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The German Energy Transition. Progress and Challenges Ahead

2018 Korea Energy Transition Conference
Korean-German Energy Transition Forum

Dr Felix Chr Matthes
Seoul | 4th October 2018

Energy Transformation in Germany
A target-driven structural change of the economy

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	Targets as of …												
	2018	2016	2016	2016	2016	2016	2010	2018	2010	2010	2010	2010	2011
	Greenhouse gas emissions						Renewable energies		Energy efficiency				Nuclear energy
	Total	Energy sector	Buildings	Transport	Industry	Agri-culture	Gross final energy	Power gene-ration	Primary energy	Space heating	Final energy ransport	electricity con-sumption	
2011													-41%
2015													-47%
2017													-54%
2019													-60%
2020	~~-40%~~						18%	35%	-20%	-20%	-10%	-10%	
2021													-80%
2022													-100%
2025								~~40 to 45%~~					
2030	-55%	-61 to -62%	-66 to -67%	-40 to -42%	-49 to -51%	-31 to -34%	30%	65%					
2035								~~55 to 60%~~					
2040	-70%						45%	~~65%~~					
2050	-80 to -95%						60%	80%	-50%	-80%	-40%	-25%	
Base year	1990	1990	1990	1990	1990	1990	-	-	2008	2008	2005	2008	(2010)

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Greenhouse gas emission trends in Germany
Different progress for the various sectors

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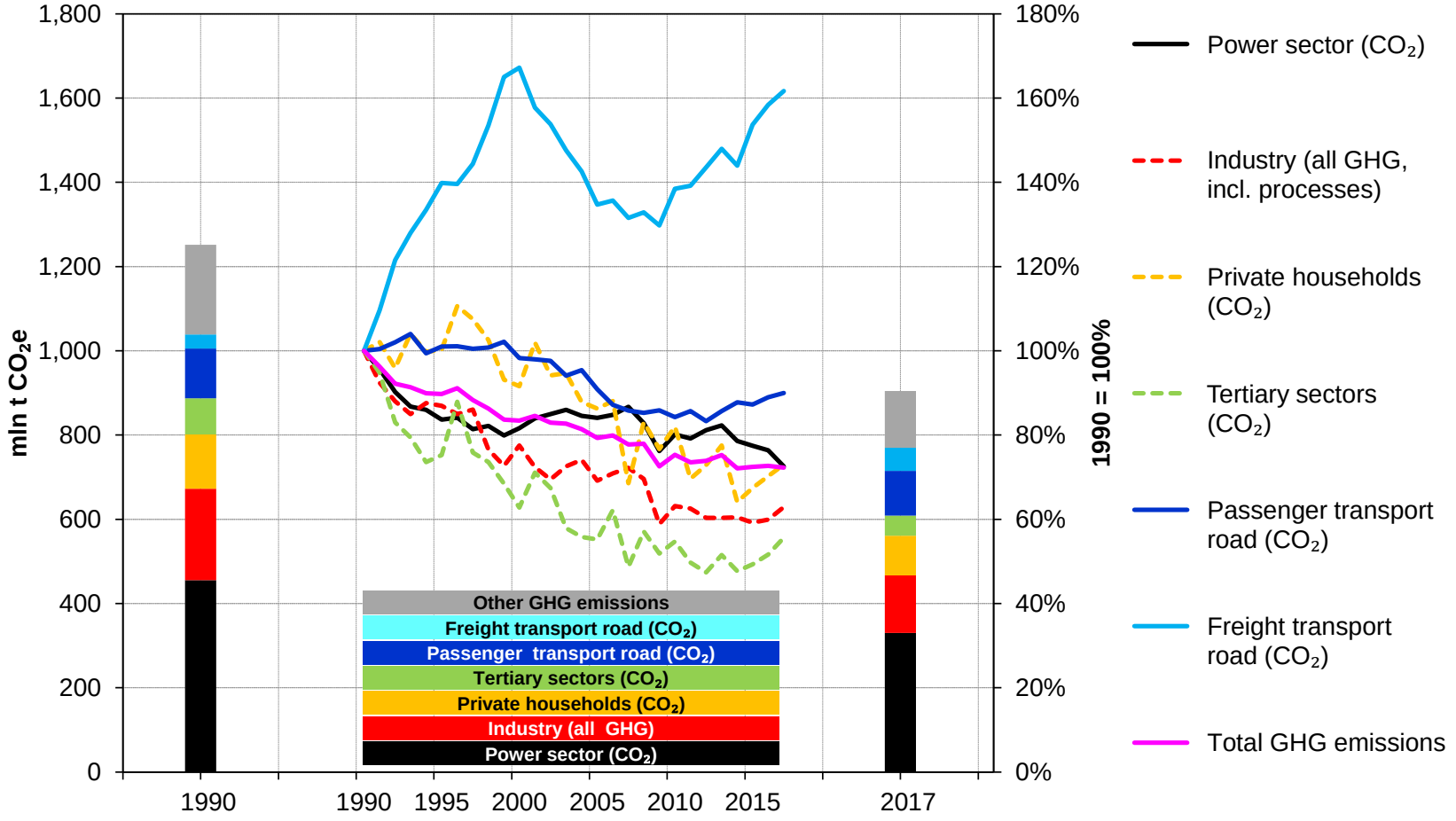

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Learning by doing: Building trust that it can be done but also awareness on the shortfalls

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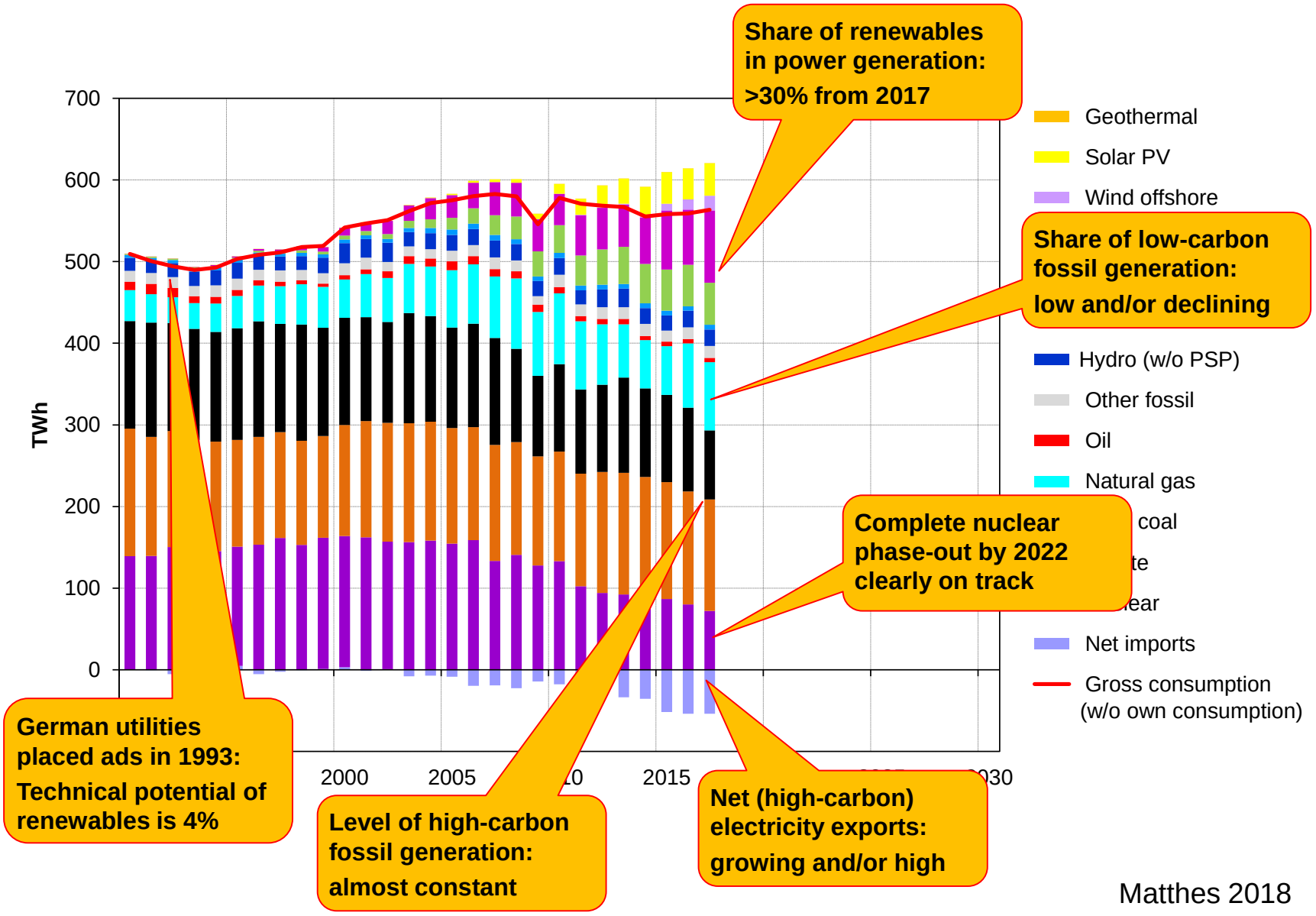

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Coal phase-out in Germany
Firmly on the agenda: the “Coal Commission”

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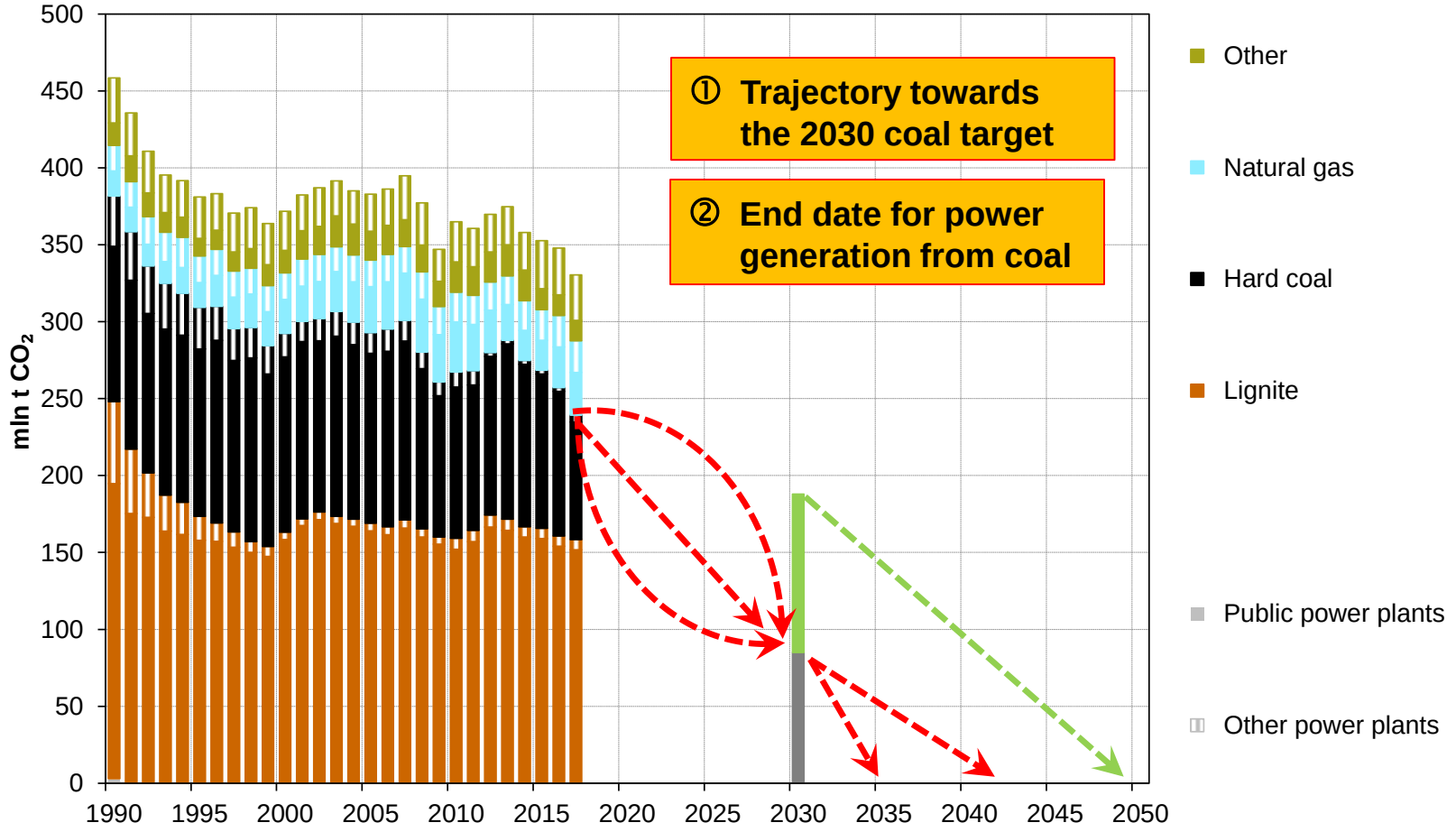

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Wholesale power prices & renewables surcharge
Historical trends and projections

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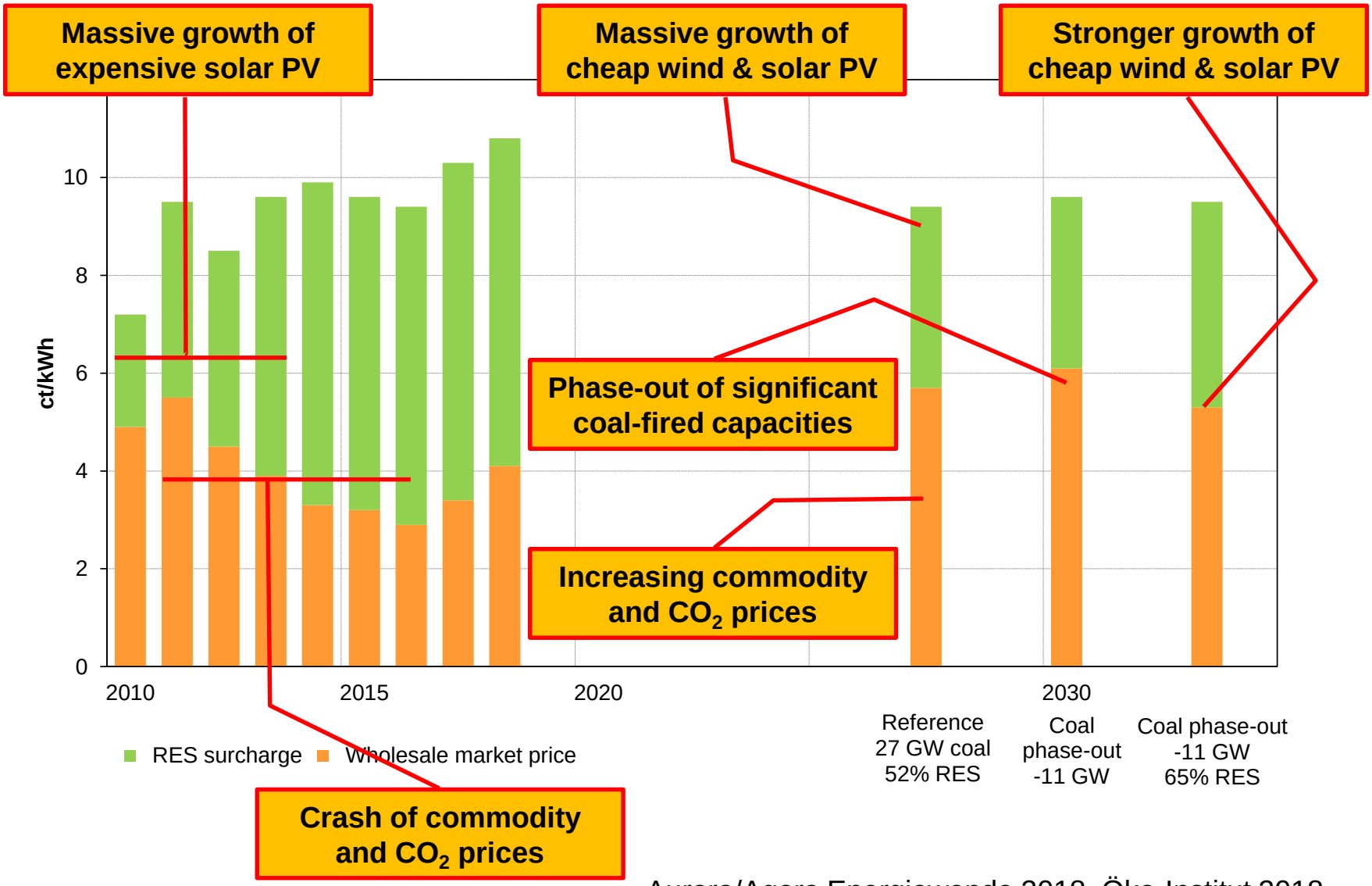

Aurora/Agora Energiewende 2018, Öko-Institut 2018

The geographic dimension of Energiewende
The old geography

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Low load / medium conventional region North

Low load

Medium nuclear capacities

Low conventional capacities

High load / high coal region West

High load

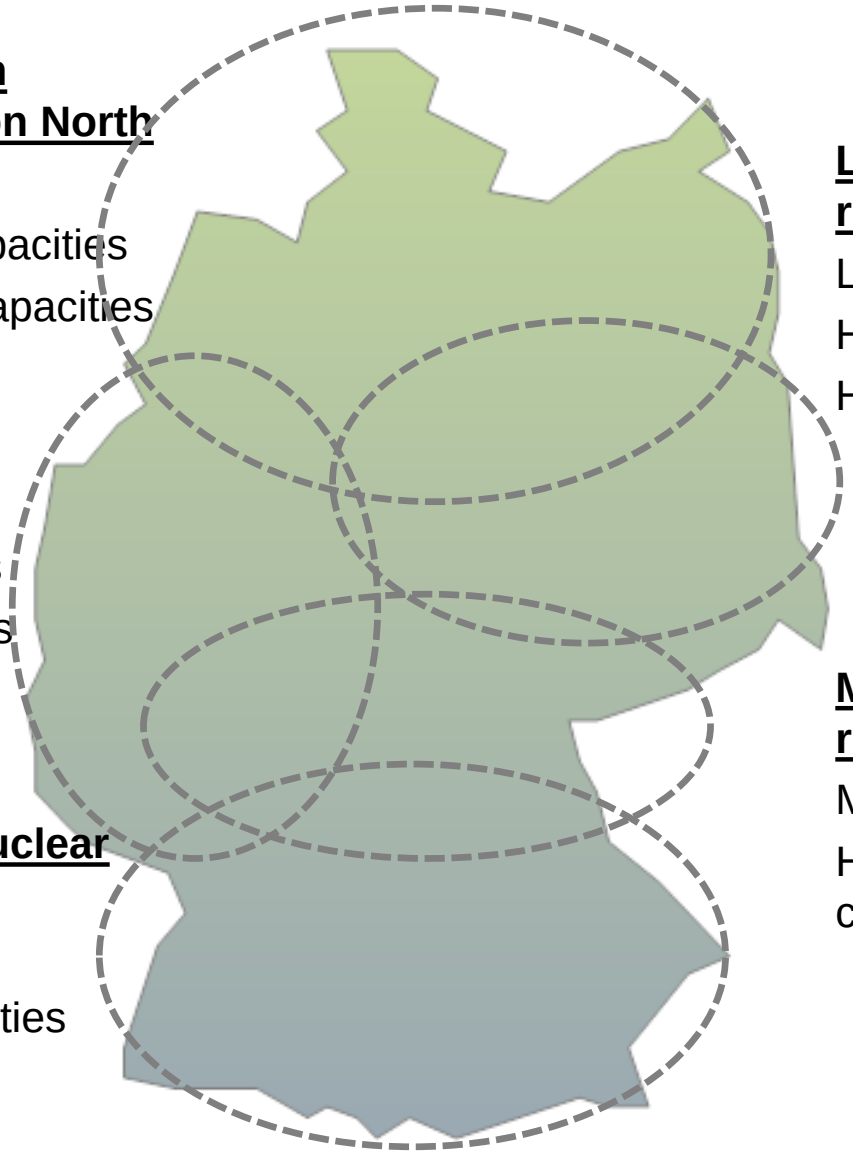
High coal capacities

High CHP capacities

High load / high nuclear region South

High load

High nuclear capacities



Low load / high coal region East

Low load

High coal capacities

High CHP capacities

Medium load / storage region Center

Medium-/ high-load

High pump-storage capacities

The geographic dimension of Energiewende
The new geography

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High wind region North

Low load

High onshore/offshore wind

High load /medium RES region West

High load

Medium RES

High CHP

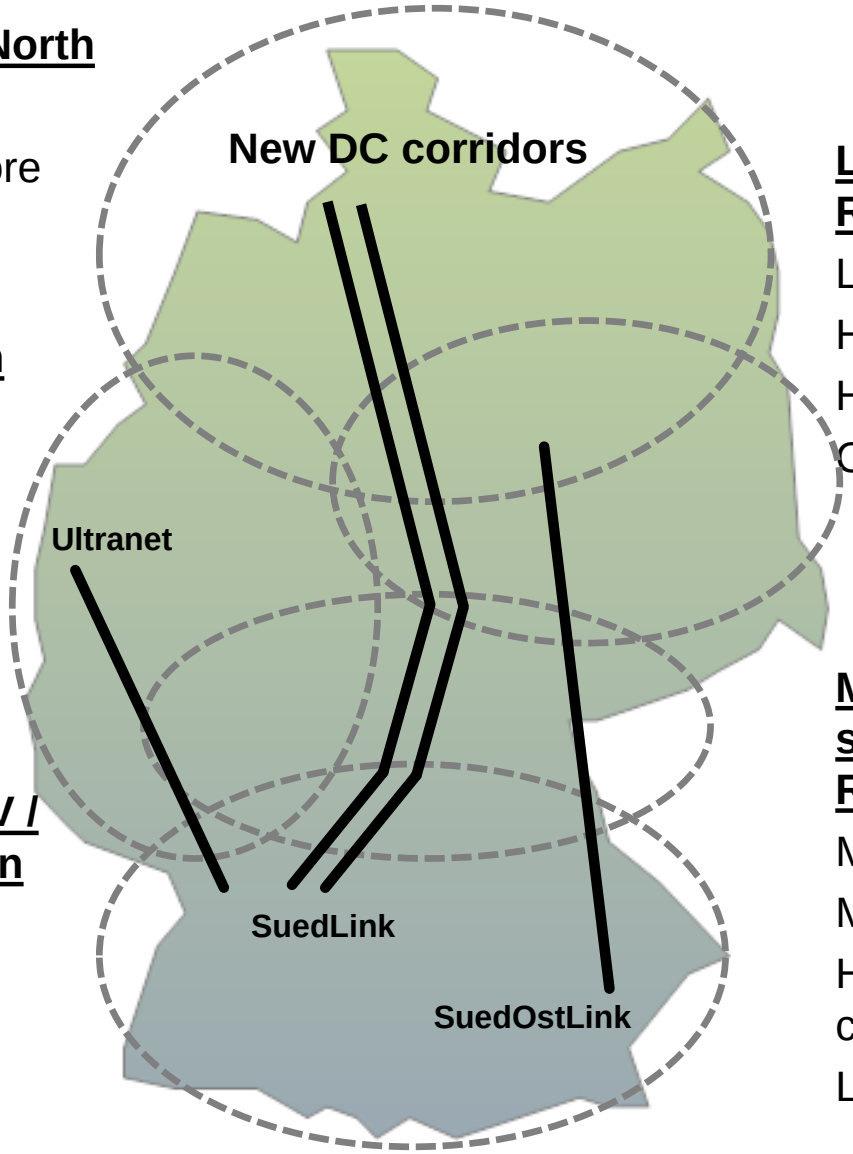
Coal phase-out

High load / high PV / high storage region South

High Load

High PV

Access to storage capacities abroad



Low load / high wind Region East

Low load

High wind

High CHP

Coal phase-out

Medium load / infra-structure & storage Region Center

Medium/high load

Medium RES

High pump storage capacities

Large electricity transits

Realizing what transforming the energy system is really about: managing structural change

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- **Energy transition: towards a low/zero carbon, risk minimized and renewables-based energy system**
  - technologies are available/in the pipeline (globally, w/o learning costs)
  - clean options are competitive and/or affordable on a LCOE basis
- **Managing structural change is the real key challenge**
  - changing characteristics of technologies: variable generation, more (but however not exclusively) distributed/decentralized
  - changing structures of costs: higher shares of fixed/capital costs
  - changing structures of players/market participants: much more diverse investors and operators with new/other (economic) appraisals, other financing approaches, sources or risk assessments
  - changing spatial structures: upgrading (distribution/transmission) grids
- **Lessons learned**
  - need for new market design (coordination & pay-back for investments), grid issues (neutrality, upgrades/investments) must be addressed early; new players, their market access and appraisals need to be reflected

Four strategic pillars of the energy transformation need to be addressed symmetrically

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- **Paving the way – for energy efficiency, clean generation & flexibility options (renewables & complementary flexibility)**
  - innovation, level playing field & roll-out for renewables (☺) , energy efficiency (😐), clean heating (😐) and zero-emission transport (☹)
  - sustainable economic basis (enabling coordination & investments) (😐)
- **Designing the exit-game – for the non-sustainable capital stocks**
  - phase-out for nuclear power (☺) and coal (☹) in the electricity sector
  - phase-out of outdated heating systems (😐), changing modal split in transportation (😐) and phase-out high-emitting vehicles (☹)
  - consistent carbon pricing (☹)
- **Triggering the necessary infrastructure adjustments with sufficient lead-times for electricity (☹), heat** (😐) **and gas** (😐)
- **Making the necessary innovation work in time**
  - an extremely broad range of innovation in the pipeline (☺)
  - attribution of innovation to the different phases of the energy transformation (😐)

Further reading

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- **Matthes, Felix Chr. (2015): The energy transition in Germany**
  - http://www.cerre.eu/sites/cerre/files/151006_CERREStudy_EnergyTransition_Final.pdf
- **Matthes, Felix Chr. (2017): Energy transition in Germany: a case study on a policy-driven structural change of the energy system**
  - https://link.springer.com/article/10.1007/s40844-016-0066-x
- **Matthes, Felix Chr. (2017): Decarbonizing Germany's Power Sector. Ending Coal with A Carbon Floor Price?**
  - https://www.ifri.org/sites/default/files/atoms/files/matthes_decarbonizing_germany_power_sector_2017.pdf
- **Matthes, Felix Chr. et al (2017): Renewables versus fossil fuels – comparing the costs of electricity systems**
  - https://www.agora-energiewende.de/fileadmin/Projekte/2016/Stromwelten_2050/Agora_Gesamtkosten-Stromwelten-EN_WEB.pdf
- **Matthes, Felix Chr. (2017): The current electricity costs of energy-intensive industries in Germany**
  - http://reinhardbuetikofer.eu/wp-content/uploads/2017/09/Matthes-2017-Memo-Electricity-costs-of-energy-intensive-industries-in-Germany-1.pdf
- **Matthes, Felix Chr. (2018): Energy transformation in Germany. Progress, shortfalls and prospects**
  - http://www.enecho.meti.go.jp/committee/studygroup/ene_situation/006/pdf/006_005_02.pdf

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Thank you very much

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