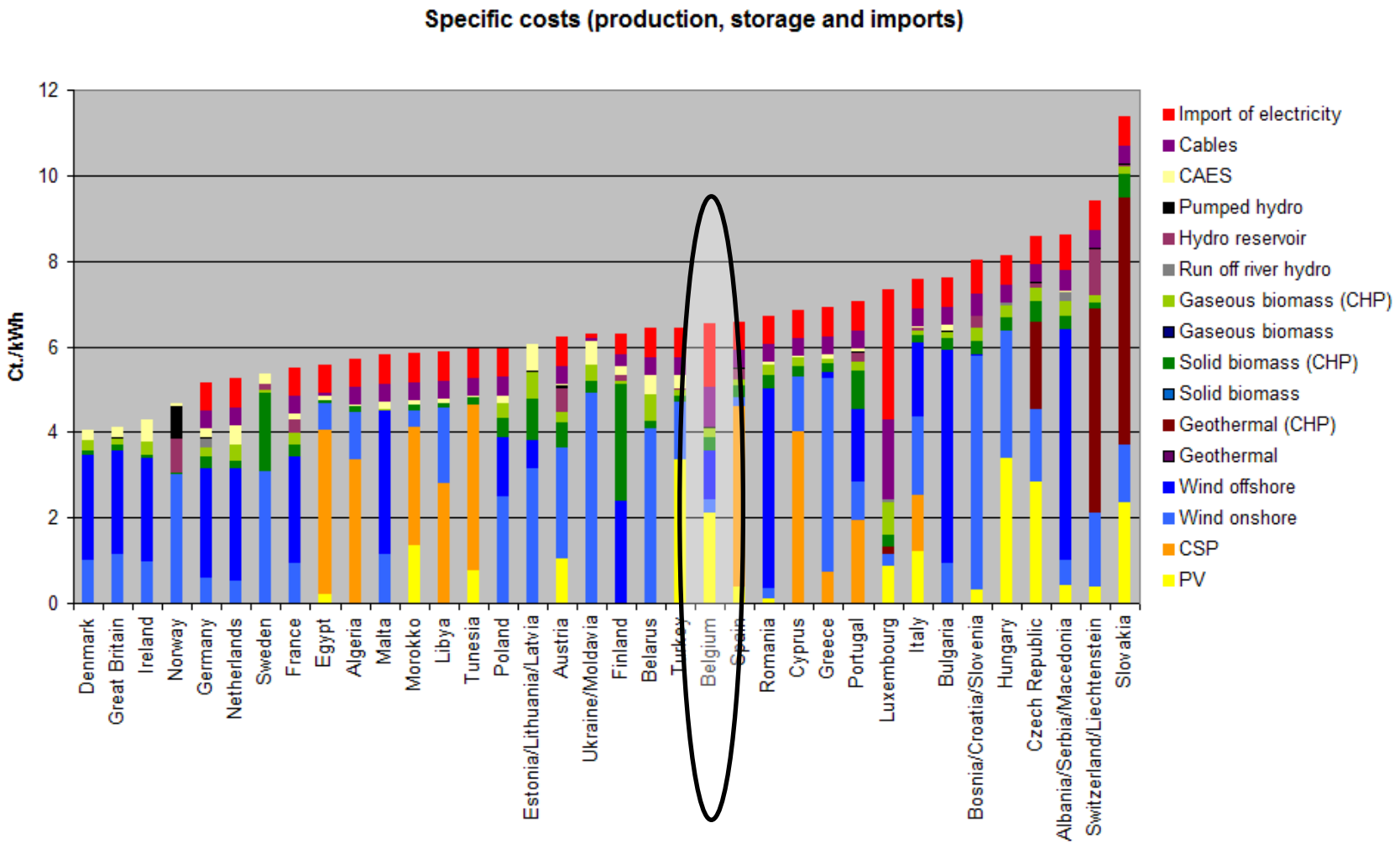
Low cost potential in Europe is factor 8-10x forecasted demand



100% is affordable

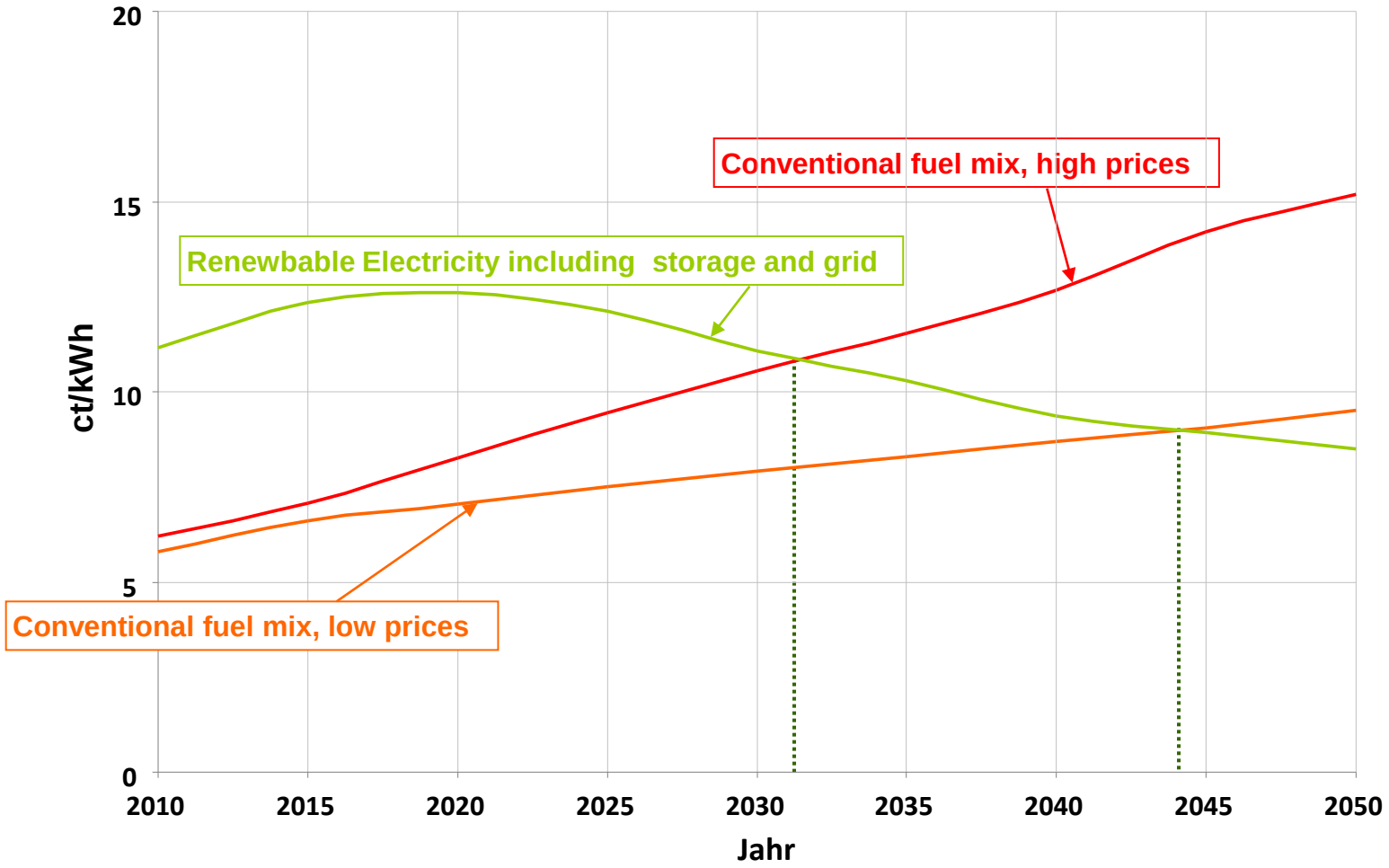
Scenario 3.a

Production, storage and import costs in EUNA countries in 2050 in c/kWh



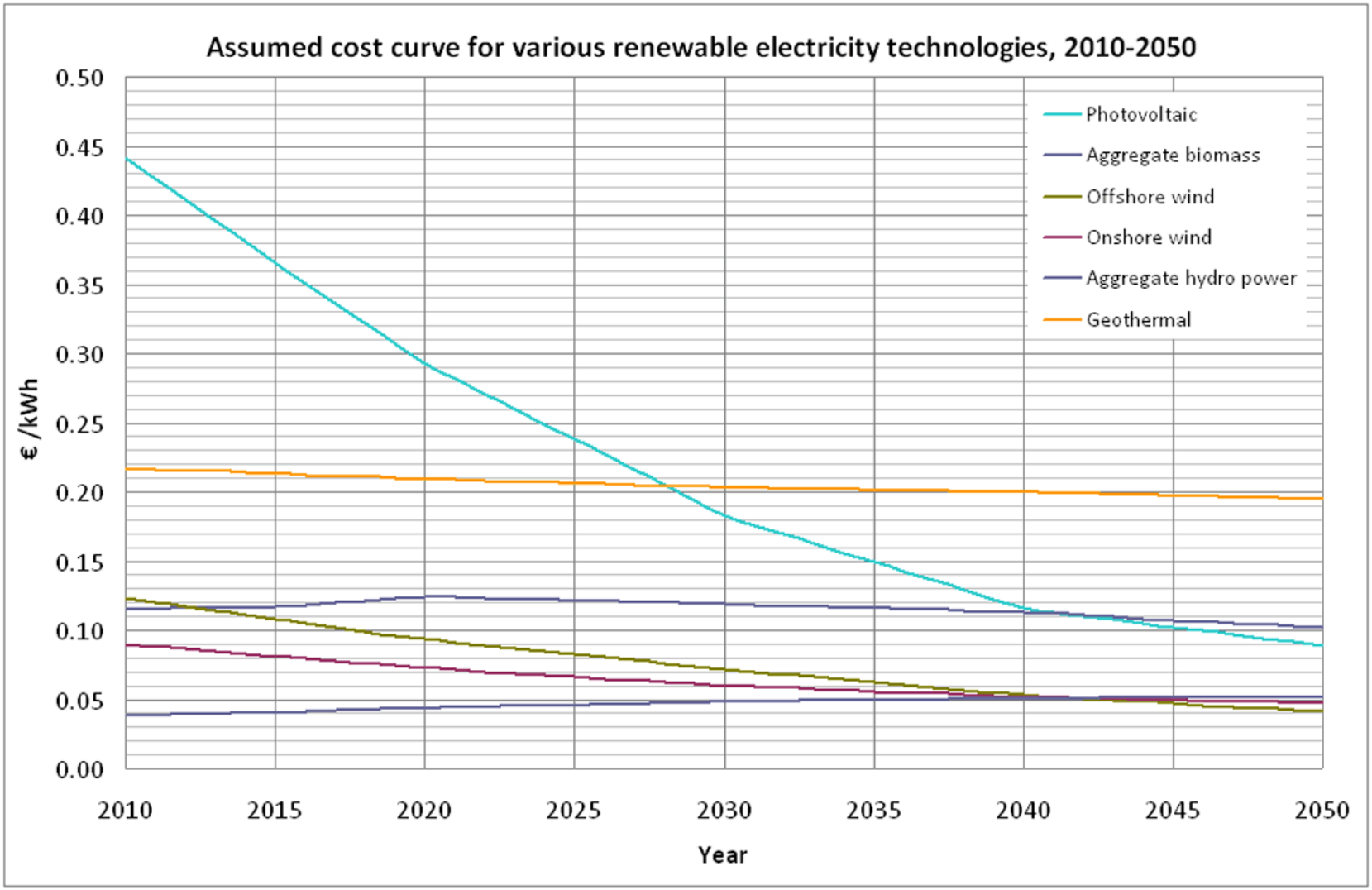
In the long run renewable electricity is cheaper ...

but higher investment during transition is needed

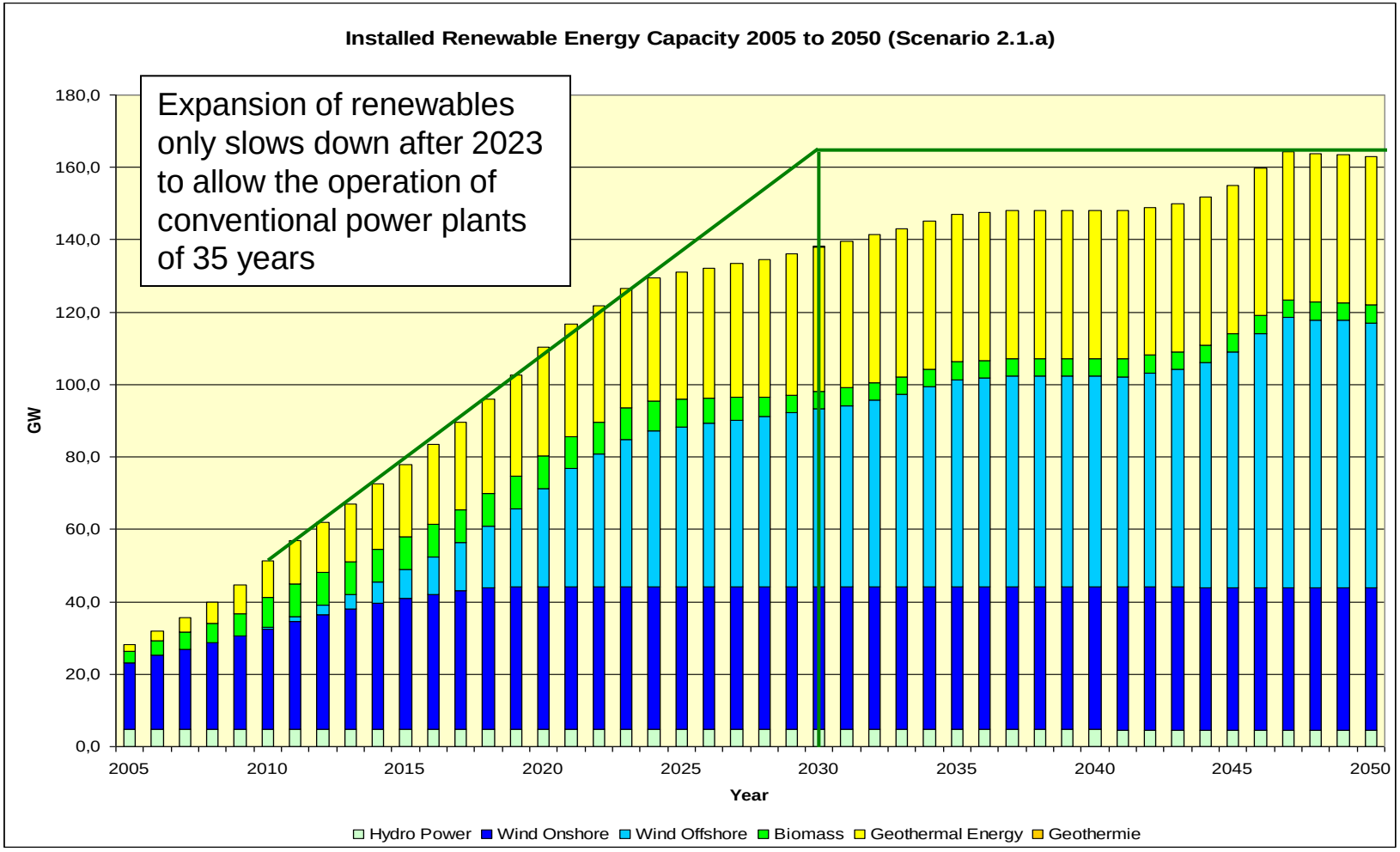


Key model assumption: Learning Cost Curves

In the middle range of literature



A smooth transition can be realized for Germany

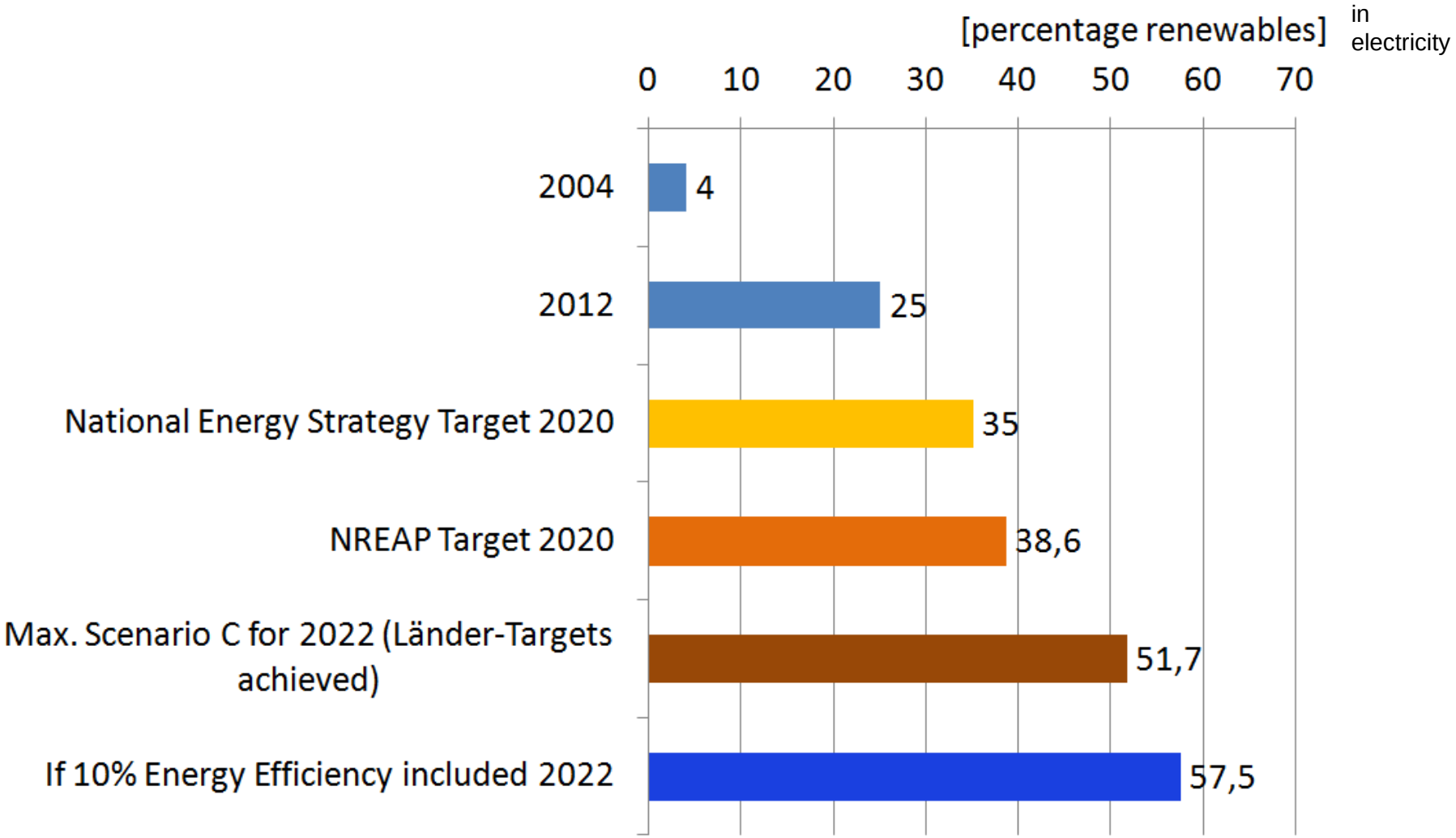


The Reality: Main Actual Issues in Debate

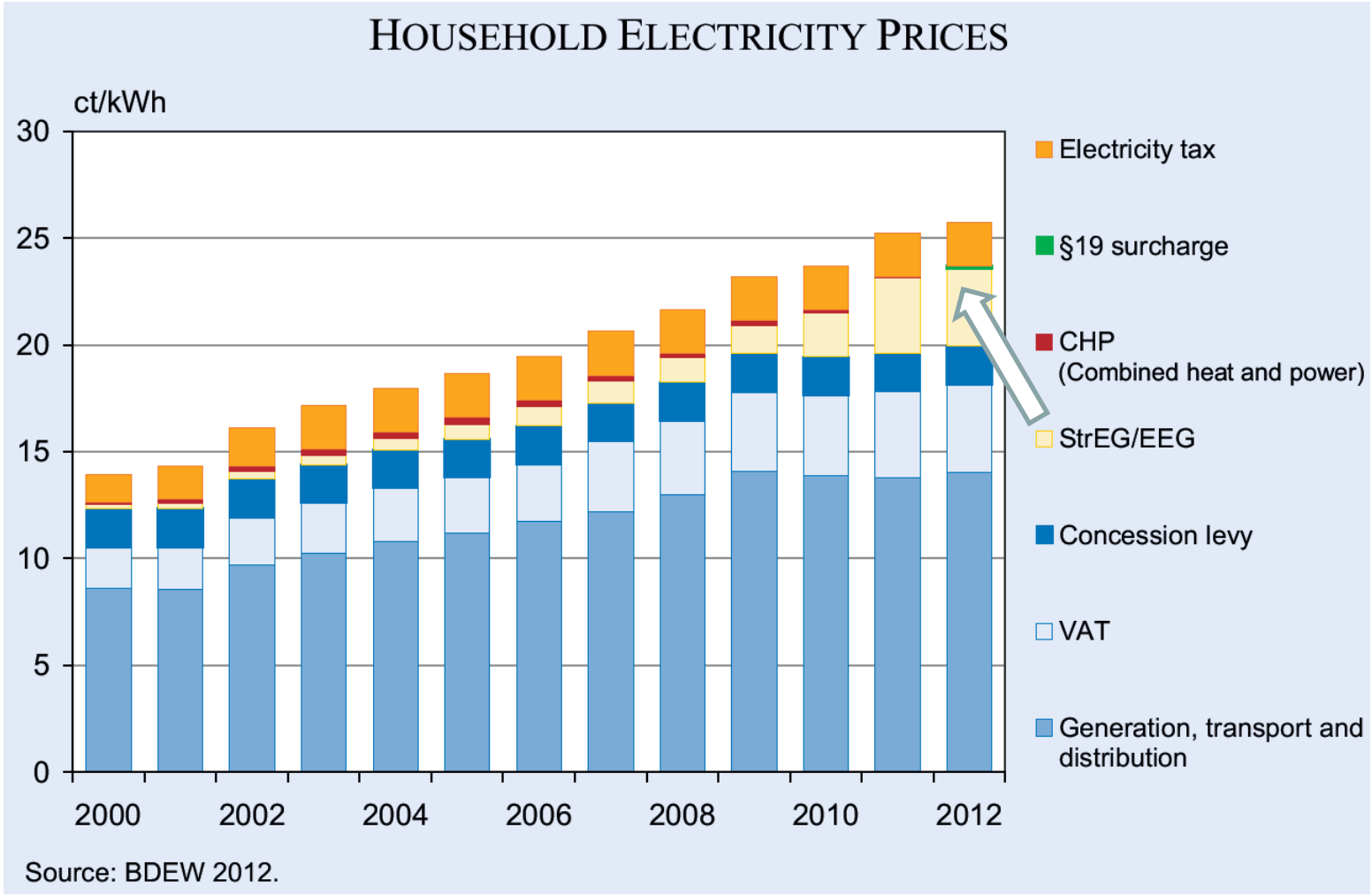
- **Too rapid renewables growth?**
- **Cost out of control?**
- **Too slow grid development?**
- **Declining profitability of conventional residual power**
- **Security of electricity supply**
- **System Coordination: Supply, Demand, Storage, Grids**

Too rapid growth of Renewables?

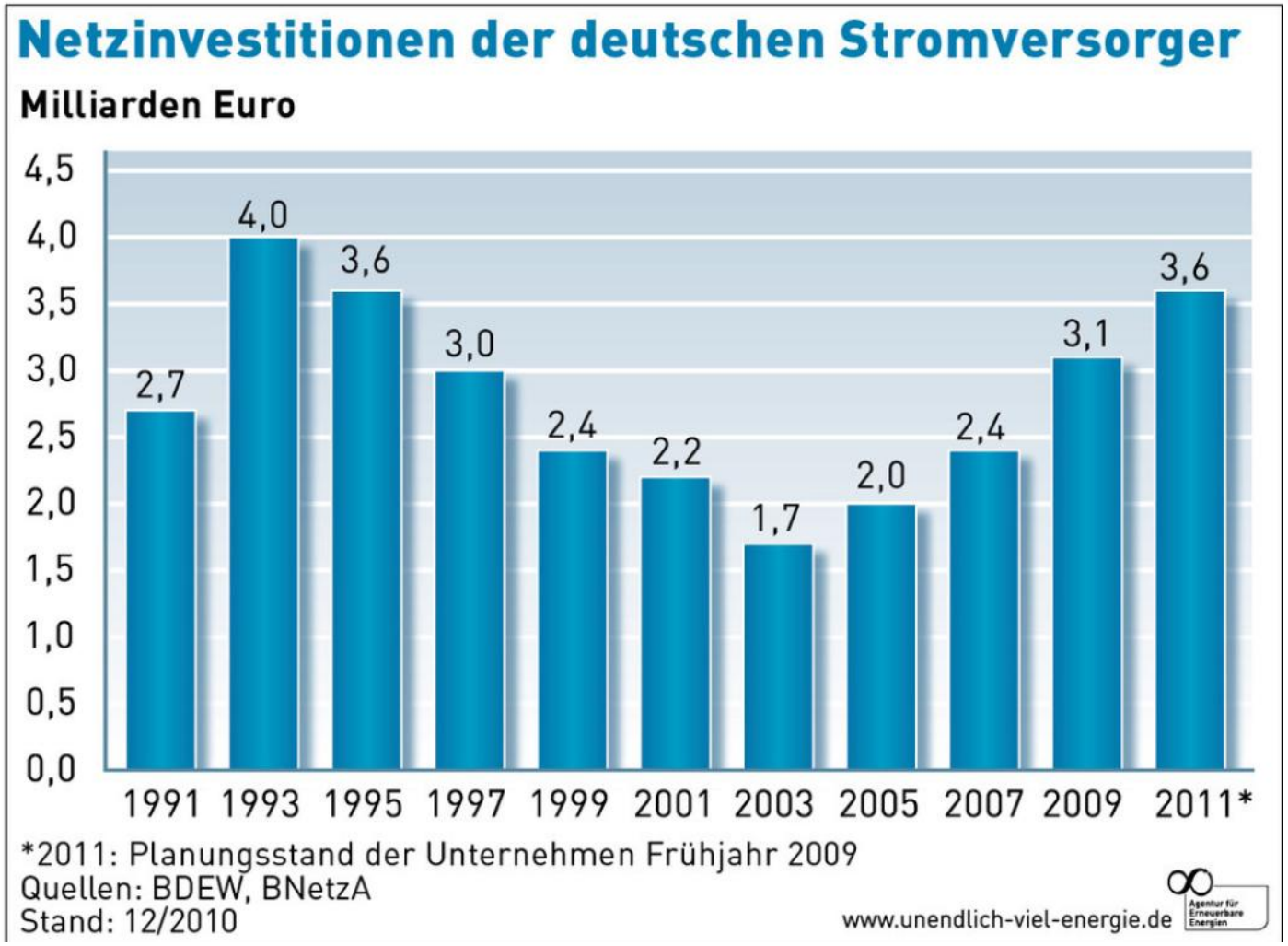
Trends and Forecasts for 2020/2022



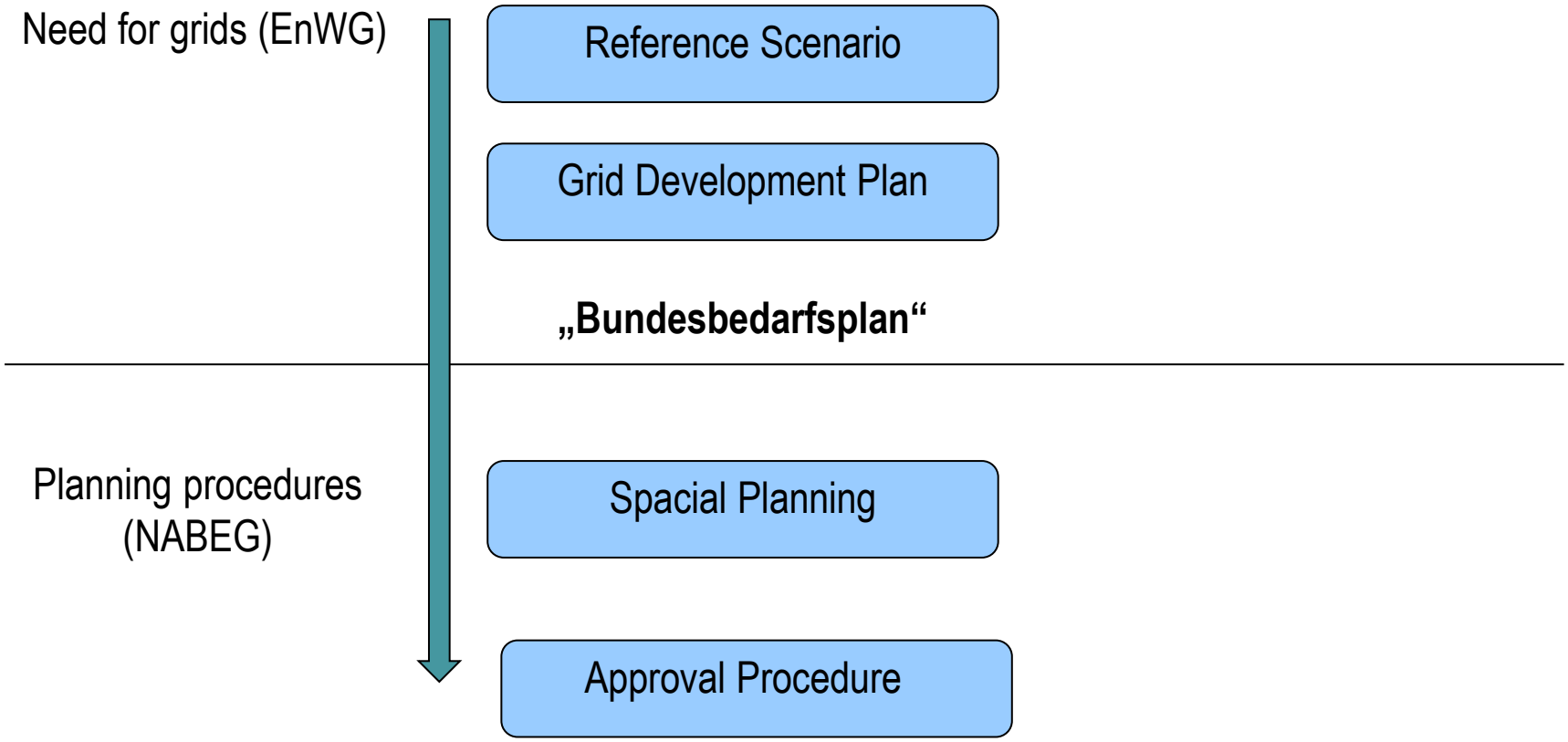
Renewables or fossil fuels as Cost Driver?



Backlog in Grid Investment



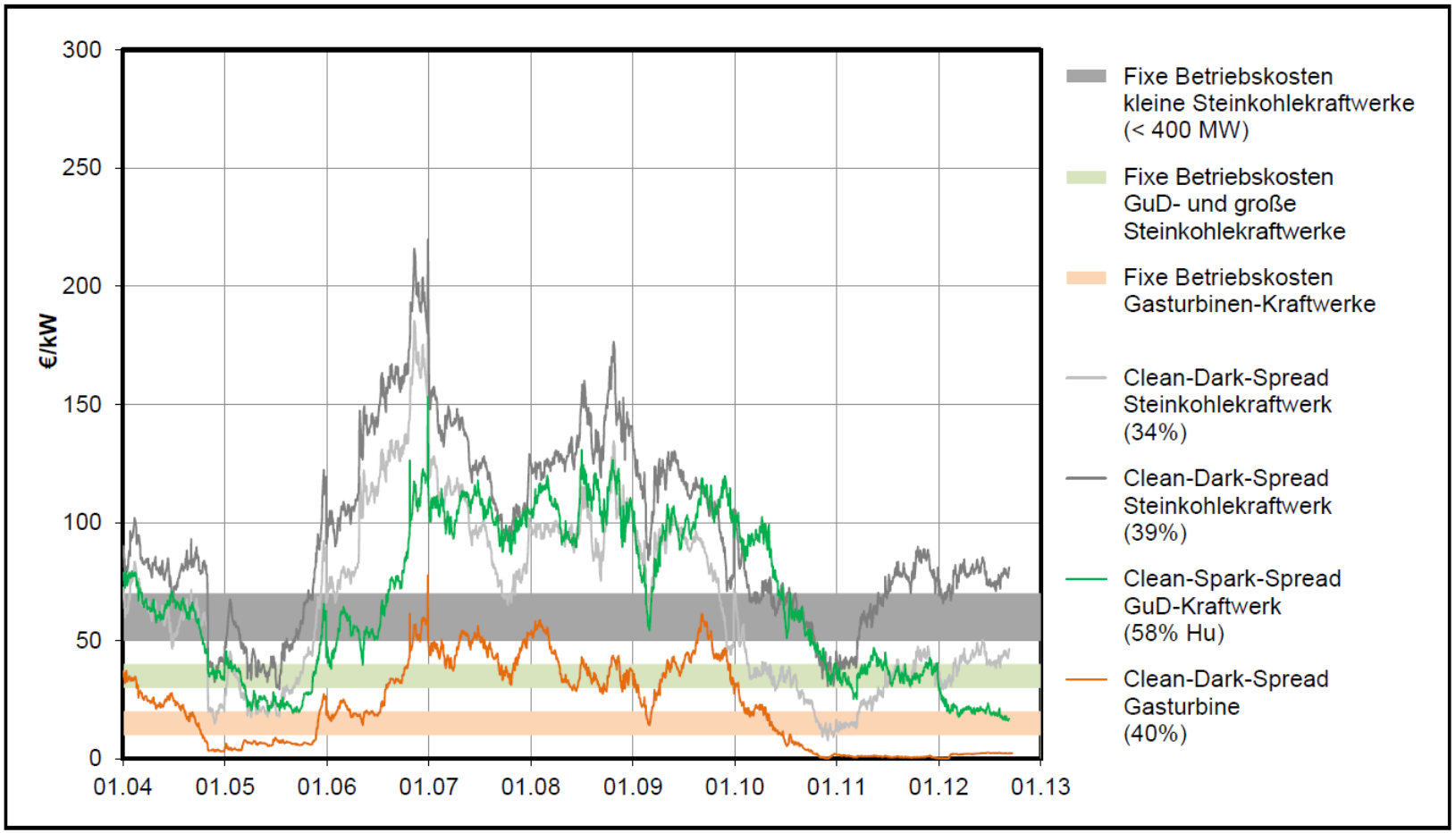
Early and continuous public participation



K. Rottmann, Germanwatch, 2012

Existing Conventional Power at risk

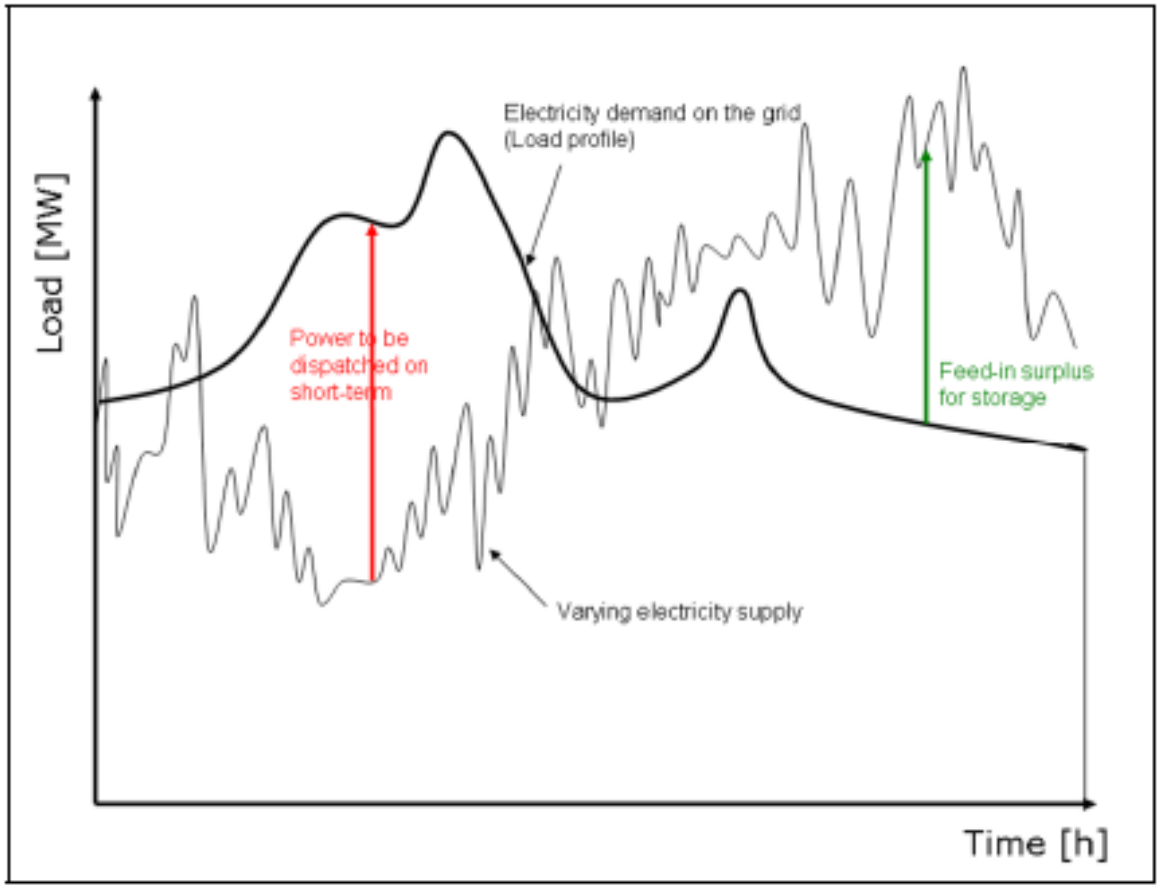
Abbildung 3 Entwicklung der Deckungsbeiträge auf die fixen Betriebskosten für Bestandskraftwerke seit Januar 2004



Quelle: EEX, Reuters, LBD-Analysen (Stand: 10.09.2012)

Intermittency as challenge

Meeting daily electricity demand in an electricity system with a high proportion of wind power



Source: SRU 2010

Systemoptimization for Flexible Power

First

- **Flexible Conventional Power, bioenergy or hydropower as residual load +**
- **Demand side management, load shifting, smart grid +**
- **some new gas-power (only if needed)**

Second

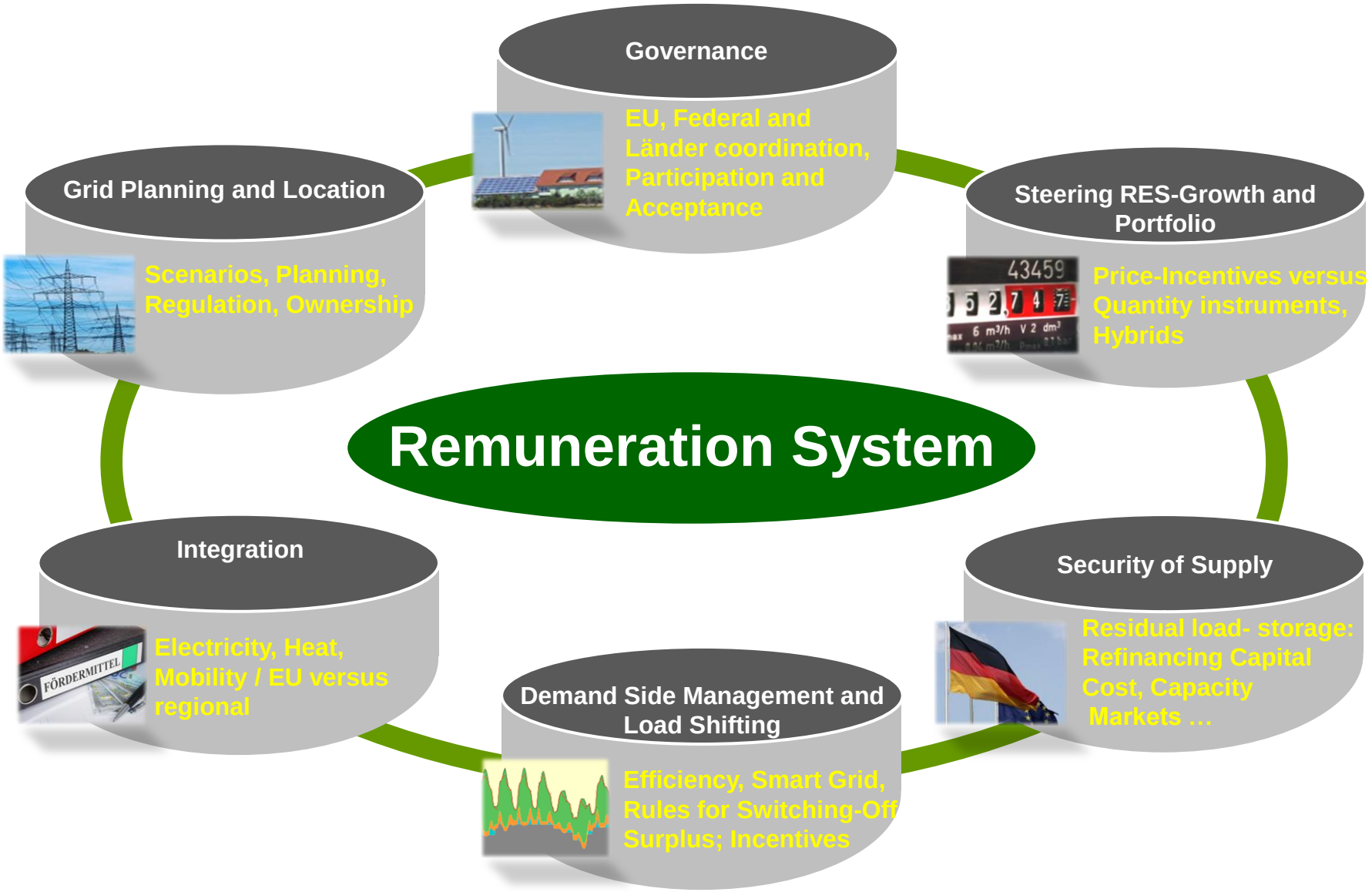
- **Integrating local markets (e.g. PV/Wind – and Heat) +**
- **national grid development, European interconnectors**

Third

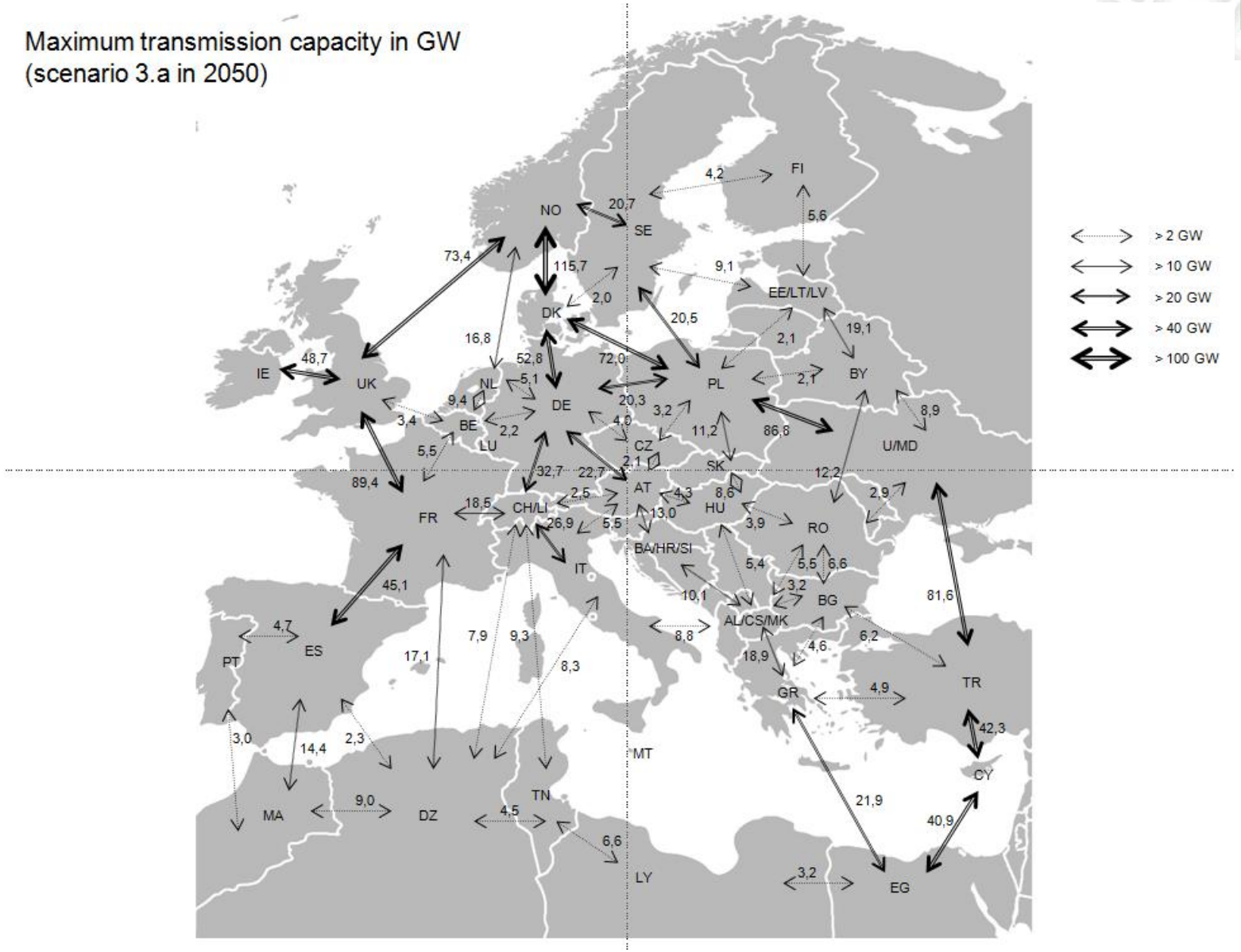
- **Storage Technologies (e.g. Pump Storage, CAES, Batteries, power to gaz) +**
- **A National and European Supergrid**

The need for a System Approach

Regulatory Issues for a renewables dominated energy system

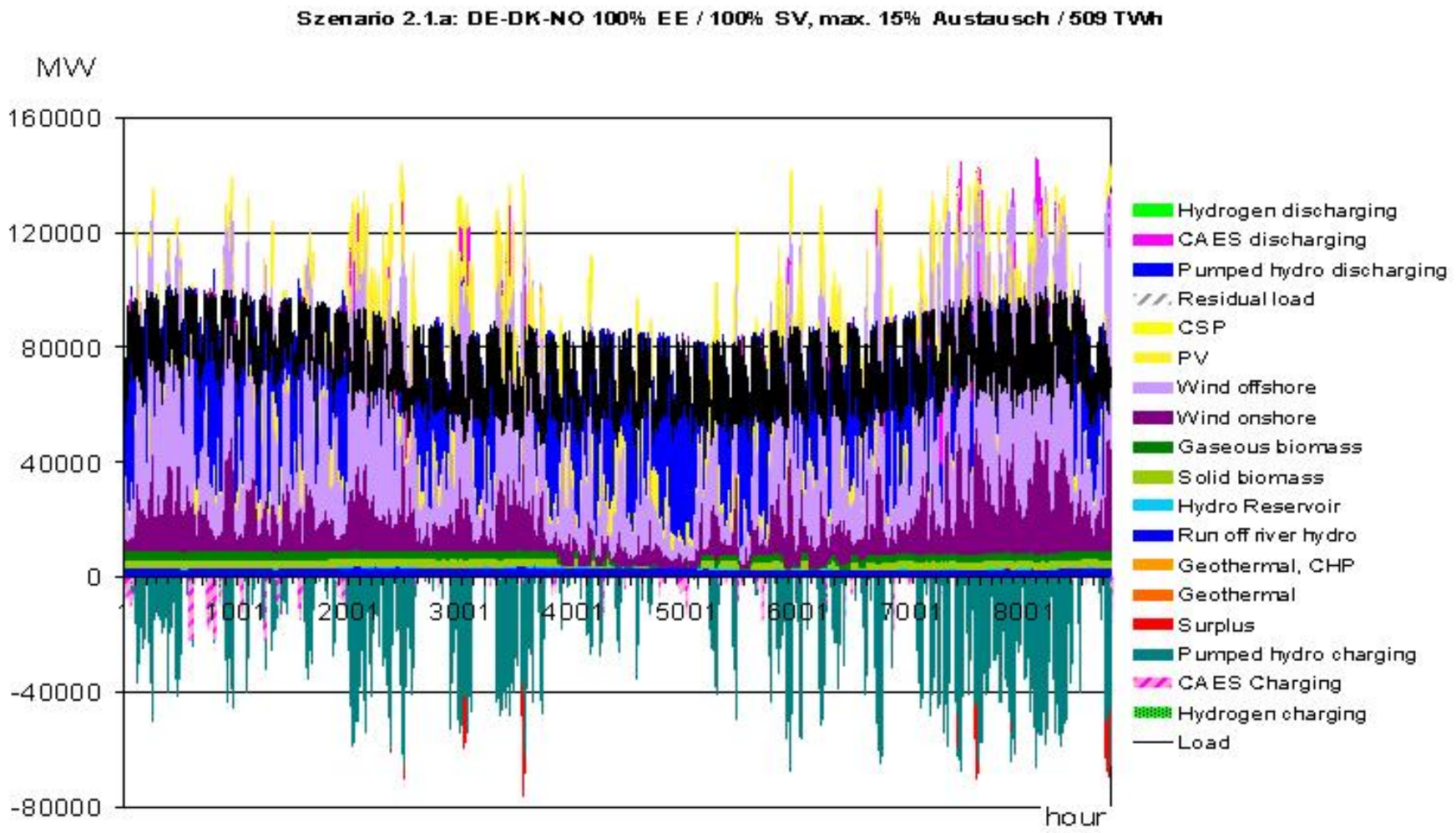


EU Dimension: Grids for Security of Supply

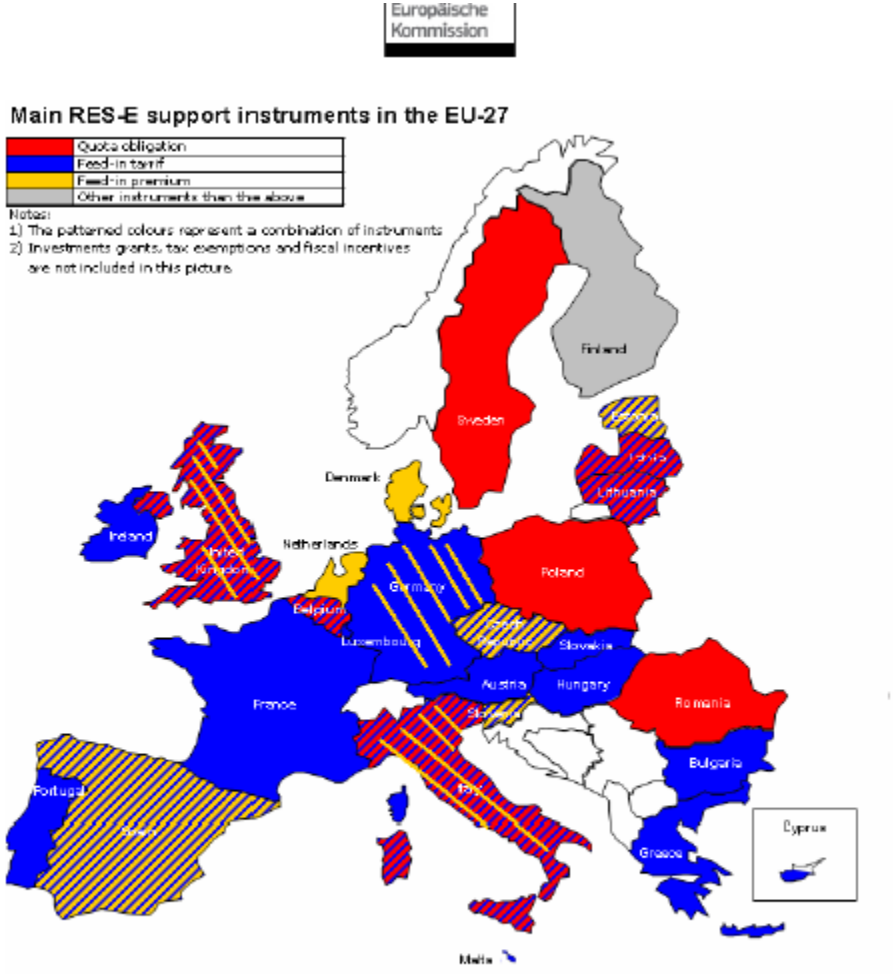


The big challenge: need for storage

(2.1.a)



EU Dimension: a bottom up approach



Battista 2012

Merci pour votre attention!

Dr. Christian Hey

Sachverständigenrat für Umweltfragen, Berlin

www.umweltrat.de