

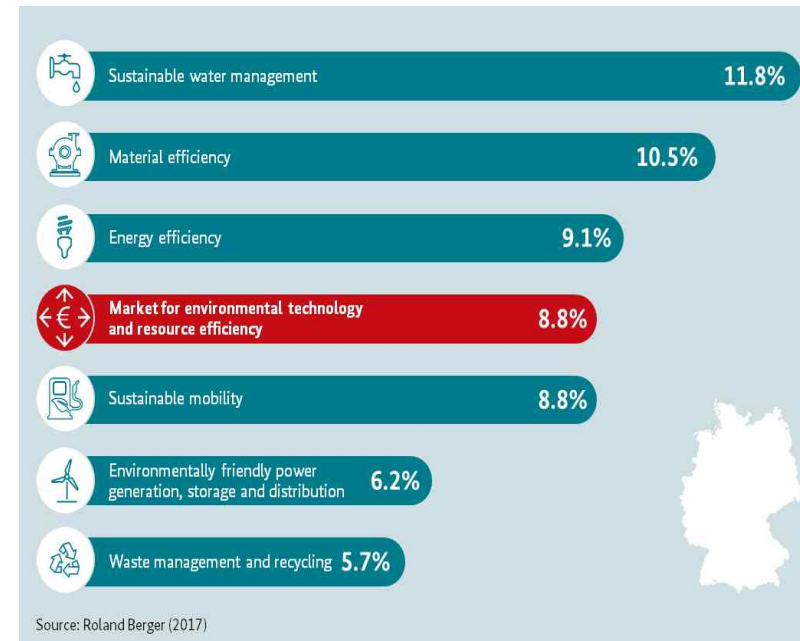
Lessons from German Energiewende

임성진

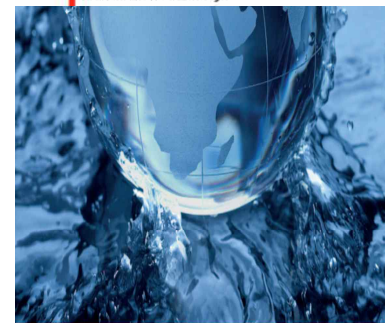
Energy Transition and Innovation

Green Innovation - Green Tech lead markets

make it beneficial for industry to support the “Energiewende“



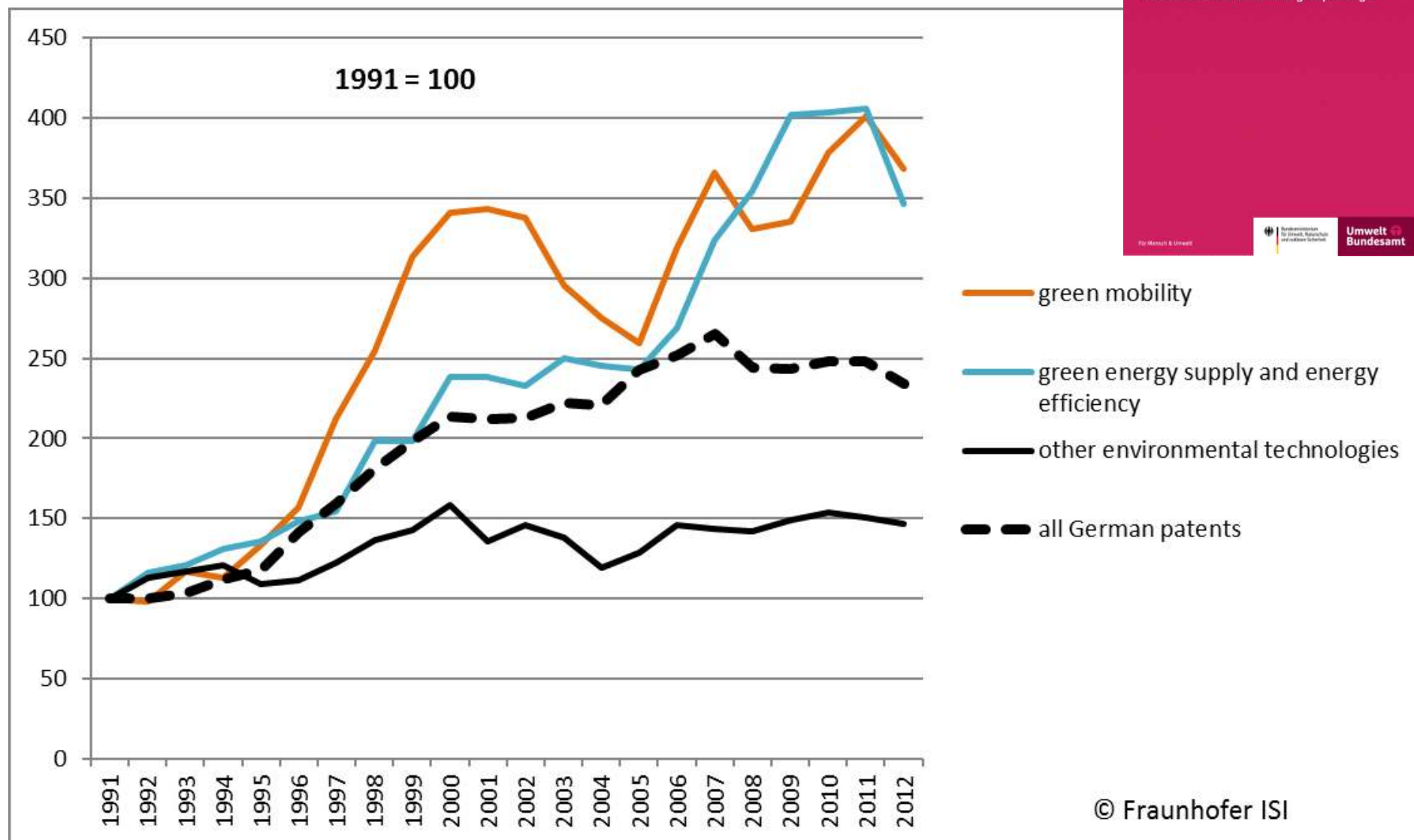
Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety



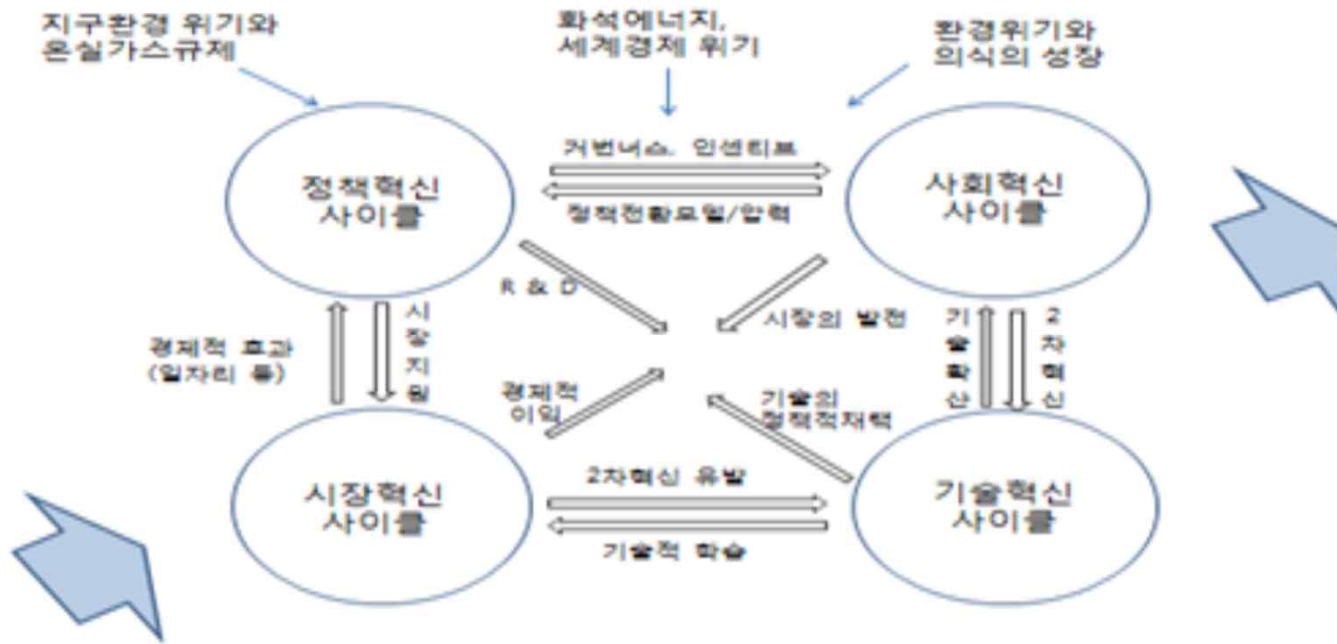
GreenTech made in Germany 2018

Environmental Technology Atlas for Germany

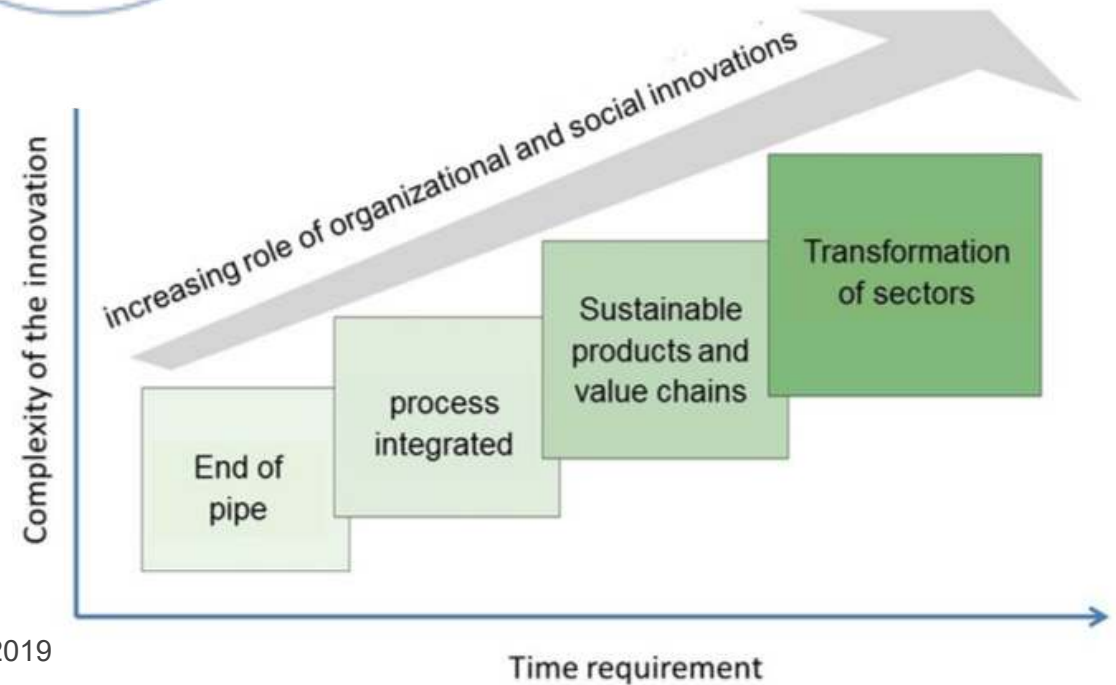
Patent dynamics in Germany in sub-fields relevant for eco-innovations



towards system innovations: 기술혁신 → 시스템 혁신



M. Jaenicke 2012, Leem 2016



에너지의 전환의 배경

Energy System Transition

지속가능 혁신
(기술-시장-정치-사회 혁신)

패러다임 전환

환경의 위기
기후변화, 미세먼지,
종의 멸종 등

안전의 위기
원전사고, 자연재해

정치경제 위기
성장의 한계, 경제위기
자원가격급등,

재생에너지혁명
기술혁신, 시장발전,
가격하락, Grid Parity
탈핵, 탈석탄

스마트기술
지능형 스마트그리드,
스마트미터, 스마트기구,
스마트홈, EV, ESS

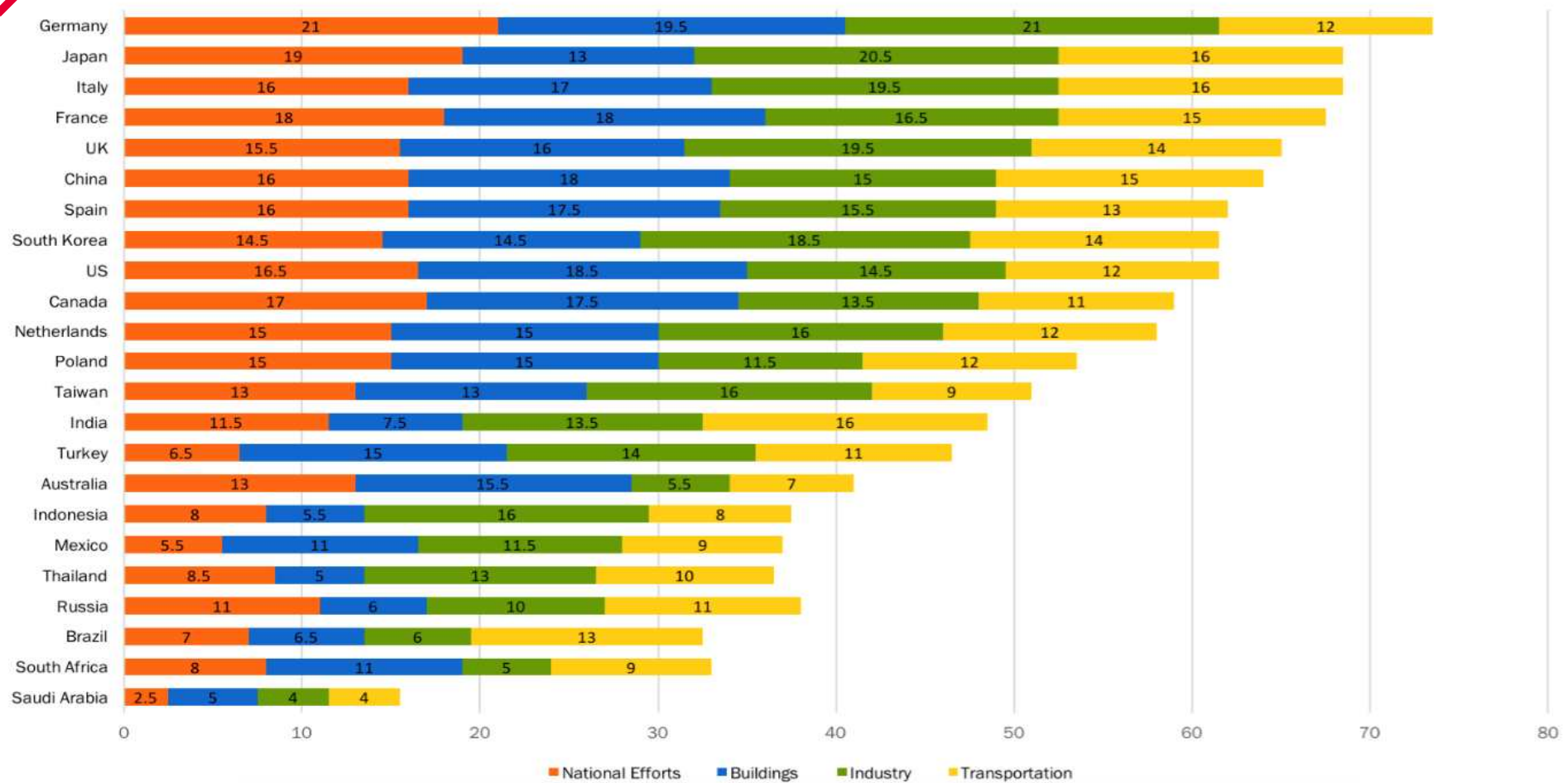
Energy Efficiency

Germany and Japan on top of global efficiency ratings

→ but huge cost-effective potentials still exist

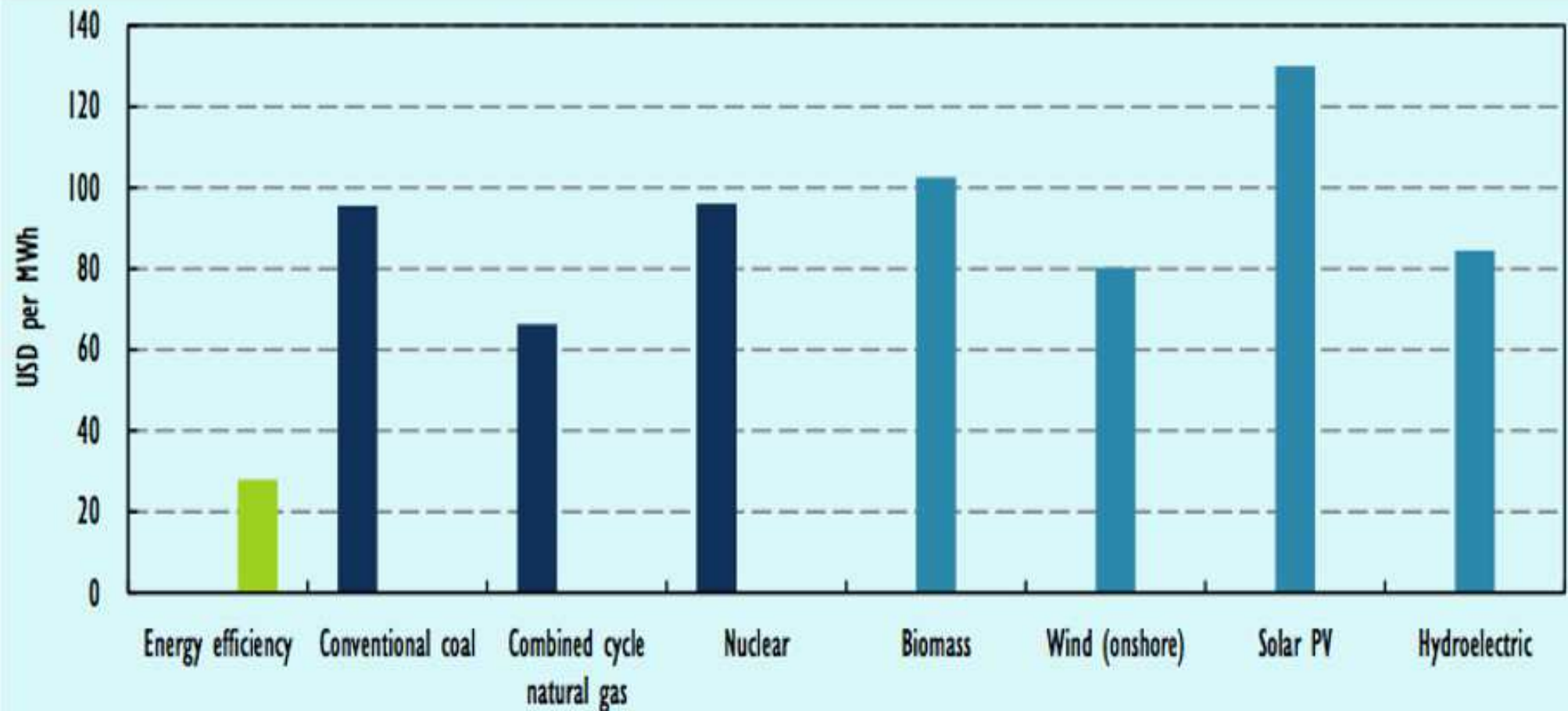


2016 INTERNATIONAL ENERGY EFFICIENCY SCORECARD © ACEEE



Kein Stromangebot ist so billig wie Energieeffizienz

Kostenvergleich der „NEGAWatts“ mit den „MEGAWatt“ für die USA

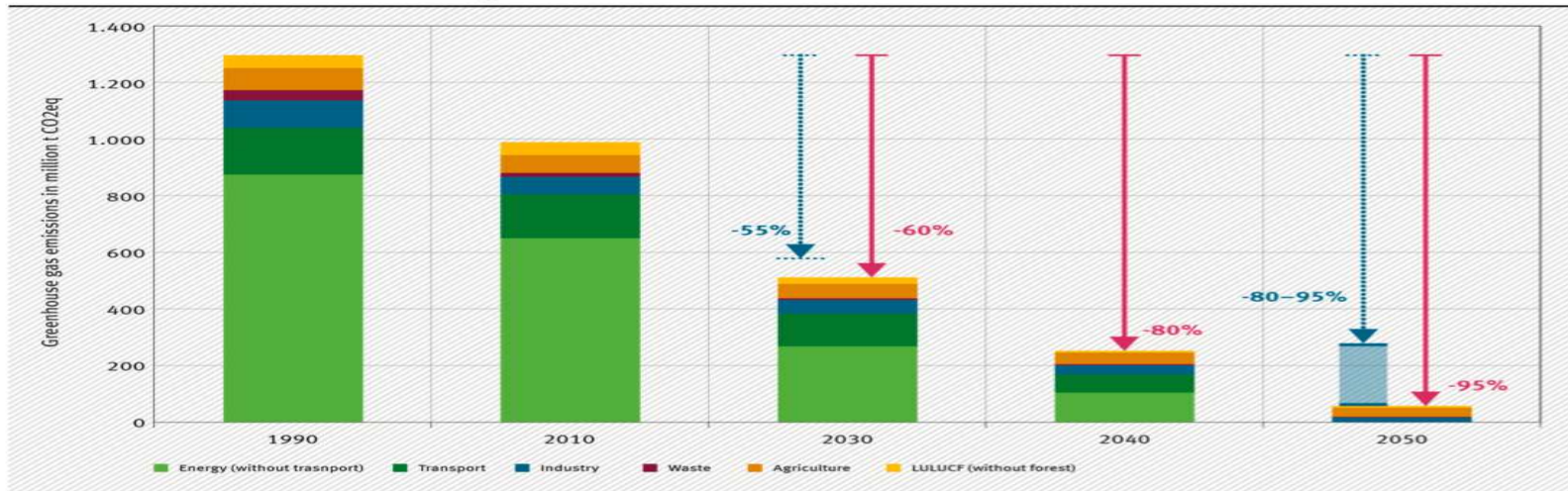


Notes: Energy efficiency costs are estimated by Molina (2014) at between USD 20/MWh and USD 50/MWh in 2012, with the average cost being USD 28/MWh. The levelised cost of electricity generation uses estimates from the US Department of Energy (US DoE) for new plants in 2019.

Climate mitigation + resource efficiency

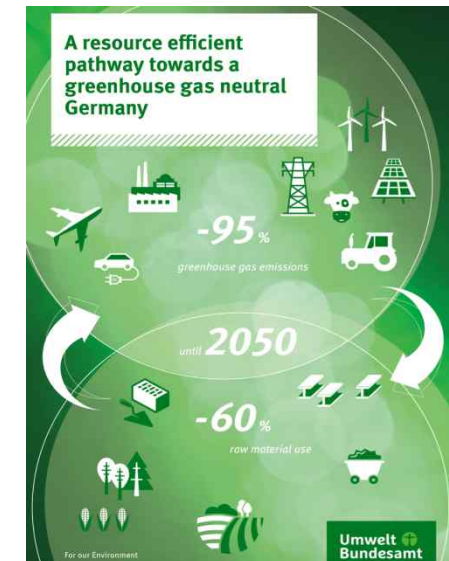
->an integrated scenario (GreenEe) of the German Env.Agency

Reduction of GHG-Emissions comp.to Government targets

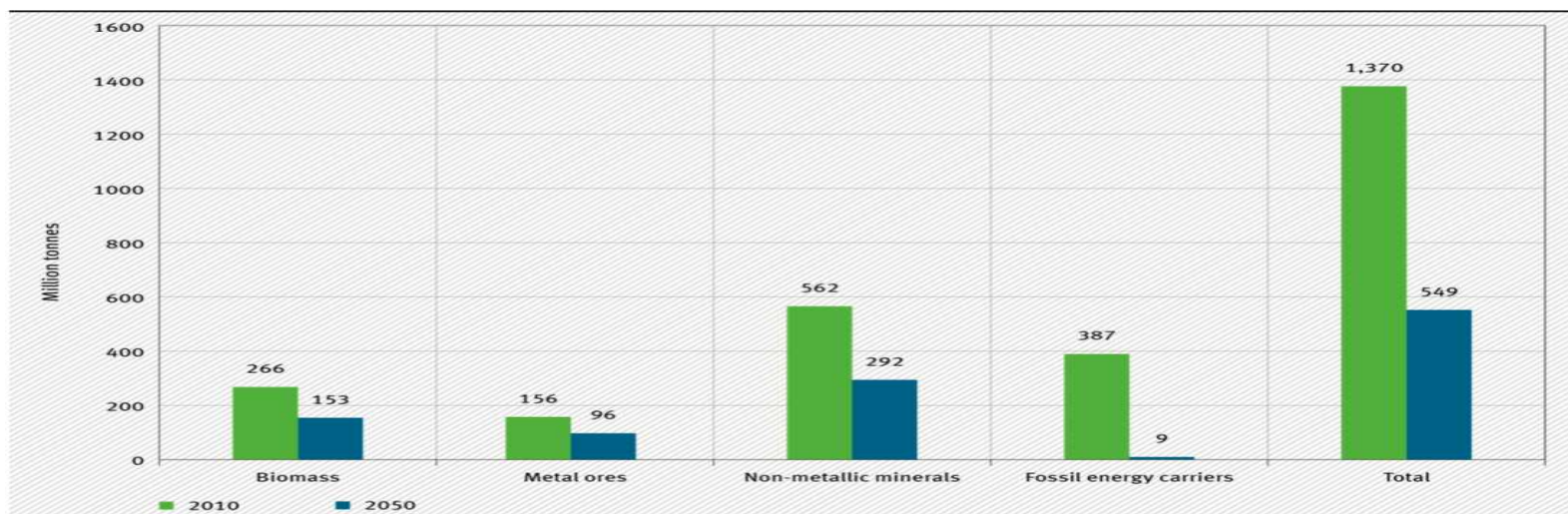


a) Without international aviation and maritime transport
b) The Federal Government's targets do not include the emission source group LULUCF.

Source: own illustration of model calculation



Reduction of raw materials (in RME)

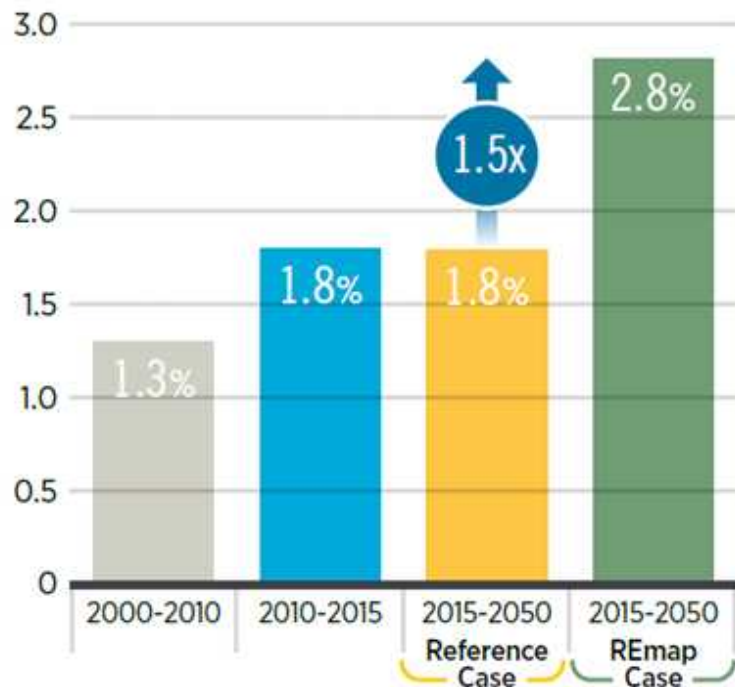


Source: own illustration of model calculation

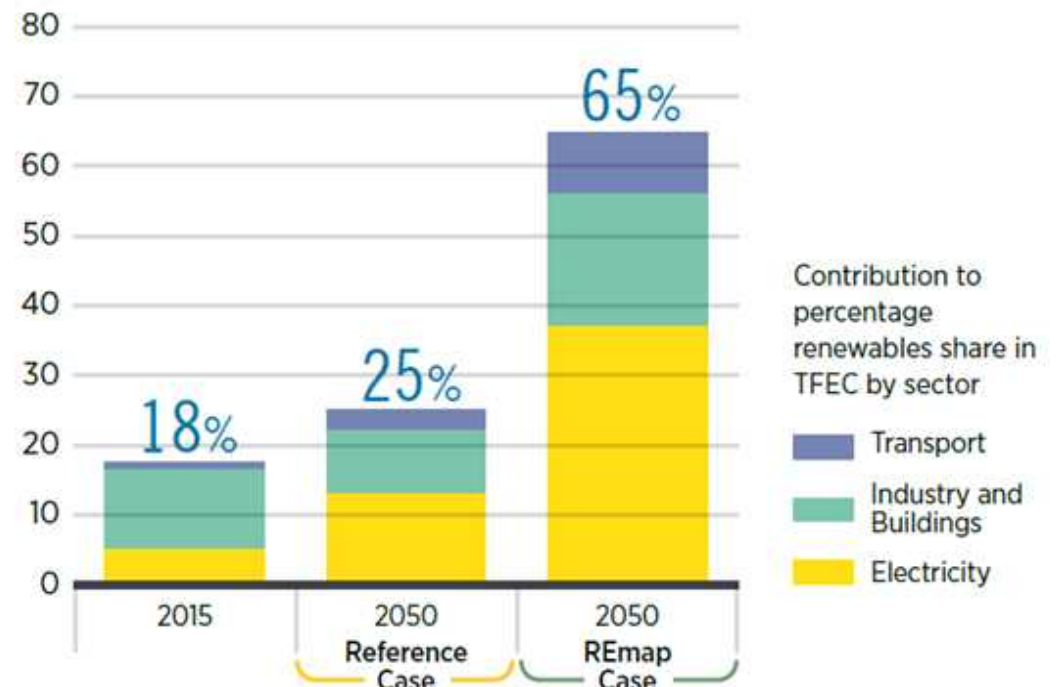
Source:
UBA, A resource efficient pathway towards a greenhouse gas neutral Germany, 2017

에너지효율 향상과 재생에너지 비중의 확대

Energy intensity improvements (%/yr)



Renewables share in TFEC (%)



RENA(2018), Global Energy Transformation: A Roadmap to 2050.

Electricity prices and consumption

- higher prices can be compensated by more efficient use!

	Annual household consumption in kWh	Electricity price in EURct/kWh	Annual electricity bill in EUR
Denmark	3,820	29.4	1,121
US	12,294	9.0	1,110
Germany ←	3,362	29.1	978
Japan ←	5,373	18.1	971
Spain	4,038	22.6	912
Canada	11,303	7.5	851
France	5,830	14.3	834
UK	4,143	17.3	717
Italy	2,485	23.3	580
Poland	1,935	15.1	291

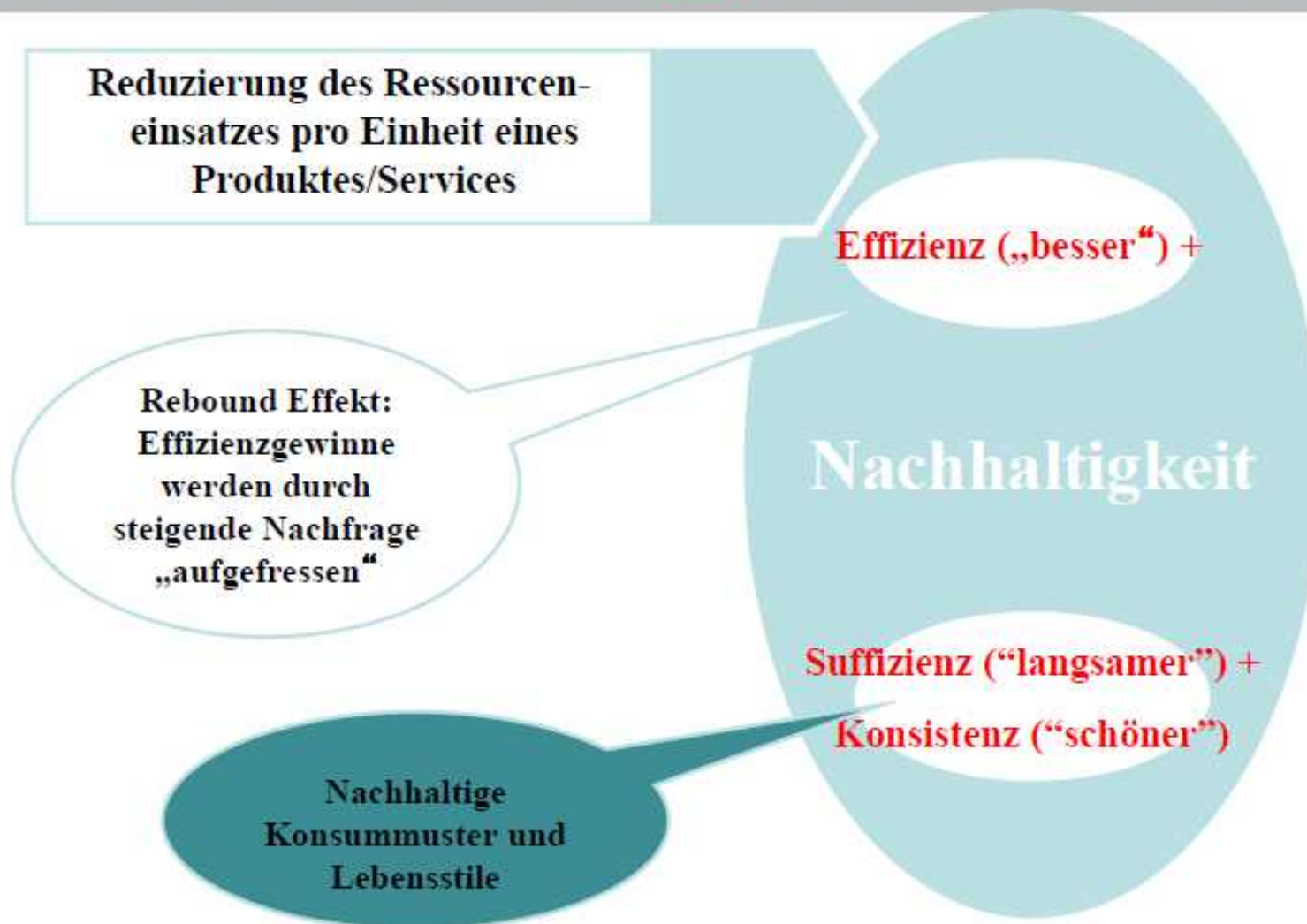
Enerdata (2015), World Energy Council (2015), own calculations

* consumption data from 2013; electricity prices data from 2014

Energy Sufficiency, Energy Service

Weltwirtschaftswachstum frisst Effizienz

25% weniger Rohstoffe pro \$ BIP, aber BIP wächst um 82% (1980-2000)
Immer mehr, schneller, weiter **oder** besser, langsamer, schöner?



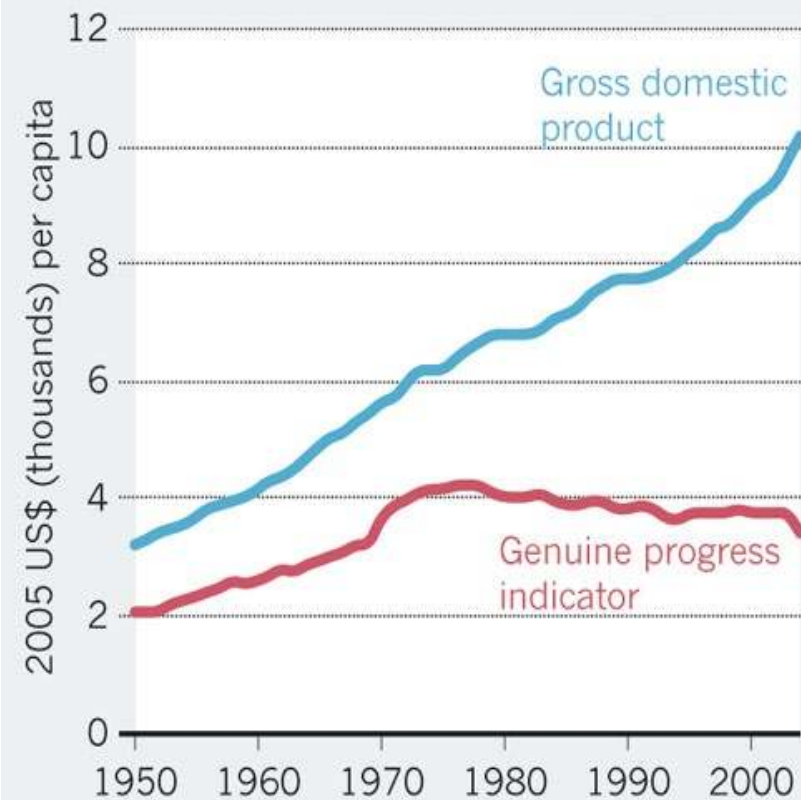
“Perverse decoupling”

of GDP growth and life satisfaction → a global problem

- For 17 OECD countries GDP/capita and the Genuine Progress Indicator (GPI/capita) developed in parallel from 1950 until about 1978, but then decoupled.
- What policies are suitable to invert the “perverse decoupling” of GDP growth and life satisfaction?
- What means “better growth” in a “green economy”? Which “green” sectors should grow and which “brown” sectors should be reduced?
- What are technical, societal and structural “leap frogging” options for the global “South”?

GENUINE PROGRESS FLATTENS

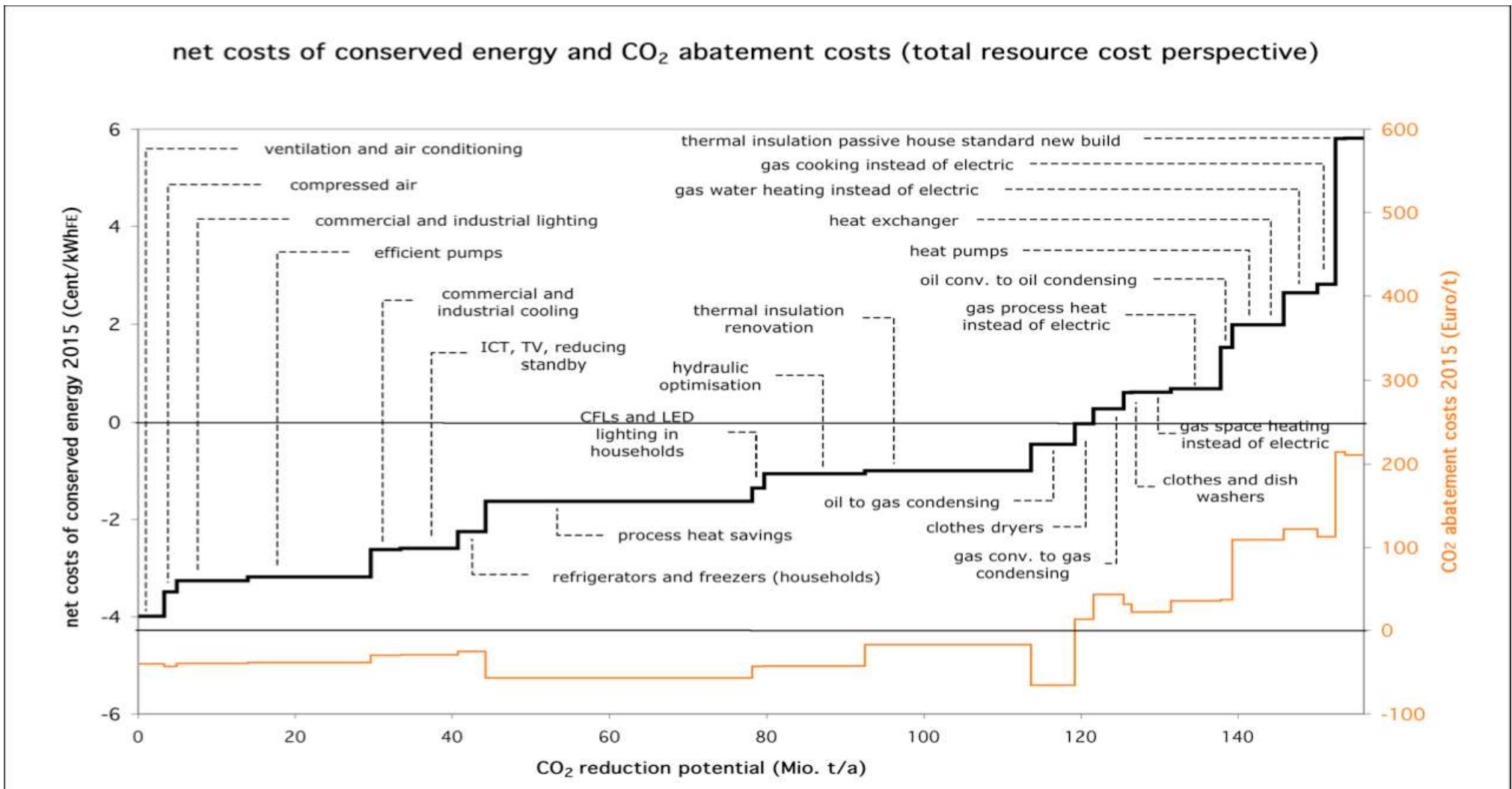
World GDP has soared since 1950, but a metric for life satisfaction called GPI has not.



The economic benefits of “Negawatts”

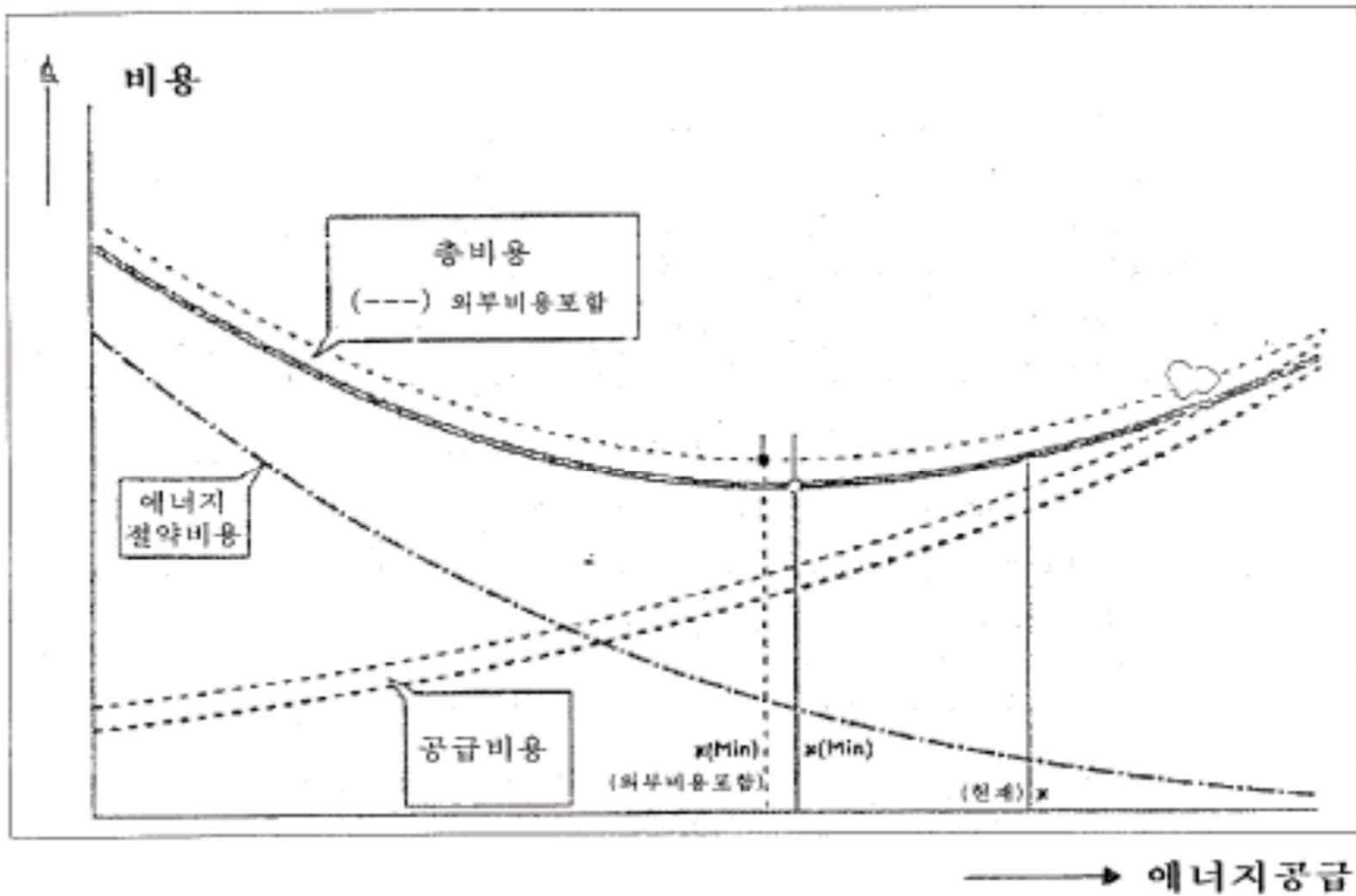
140 TWh can be saved with profit – when barriers are removed!

Example of Germany’s budget allocation chart



Source: Wuppertal Institute 2006

Einsparkkraftwerk in Hannover

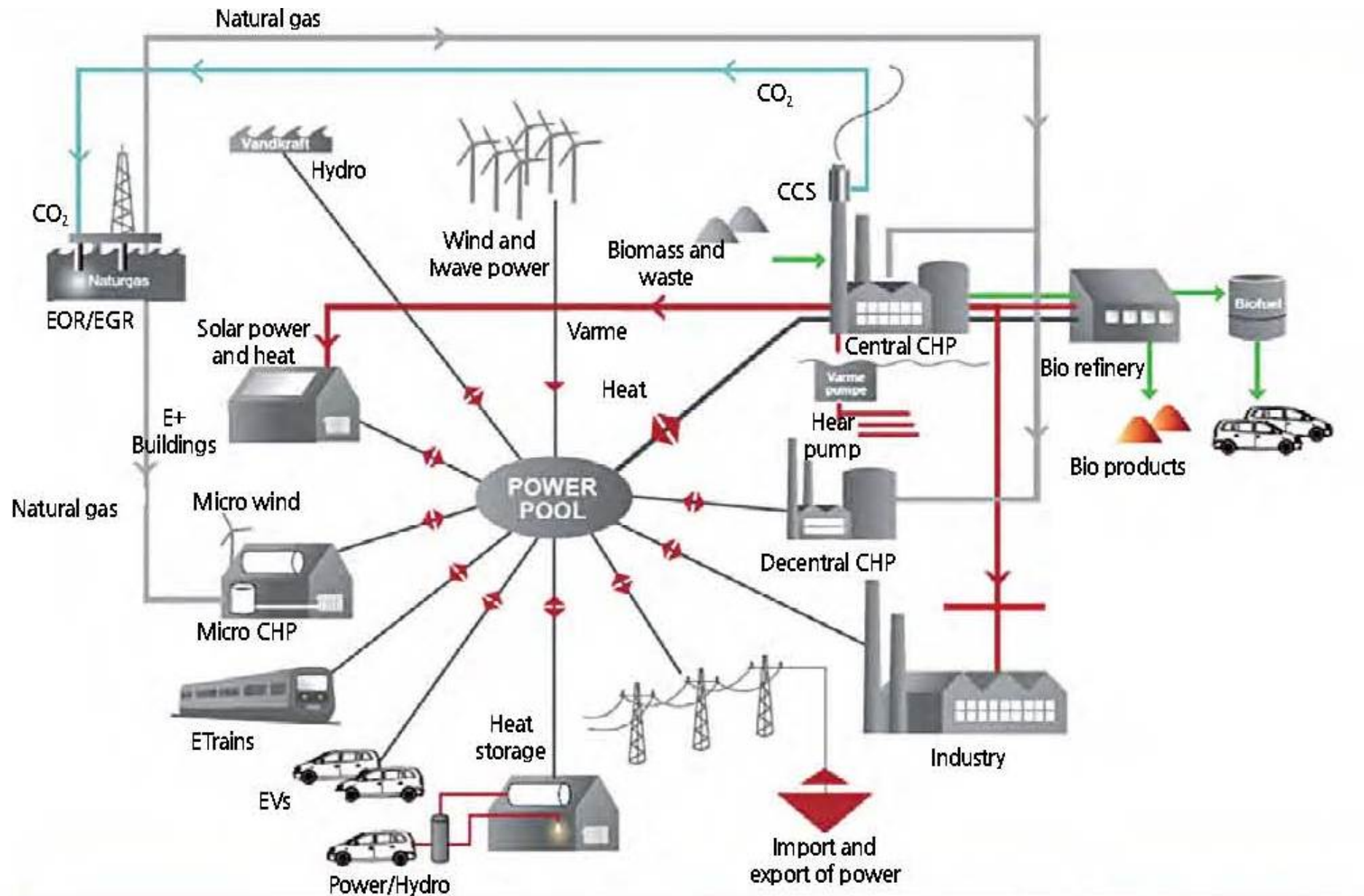


Integrierte Ressourcenplanung

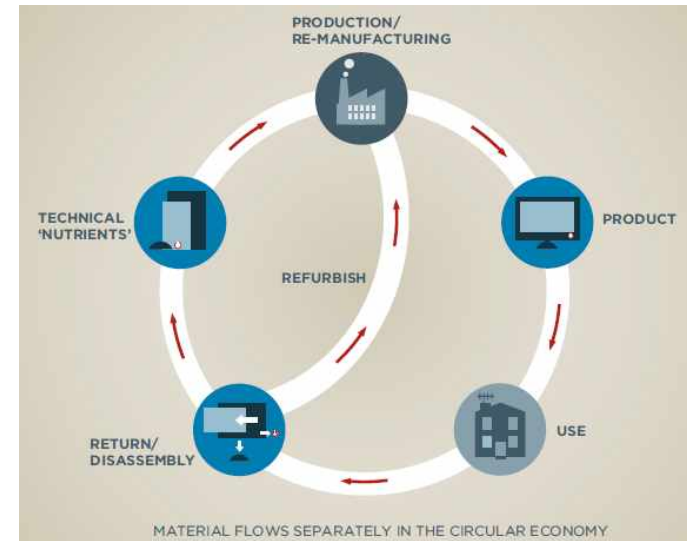
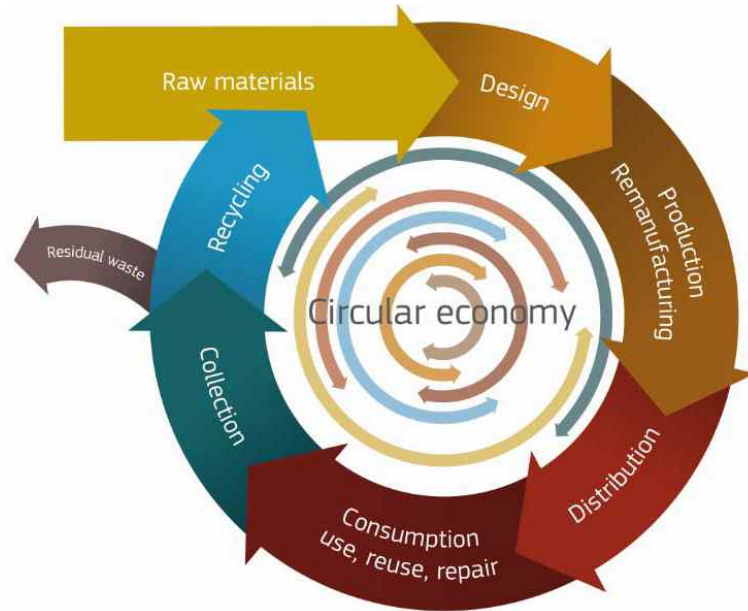
Die LCP-Fallstudie der Stadtwerke Hannover AG



VPP and high-tech decentralization



Circular or Blue Economy in Korea?

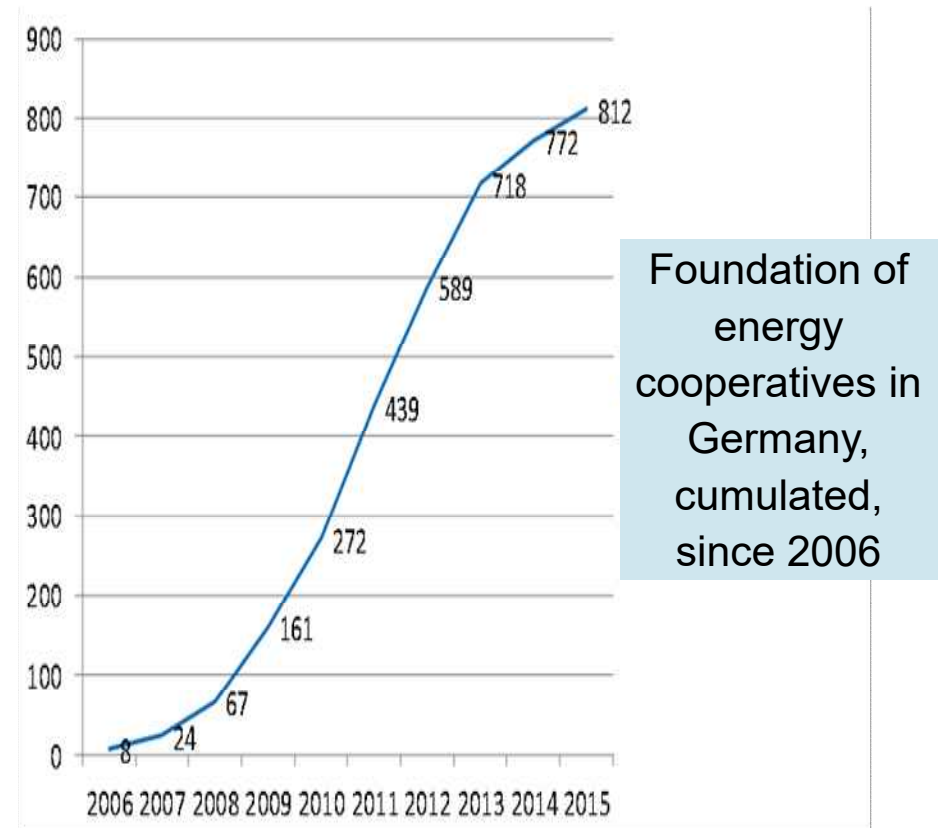


Energy Revolution by Citizens

Citizen financed energy cooperatives

Status and development of an unexpected surprise!

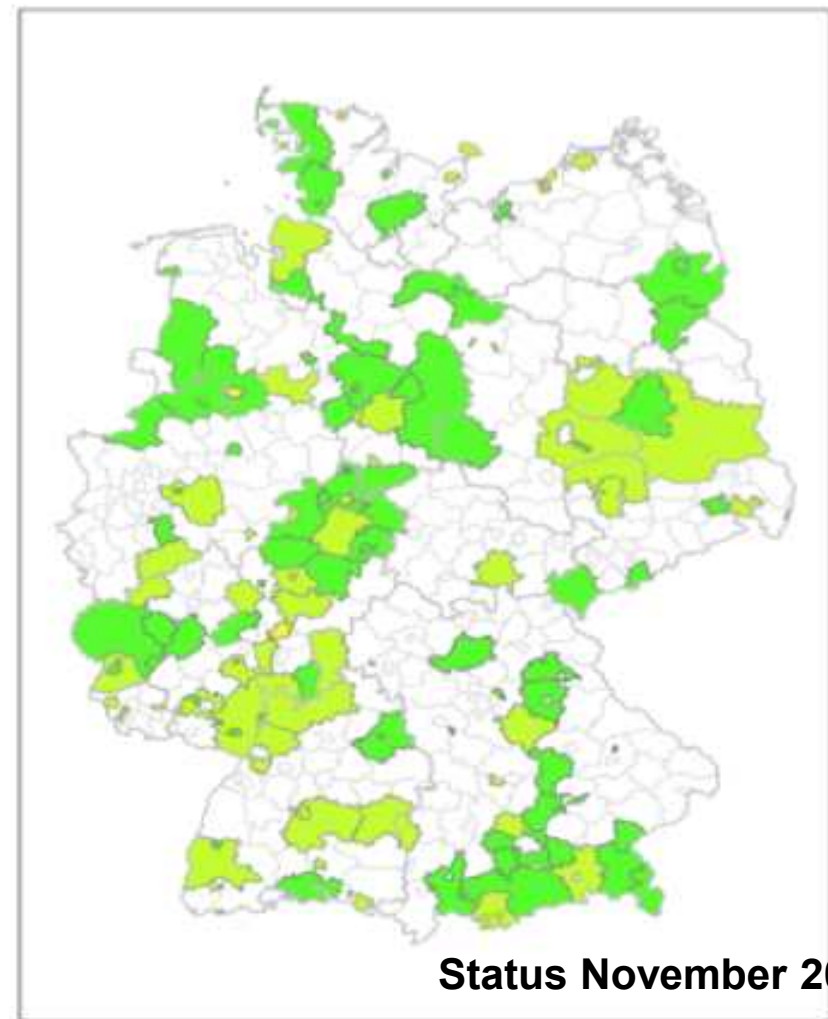
- Overall: **812** cooperatives have been founded since 2006
 - with 165 000 citizens
 - 655 million Euro member's capital
 - 1,8 billion investments in renewable energies
- Survey 2015: Slower development due to EEG-reform (e.g. tendering)



100% Renewable Energy Regions

About ¼ of the German population is on the way to decentralization

- Status 2012: More than 120 municipalities and regions are represented in the network.
- Those 100%- regions have about 19 Mio. inhabitants (23,17%) and an area of about 103 000 km² (28,81%).
- Today (status January 2014) more than 140 regions participate throughout Germany.



Reregulation, Smart regulation



에너지전환 혁신을 위한 정부의 Smart Regulation

적극적인 시장과 기술 촉진 정책

