

**Electricity generation without
nuclear and coal in Germany and
the EU:
Climate friendly, secure, affordable**

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- ❑ 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)



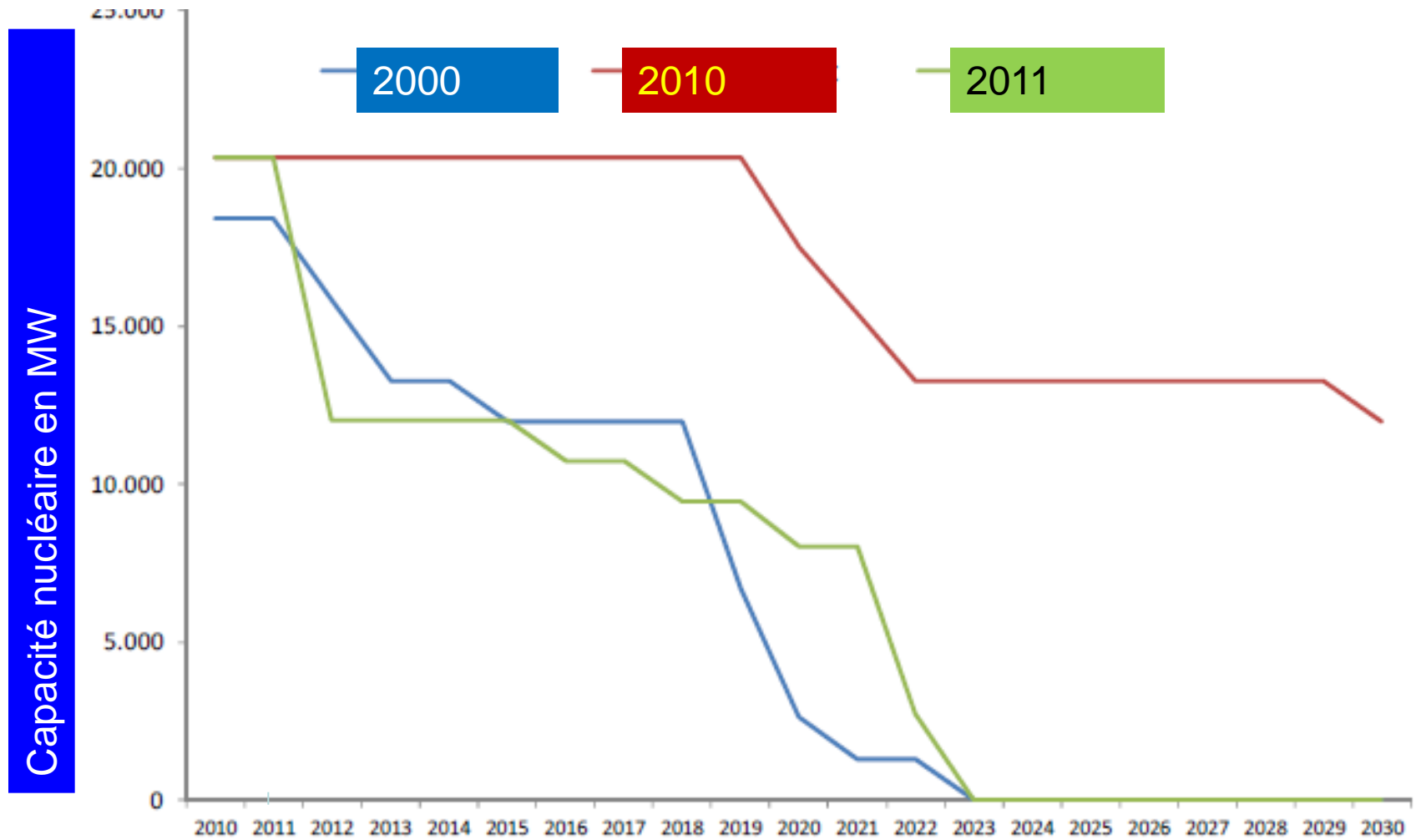


- **The "Energiewende": a role model?**
- **Perspective 2050: 100% renewable electricity: possible, safe and affordable – insights from scenario analysis**
- **The “reality”: Main issues in the national debate**
- **EU Dimension: a bottom-up strategy**

Germany's main energy policy goals

	Climate	Renewable Energy		Efficiency				
	Greenhouse Gas Emissions (vs. 1990)	Share Electricity	Share total	Primary Energy	Electricity	Energy productivity	Transport	Heat Demand in Buildings
2020	- 40 %	35%	18%	- 20%	-10%		-10 %	
2030	- 55 %	50%	30%	⋮	⋮	Increase by 2.1% per year compared to final energy consumption		
2040	- 70 %	65%	45%	▼	▼			
2050	- 80-95 %	80%	60%	- 50%	-25%			- 40 %

The « Energiewende»: Nuclear Phase-out 2011



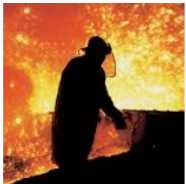
Key Benefits of the "Energiewende"



Decarbonization



Less Import Dependency



Green Growth (Investment, Employment)



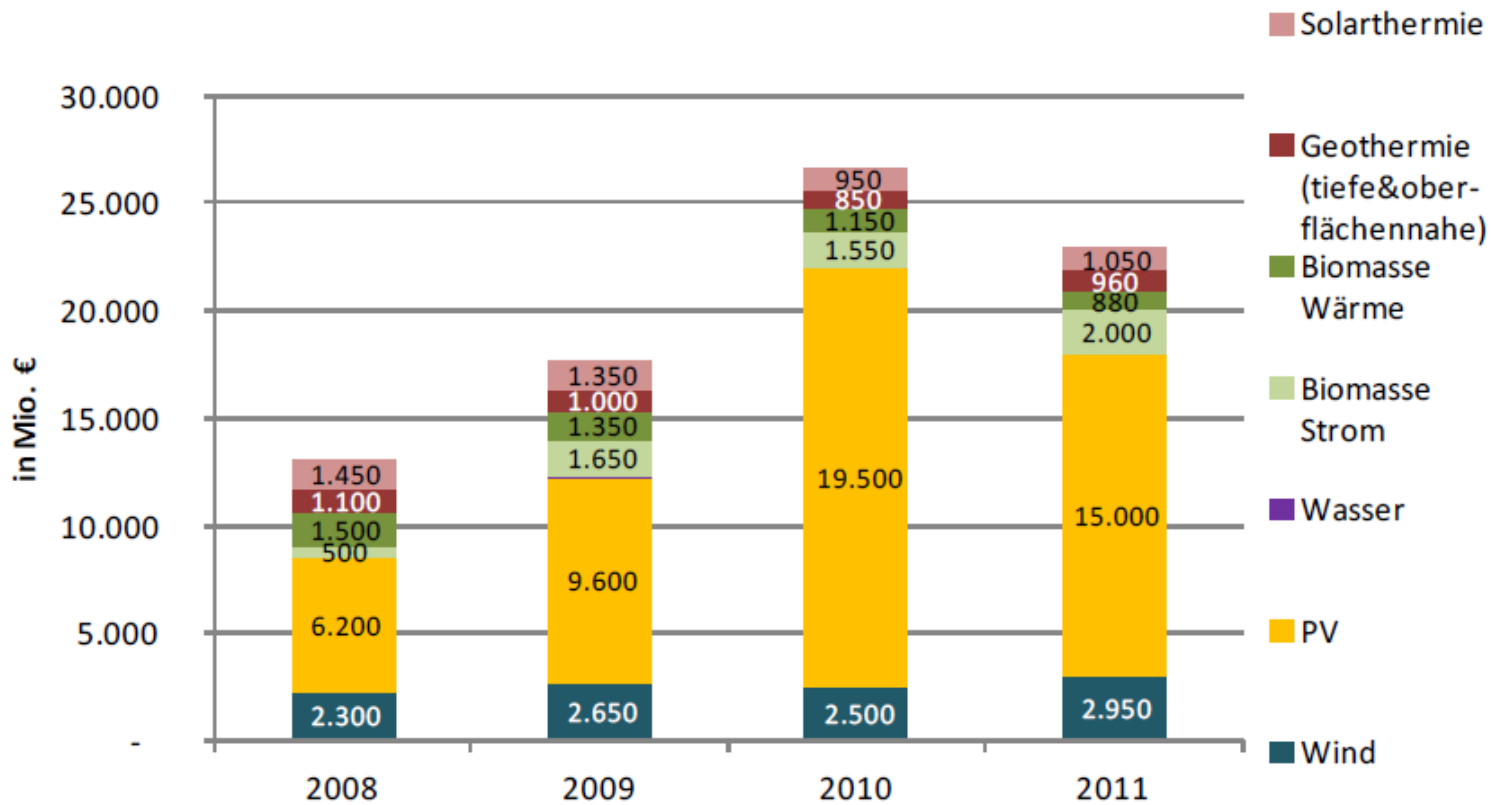
Technological Innovation



Political Consensus

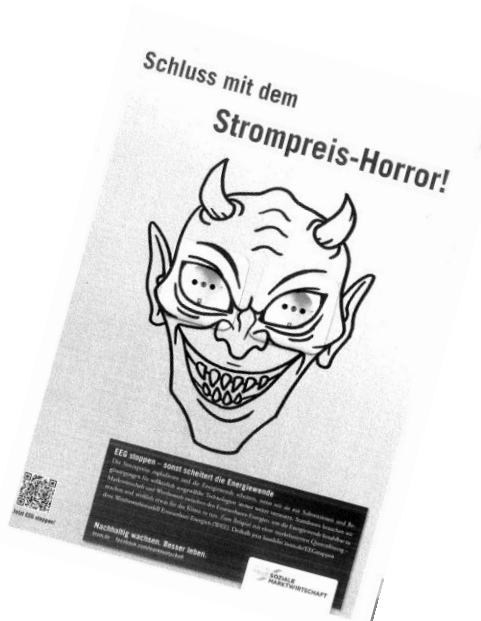
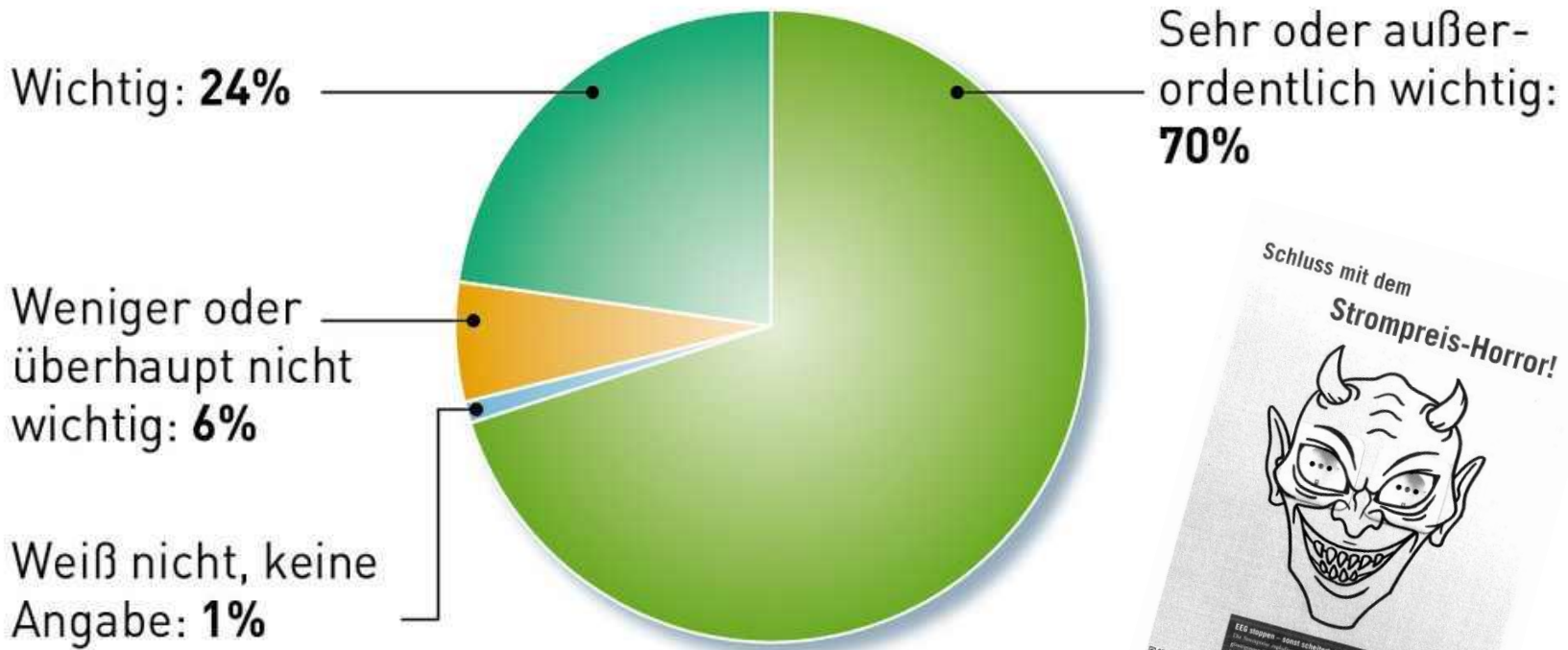
Global Role Model

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



A Broad Societal Consensus

93% of Germans support RES Growth



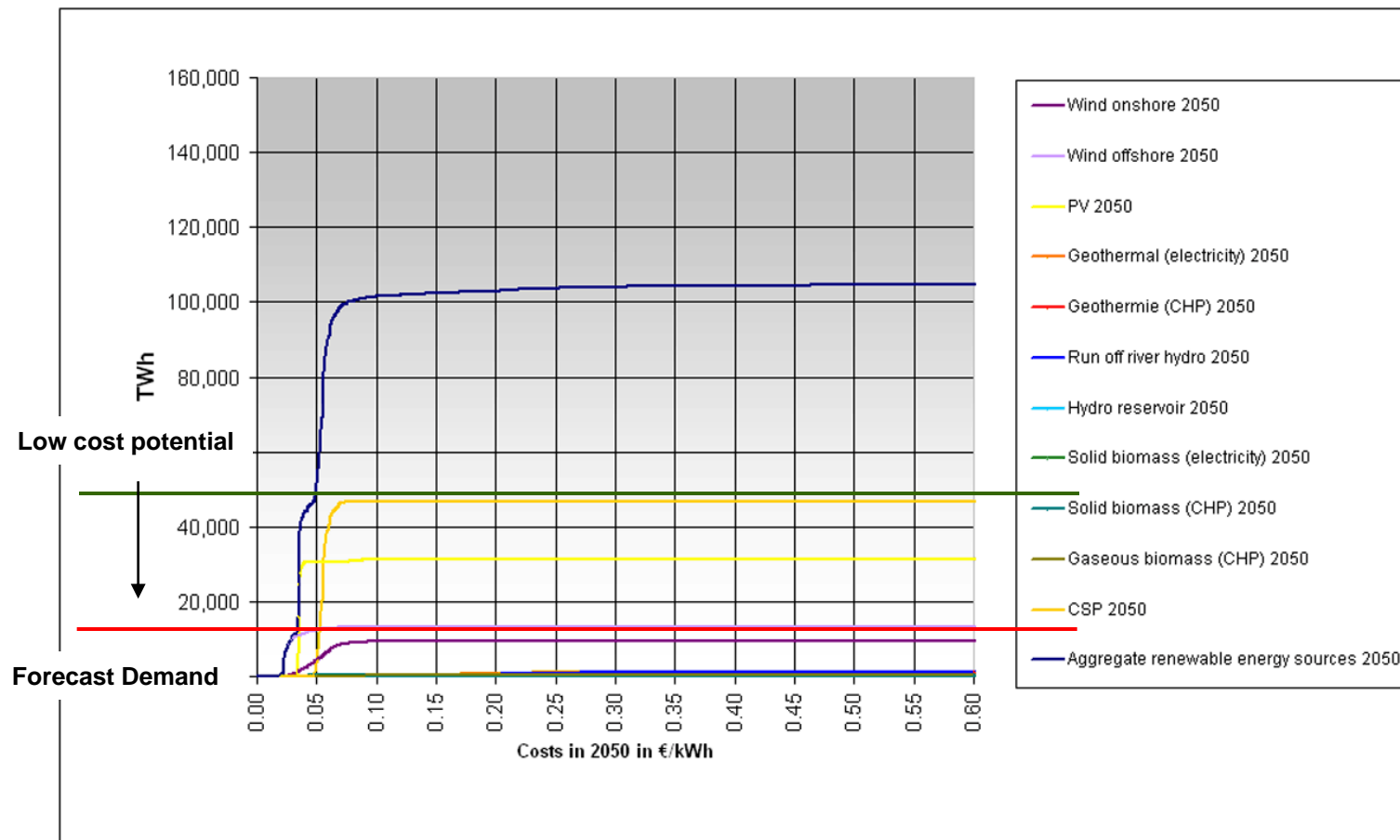
Quelle: Umfrage von TNS Infratest 2012, 3.798 Befragte, im Auftrag der Agentur für Erneuerbare Energien. Stand: 10/2012

- 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



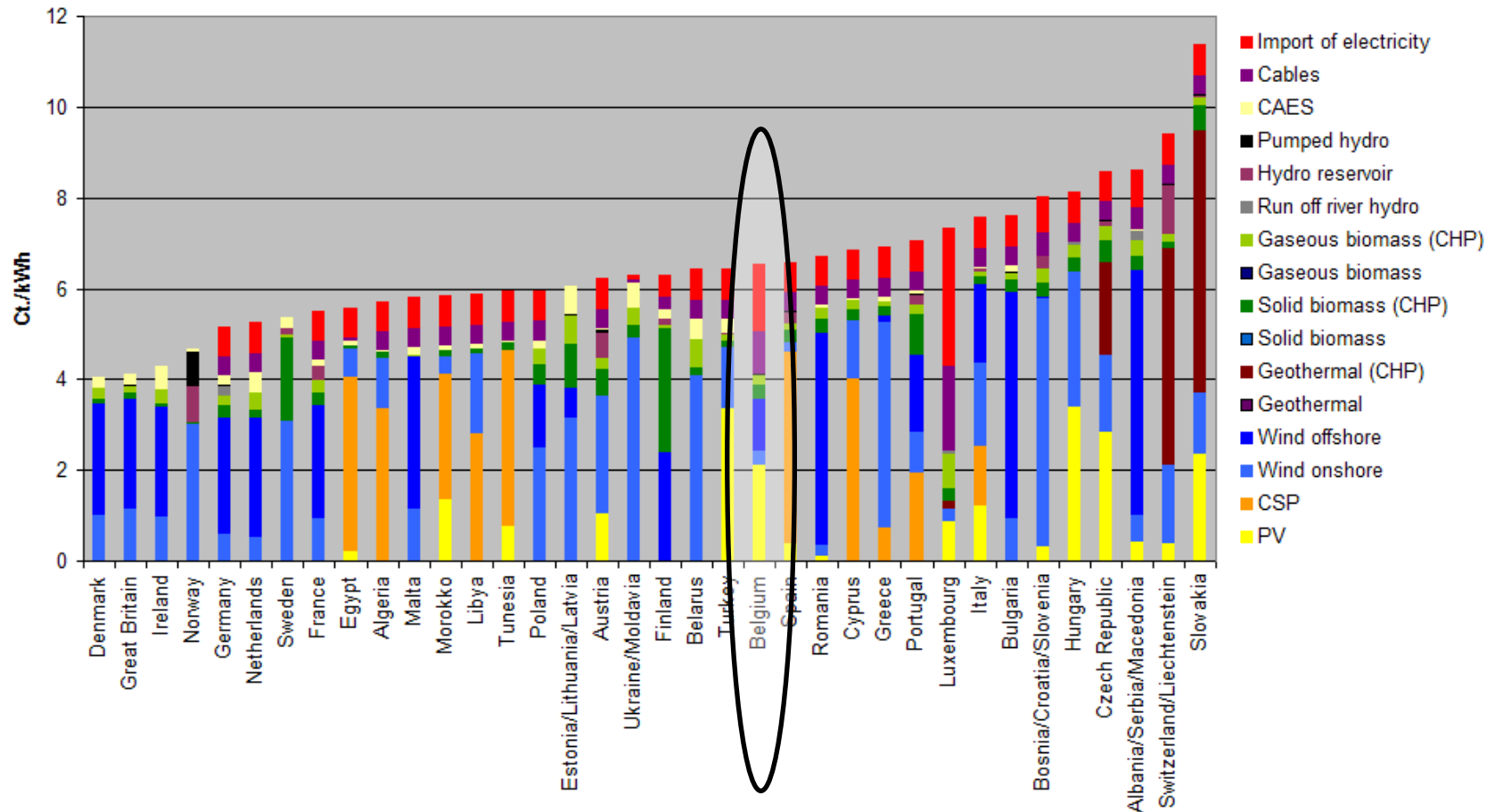
100% is affordable



Scenario 3.a

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

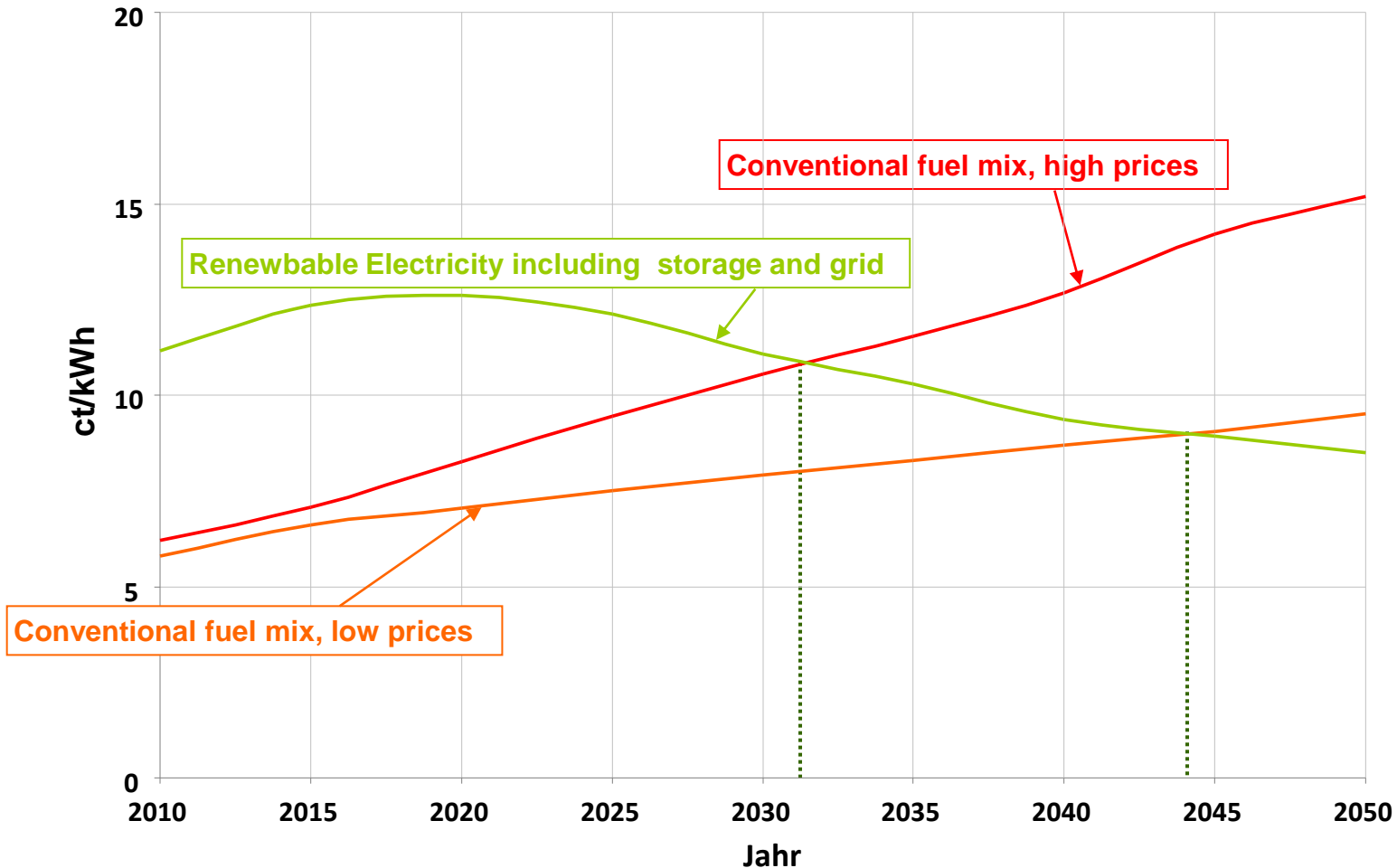
Specific costs (production, storage and imports)



In the long run renewable electricity is cheaper ...



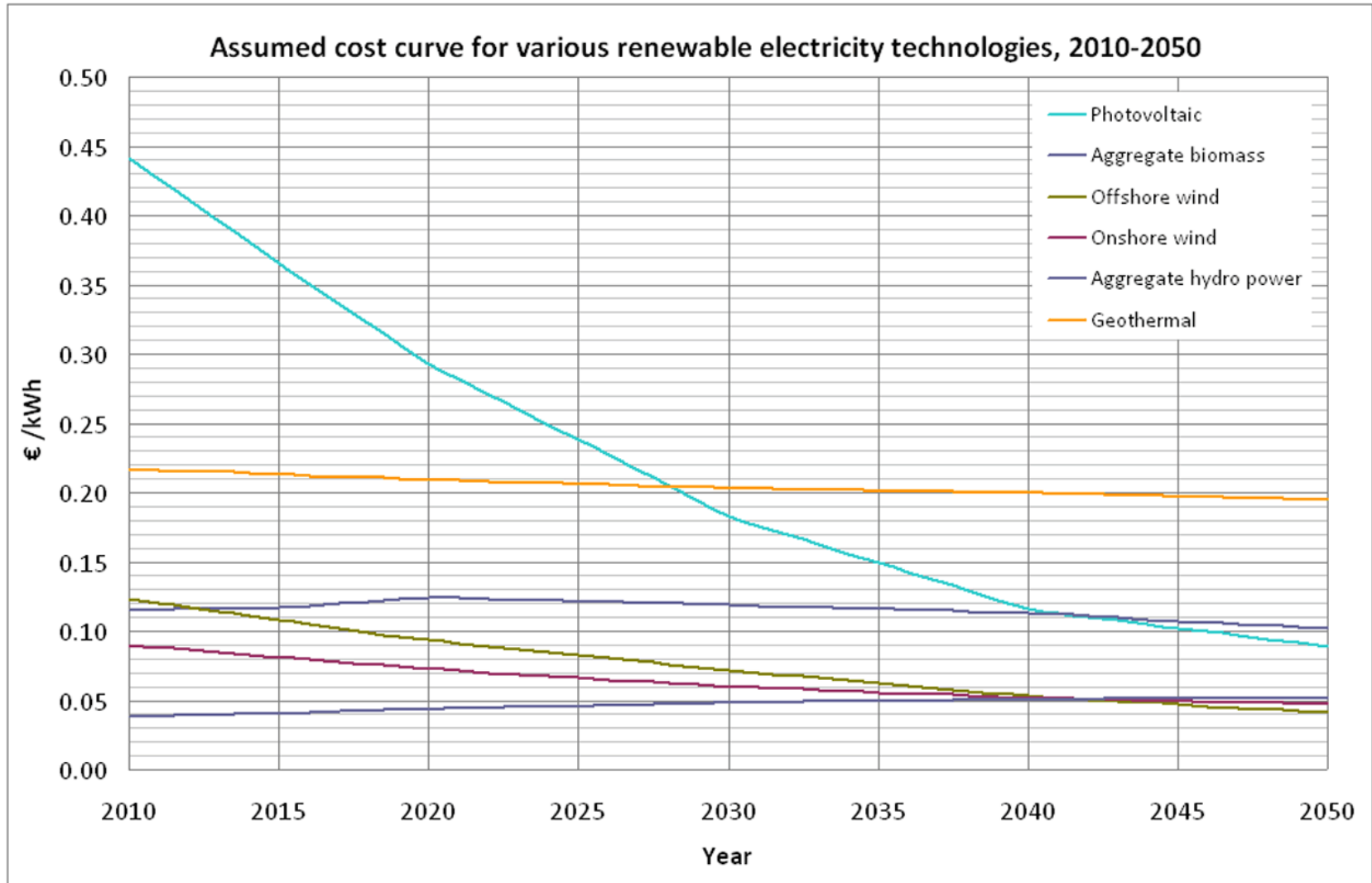
but higher investment during transition is needed

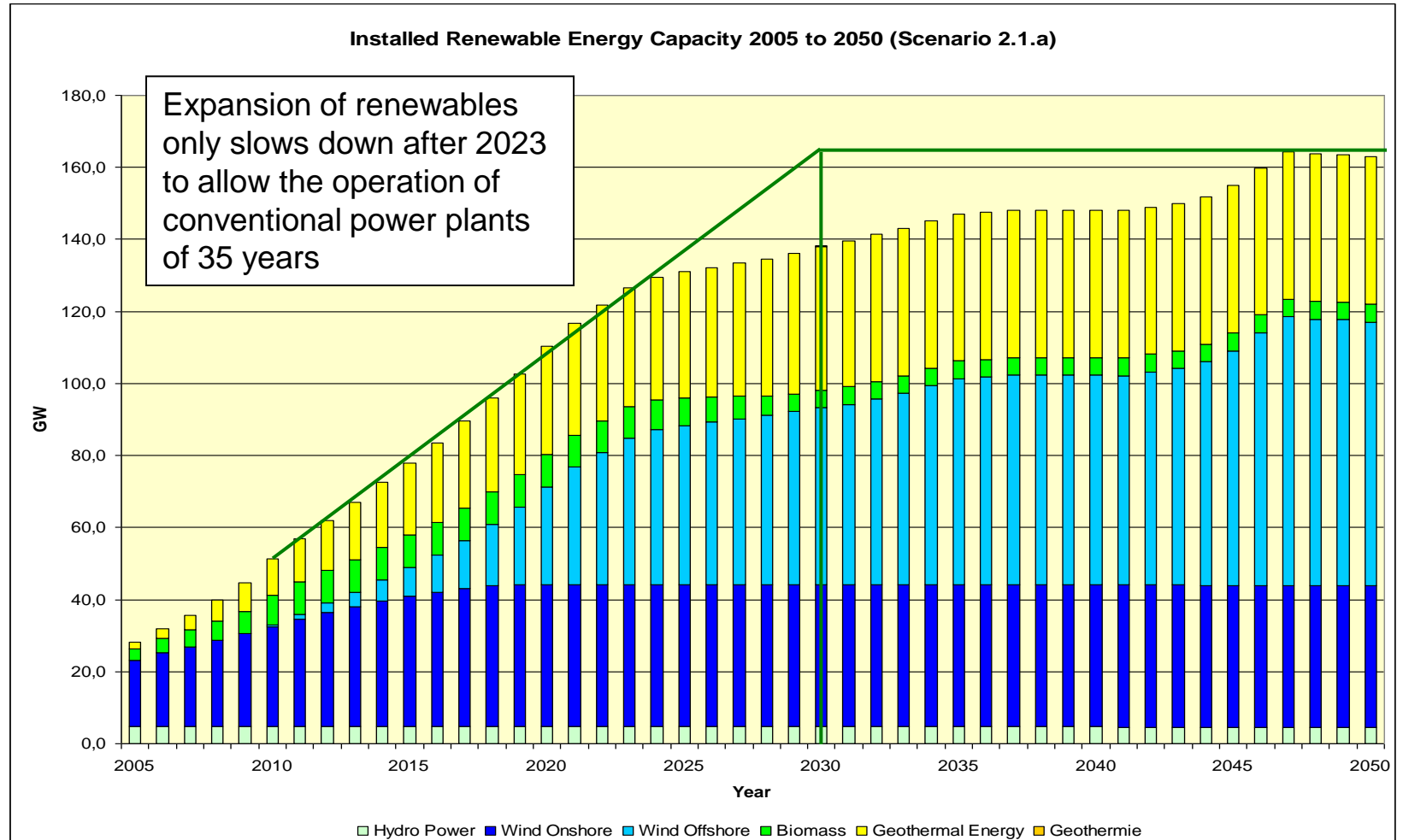








Key model assumption: Learning Cost Curves



In the middle range of literature



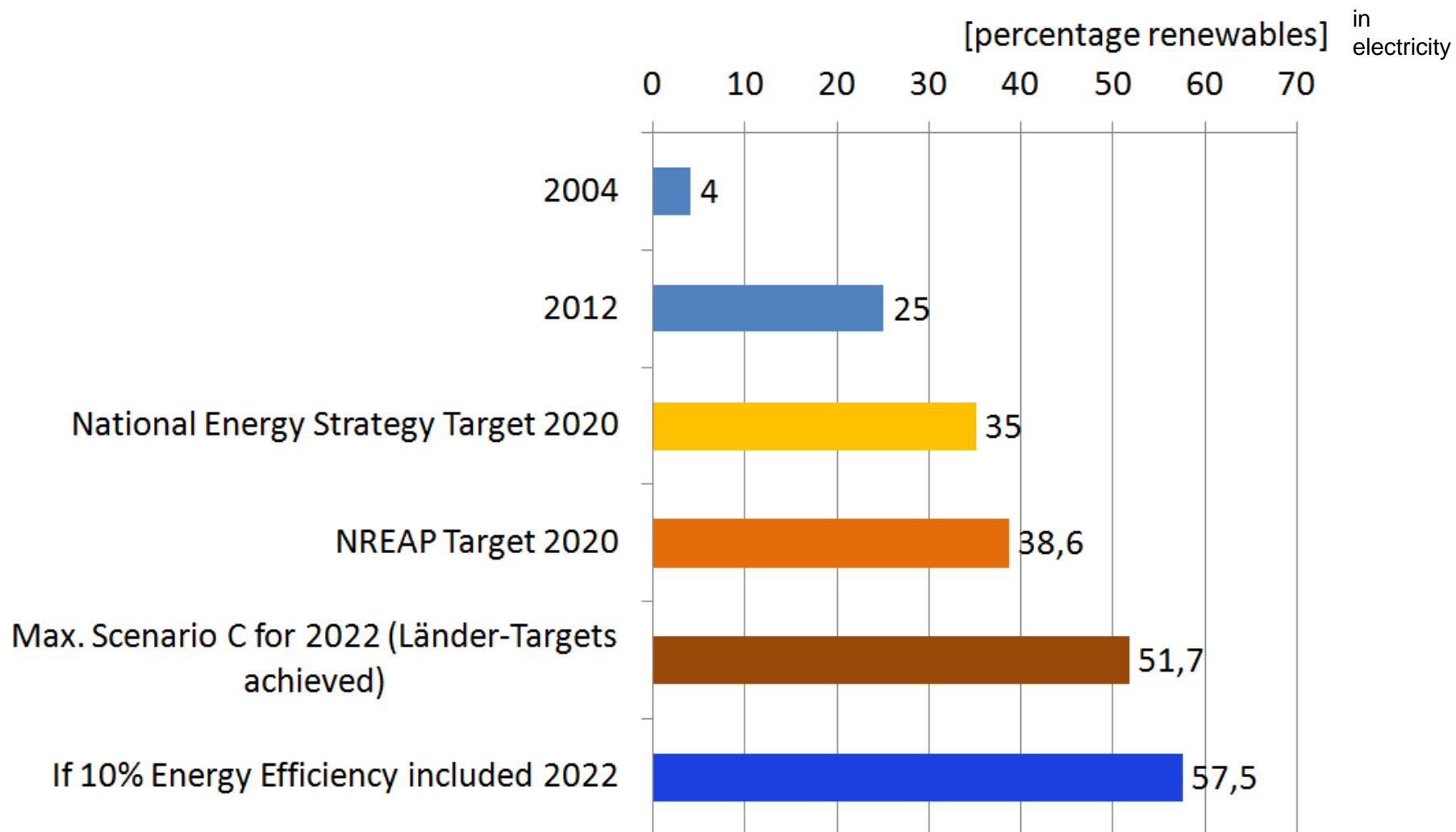


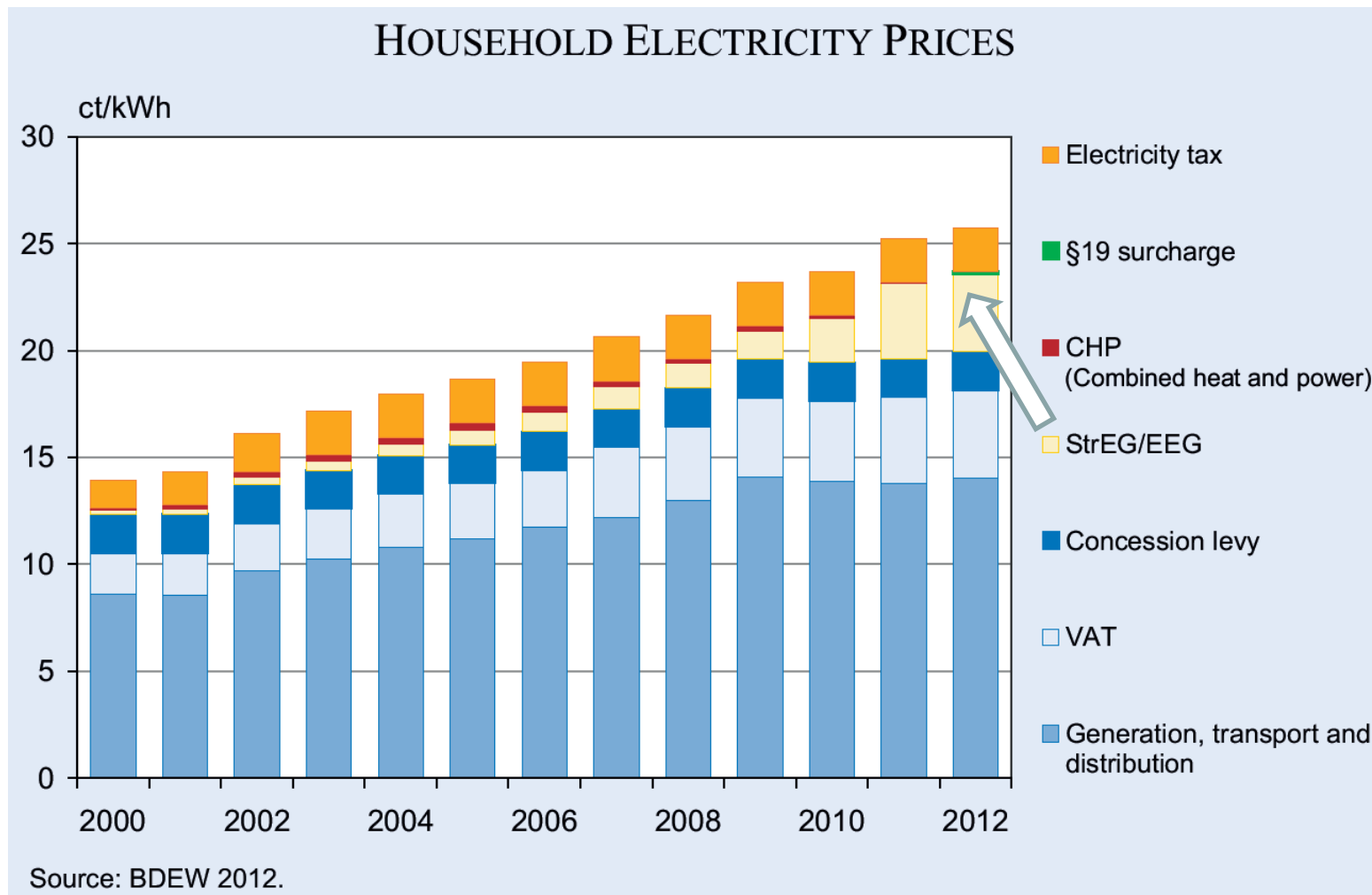
-  **Too rapid renewables growth?**
-  **Cost out of control?**
-  **Too slow grid development?**
-  **Declining profitability of conventional residual power**
-  **Security of electricity supply**
-  **System Coordination: Supply, Demand, Storage, Grids**

Too rapid growth of Renewables?



Trends and Forecasts for 2020/2022





Netzinvestitionen der deutschen Stromversorger

Milliarden Euro



*2011: Planungsstand der Unternehmen Frühjahr 2009

Quellen: BDEW, BNetzA

Stand: 12/2010

www.unendlich-viel-energie.de



Need for grids (EnWG)

Reference Scenario

Grid Development Plan

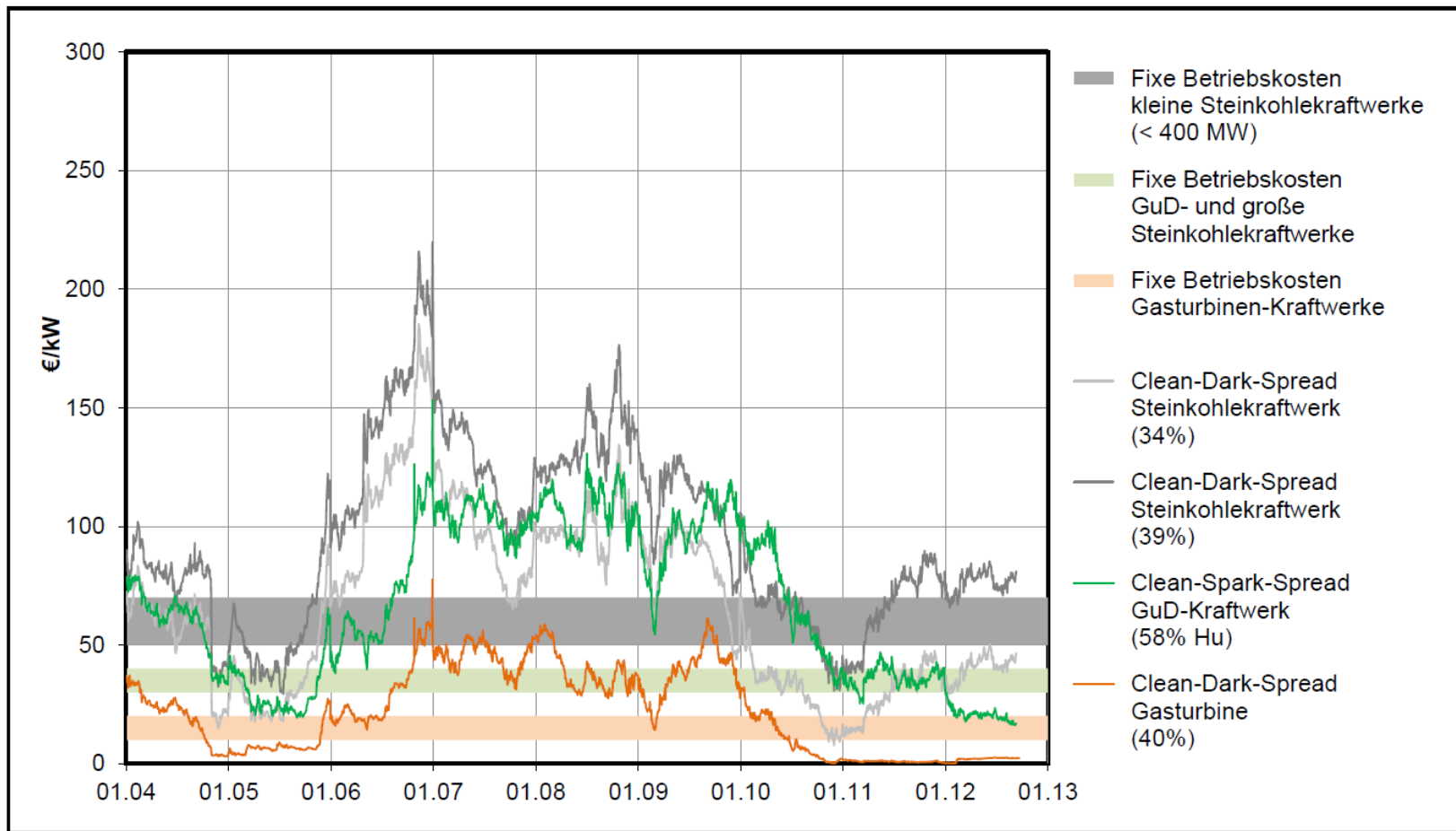
„Bundesbedarfsplan“

Planning procedures
(NABEG)

Spacial Planning

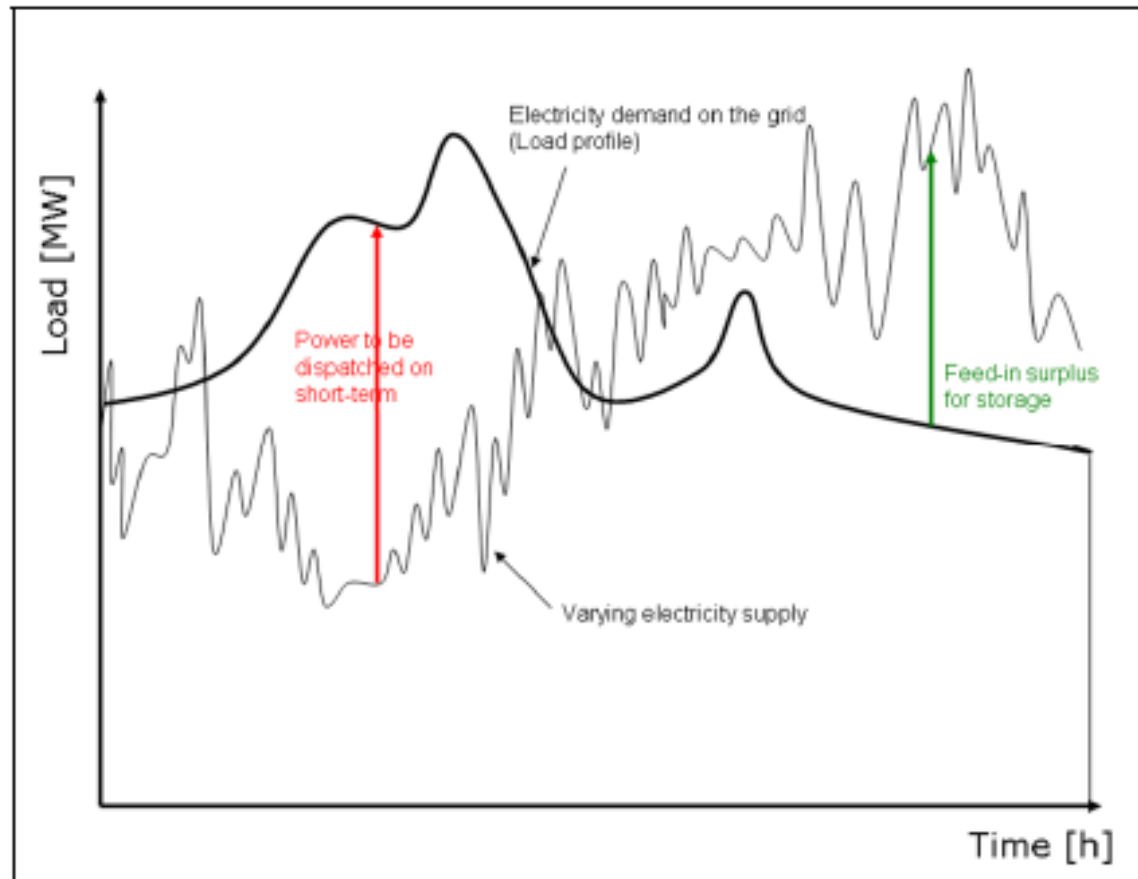
Approval Procedure

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



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

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



Source: SRU 2010



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



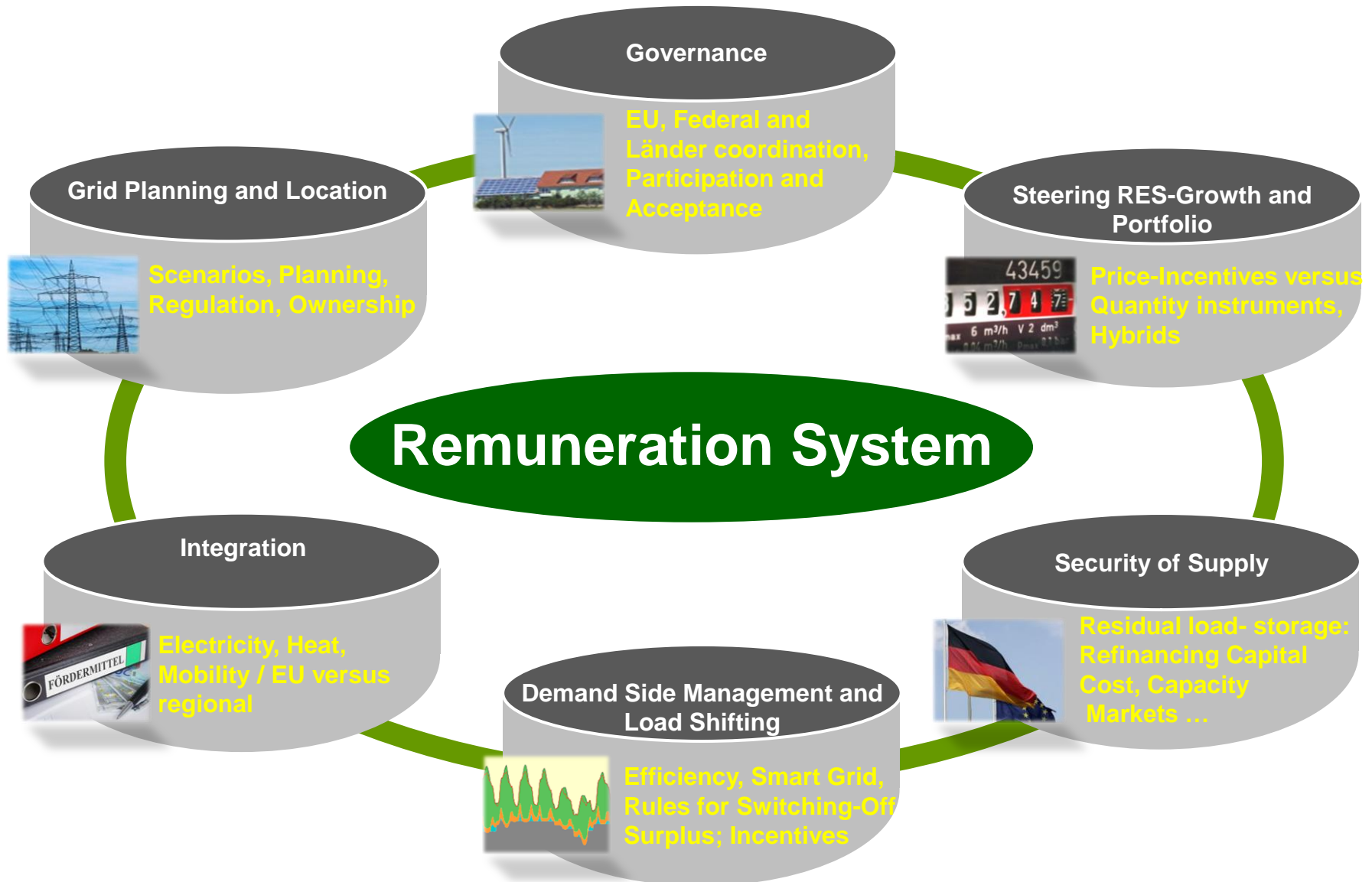
Third

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

The need for a System Approach



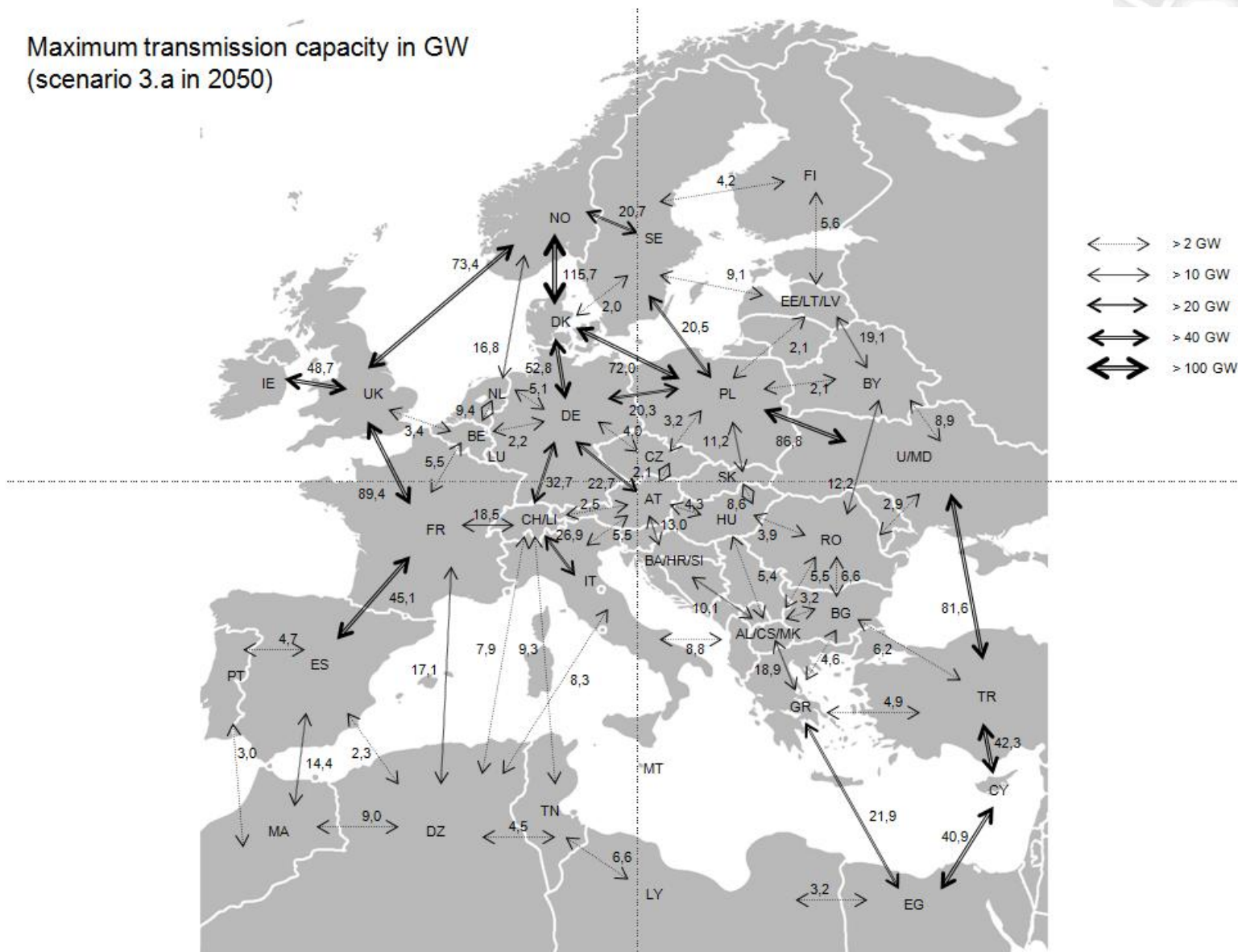
Regulatory Issues for a renewables dominated energy system



EU Dimension: Grids for Security of Supply



Maximum transmission capacity in GW
(scenario 3.a in 2050)

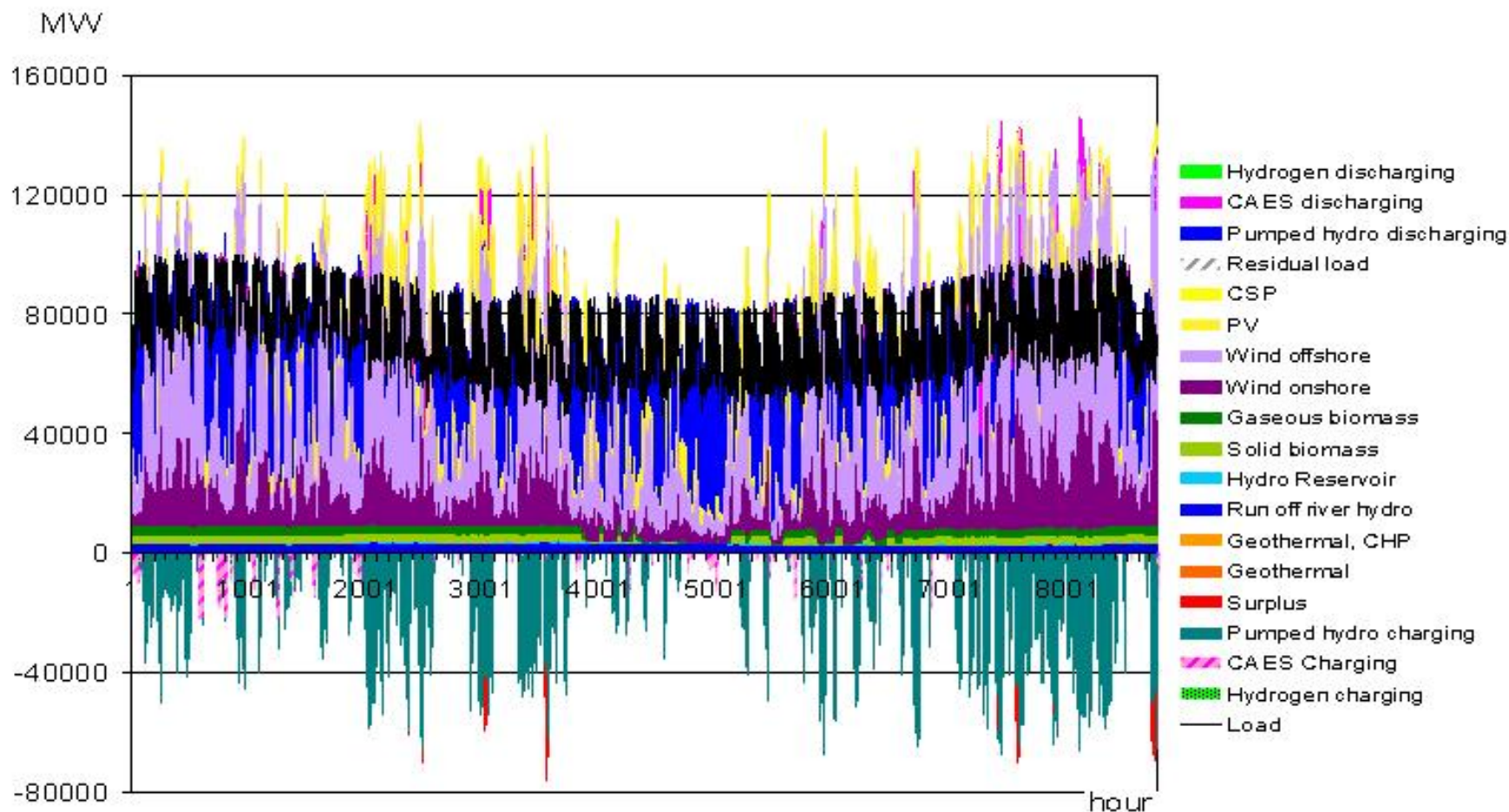


The big challenge: need for storage



(2.1.a)

Szenario 2.1.a: DE-DK-NO 100% EE / 100% SV, max. 15% Austausch / 509 TWh



Europäische
Kommission

Main RES-E support instruments in the EU-27

Red	Quota obligation
Blue	Feed-in tariff
Yellow	Feed-in premium
Diagonal lines	Other instruments than the above

Notes:

- 1) The patterned colours represent a combination of instruments
- 2) Investments grants, tax exemptions and fiscal incentives are not included in this picture



Merci pour votre attention!

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www.umweltrat.de