„Transformation of the Electricity System: A German Perspective” “

Presentation at the 18th National Energy Conference „Energy & Development 2013“

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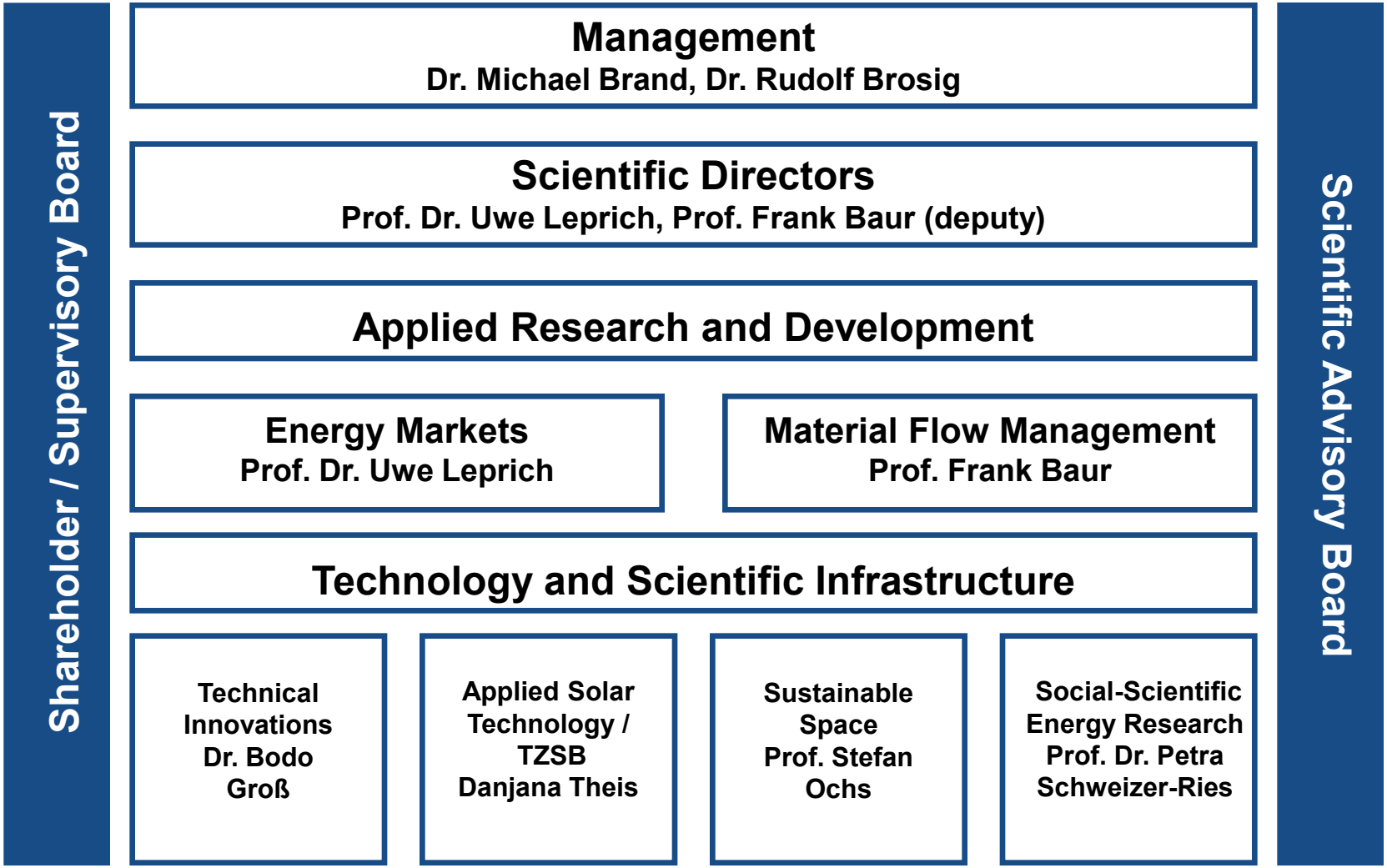
Uwe Leprich

- Professor at the business school of the University of Applied Sciences in Saarbruecken since 1995
- At the same time scientific head of the Institute for Future Energy Systems (IZES), a university based research institute focussing on renewable energies, energy efficiency and decentralised power generation
- Author and co-author of several books and articles liberalised electricity markets, feed-in law regulations and instruments for promoting renewable energies in the heat market.
- Alternate member of the Administrative Board of ACER (Agency for the cooperation of Energy Regulators)
- Spokesman of the Renewable Energy Research Association till November 2013

IZES gGmbH – Institute for Future Energy Systems



1. Targets as cornerstones of the German „Energiewende“

Targets of the Energy Concept 2010

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	Climate	Renewable energies		Efficiency			
	Greenhouse gases (vs. 1990)	Share of electr.	Overall share	Primary energy consumption	Electri-city consumption	Energy consump in buildings	Trans-port
2020	- 40%	35%	18%	- 20%	- 10%	-20 % heat demand	-10%
2030	- 55%	50%	30%				
2040	- 70%	65%	45%			-80% primary energy	-40 % final energy
2050	- 80-95%	80%	60%	- 50%	-25%		

Source: Schafhausen 2011

The triangle of electricity policy for 2020 / old government

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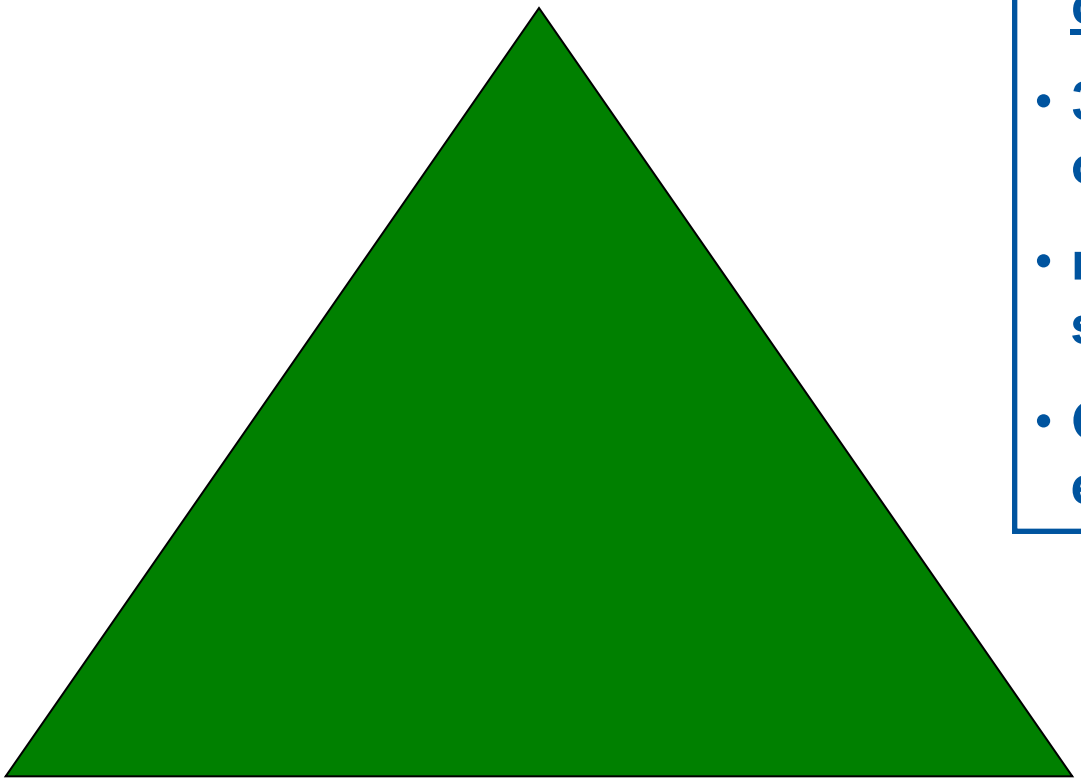
35% Renewables



10% Reduction

25% CHP

Other Framework conditions

- 3 further NPPs off-grid
- no significant storage expansion
- Grid restrictions eliminated?

The triangle of electricity policy / new government

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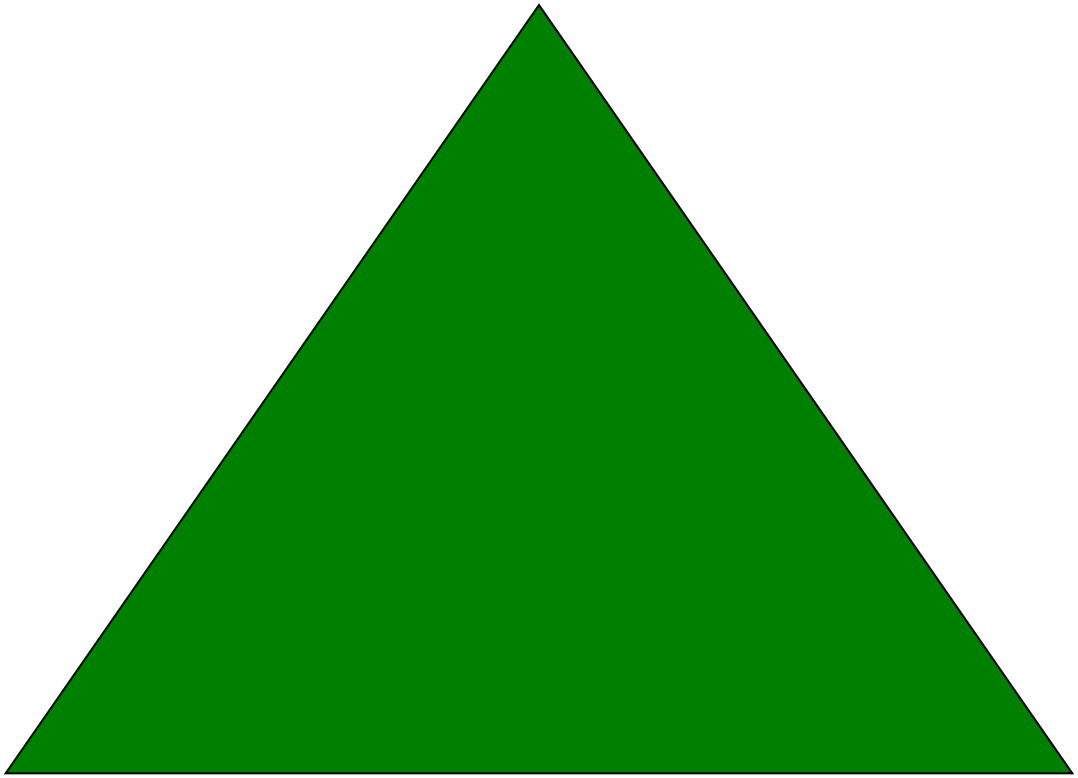
40-45% renewables till 2025



no reduction target

25% CHP till 2020

2. The German electricity system in 2012

Gross electricity generation 2012

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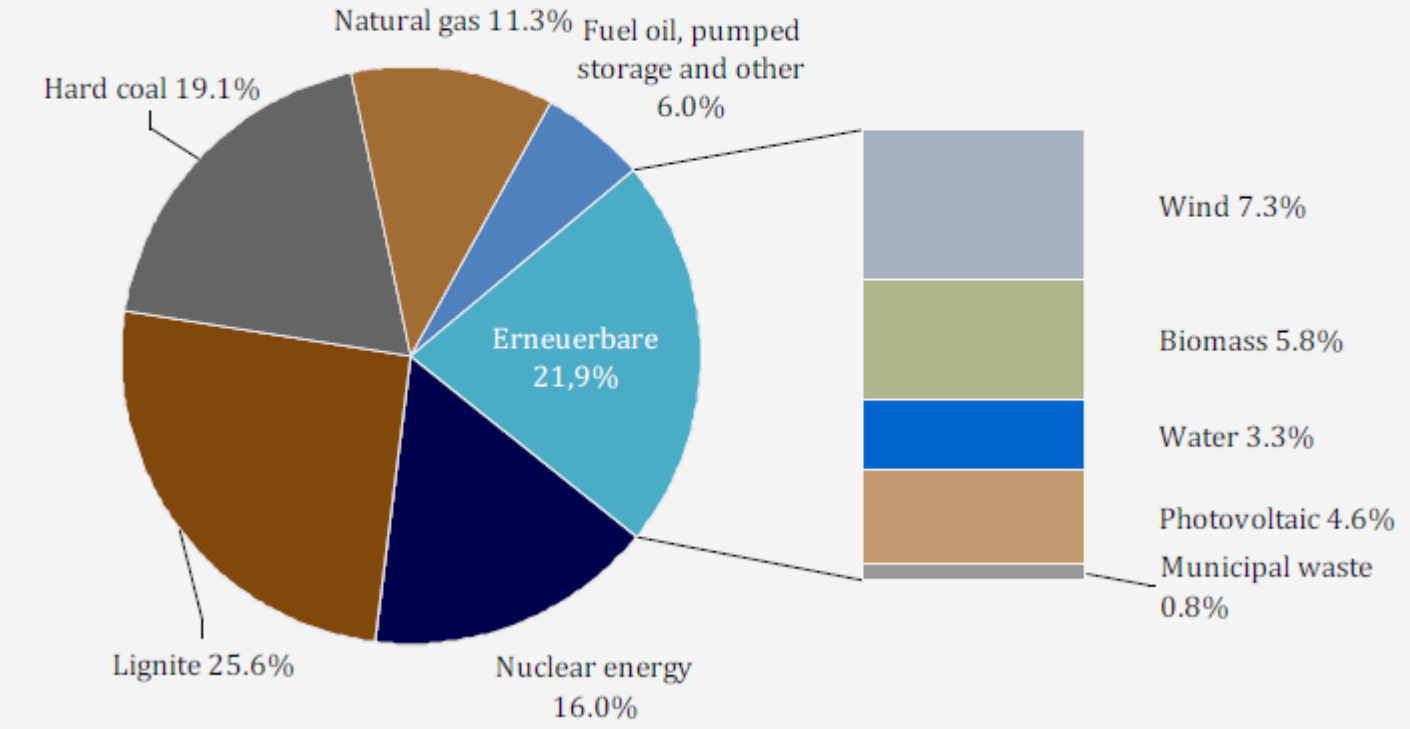
Gross electricity generation
by energy sources in 2012

bdew
Energie. Wasser. Leben.

Gross electricity generation in Germany in 2012: 617 billion kilowatt-hours*

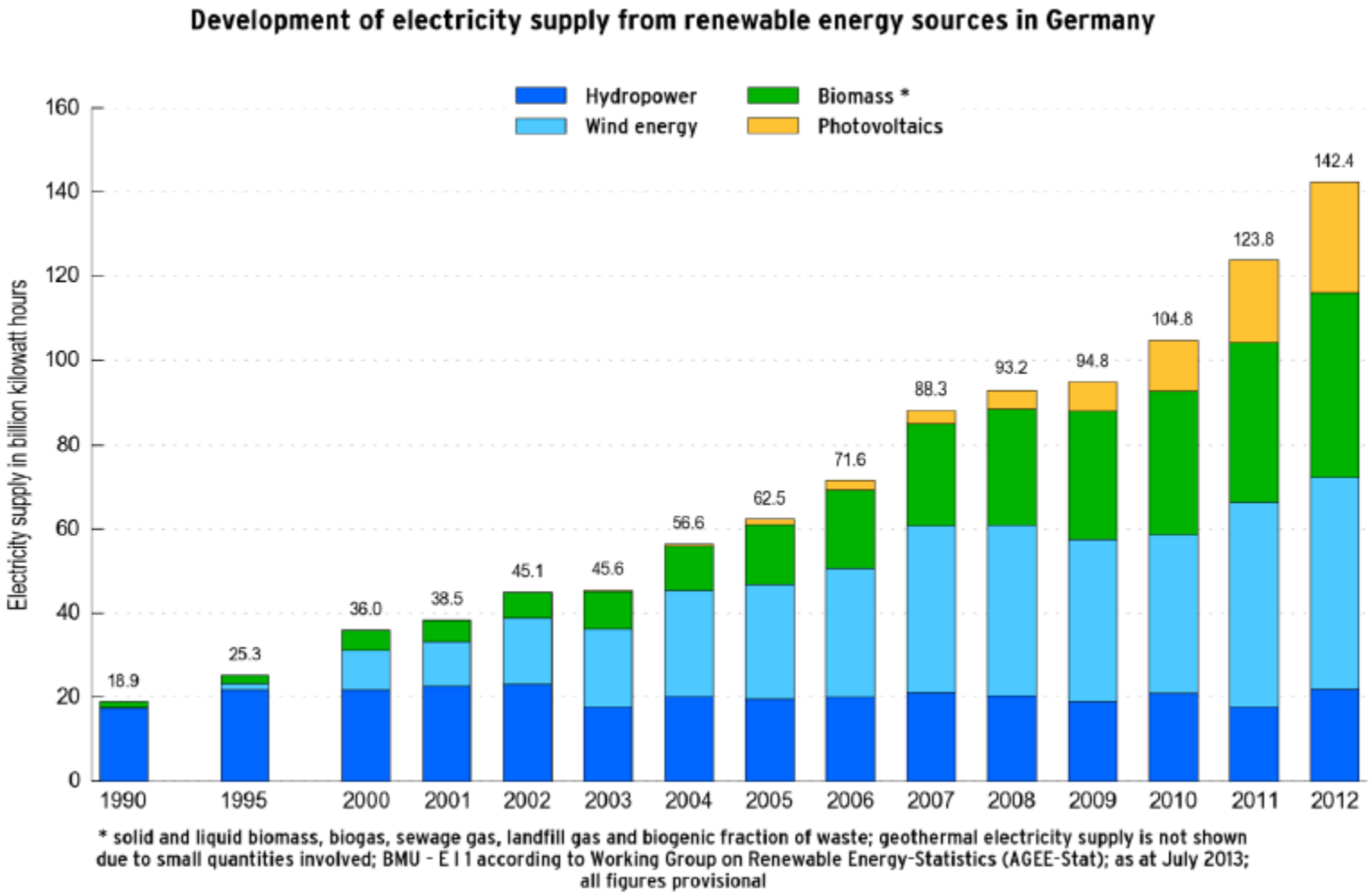


Sources: BDEW, AG Energiebilanzen, status: 12/2012

* provisional, partly estimated

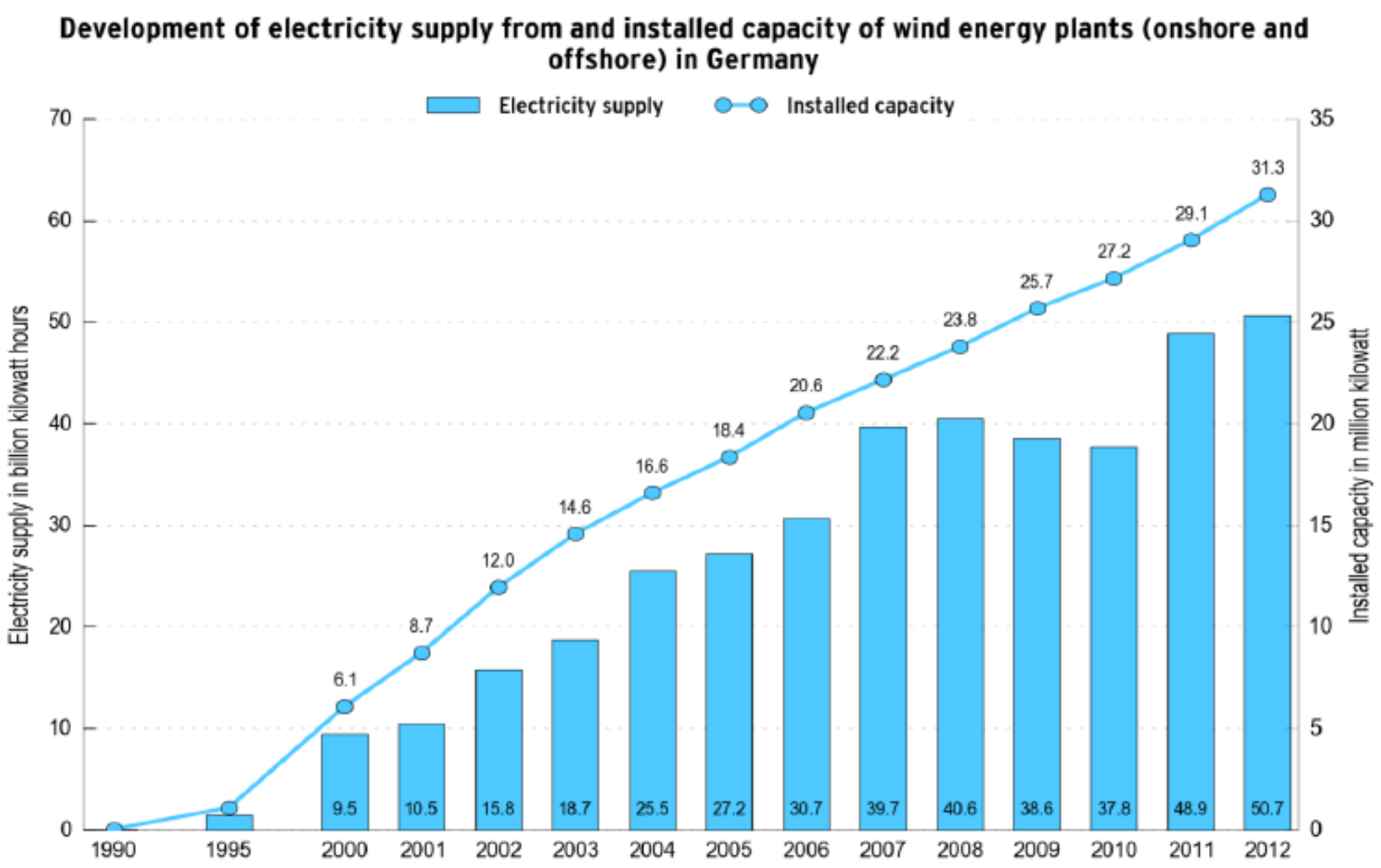
Source: BDEW 2013

Development of renewables for electricity generation



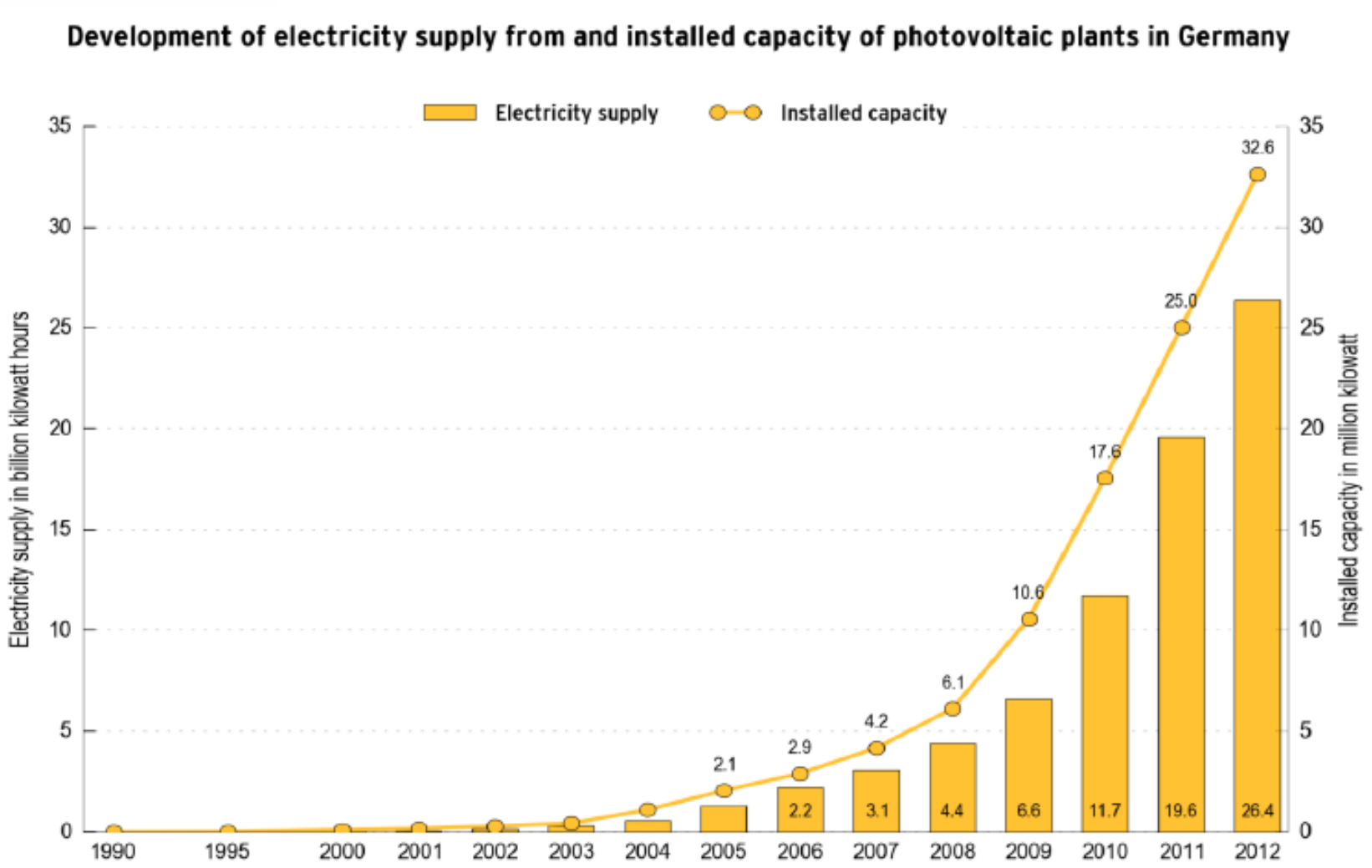
Source: BMU 2013

Development of wind power



Source: BMU 2013

Development of solar power

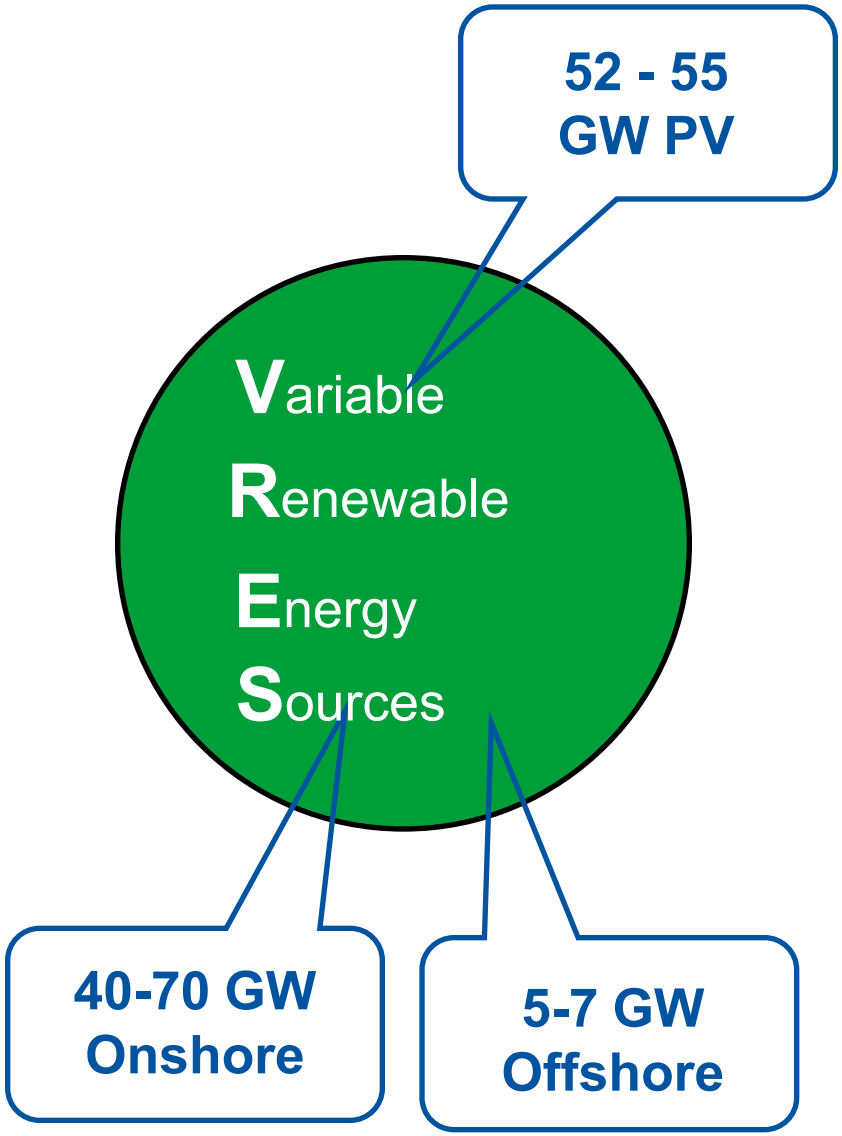


Source: BMU 2013

3. The technical components of the future electricity system

System Part #1

The VRES (wind, PV, water) will cover **half** of the total power generation in the medium run – due to that they will determine the rationality of the system



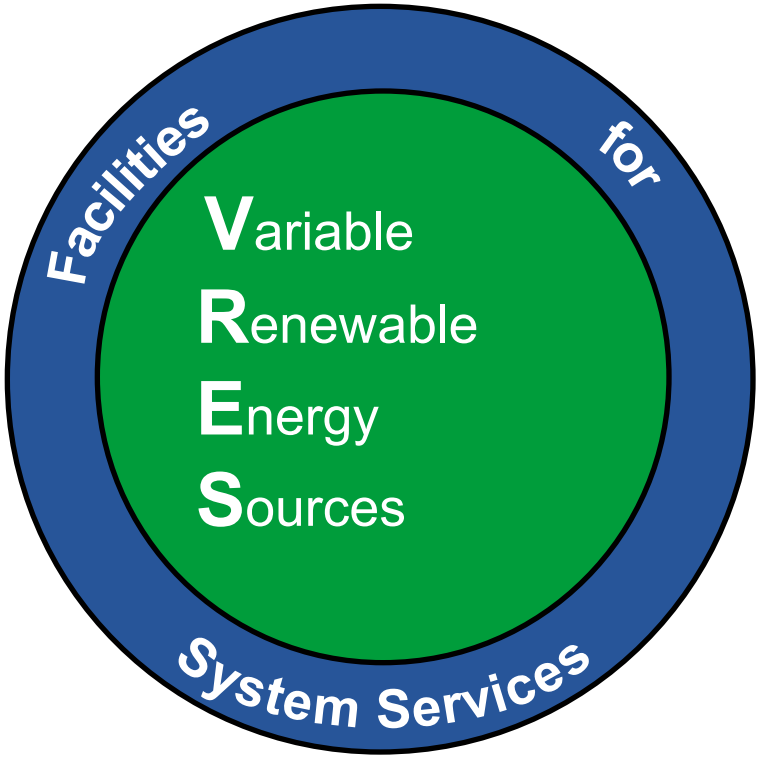
By the way:

The development of wind and PV is increasingly less justified with CO_2 reduction targets, but increasingly with

- increase of added domestic value
- job creation
- reduction of import dependency
- stabilization of electricity prices in the long term
- export opportunities of the system
- etc.

System Part #2

Facilities for System Services (FfSS) are network-related facilities, usually large power plants



System Services

- voltage control
- frequency control
- reactive power
- re-establishment of power

System Part #3

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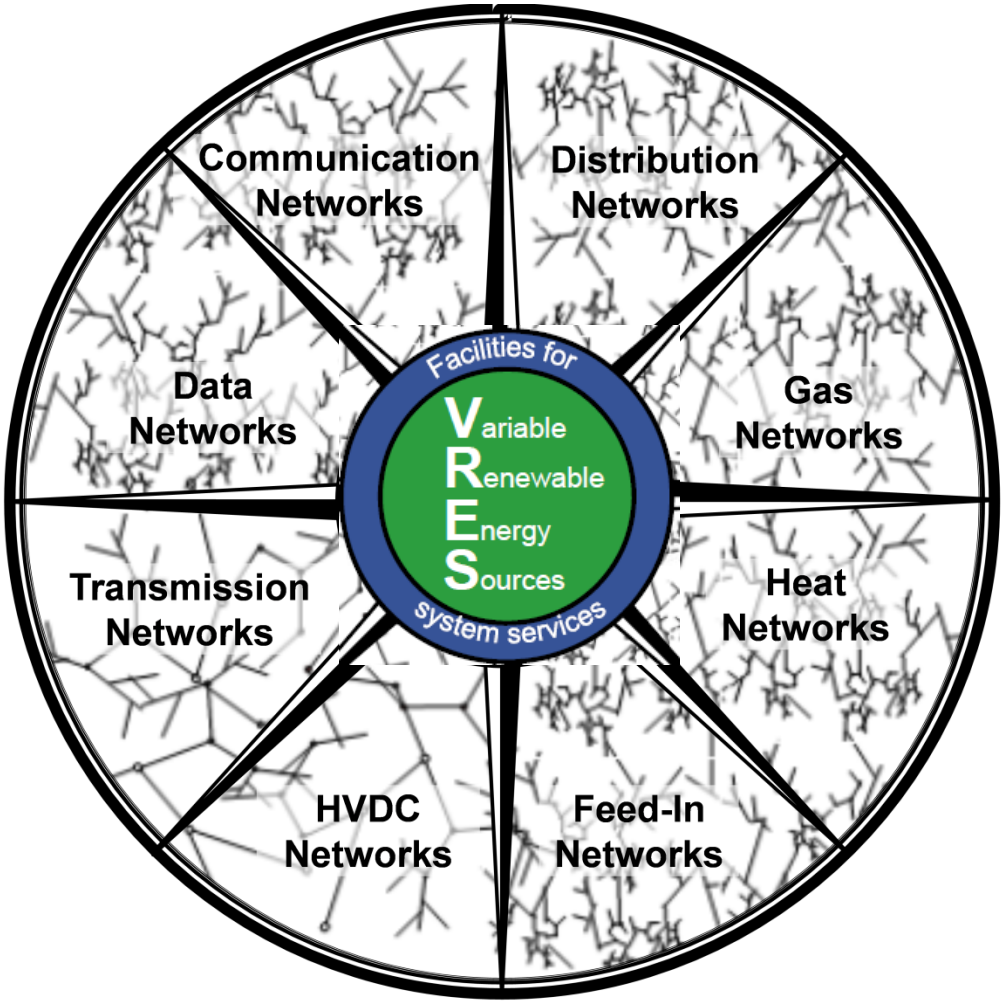
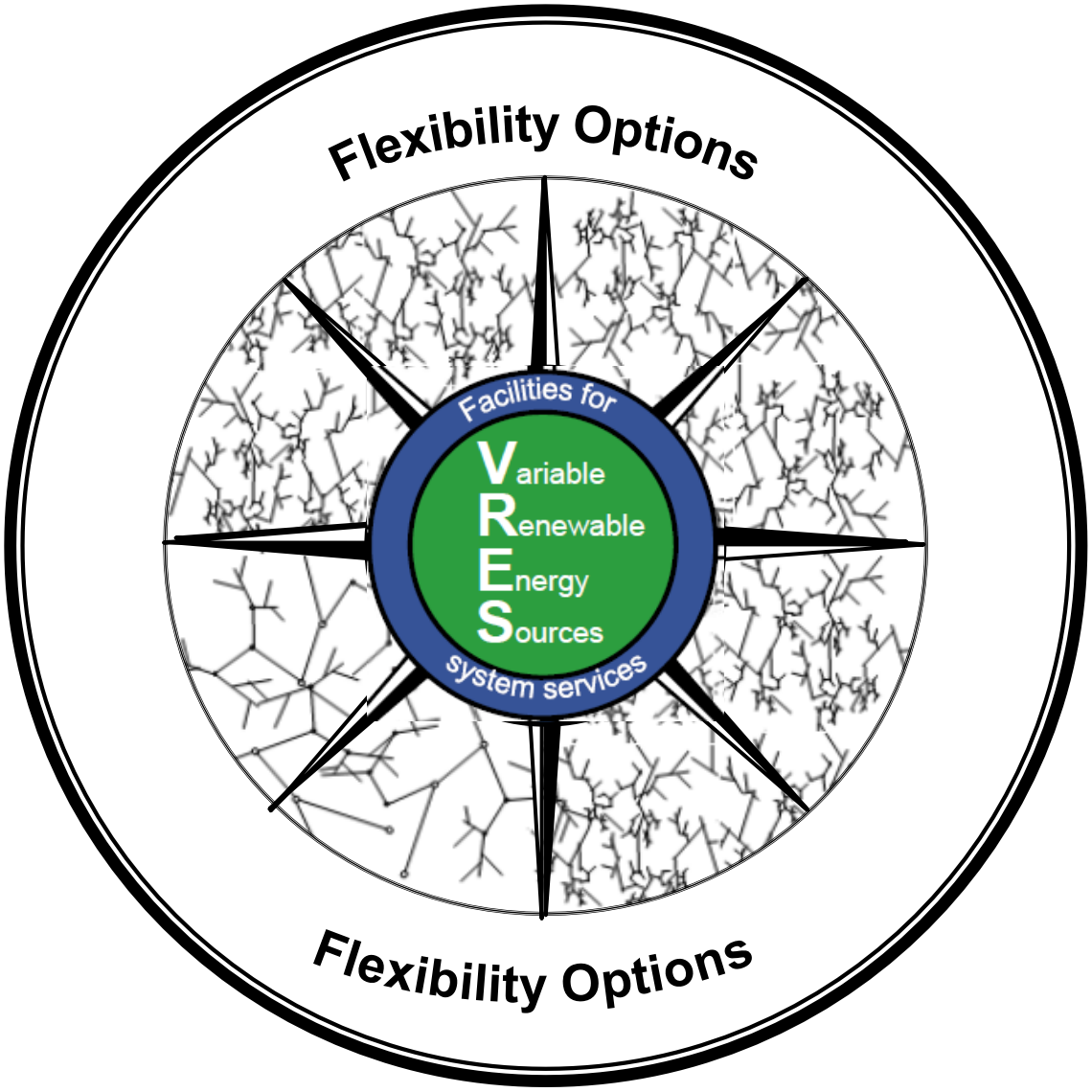
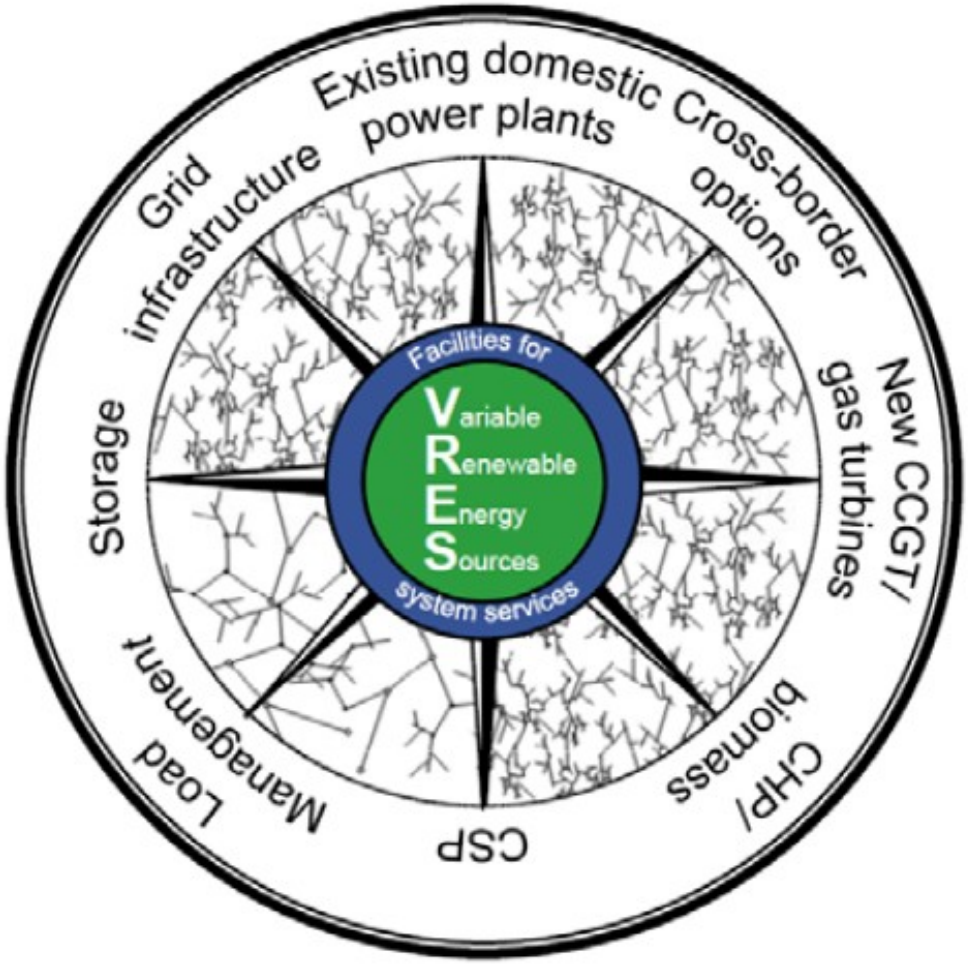
Infrastructure as a system requirement



System Part #4



The future electricity system

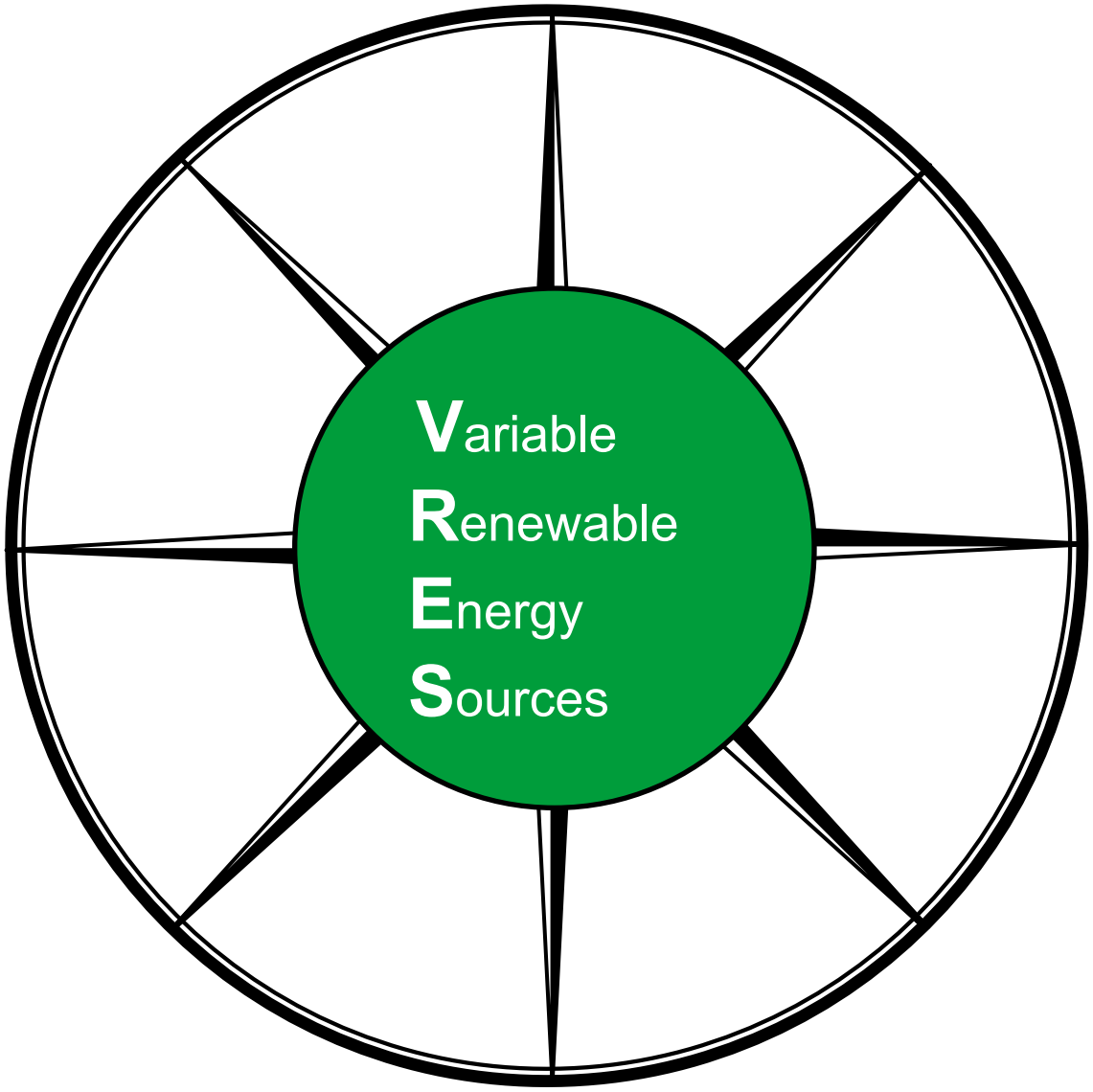


4 technical system components:

- **VRES**
- **FfSS**
- **FO**
- **Grids**

4. System design: How to finance the future electricity system?

1st segment



Hypothesis: the markets will not do it!

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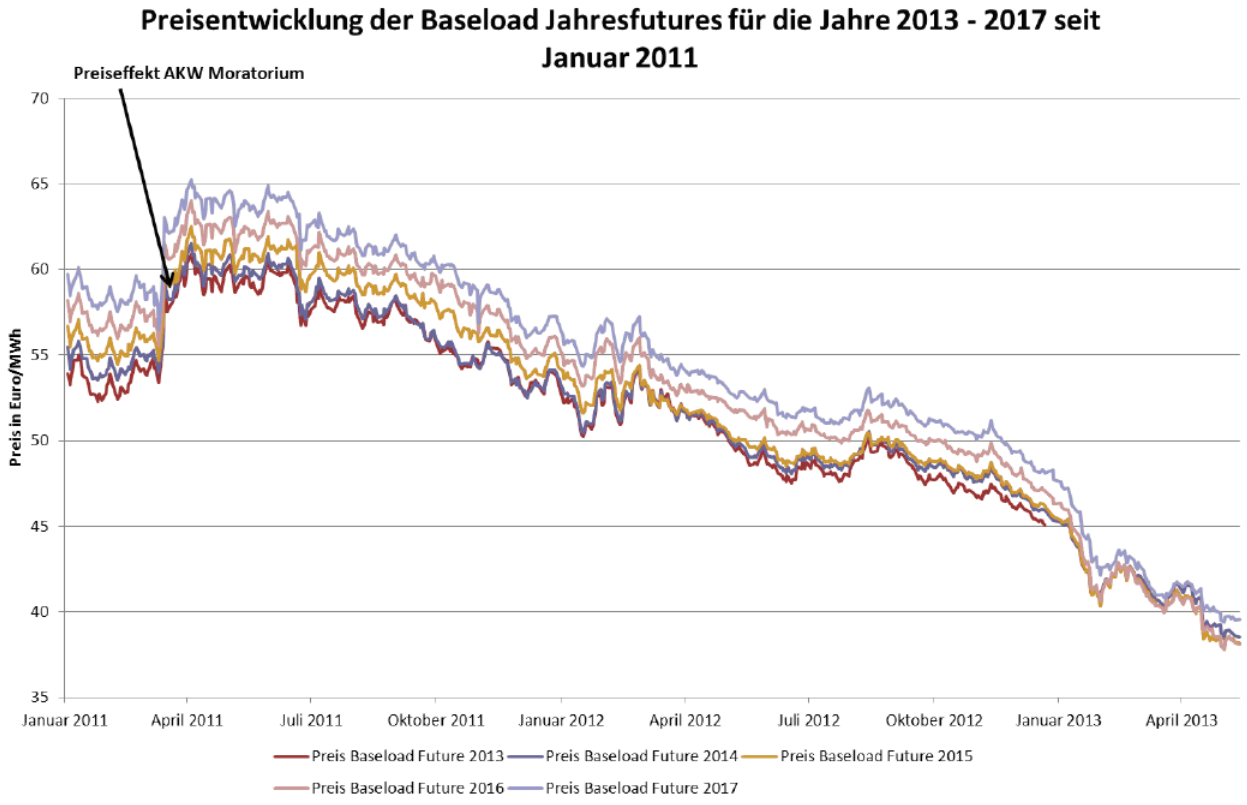
Market prices are declining; one of the reasons is the „merit order effect“ which will continue



Phelix Baseload Year Futures

VRES will not be able to recover their investment costs through the (wholesale) markets for the foreseeable future

➔there has to be a "funding mechanism"

Funding mechanisms for VRES

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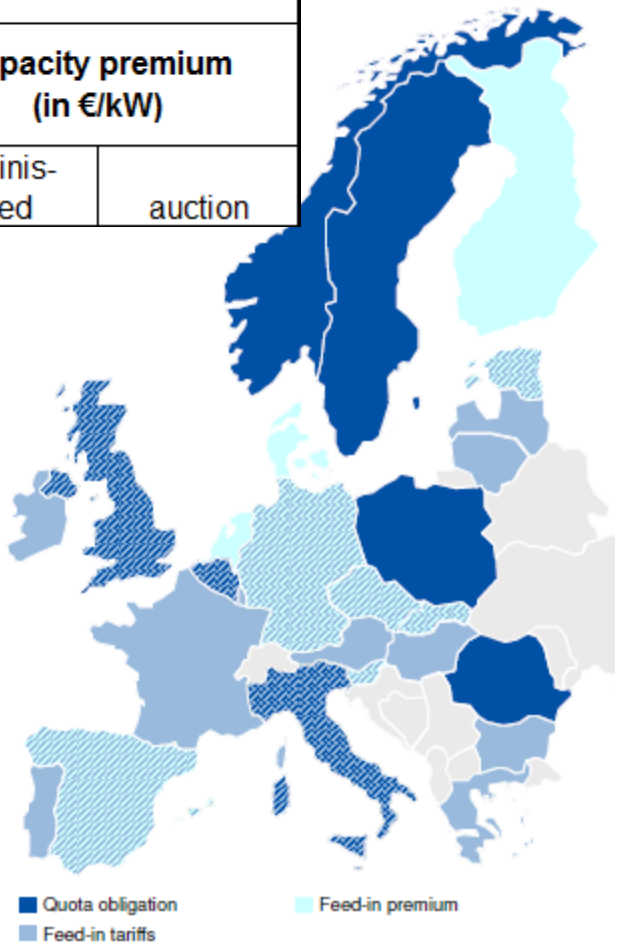
mechanisms with technology / regional differentiation						
Feed-in tariff	**Premiums**					
	market premium in ct/kWh				**capacity premium (in €/kW)**	
	sliding		fix			
	adminis-tered	auction	adminis-tered	auction	adminis-tered	auction

technology neutral mechanisms				
Premiums				**Quota Obligation**
fix market premium (in ct/kWh)		**capacity premium (in €/kW)**		
adminis-tered	auction	adminis-tered	auction	



Source: RWE 2013

The German discussion on electricity prices

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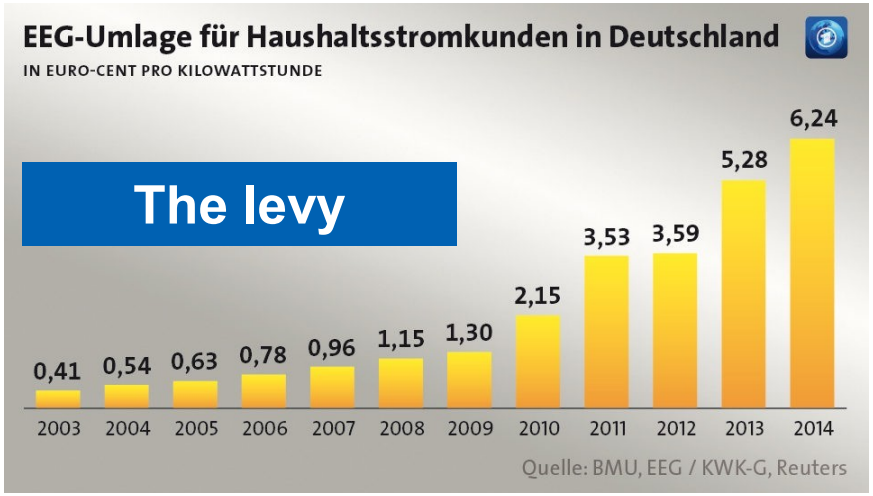
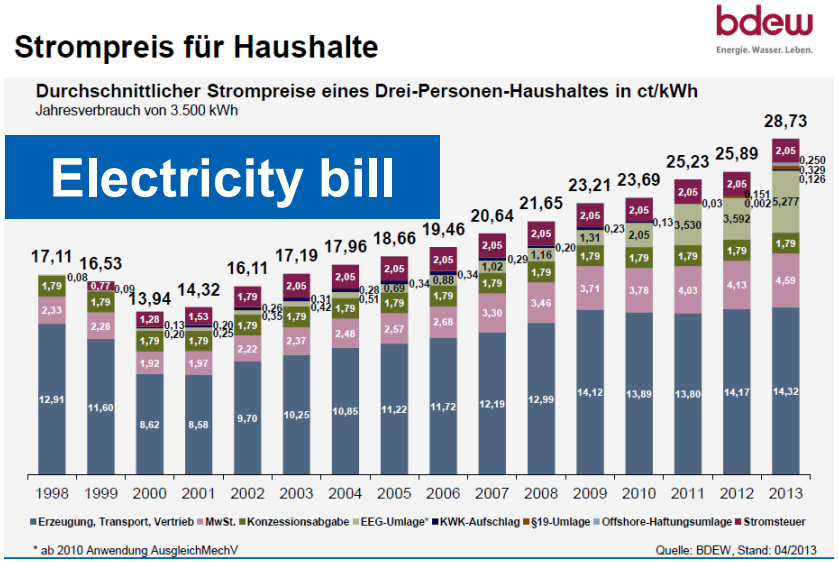
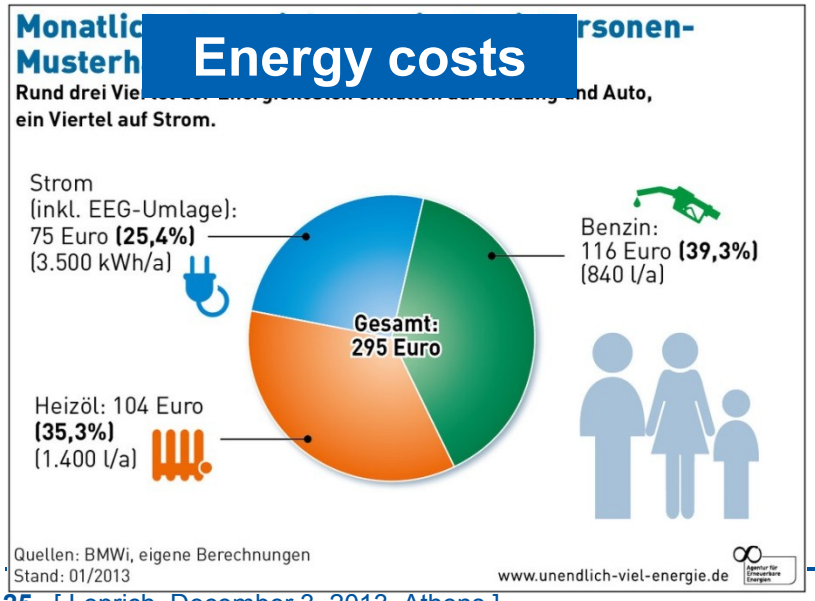
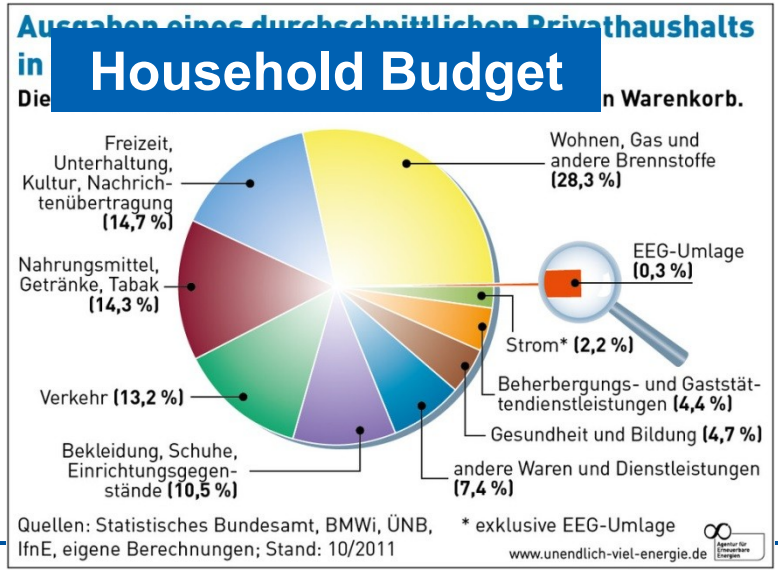








The „best“ funding mechanism is the FIT

- it has low financing costs due to low investment risks
- it has been very effective
- it has accomplished a broad variety of private investors to participate in funding the plants
- it is easy to administer
- it has brought the cost down significantly
- ….

At the end of the day ….

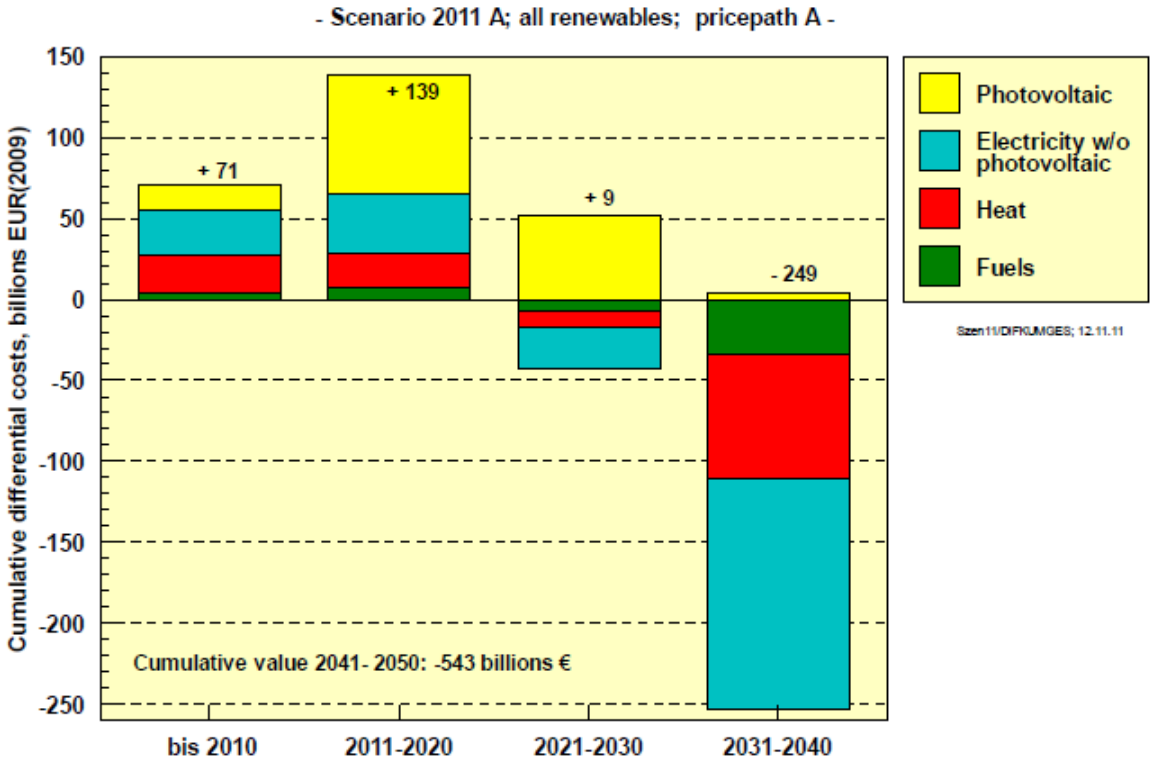


Figure 19: Cumulative system-analytical differential costs of entire provision of energy from renewables in Scenario 2011 A for 10-year segments and price path A

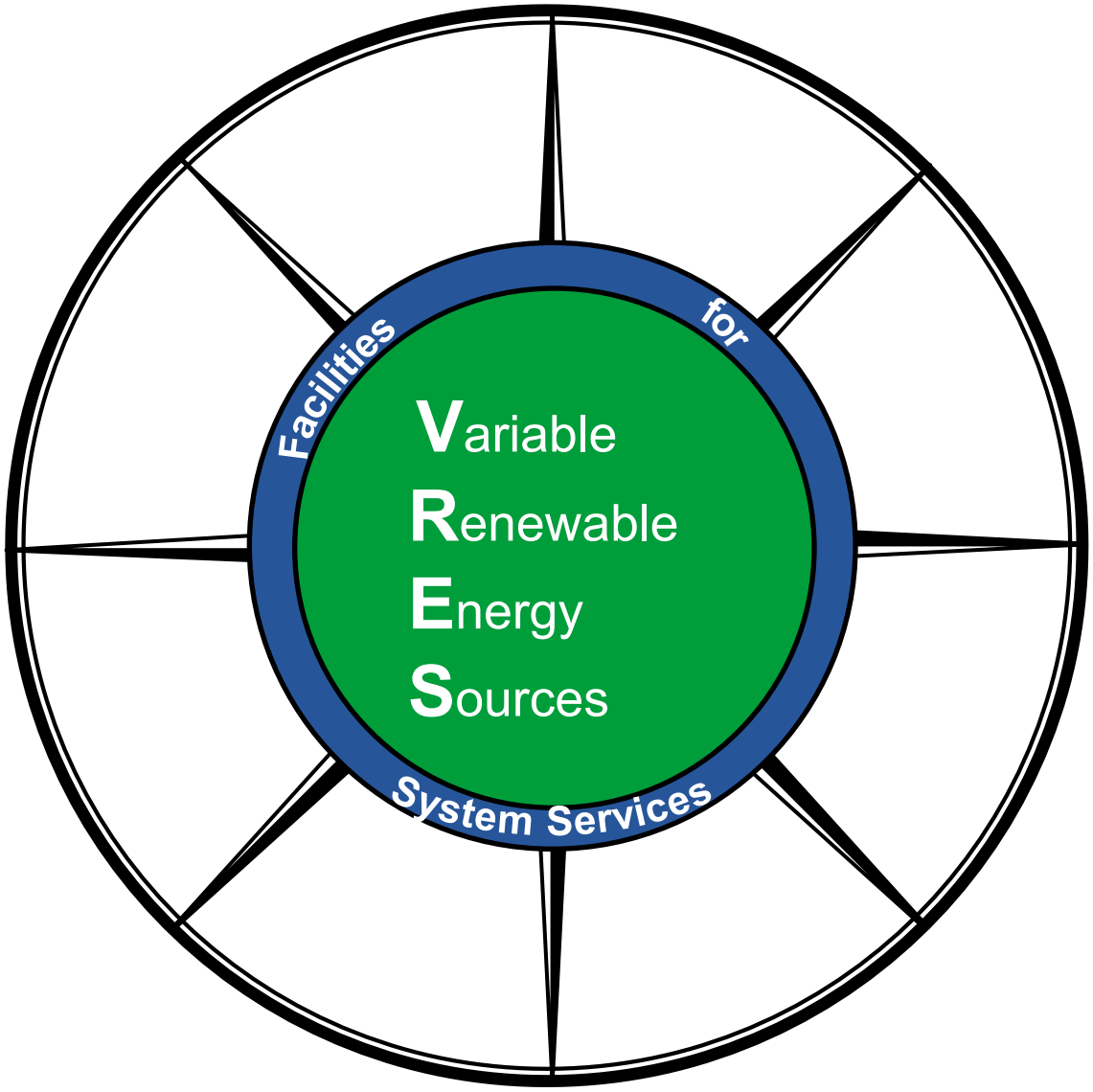
… an electricity system based on renewables is cheaper than one based on fossile fuels or nuclear

Source: DLR/IWES/IfNE 2012

2nd segment

To do:

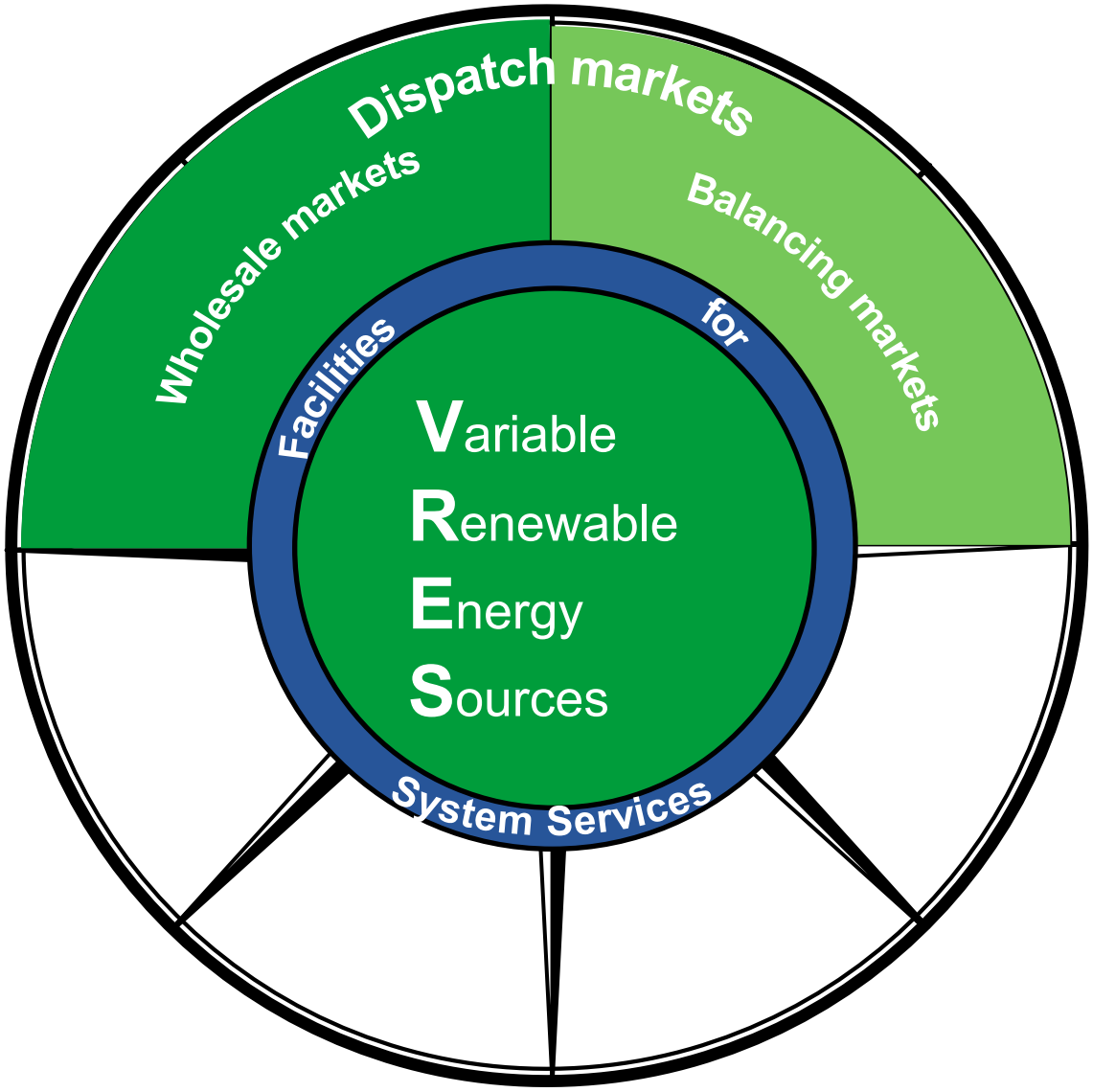
The renewables have to take over



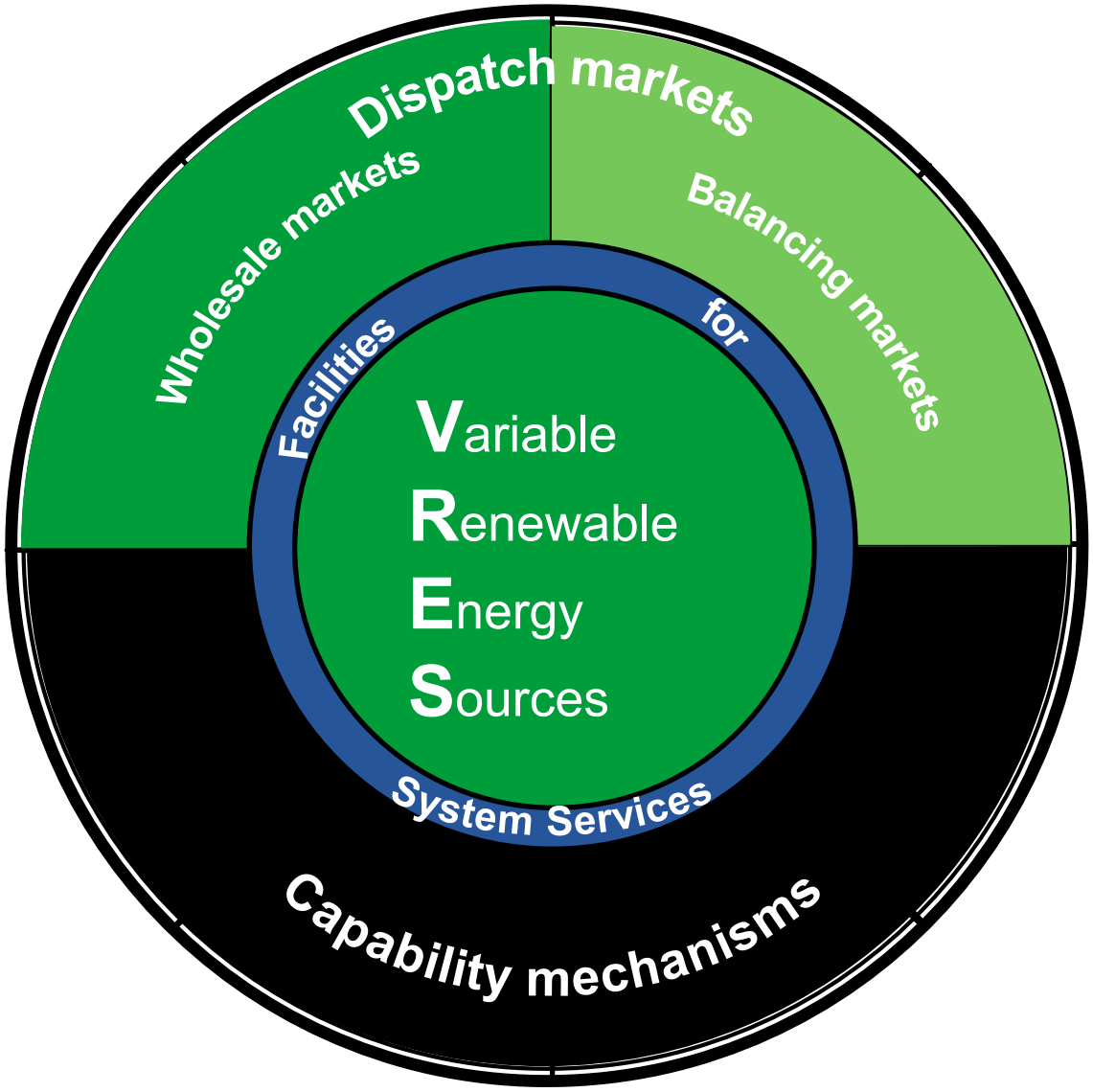
3rd segment

To do:

Better harmonisation between the dispatch markets and the VRES



4th segment


Dispatch markets
Wholesale markets
Balancing markets
Facilities
for
Variable
Renewable
Energy
Sources
System Services
Capability mechanisms

The design of capability mechanisms …

- is necessary in order to ensure the supply of the public good “security of supply”
- is complicated
- is very difficult with respect to timing
- should avoid large free-rider effects
- should be compatible with the necessities of the system transformation and climate policy
- should be harmonized at least with mechanisms of neighboring countries

Resume

- The center of the German Energiewende is the electricity system
- The future electricity system will be dominated by variable renewable energies; they will define the rationality of the system
- Therefore the challenge is much more than “market integration” of renewables; it is a fundamental “system transformation”
- To finance the future electricity system one has to have a specific funding mechanism for VRES
- To guarantee security of supply as a public good one has to complete the system with capability mechanisms that reward the provision of capacity

Thank you very much for your attention!

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