For our environment

Umwelt Bundesamt

Keynote

„The energy system 2030 – transition completed?“

Prof. Dr . Uwe Leprich
Head of Department I 2:
Climate Protection and Energy

UFZ Energy Days 2017
Leipzig, 15 March 2017

Which energy system are we talking about?

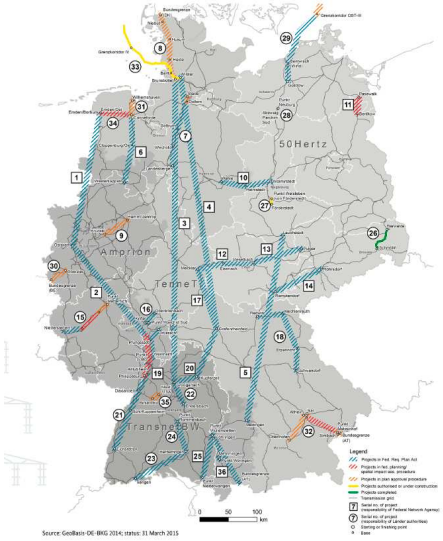
Energy transition and Energy Systems: centralized or decentralized?

WIRTSCHAFT MEGAPROJEKT

China plant ein Stromnetz für die ganze Welt

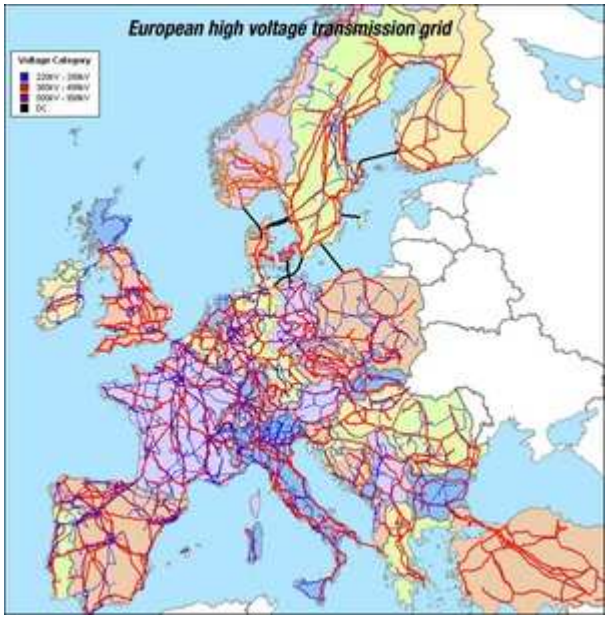
Liu sprach vom Ausbau großer Windkraftkapazitäten am Nordpol, die mit Solarparks rund um den Äquator verbunden werden sollten. Grundlage für das Netz sei die Ultrahochspannungstechnik (UHV), mit der China bereits seit rund zehn Jahren Erfahrungen sammle. Dabei werden 800.000 Volt über Gleichstromkabel oder bis zu 1,1 Millionen Volt über Wechselstromsysteme geleitet

Global copper plate

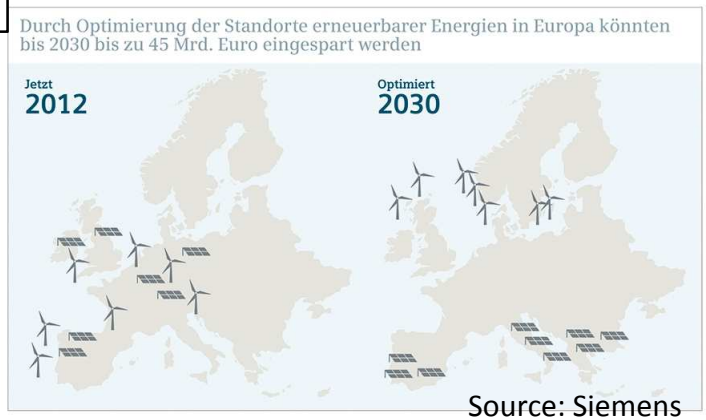


National copper plate

Copper plate as a cornerstone for the future energy system?

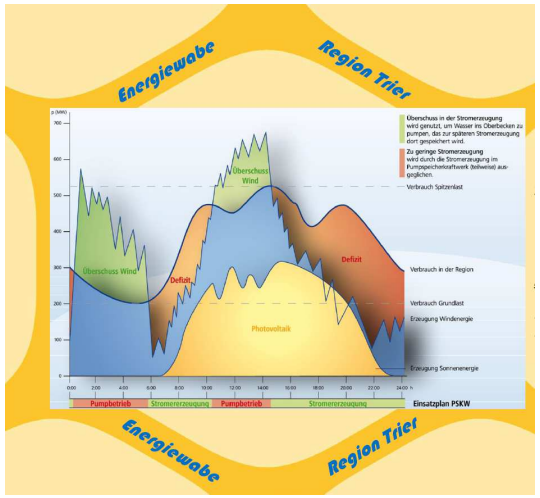


European copper plate



Source: Siemens

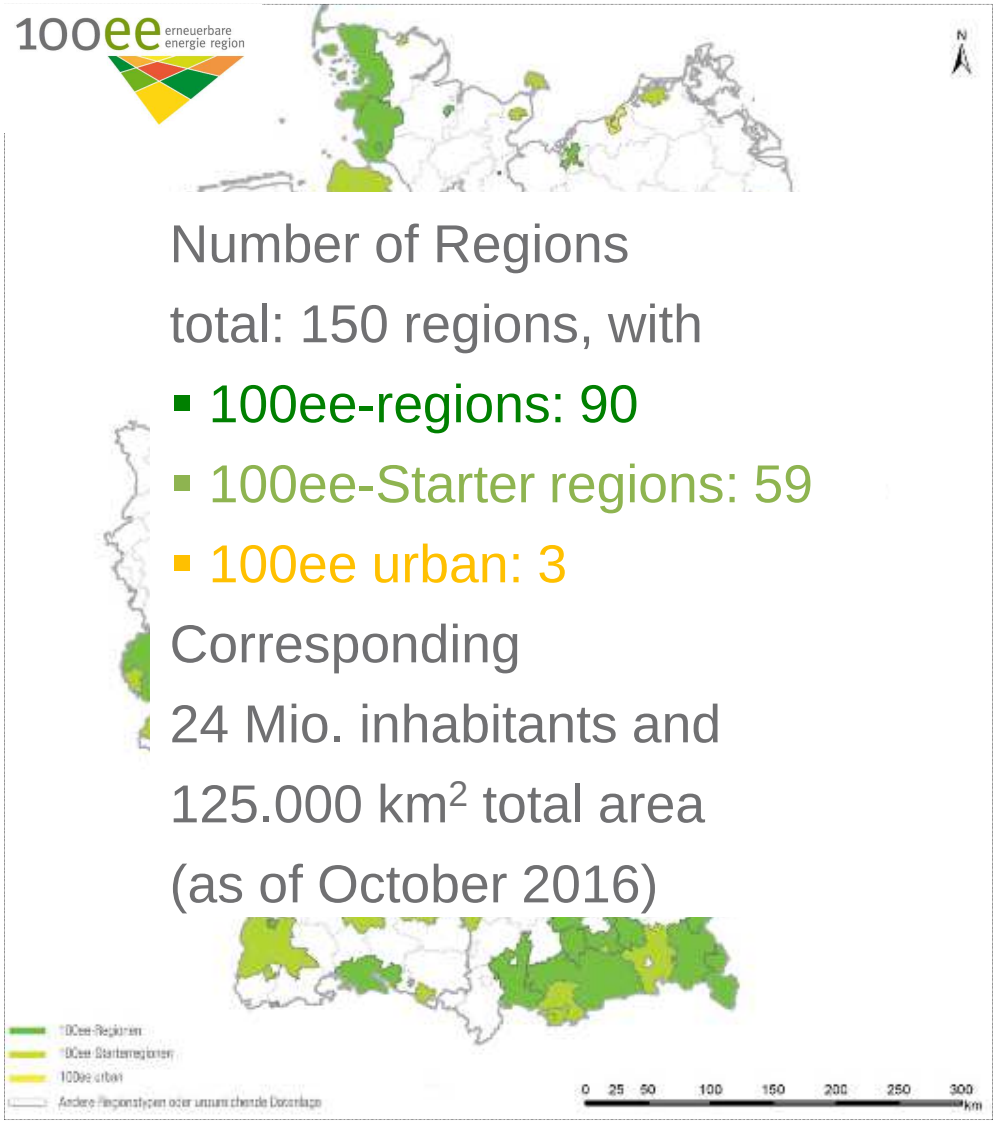
Energy transition and Energy Systems: centralized or decentralized?



Source: Schöller 2015

A regional approach

Energy autarkic home



Number of Regions

total: 150 regions, with

- 100ee-regions: 90
- 100ee-Starter regions: 59
- 100ee urban: 3

Corresponding

24 Mio. inhabitants and

125.000 km^2 total area

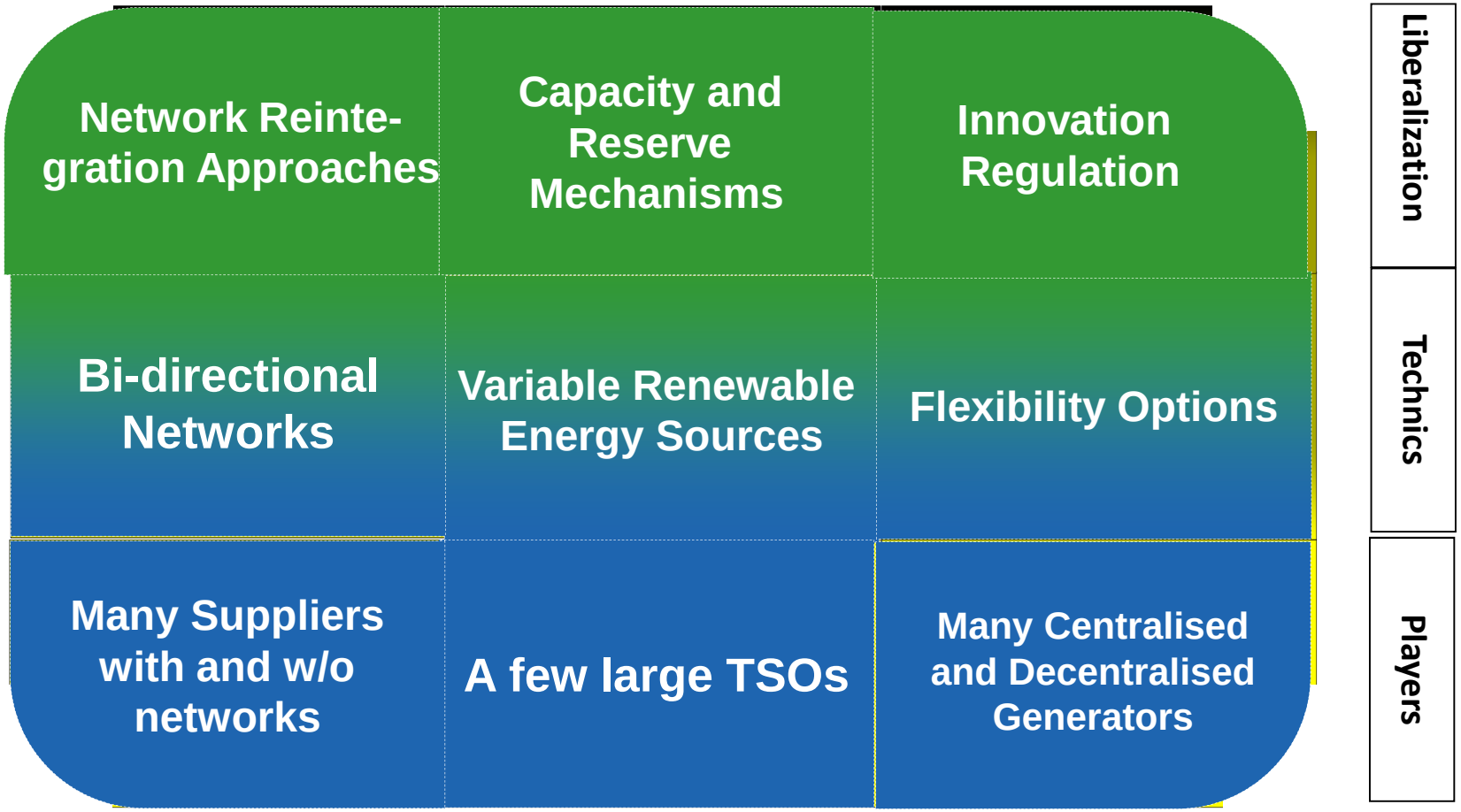
(as of October 2016)

The German energy transition story in a nutshell

The energy system 2030 – transition completed?

(Ownership) Unbundling	Power Exchange	(Efficiency) Network Regulation	Liberalization
Uni-directional Networks	Big Nuclear and Coal Power Plants	Peak load plants (gas, oil)	Technics
Many Small Municipal Utilities as Suppliers and DSOs	A few large integrated Utilities as Generators and TSOs	Decentralised Generators with a fix Remuneration	Players

The energy system 2030 – transition completed?



Energy targets and energy scenarios 2030 and beyond

Transformation of the energy system

- Germany's Target in 2050: 80-95% reduction of greenhouse gas emissions
  - ➢ Implications for the energy sector: Decarbonisation

	Climate	Renewable Energy		Efficiency		
	GHG (vs. 1990)	Electric power	Total share	Primary energy	Energy productivity	Modernising buildings
2020	– 40 %	35%	18%	– 20%	increase to 2.1% p.a.	double rate 1% → 2%
2030	– 55 %	50%	30%			
2040	– 70 %	65%	45%			
2050	– 80-95 %	100 % !!!		– 50%		

Climate Protection Plan 2050 – sector targets

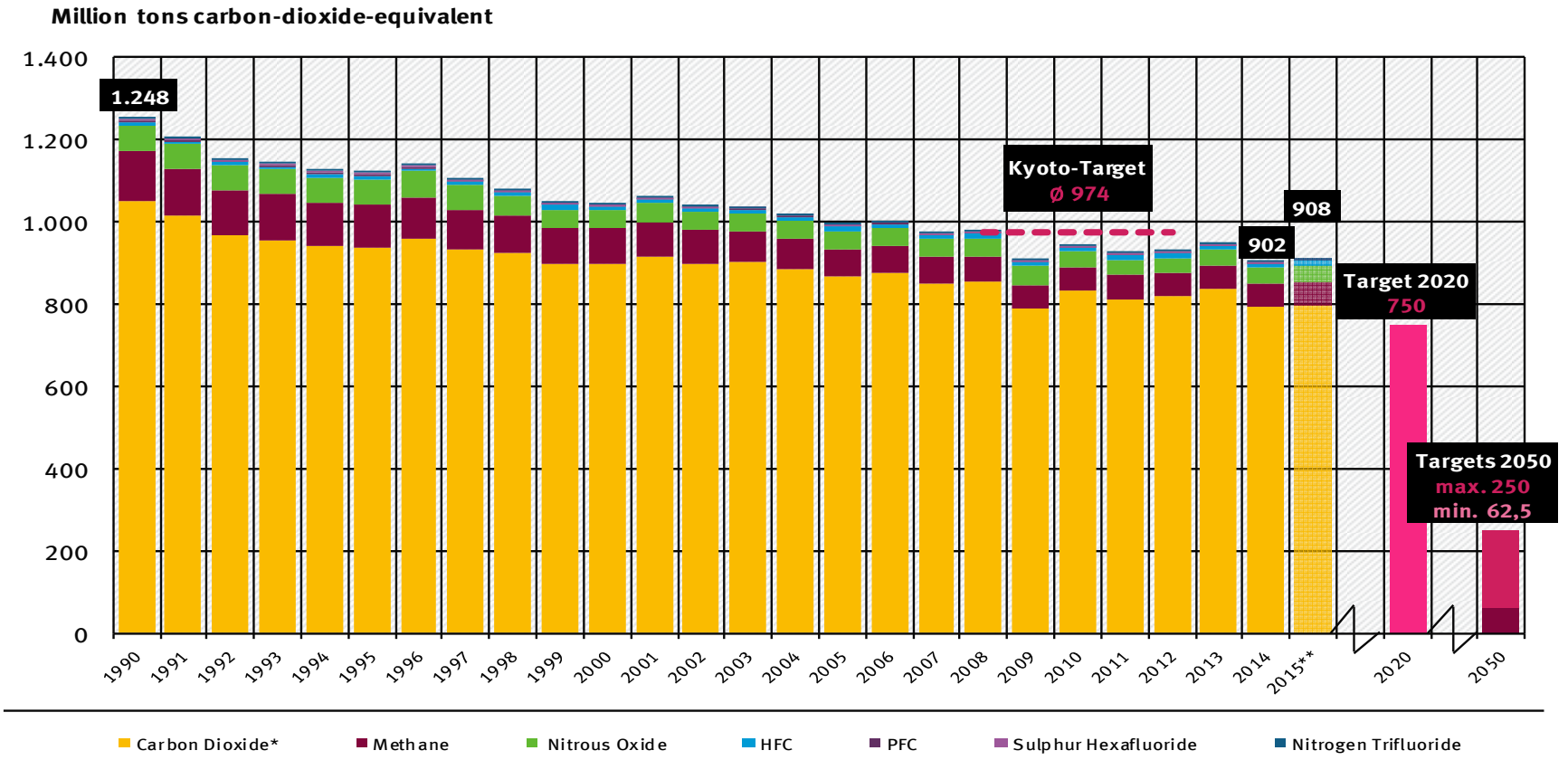
	1990	2015	2015	2030	2030
Handlungsfeld	(in Mio.t CO2-Äquiv.)		Änderung ggü. 1990 in %	in Mio. t CO2-Äquiv.	Änderung ggü. 1990 in %
Energiewirtschaft	466,4	347,3	-25,5	175-183	62-61
Gebäude	209,7	122,0	-41,8	70-72	67-66
Verkehr	163,3	159,6	-2,3	95-98	42-40
Industrie	283,3	188,6	-33,4	140-143	51-49
Landwirtschaft	90,2	73,2	-18,8	58-61	34-31
übrige Emissionen	38,0	11,2	-70,5	5	87
Summe THG	1250,9	901,9	-27,9	543-562	56-55

Source: KSP 2050

GHG trend description – overview

Greenhouse Gas emissions in Germany since 1990, by gas

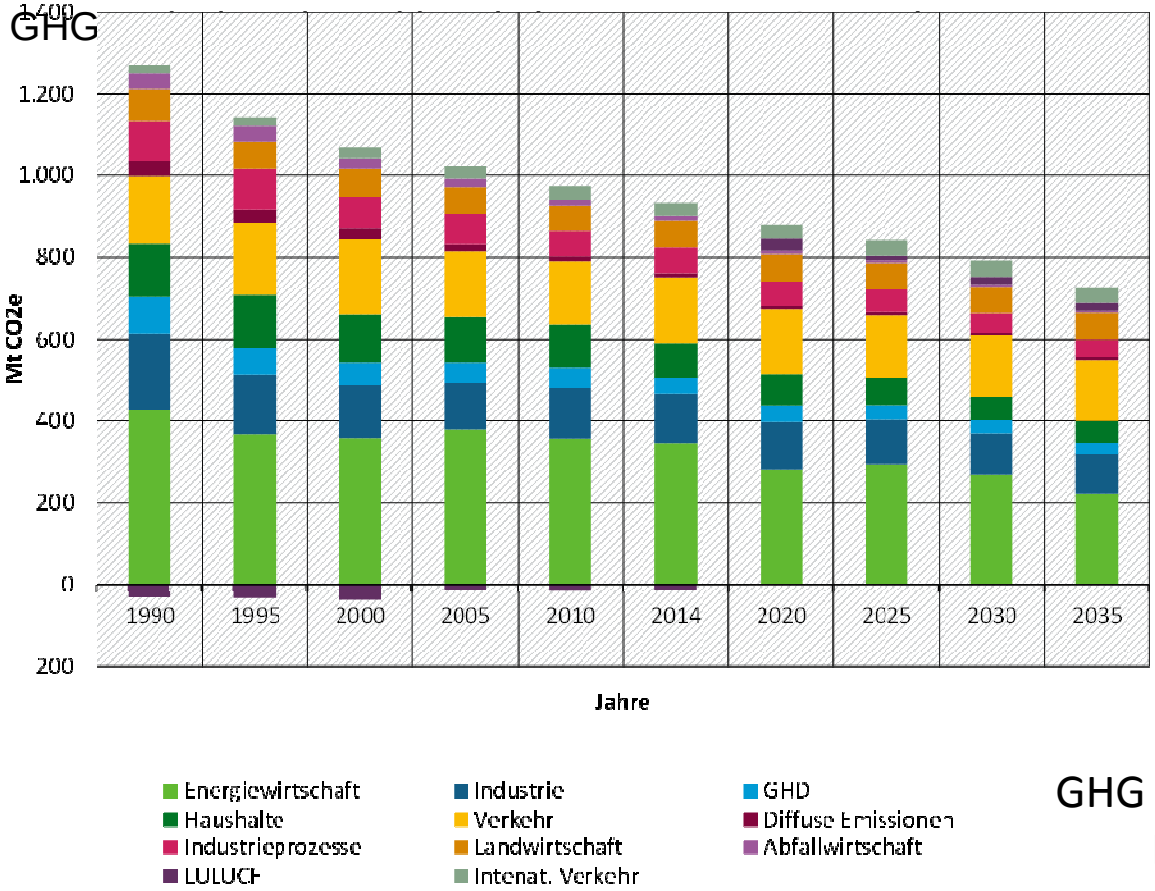
and targets for 2008-2012 (Kyoto-Protokoll), 2020 and 2050 (federal government)



* w/o carbon dioxide from LULUCF
** short-term prognosis for 2015

Quelle: Federal Environment Agency 2015, National Greenhouse-Gas-Inventories 1990 to 2014 (Version: 01/2016) and short-term prognosis 03/2016

Are we on the right track? – Projections Report 2017



GHG emissions in 2030 ("With Existing Measures Scenario"):

792.5 mt CO_2e

GHG Projections Report 2017

Measure driven scenario

Includes all policies and measures adopted by July 2016

A comparison across studies

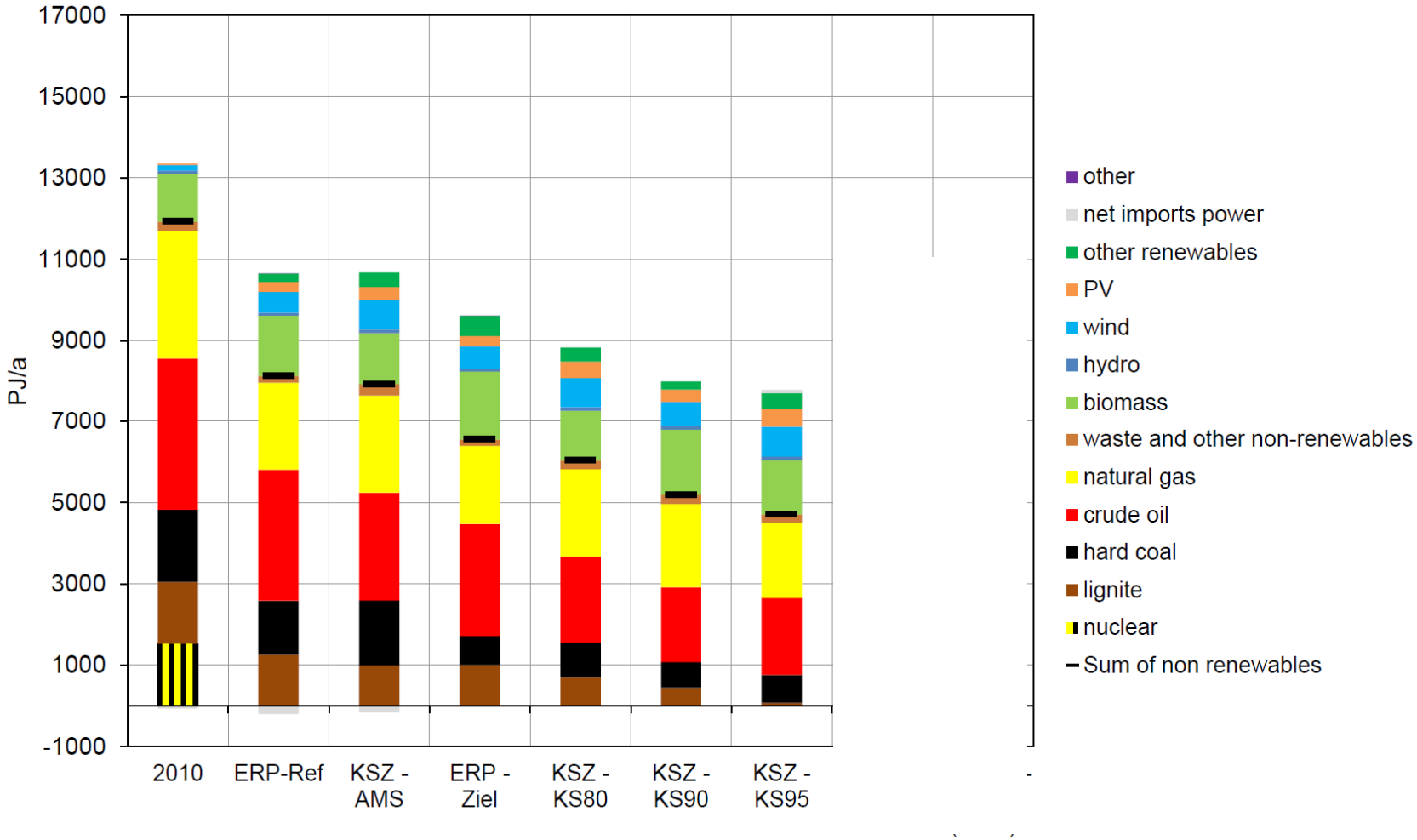
- What do different scenarios implicate for the energy market in 2030?

Szenario	THG-Minderungsziel in 2050	Abkürzung
Referenzszenarien:		
Entwicklung der Energiemärkte - Energiereferenzprognose, Referenzszenario Trendszenario	-	ERP-Ref
Klimaschutzszenarien 2. Runde, Aktuelle Maßnahmen Szenario	-	KSZ-AMS
Zielszenarien:		
Entwicklung der Energiemärkte - Energiereferenzprognose, Zielszenario	80% (1)	ERP-Ziel
Klimaschutzszenarien 2. Runde, Klimaschutzszenario 80	80%	KSZ-KS80
Klimaschutzszenarien 2. Runde, Klimaschutzszenario 95	95%	KSZ-KS95
Klimaschutzszenarien 1. Runde, Klimaschutzszenario 90	90%	KSZ-KS90
Leitstudie 2011, Szenario A	80%	LS 2011-A
Leitstudie 2011, Szenario THG95	95% (2)	LS 2011-THG95
Treibhausgasneutrales Deutschland im Jahr 2050	95%	THGND

1) nur energiebedingte Emissionen
2) Ziel wird erst in 2060 erreicht

Source: Studie „Überblick über vorliegende Szenarienarbeiten für den Klimaschutz in Deutschland bis 2050“, Öko-Institut

Primary energy demand 2010 and 2030



Source: Studie „Überblick über vorliegende Szenarienarbeiten für den Klimaschutz in Deutschland bis 2050“, Öko-Institut

Critical points

- Network expansion / network upgrades
- Further ambitious investments in renewable energies
- Speed of energy efficiency progress in all sectors
- phase-out of coal power plants

Germany 2050: a GHG neutral country

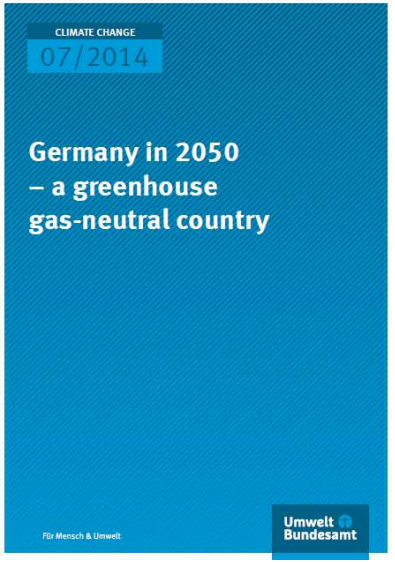
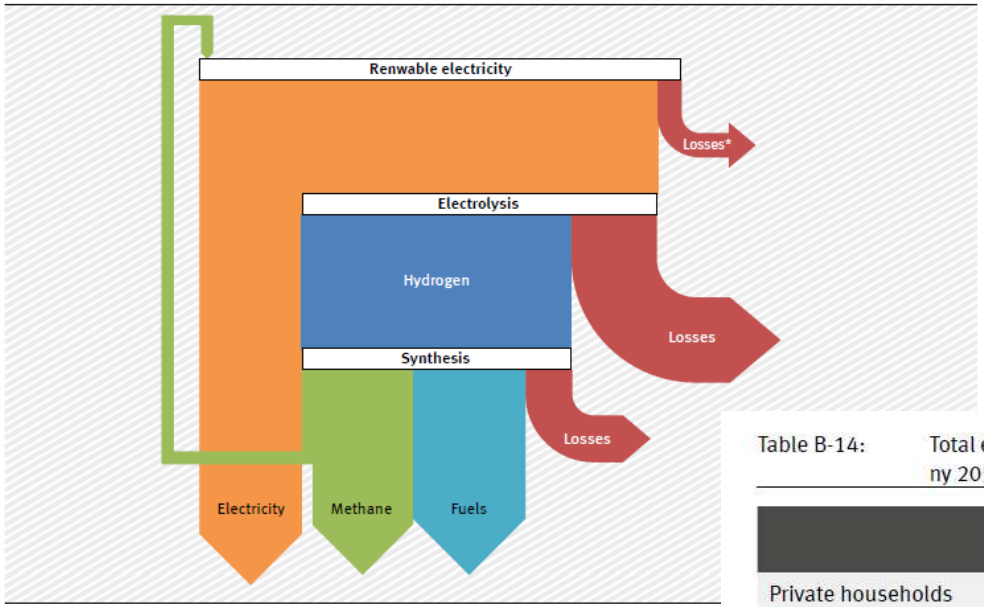


Figure B-25: Qualitative energy flow representation,[C.CI] own graphics



* incl. grid losses, losses from consumption of methane into electricity and losses from use of biomass for electricity provision

Table B-14: Total energy consumption in the Federal Environment Agency's GHG-Neutral Germany 2050 scenario

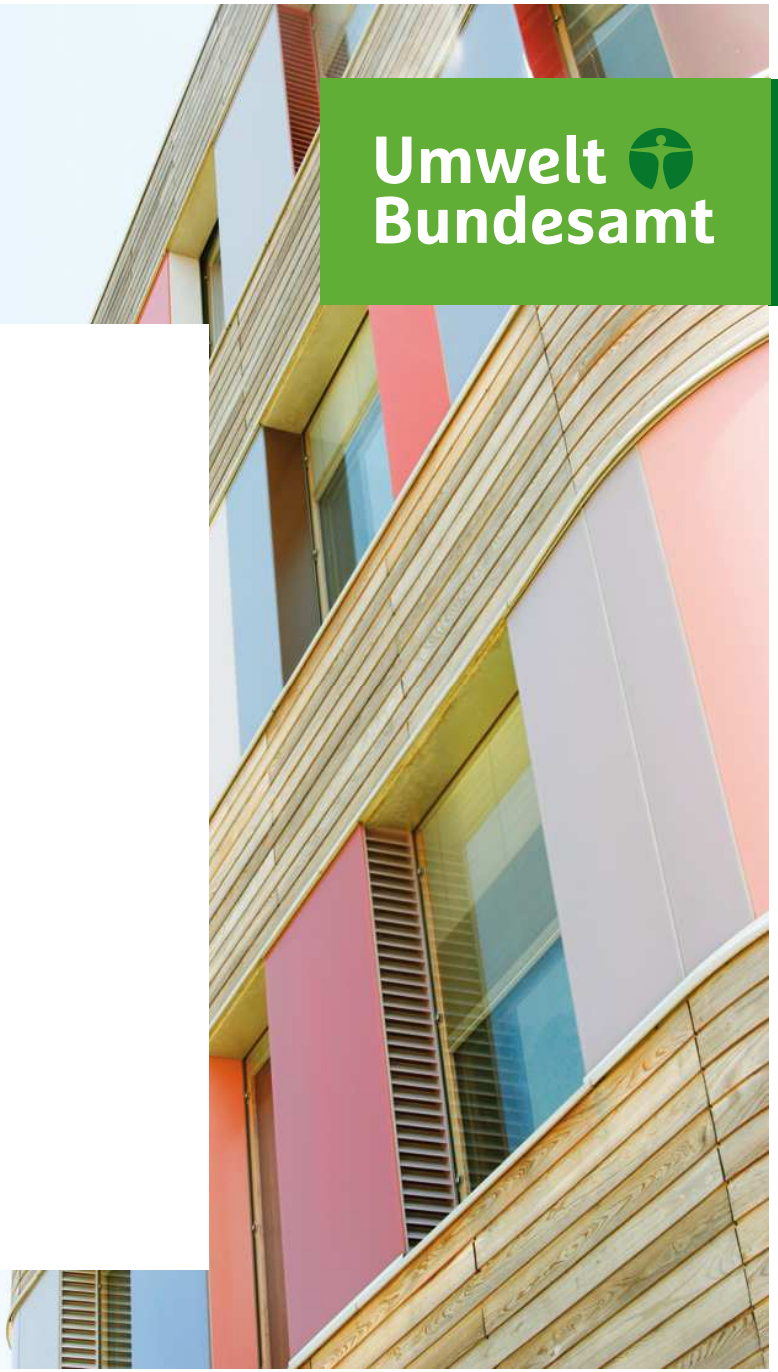
	Electricity in TWh	Renewable methane in TWh	Liquid renewable fuels in TWh
Private households	104.7	44.5	0
Commerce, trade and services	90.3	62.4	18.6
Industry[LXXXIX,XC]	179.7	198.8	0
Transport	91.1	0	533.3
Total energy	**465.8**	**305.7**	**551.9**
		1323.4	
Industry material use		282	
Total energy and material		**1605.4**	

Germany 2050: a GHG neutral country

- Ambitious climate targets can be reached: per-capita emissions of just one metric ton of CO_2e in 2050 possible!
- Through sector coupling **emissions** from the entire energy sector including electricity, heating, and transport could **fall to near zero** by 2050.
- Some emission sources have a limited capacity to reduce their emissions, emission socket remains (agriculture, industries).
- Sector coupling supports the **large scale integration of RES** into the system as synergistic effects can be harnessed due to different demand structures.
- Sector coupling facilitates a **substitution strategy for fossil energy carriers** in all sectors in the long term.

Perspective

- The new energy system will be dominated by variable renewable energies, mainly wind and solar
- Flexibility options like gas turbines, CHP plants, storages, DSM measures etc. will stabilize the system and compete against each other
- The better the network the less flexibility options are needed
- There will be no coherent optimized central system from the scratch; decentralized subsystems will play a role
- 2030 will be a way station on the way to a 100% renewable energy system; however the energy transition will not be reversible



Thank you very much!

Uwe Leprich
uwe.leprich@uba.de

www.uba.de