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Prof. Dr. Peter Hennicke

Background and goals of the German-Japanese Energy Transition Council (GJETC)

Presentation at the 21st Reform Group Meeting, Salzburg

August 28, 2017

The global background

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The energy transition in Germany as well as in Japan is embedded in two global megatrends which are about to be strategic game changers:

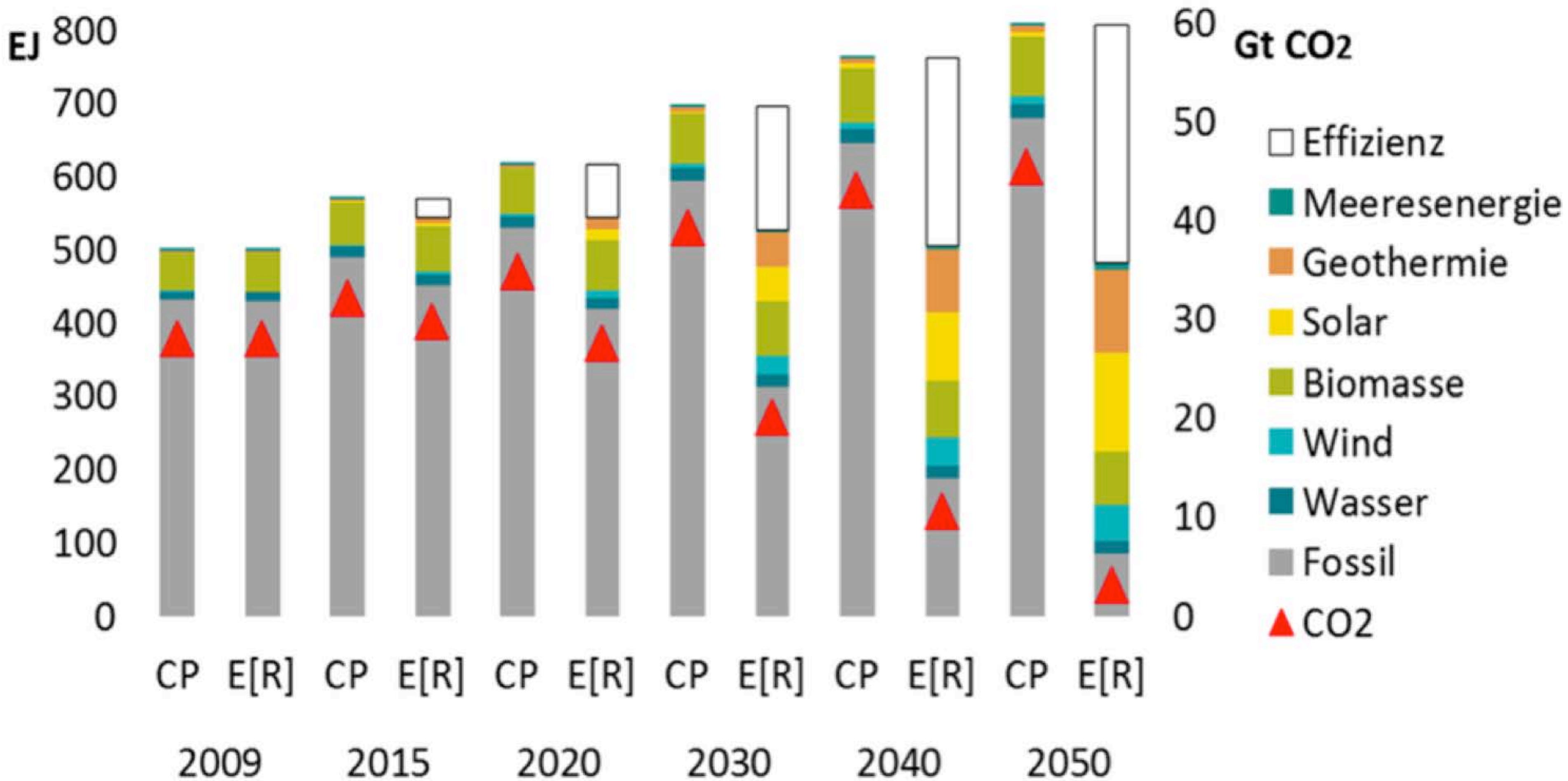
The paradigm shift to "Efficiency First" (IEA/Paris) and the spectacular decreasing costs of electricity from wind and PV.

The strategic combination of energy efficiency, renewable electricity and electrification of the transport and heat market makes a global energy transition technically and economically possible.

International cooperation between countries like Japan and Germany can encourage the global energy transition and ambitious climate mitigation.

Global pathway to zero emissions: Efficiency + Renewables

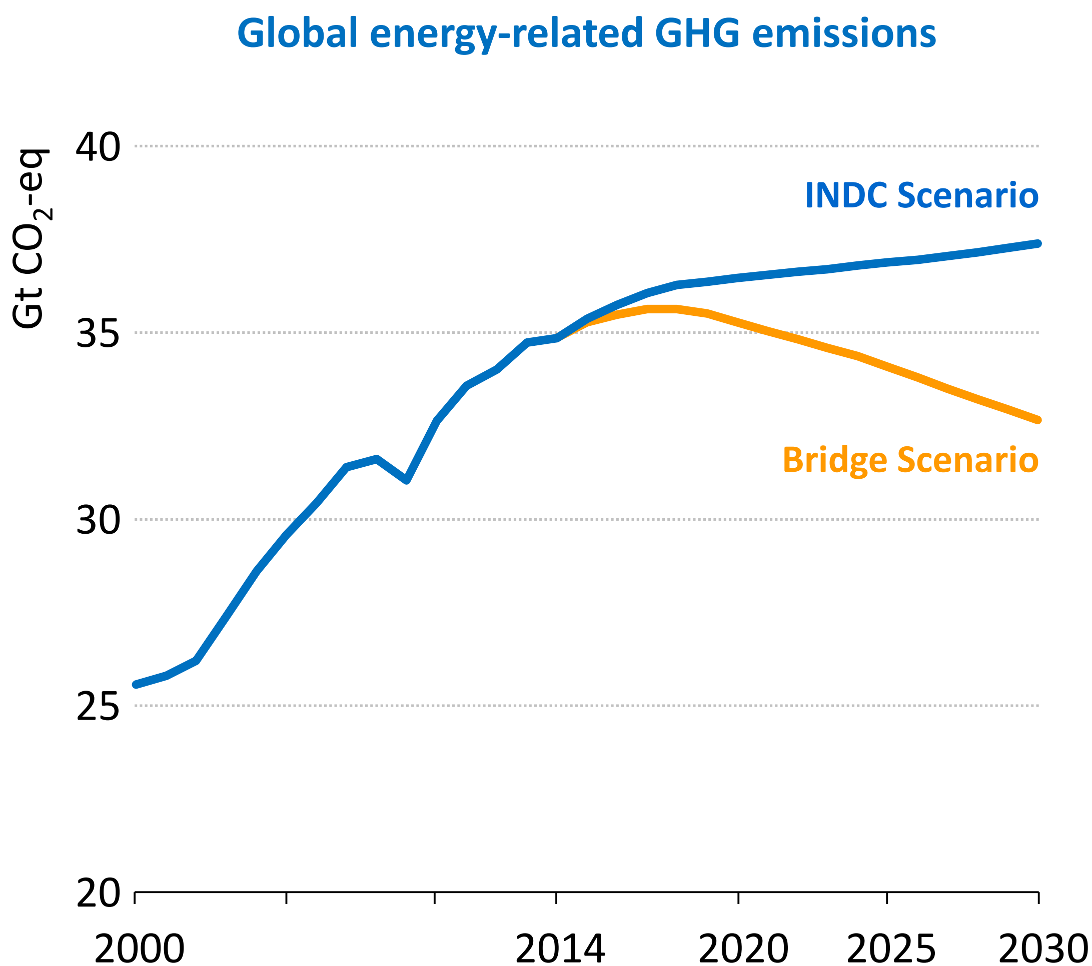
IEA Current Policy (CP) vs. Energy (r)evolution (E(R))

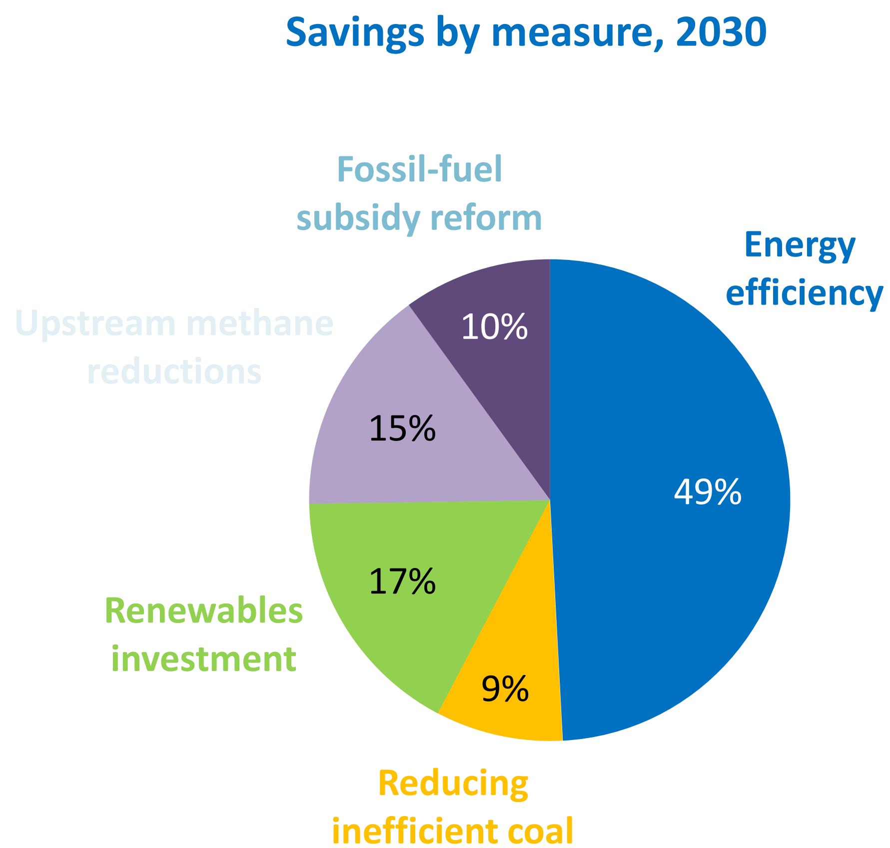


Source: DLR 2015.

IEA-Bridge Scenario (2015)

Peak in emissions around 2020 achievable – 49% by energy efficiency!





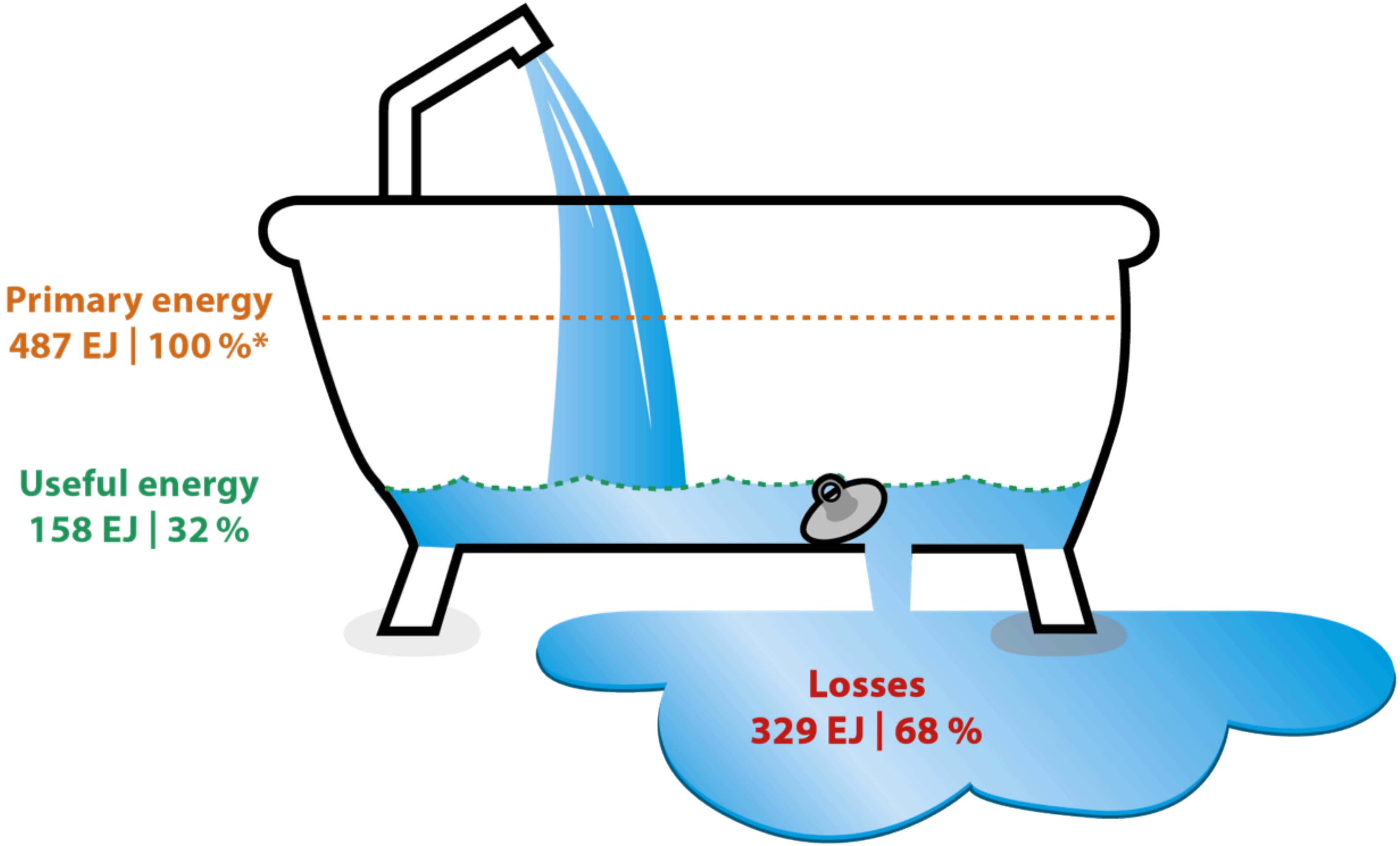
Source: IEA, Energy and Climate 2015

INDCs: Intended Nationally Determined Contributions

Five measures – shown in a "Bridge Scenario" – achieve a peak in emissions around 2020, using only proven technologies & without harming economic growth

"Efficiency First" (IEA):
Reduce losses of the global energy system

…by the "energy efficiency revolution" and decentralized power!

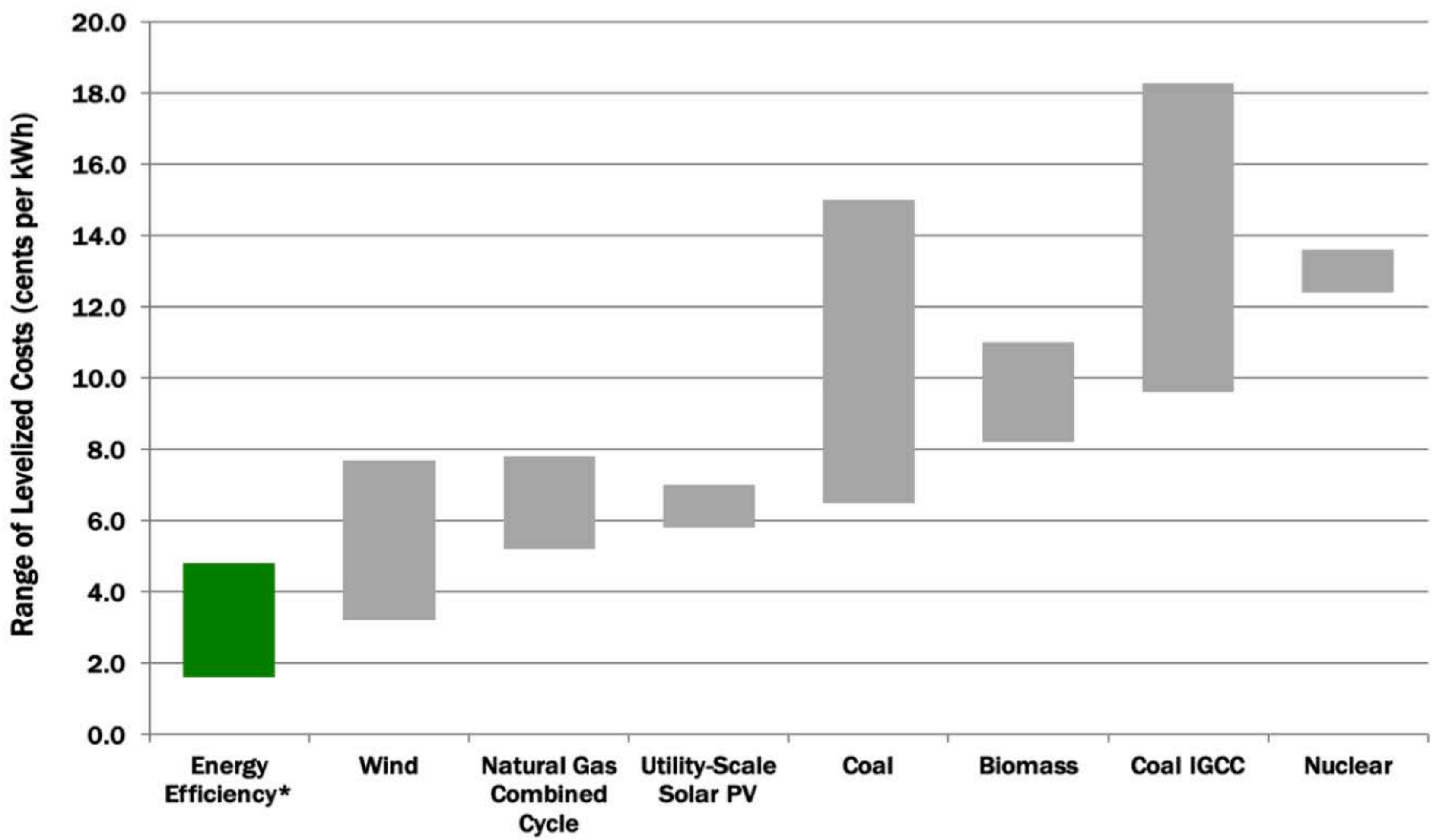


*Total primary Energy 519 EJ less 32 EJ non energetic consumption

Source: Hennicke/Grasekamp 2014; based on Jochem/Reize 2013; figures from IEA/OECD/IREES

US: Cost of utility efficiency programs (average: 2.8 cents per kWh)

A factor of 50-75% less than levelized cost of new power

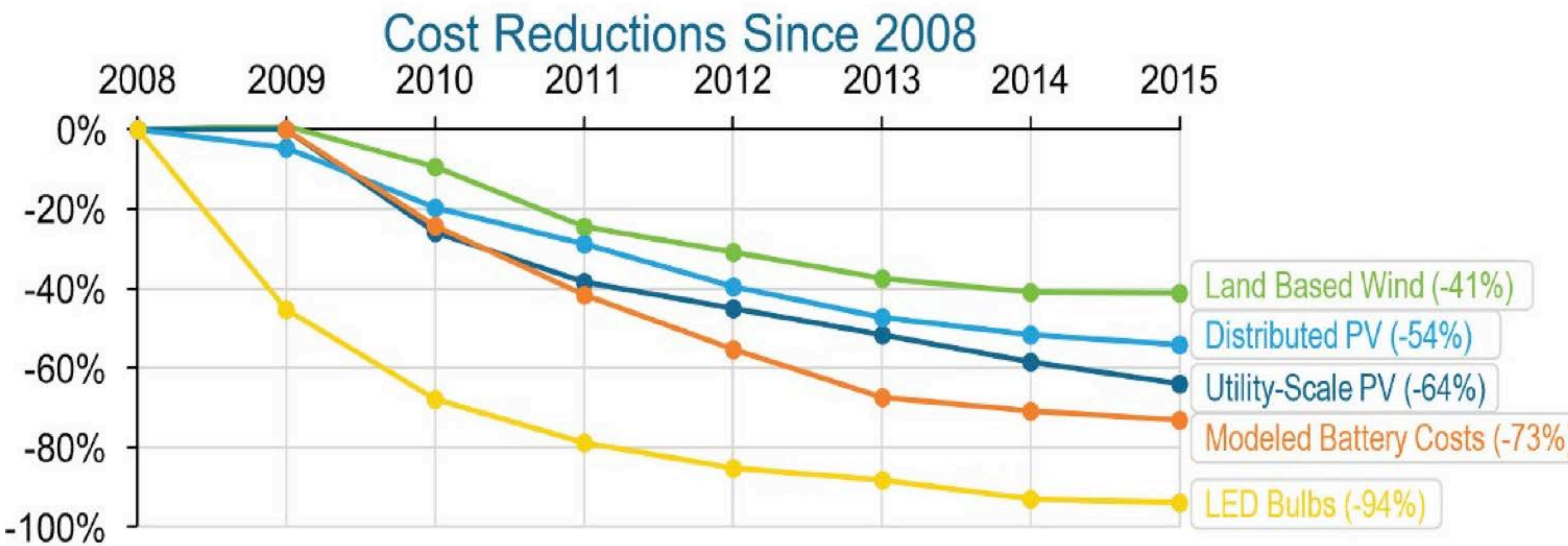


*Notes: Energy efficiency program portfolio data from Molina 2014; All other data from Lazard 2015. High-end range of coal includes 90% carbon capture and compression.

Source: ACEEE 2017.

Cost reduction in key technologies

- for decentralized power generation and consumption



Notes: Land based wind costs derived from levelized cost of energy from representative wind sites from references [1] and [2]. Distributed PV is average residential installed cost from reference [3]. Utility-Scale PV is median installed cost for utility-scale PV systems from reference [4]. Modeled battery costs are at high-volume production of battery systems, derived from DOE/UIS Advanced Battery Consortium PHEV Battery development projects. LED bulbs are for A-type bulbs from reference [5].

Source: US Department of Energy 2016.

PV in Dubai: 800 MW 2,99 cts/kWh
→ PV in Abu Dhabi: 2,42 cts/kWh

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Dubai Electricity & Water Authority 01.05. 2016

Another global record broken in utility scale solar PV IPP's:
Lowest tariff to date

Dubai, 1st May 2016

CEST 20.9.2016

UPDATE - Abu Dhabi confirms USD 24.2/MWh bid in solar tender

Sep 20, 2016 15:41 CEST

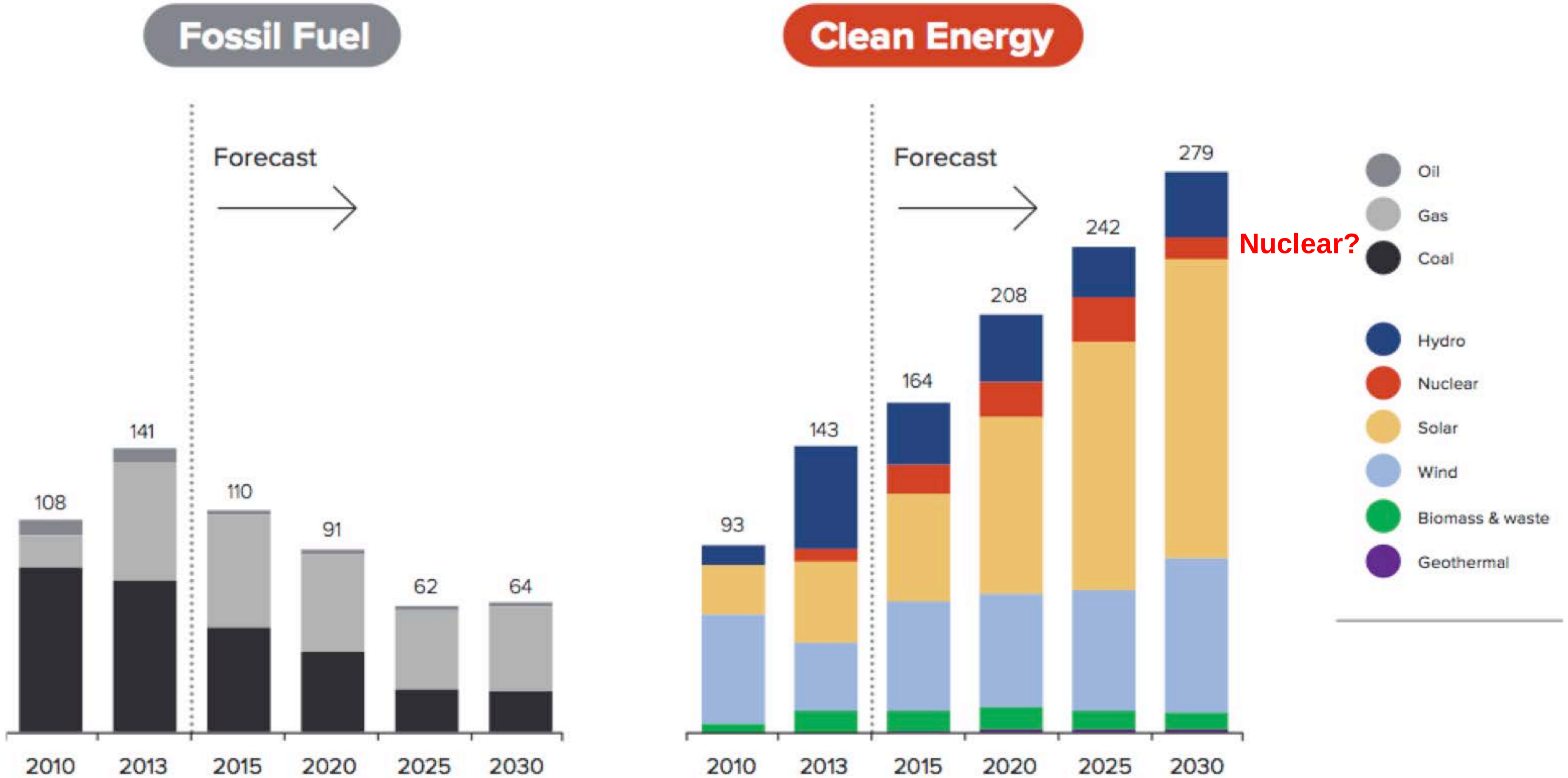
by **Ivan Shumkov**

Abu Dhabi landscape. Author: jaavaaguru. License: Creative Commons, Attribution 2.0 Generic.

"The costs of (onshore) wind power in Marocco are 3cts/kWh" (Siemens)
Shell won a tender in the Netherlands for offshore at 5,45cts/kWh (2016)

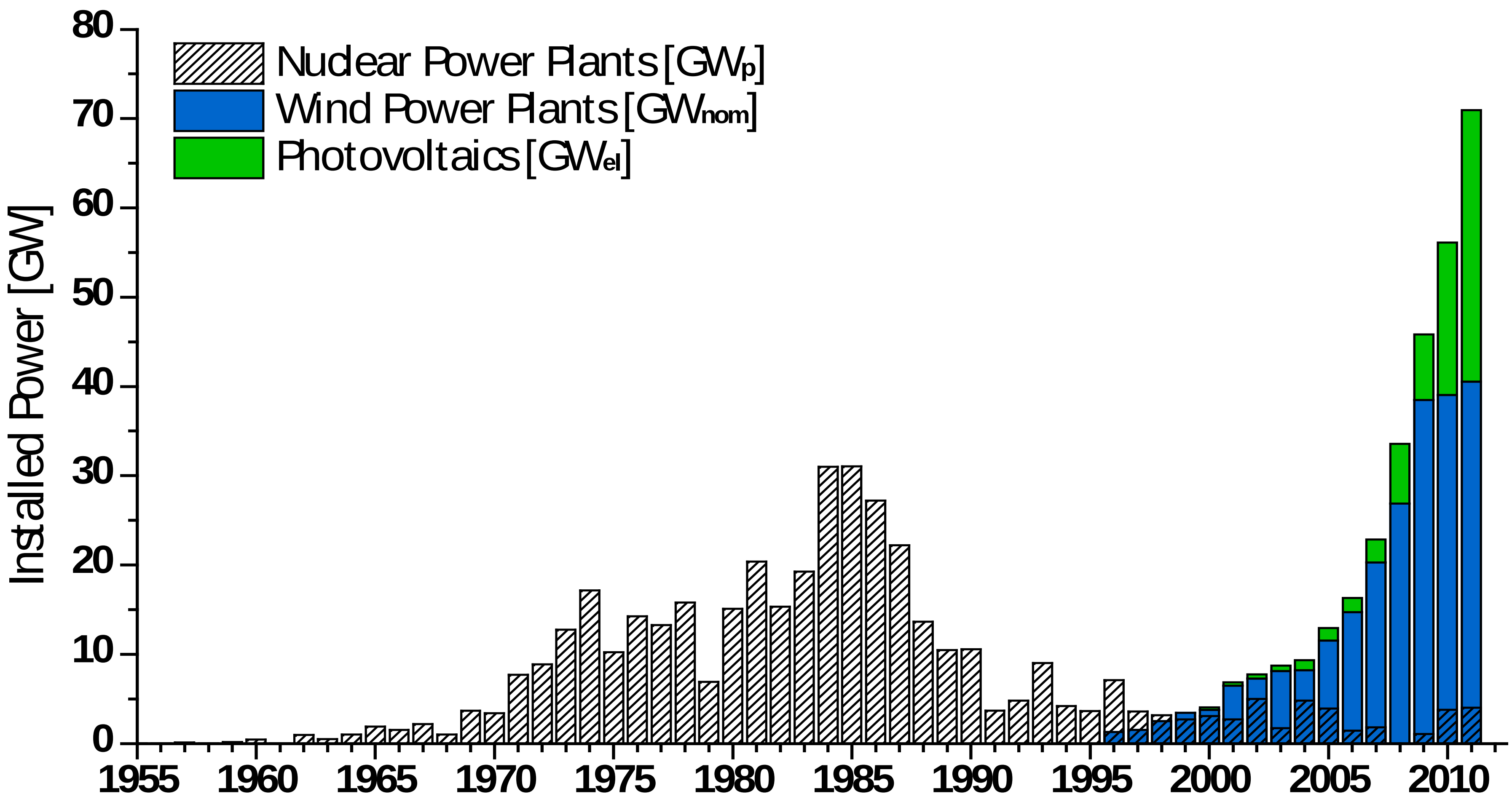
Promising perspectives for green electricity

- Capacity increase is 4 times higher than fossil fuels



Source: Bloomberg New Energy Finance, 2015.[13]

PV/Wind vs. Nuclear power worldwide



Source: IAEA, GEWC, EPIA.

Successful start of the GJETC in Tokyo

Start signal for the GJETC (fltr): Mr. Wilhelm Meemken (ECOS), Mr. Yota Ono (METI), Prof. Dr. Peter Hennicke (Wuppertal Institute), Prof. Masakazu Toyoda (IEEJ) and Dr. Hans Carl von Werthern (Deutscher Botschafter in Japan). Foto: Lisa Eidt

First GJETC-Meeting at IEEJ Tokyo, September 29-29th

1. Preamble: Our common understanding

- For climate and resource protection, to improve competitiveness and energy security, **the sustainable transformation of the energy sector** is of utmost importance.

- Germany and Japan are facing **common challenges**: The establishment of a long-term risk-minimizing energy strategy based on public consensus and sound research.

- As leading industrialized countries, Japan and Germany face a responsibility to contribute as much as possible to a **global deep decarbonization pathway** through

    (1) Energy Efficiency
    (2) the Decarbonization of Electricity Supply
    (3) end-use fuel-switching to green electric sources

1. Preamble: Our common understanding

- In global lead markets, such as for example

  (1) Energy and Resource Efficiency
  (2) Zero Carbon Technologies
  (3) Cleaner Use of fossil fuels
  (4) Sustainable mobility
  (6) Energy related green IT

  Japan and Germany should play an outstanding role as key players.

- The research-based and independent work of the GJETC can support Japanese-German activities, in order to **intensify the cooperation** and to extend the continuity of scientific knowledge exchange between both countries.

- GJETC respects **different natural, economic, and social framework conditions and current policy majorities and goals in both countries.**

2. Rules of Procedure

The work of the GJETC is based on the following principles:

1. The GJETC is **a non-governmental initiative**.
2. The GJETC has currently been established **for two years**.
3. The GJETC concentrates on **strategic and systematic analysis** and develops policy advice which is focused on problem solutions respecting the different framework conditions and energy policies in both countries.
4. The **Council Meetings will be held biannually** in each country.
5. **Council Members and invited experts** from both countries will make presentations on topics agreed in advance by the Council, regarding energy system transition. They discuss challenges and appropriate measures to be taken to seek better solutions for the future of their energy systems.
6. The GJETC works under the **Chatham House Rule** and as transparent as possible to the broader public.

2. Rules of Procedure

The work of the GJETC is based on the following principles:

7. **Working language of the GJETC is English**. At Council Meetings simultaneous translation into Japanese and German will be provided.

8. The GJETC has **6 Full Members from Academia**, up to **3 Associated Members** with special expertise and one Co-Chair. Full and Associated Members of the Council will be appointed by the Co-Chairs. The **Scientific and Organization Secretariats** support the work of GJETC.

9. All members of **the Council and the secretariats** work independently, free from conflict of interest, and with a strong commitment to support the Council's work during the two years period of the GJETC.

10. The GJETC will conduct a comprehensive **Study Program** according to transparent procedures, built an bilateral consortia of renowned research institutes and bidding processes.

Study program 2016/2017

Strategic topics of mutual interest

GJETC

Topic	Consortia	Reviewers
ST1: Energy transition as a central building block of a future industrial policy - Comparison and analysis of long-term energy transition scenarios	Wuppertal Institut, DIW Econ IEEJ	F. C. Matthes, E. Weber, C. Kemfert Koji Nomura
ST2: Strategic framework and socio-cultural aspects of the energy transition	IZES, Arepo Consult Nagoya University	Miranda Schreurs Yasumasa Fujii
ST3: New allocation of roles and business segments of established and new participants in the energy sectors currently and within a future electricity market design	IZES JEPIC	Felix C. Matthes Junichi Ogasawara
ST4: Energy end-use efficiency potentials and policies and the development of energy service markets	Ecofys IAE	Stefan Thomas, Manfred Rauschen Toshiharu Ikaga
[ST5: Development of technical systems and new technologies on the way to an energy transition]		

2. Tasks

Transparent examination to strengths and weaknesses of both countries

Each study contains three work packages

1. The analysis of the specific topic by a German or Japanese institute, according for 50% of the study volume (25% for each country)

1. Mutual comments, accounting for about 40% of the study volume
    1. The German institute comments on the Japanese analysis and vice versa.
    2. Both institutes work out a synopsis of points of similar or diverging results.
    3. A first analysis of potential reasons for diverging results is expected.

2. The preparation of joint or differentiated policy recommendations, accounting for about 10% of the study volume.

Stakeholder Dialogue: Participants and replies to the GJETC questionnaire

		Organisation	Participant	Industry	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Germany	1	**AHK Japan** **German Chamber of Commerce**	**Marcus Schürmann** CEO	Chamber of Commerce	x						x		x	
	2	**Daimler/FUSO**	**Dr. Albert Kirchmann** President & CEO	Automotive			x	x						x
	3	**Enercon**	**Jørn Kristensen** Senior Advisor	Renewable energies	x	x	x	x	x	x	x	x	x	x
	4	**TÜV Rheinland Japan Ltd.**	**Tobias Schweinfurter** President & CEO	Service Company				x						x
	5	**BayWa RE**	**Masahiro Ito**	RE project development/RE system supply	x	x	x	x	x	x	x	x	x	x
	6	**EWE AG enera**	**Christian Arnold**	Smart grid, renewable energies										
	7	**ADLER Solar Works**	**Gerald Wotruba,** Representative Director	PV										
Japan	1	**JX Nippon Oil & Energy Corporation**	**Mr. Hiroshi Hosoi** Senior Vice President	Oil	x	x	x	x		x			x	
	2	**Global CCS Institute**	**Mr. Hiroshi Nambo** Branch Representative - Japan	CCS	x	x								
	3	**Hitachi GE Nuclear Energy**	**Mr. Masahito Yoshimura** Senior Vice President and General	Nuclear Power			x		x			x		
	4	**Sumitomo Corporation**	**Mr. Takahiko Onozuka**	Trading House	x			x				x	x	
	5	**DAIKIN Industries, Ltd**	**Mr. Takash Mishina** Department Manager,	Air conditioner	x			x					x	
	6	**NTT DATA Business Solutions**	**Mr. Motoshi Muraoka** Partner,	Information						x				
	7	**Tokyo Electric Power Company Holdings, Inc. (TEPCO)**	**Dr. Hiroshi Okamoto** Managing Executive Officer	Power										
	8	**Euras Energy Holdings Corporation**	**Mr. Minoru Saito** Director	Wind Power										
	9	**Toyota Motor Corporation**	**Dr. Katsuhiko Hirose** Hydrogen & Fuel Cell Promotion Group, R&D and Engineering Management Division Advanced R&D and Engineering Company, Toyota Motor Corporation	Automotive	x	x	x	x	x	x	x	x	x	x

Structure of the GJETC

Reknowned energy experts from Japan and Germany

JAPAN		GERMANY
METI	Financing	DBU + Mercator + Others
CHAIR: Masakazu Toyoda	Management	CHAIR: Prof. Peter Hennicke
Organization Office & Scientific Secretariat: IEEJ		Organization/Consulting: ECOS Consult Scientific Secretariat: Wuppertal Institute

Full Member Experts

Japan		Germany	
Jun Arima	Yasumasa Fujii	Claudia Kemfert	Patrick Graichen
Toshiharu Ikaga	Koji Nomura	Felix C. Matthes	Miranda Schreurs
Junichi Ogasawara	Tomihiro Taniguchi	Stefan Thomas	Eicke Weber

Associated Members

Japan			Germany		
Mami Ito	Hiroshi Okamoto	Shinichi Sasayama	Uwe Leprich	Manfred Rauschen	Franzjosef Schafhausen

The partners of the GJETC

Wuppertal Institut

Organized by:

Wuppertal Institut

HENNICKE CONSULT

ECOS

IEE JAPAN

Financed by:

sponsored by DBU Deutsche Bundesstiftung Umwelt www.dbu.de

STIFTUNG MERCATOR

経済産業省 Ministry of Economy, Trade and Industry

Federal Foreign Office

jdzb Japanisch-Deutsches Zentrum Berlin ベルリン日独センター Japanese-German Center Berlin

Supported by:

Federal Office for Economic Affairs and Export Control

AHK Deutsche Industrie- und Handelskammer in Japan 在日ドイツ商工会議所

Media Partner:

Medienbüro am Reichstag Public Relations – Public Affairs

Main dissens: Different policies on nuclear energy

→ GJETC focuses on solutions of common interest!

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1. Definition of Energy Transition

IEE JAPAN

Japan : To promote energy conservation and then seek a balanced energy mix to reduce but keep nuclear energy with 20-22% out of total power generation

Germany : To phase out of nuclear energy in 2022 and to promote energy conservation and use of renewable energy

Japanese energy problems that need to be solved:

Minimize the impact of earthquakes and tsunamis (increase resilience)

Reduce energy prices and emissions of CO_2

Guarantee reliability of supply – Reduce dependence on imports

Raise competitiveness in a global context

Integrate "cost reductions of renewable energies and efficiency first"

What Germany can learn from Japan:

Excellent (system) technologies
e.g. in the areas of electromobility, rail transport/public transport, batteries, information and communication technologies, fuel cells, hydrogen economy and impressive energy-saving campaign ("Setsuden")

Different frame conditions

for the energy transition in Germany and Japan

- G: 30 years of harsh conflicts for nuclear phase-out and alternatives – in future gradual transformation
- J: immediate nuclear phase-out, protest against restart, decision to increase nuclear share

- Ten vertically integrated energy suppliers; deregulation of the electricity market slow
- Until 2012 no FIT in Japan and little incentive for market launch of green electricity

- Decentralized supply infrastructure and the role of the municipalities are weak
- No integration into a transnational power market (insularity)
- Transport networks with different frequencies (60Hz/East and 50Hz/West)

- Strong alliance of politics and the “nuclear village”
- Public participation and independent reporting weak
- Scientific controversies and processes of public opinion-forming underdeveloped
- Anti-nuclear movement weak, but increased after 2011 (e.g. 95 Mayors against restart)

Absolute (G) and relative (J) decoupling
of primary energy, GDP and GHG emissions

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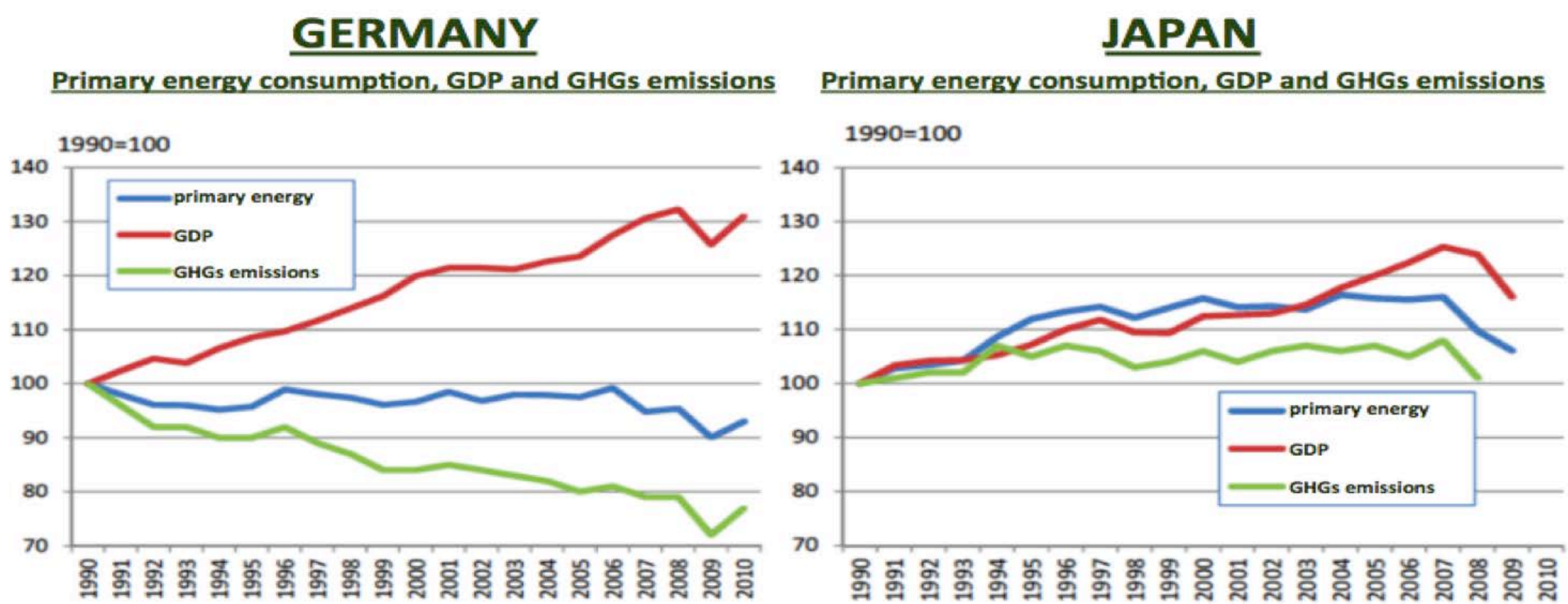
Decoupling of energy, GDP and emissions

自然エネルギー財団



source: "Points to revise 'energy basic plan,'" November 2011, Hisashi tiajiyama

International status: Comparable per capita emissions

in Japan and Germany

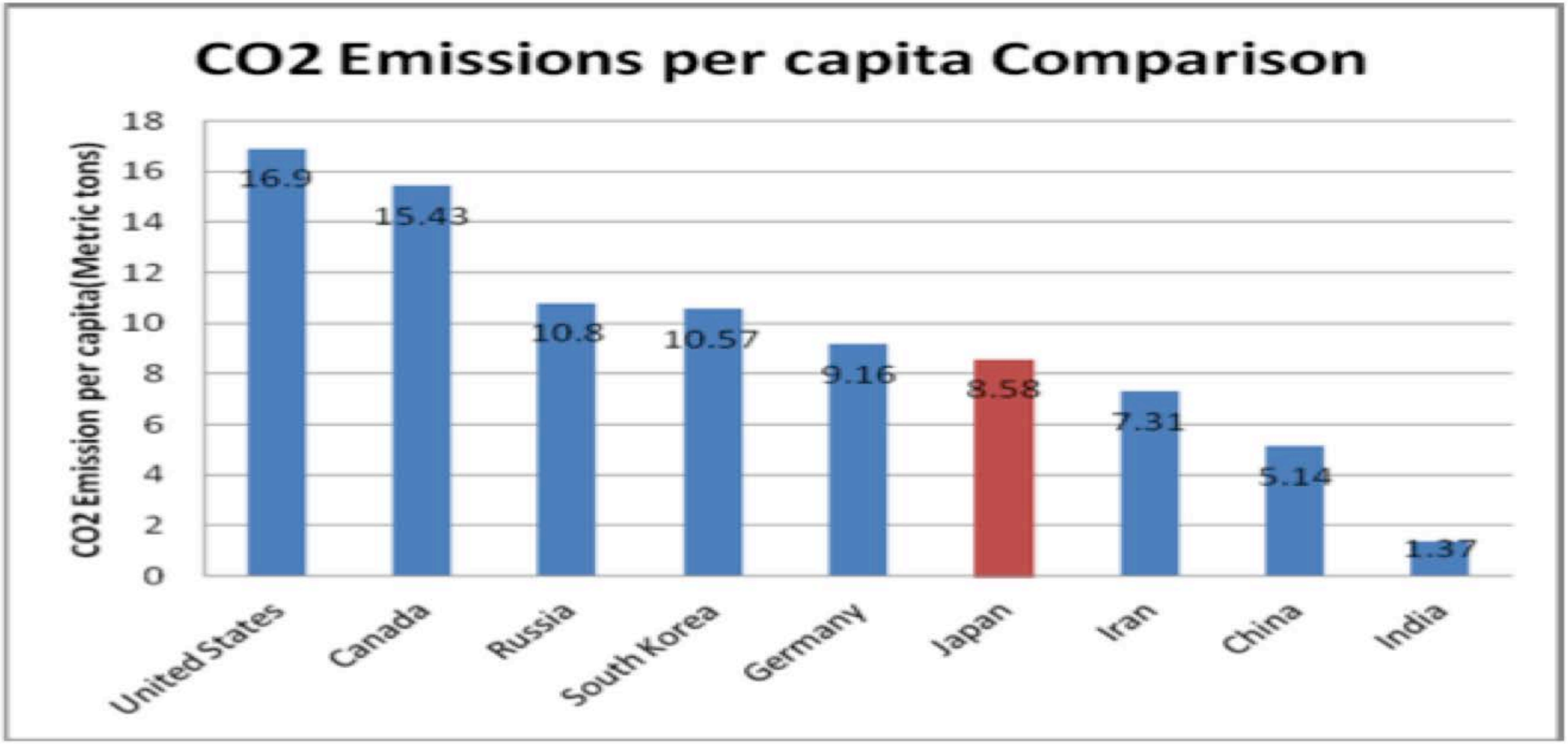
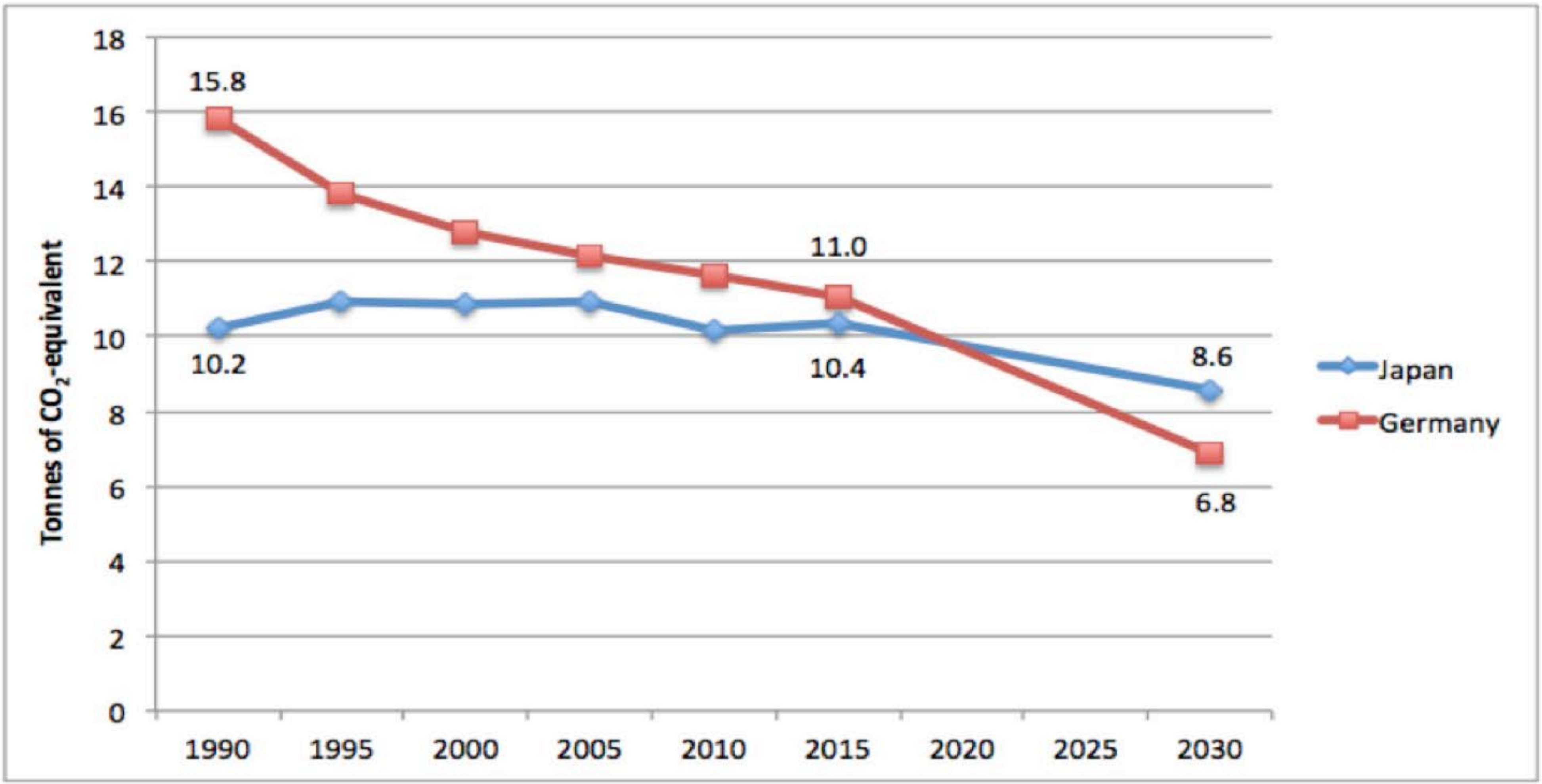


Figure 4 CO_2 Emissions Per Capita Comparison
Source: PBL Netherlands Environmental Assessment Agency, *Long-term Trend in Global CO_2 Emissions*, 2011

Source: Takatoshi Kojima: How is 100% Renewable Energy Possible in Japan by 2020?, p.8.

...but different development of per capita emissions

1990-2015 and 2030 according to government targets



Sources: Own figure based on data from OECD (2017), UN (2017).

Source: GJETC (ed.): Energy transition as a central building block of future industrial policy, 2017.

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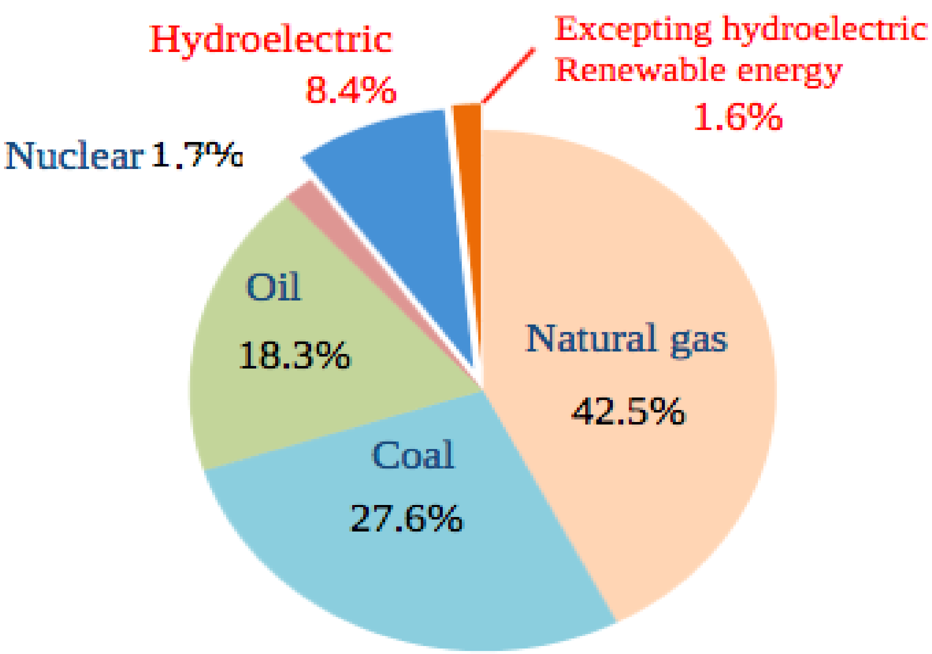
Ministry of Economy, Trade and Industry
Agency for Natural Resources and Energy

The State of Energy in Japan

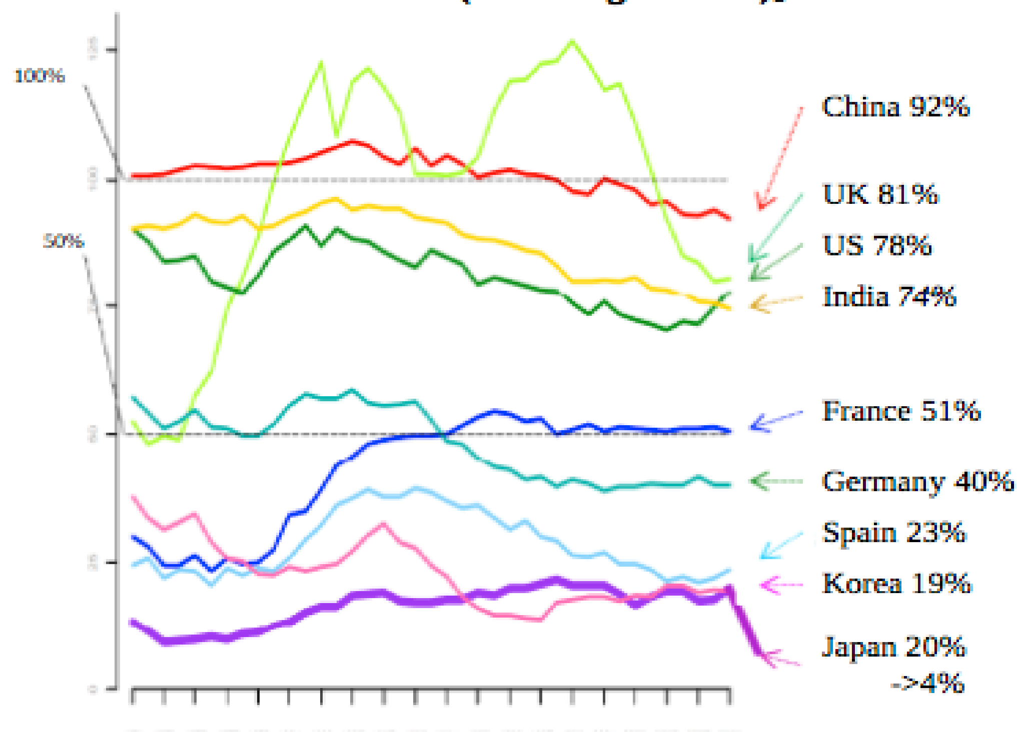
- The percentage of renewable energy included in the total amount of electricity generated in FY2012 was roughly 10%. The majority of that was from hydroelectric generation, which subtracted, leaves a ratio of only 1.6%.
- Since the Great East Japan Earthquake, Japan's rate of energy self sufficiency dropped from 20% to 4%, significantly lower than that of other developed nations.

[Electricity source breakdown for 2012]



(Source) "Ratio of Electrical Power Generation Amount by Source" The Federation of Electric Power Companies of Japan

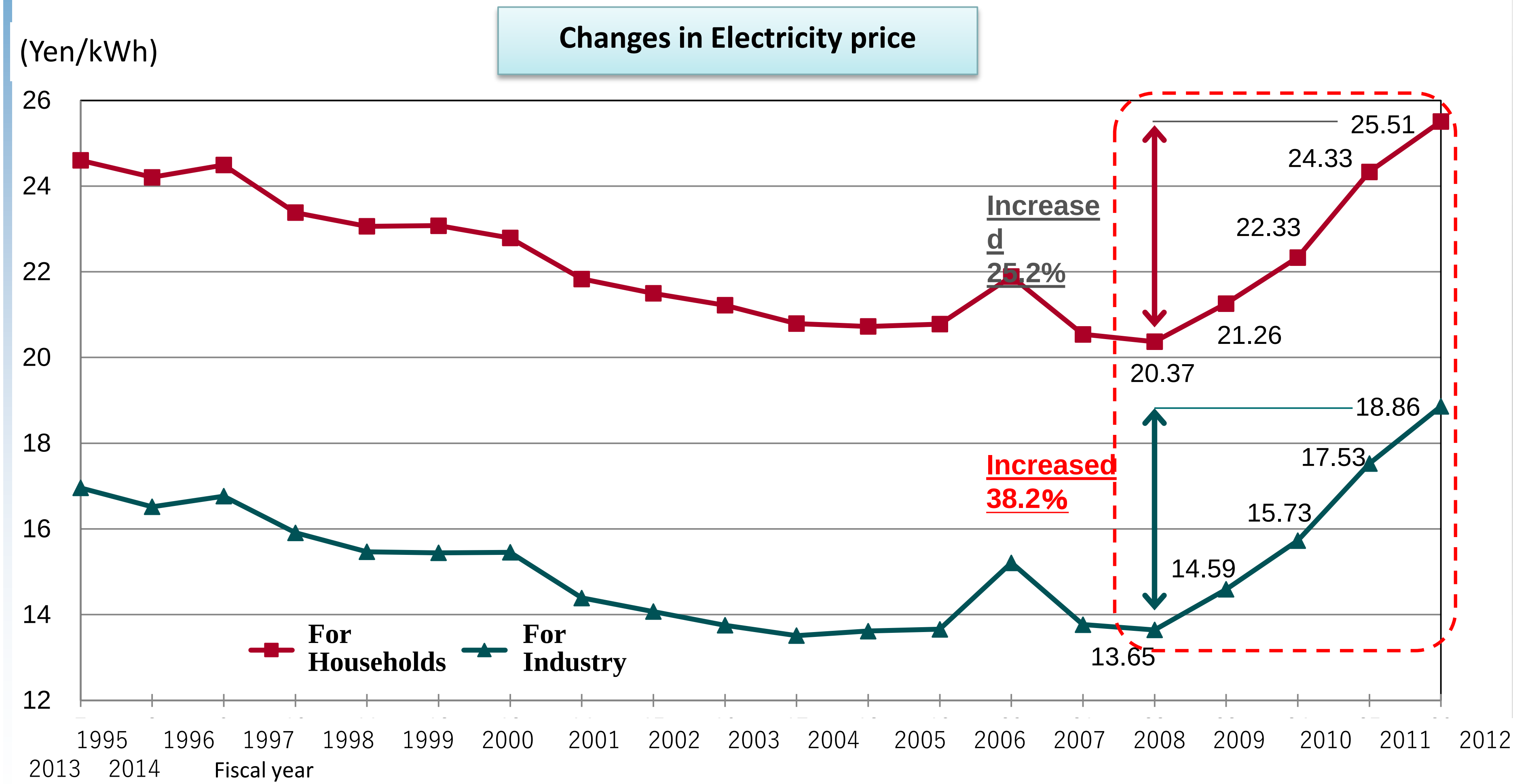
[Changes in energy self sufficiency of each nation (including nuclear)]



Source:

Changes in Electricity price (1)

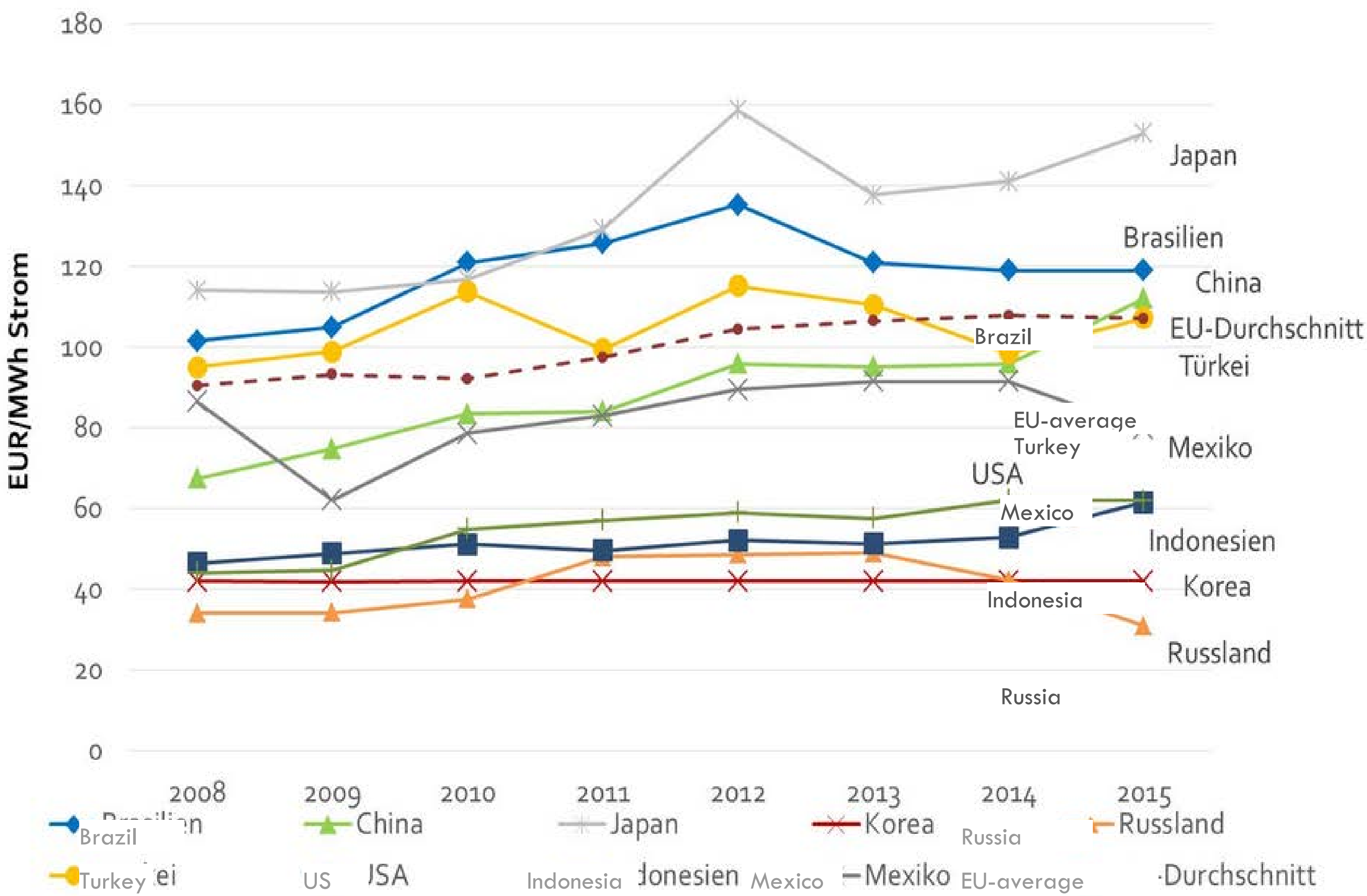
◆ Since the Great East Japan Earthquake followed by the nuclear accident, the average electricity price rose by around 25% for households and around 40% for industry because of increasing fuel costs and so on.



[Source] Created based on the "Electricity Demand Report" (Federation of Electric Power Companies in Japan) and the materials concerning the power companies' final settlement reports, etc.

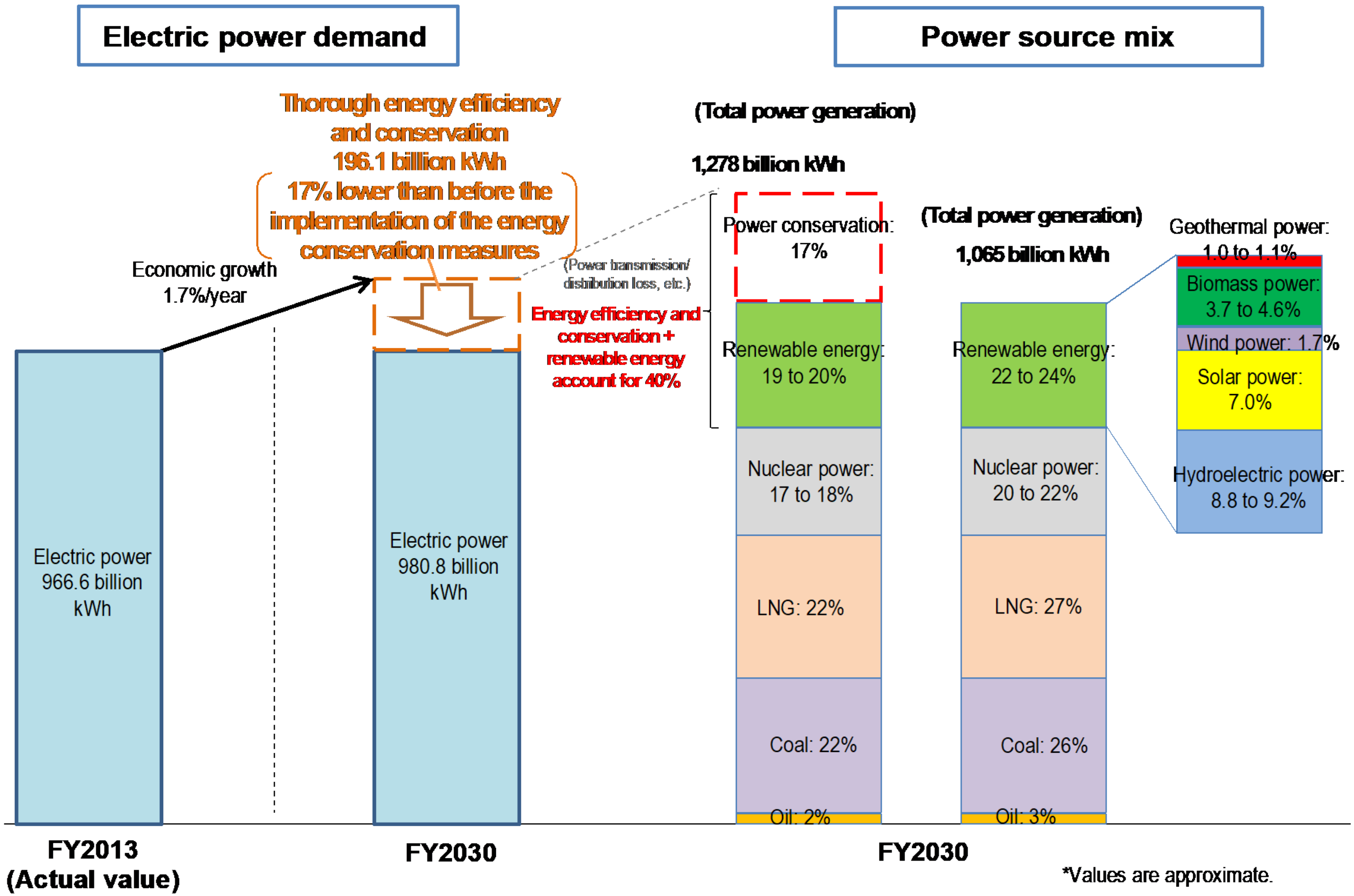
Average electricity prices for industry

international comparison



Source: Europäische Kommission, Generaldirektion Energie, „BERICHT DER KOMMISSION AN DAS EUROPÄISCHE PARLAMENT, DEN RAT, DEN EUROPÄISCHEN WIRTSCHAFTS- UND SOZIALAUSSCHUSS UND DEN AUSSCHUSS DER REGIONEN - Energiepreise und -kosten in Europa,“ 2016.

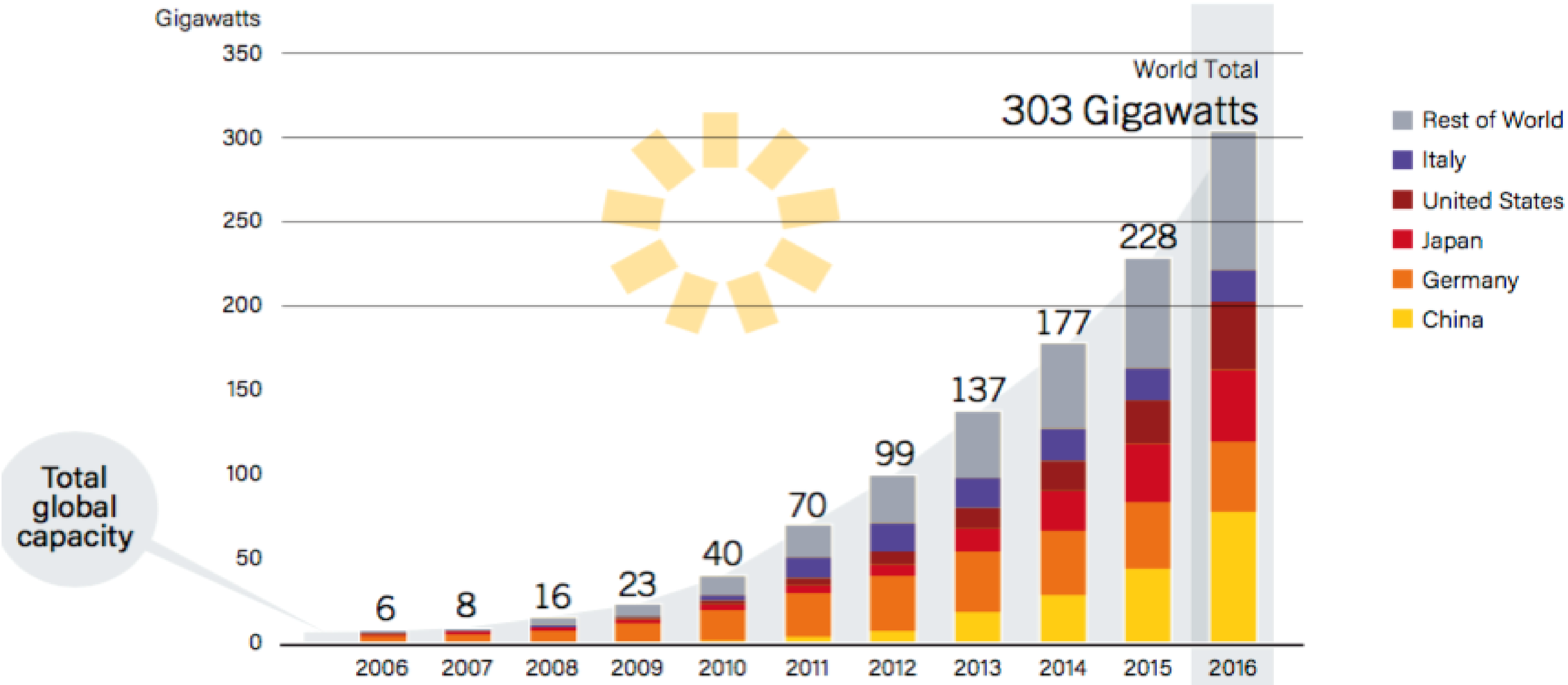
Japan's energy mix targets for 2030



Source: METI (2015b: 8)

Japan surpassed Germany in 2016

Installed PV capacity



Source: REN21, 2017

Ranking list of new electricity providers (PPS)

by sales volumes in the household segment (April-Nov. 2016)

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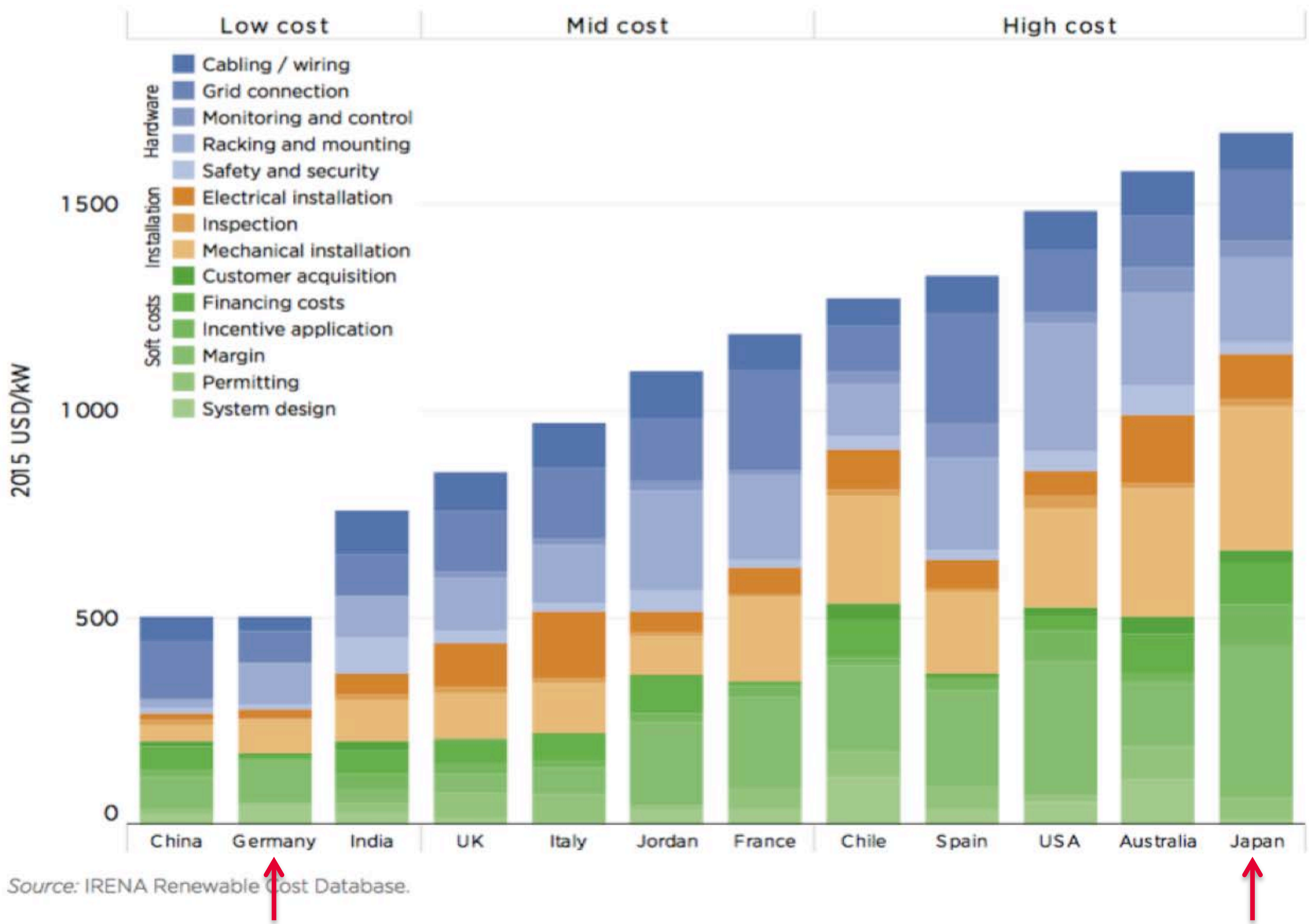
	Sales volume	Share under PPS	Sector / Category
Tokyo Gas	1.057.522 MWh	31,8%	Gas
Osaka Gas	441.092 MWh	13,3%	Gas
KDDI	299.796 MWh	9,0%	Mobile communication
JX Energy	271.114 MWh	8,2%	Oil
Saisan	101.485 MWh	3,1%	Gas
Tokyu Power Supply	89.090 MWh	2,7%	Railway company
K-opticom	72.872 MWh	2,2%	Subsidiary company of Kansai EPCO
J:COM West	71.515 MWh	2,2%	Cable television
Tonen General Sekiyu	55.697 MWh	1,7%	Oil
SB Power (Softbank)	50.139 MWh	1,5%	Mobile communication
Restliche Stromanbieter	812.680 MWh	~24,5%	-

Source: Eigene Darstellung von Robin Goeßmann; Die Liberalisierung des japanischen Strommarktes nach dem Atomunfall von Fukushima/ Hintergründe, Auswirkungen/ Rahmenbedingungen; Masterarbeit 2017; Daten entnommen aus: METI (2017b: Internet)

„After the Fukushima Daiichi nuclear disaster, nearly **800 PPS** companies filed documentation required by law, but only 135 have actually supplied any electricity, and they held only about 9 percent of the market share at the end of fiscal 2015 (i.e., March 31, 2016)".
Source: Japan For Sustainability", No. 171, Nov. 2016); PPS = Power producer and supplier

Astonishing global differences of PV costs (2015)

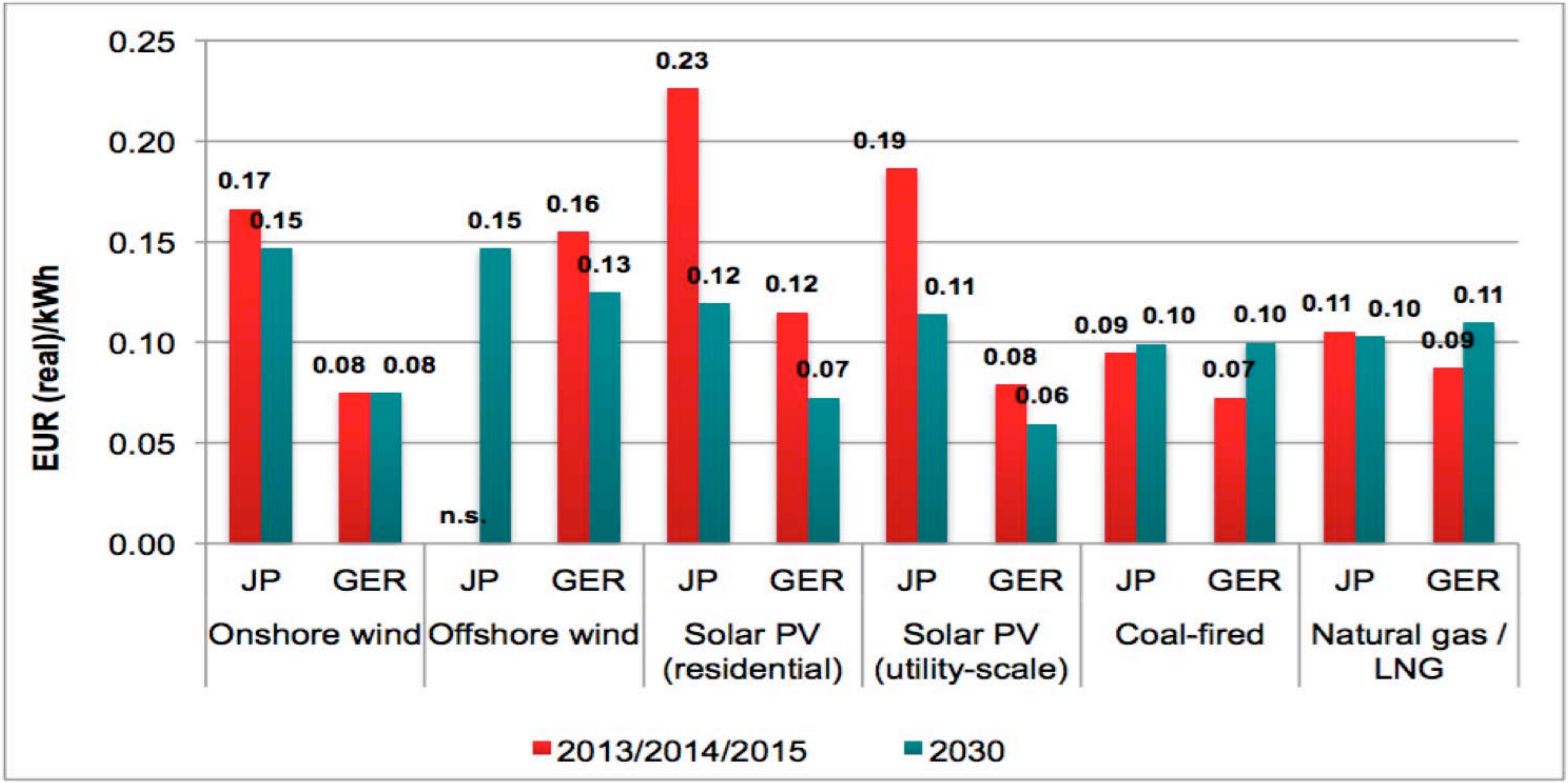
= great cost reduction potential in Japan



Source: IRENA 2016

LCOE cost estimates in Japan and Germany

for new plants recently built (2013-2015) and for 2030

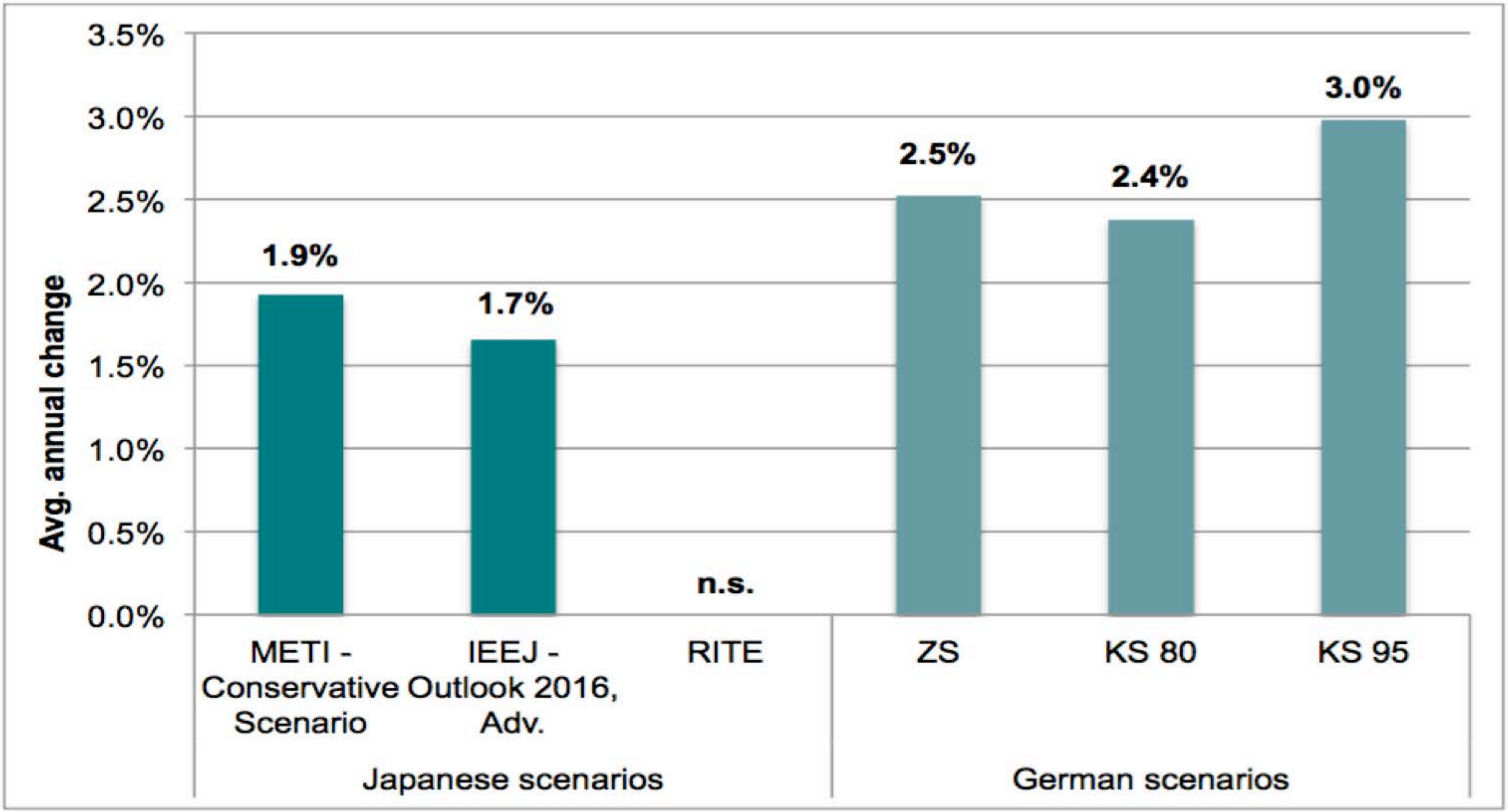


Data sources: METI (2015), Fraunhofer ISE (2013a), Agora Energiewende (2015).
Note: A conversion rate of 1 Yen = 0.0077 Euro has been used to convert the Japanese cost data from Yen to Euro.

Source: GJETC (ed.): Energy transition as a central building block of future industrial policy, 2017.

LCOE: Life cycle cost of energy
Lifetime cost divided by energy production

Average annual increase of energy productivity
(2010-2013) in selected scenarios for Japan and Germany

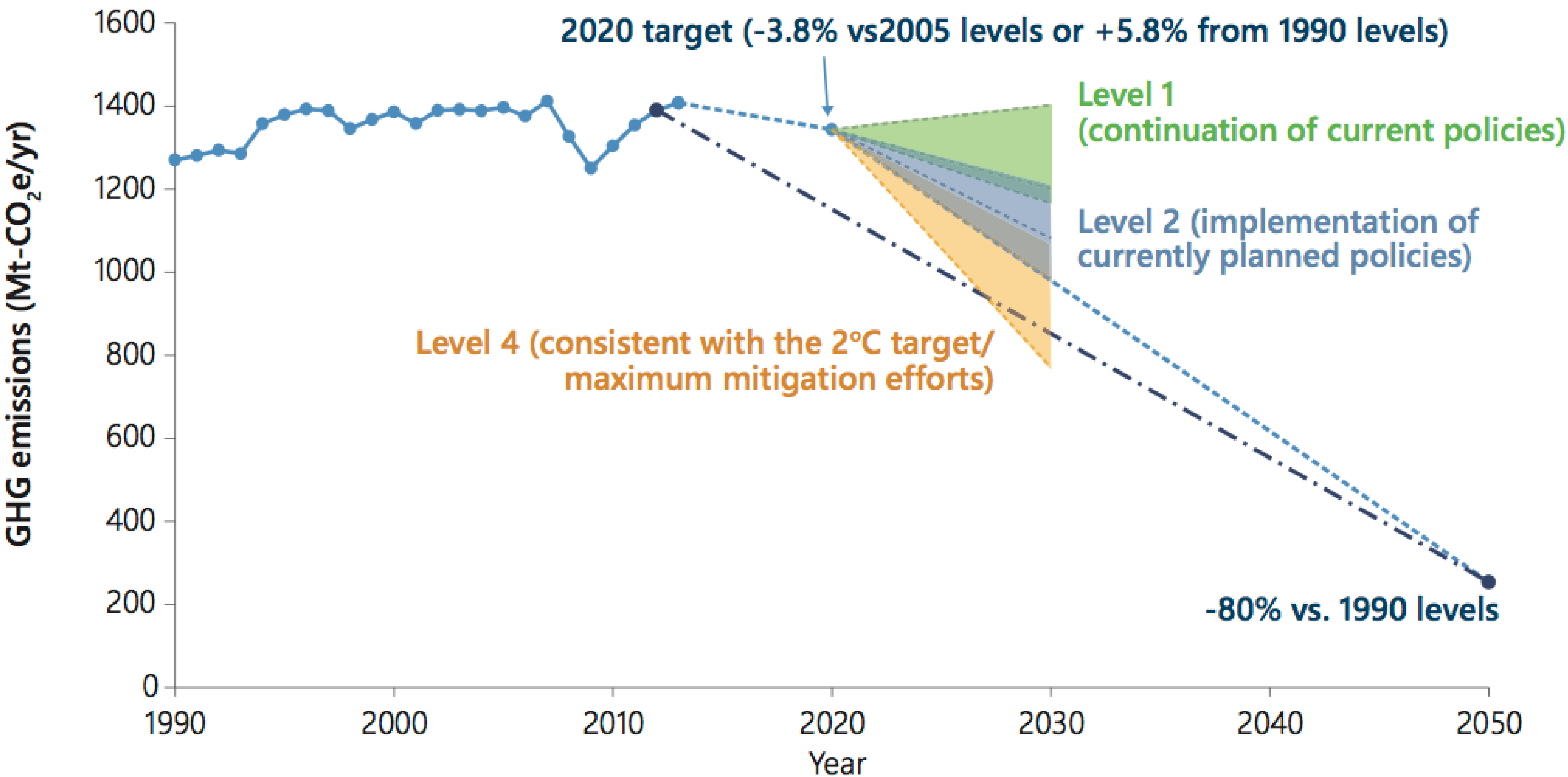


Sources: Own figure and calculations based on the data found in the cited scenarios and studies.

Source: GJETC (ed.): Energy transition as a central building block of future industrial policy, 2017.

IGES-Metastudy on GHG emissions in Japan

reduction paths for 80%-target in 2050

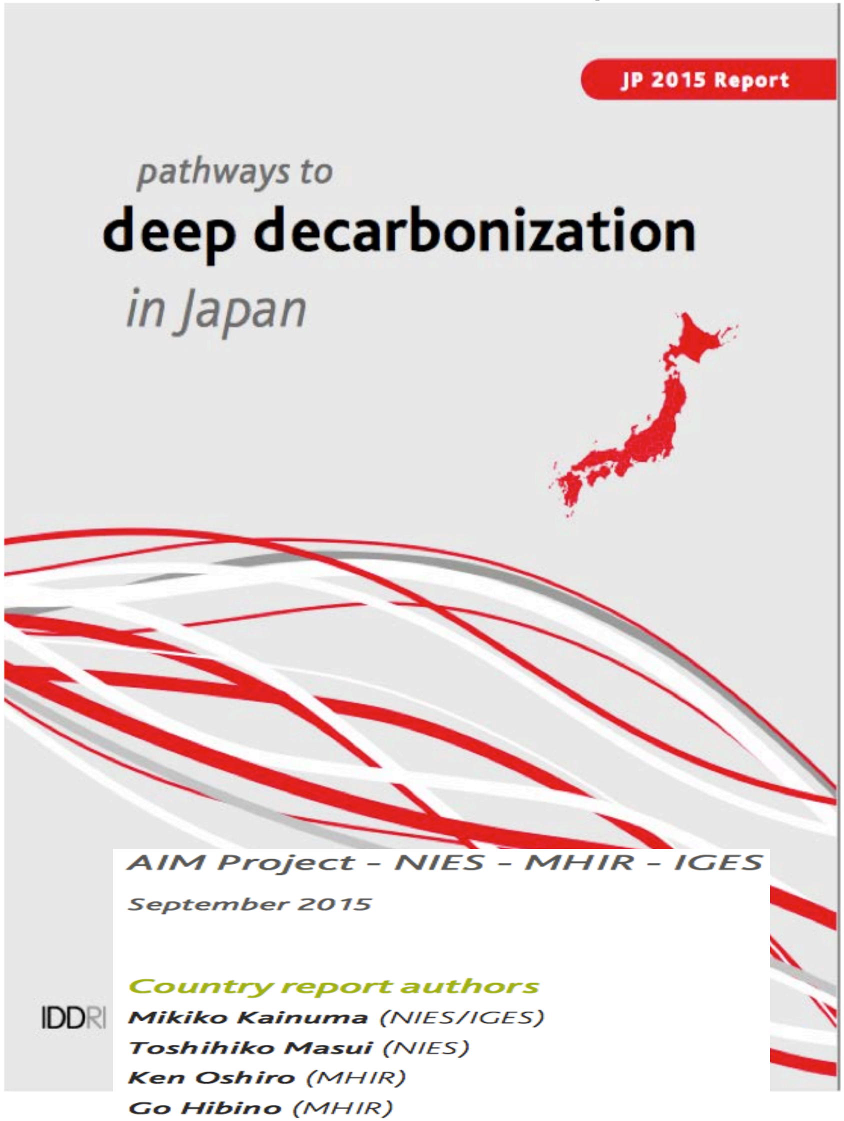


Source: IGES
2015

Japan and Germany:

Case studies of the DDPP-Project

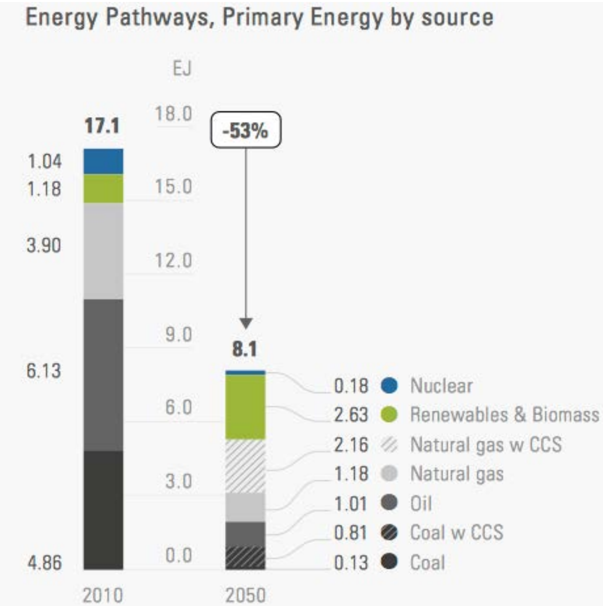
DDPP = **D**eep **D**ecarbonization **P**athway **P**roject
(16 countries are included)

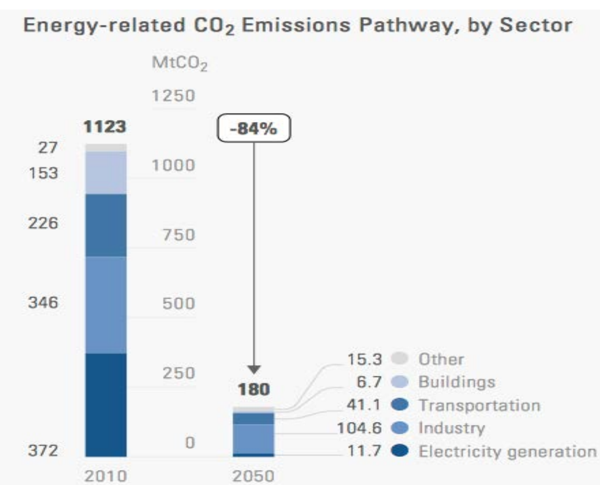


Three typical strategies for Deep Decarbonization in Japan

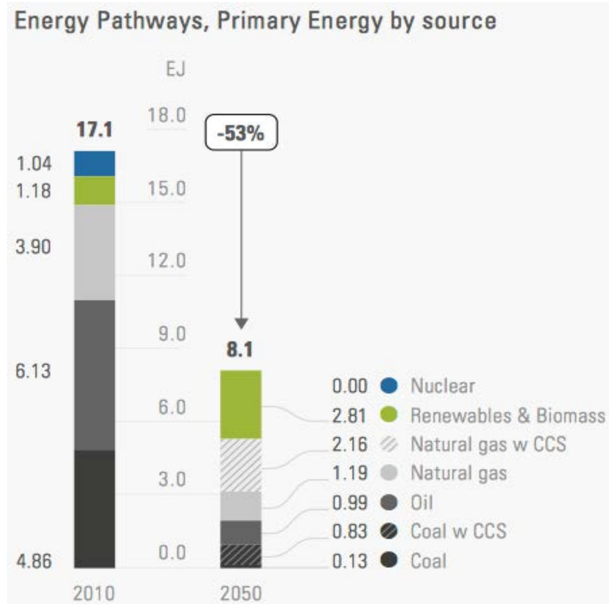
DDPP-Scenarios (2015) demonstrate a broad range

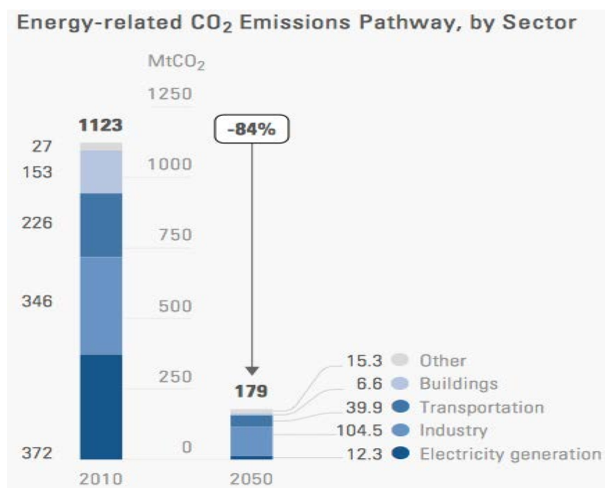
Mixed



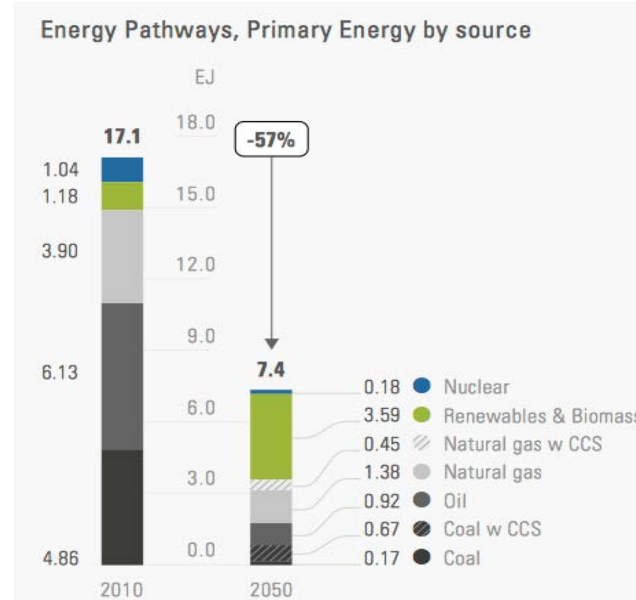


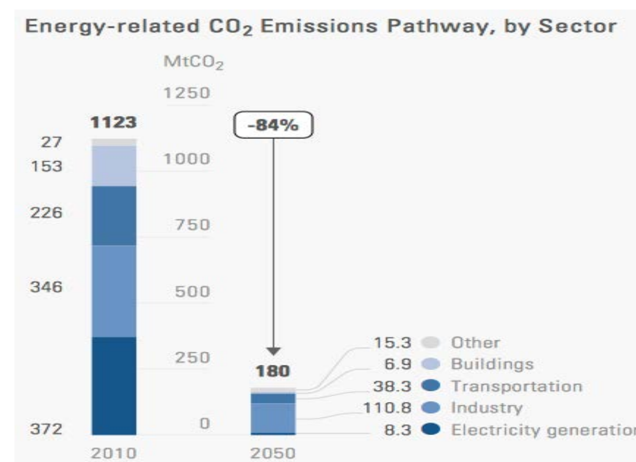
No Nuclear





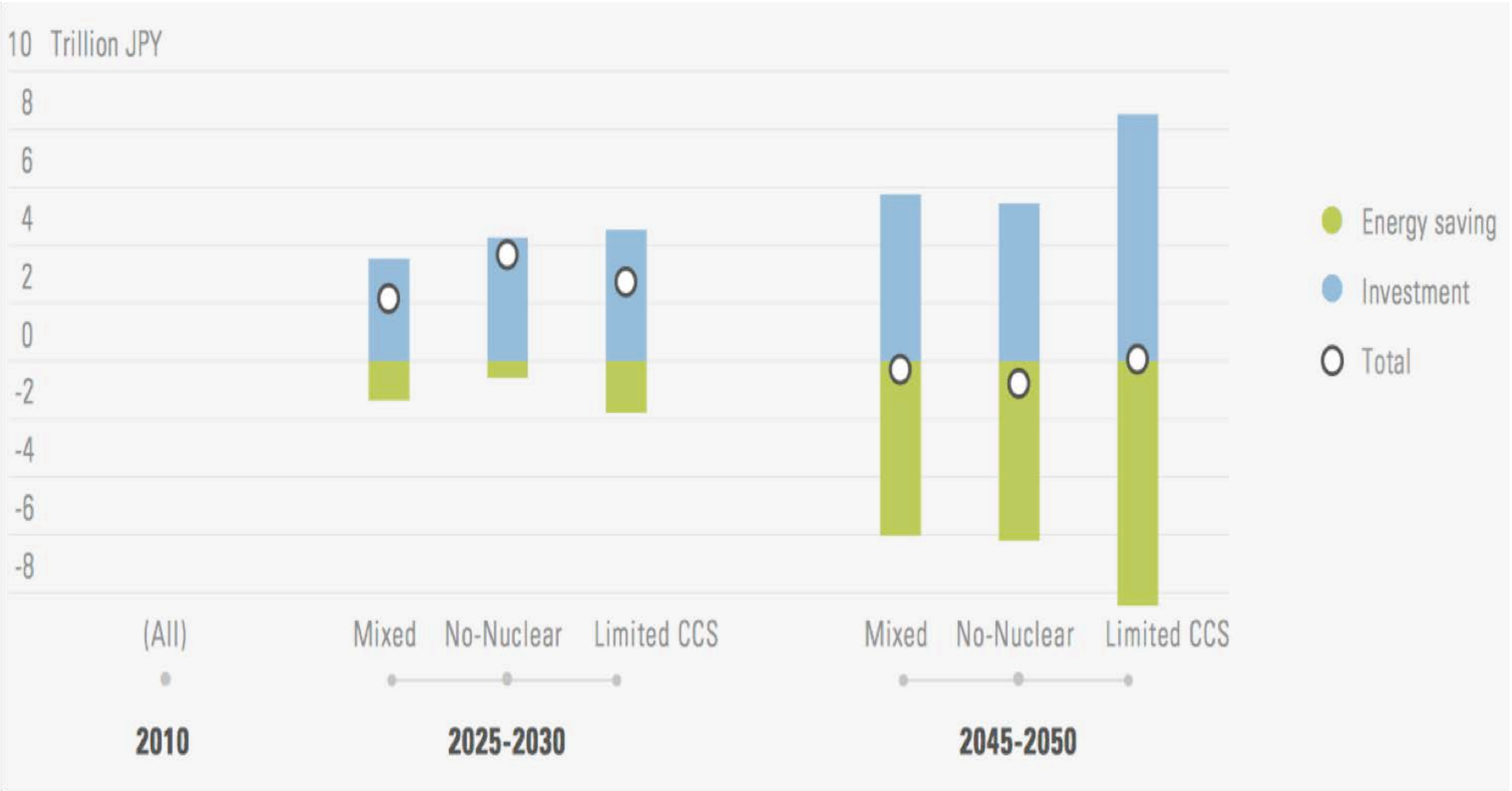
Limited CCS





Comparable costs in DDPP scenarios for Japan

(investment cost minus energy cost savings = nearly zero)



Source: DDPP, JP 2015 Report, 2015.

What could Japan interest in the German Energiewende?

Consensus building concerning long-term objectives

Developing a design for green power (e.g. PV and wind) and flexibility options

Grid regulation and non-discriminatory grid access

Expanding decentralized and municipal power generation

Motivating participation and public discourses

Macroeconomic cost-benefit analysis

Last but not least:

Avoiding the failures e.g. deficits in management!

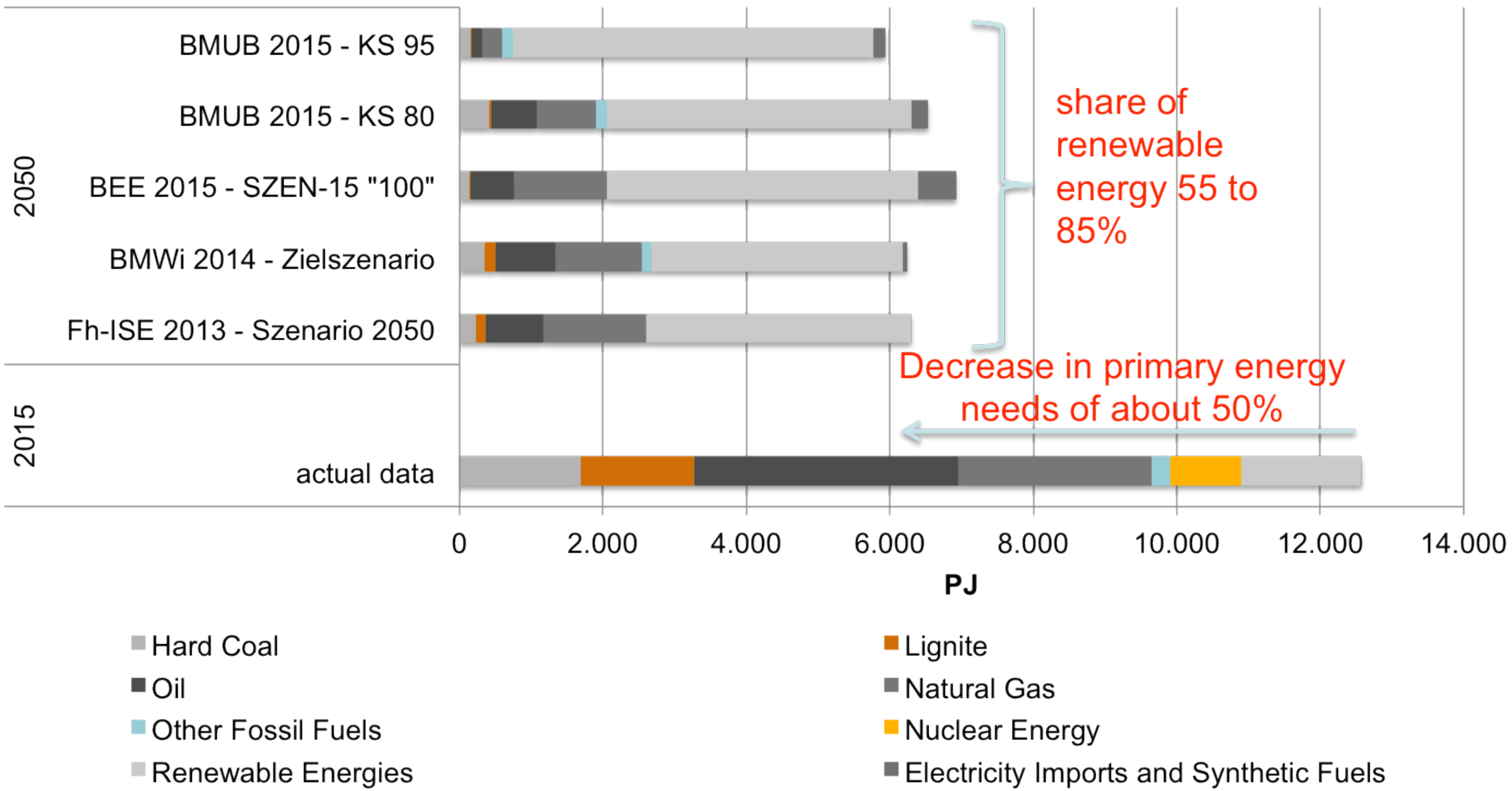
"Revolutionary Targets" (Chancellor Merkel)

Energy Concept, Federal German Government, 09/2010

	2014	2015	2020	2030	2040	2050
Greenhouse gas emissions						
Greenhouse gas emissions (compared to 1990)	-27.7 %	-27.2 %	minimum -40 %	min -55 %	min -70 %	min -80 to 95 %
Increase in share of renewable energy in final energy consumption						
Share in gross final energy consumption	13.6 %	14.9 %	18 %	30 %	45 %	60 %
Share in gross power consumption	27.3 %	31.6 %	min 35 %	min 50 % (2025: 40-45 %)	min 65 % (2035: 55-60 %)	min 80 %
Share in heat consumption	12.5 %	13.2 %	14 %			
Share in transport sector	5.6 %	5.2 %	10 % (EU goal)			
Reduction of energy consumption and increase in energy efficiency						
Primary energy consumption (compared to 2008)	-8.3 %	-7.6 %	-20 %			-50 %
Final energy productivity	1.6 % per year (2008-2014)	1.3 % per year (2008-2015)	2.1 % per year (2008-2050)			
Gross electricity consumption (compared to 2008)	-4.2 %	-4 %	-10 %			-25 %
Primary energy demand buildings (compared to 2008)	-19.2 %	-15.9 %				around -80 %
Heat demand buildings (compared to 2008)	-14.7 %	-11.1 %	-20 %			
Final energy consumption transport (compared to 2005)	1.1 %	1.3 %	-10 %			-40 %

Research consensus: “Energiewende” is technically feasible

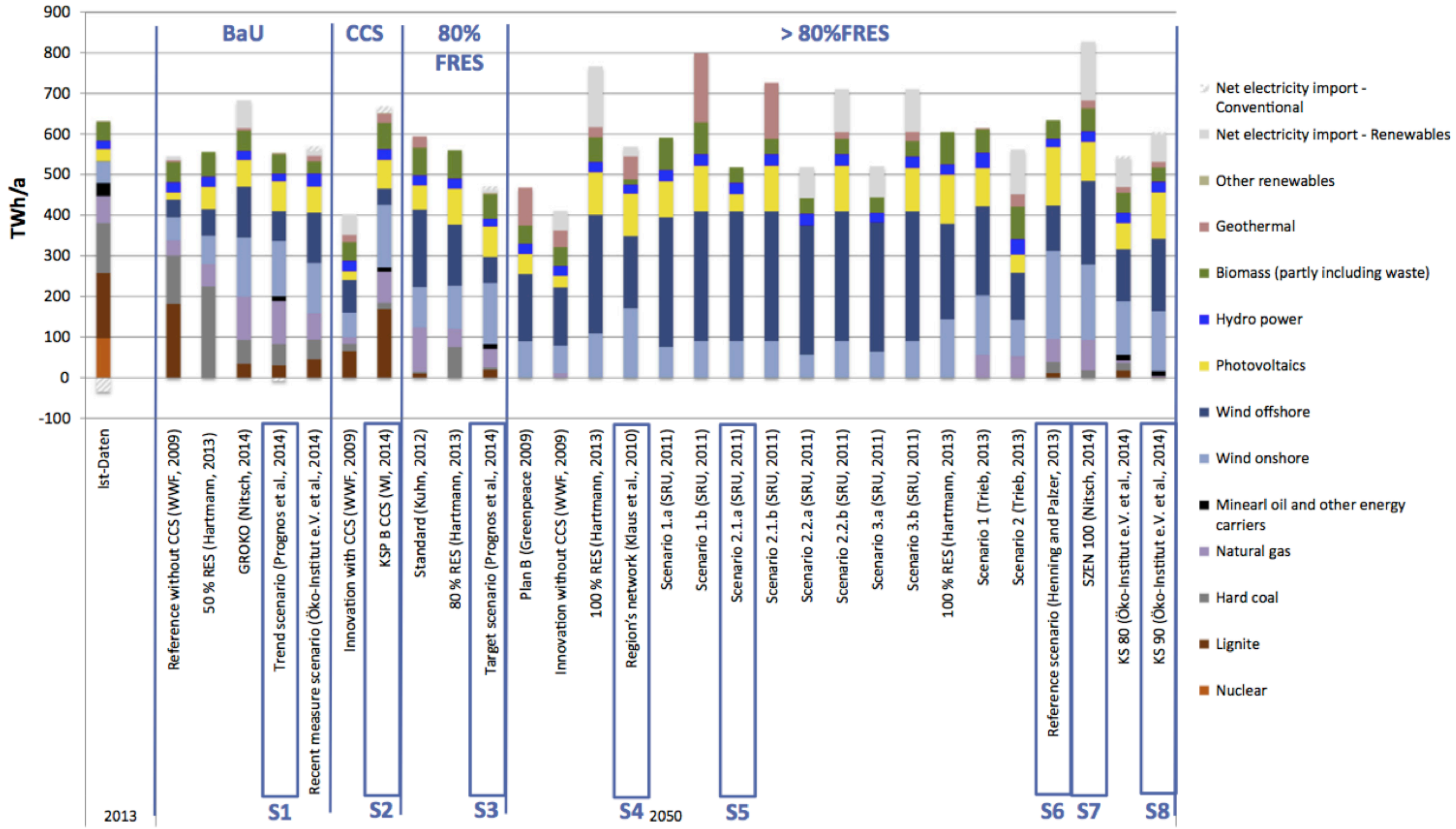
Decoupling GDP from quality of life



Source: Particular scenario studies and AG Energiebilanzen 2015.

Typical scenarios of German electricity production

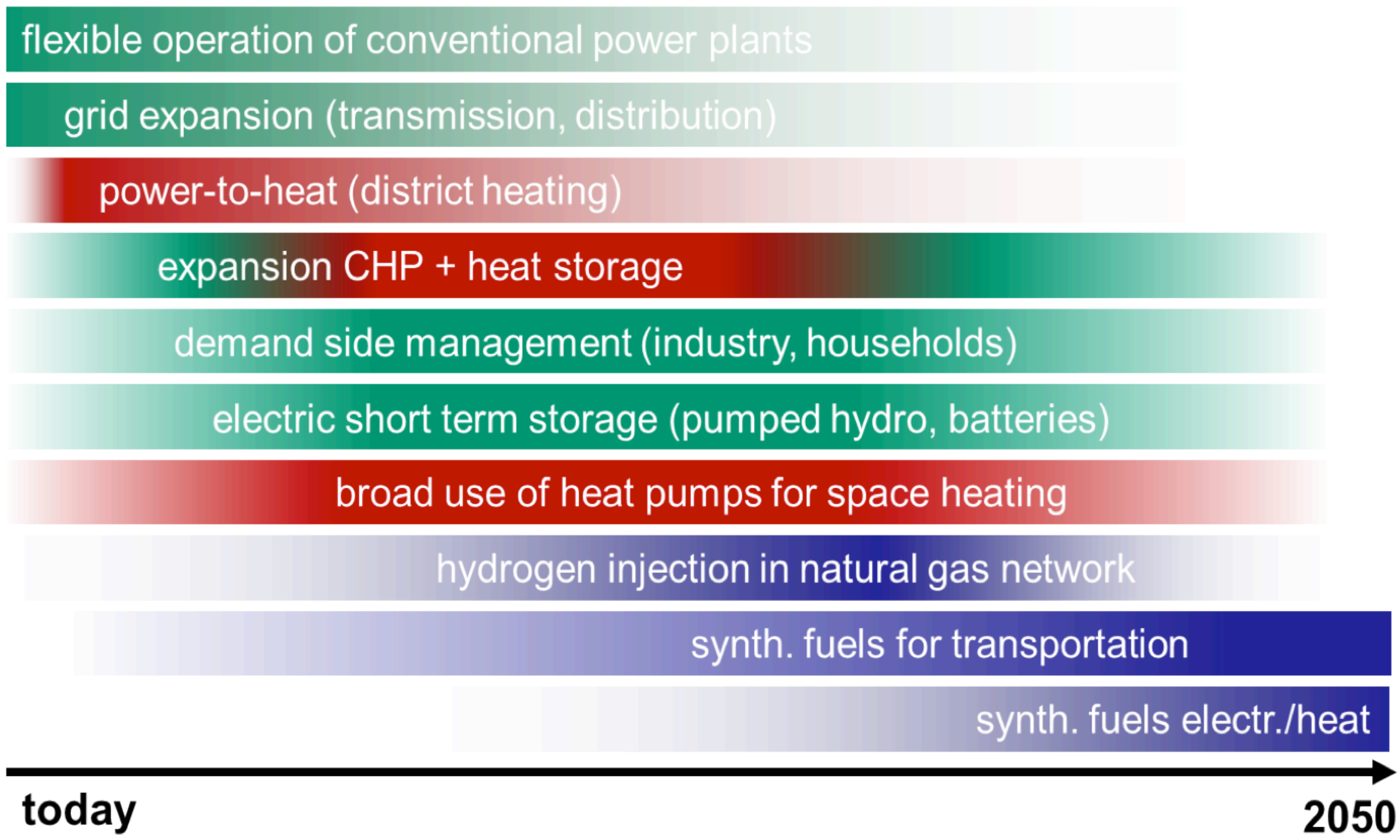
Many options, but huge uncertainty on electricity demand in 2050



Source: B. Lunz et al. 2016.

Major flexibility options on timeline to 2050

Enough potential to manage fluctuating power (PV, Wind)?

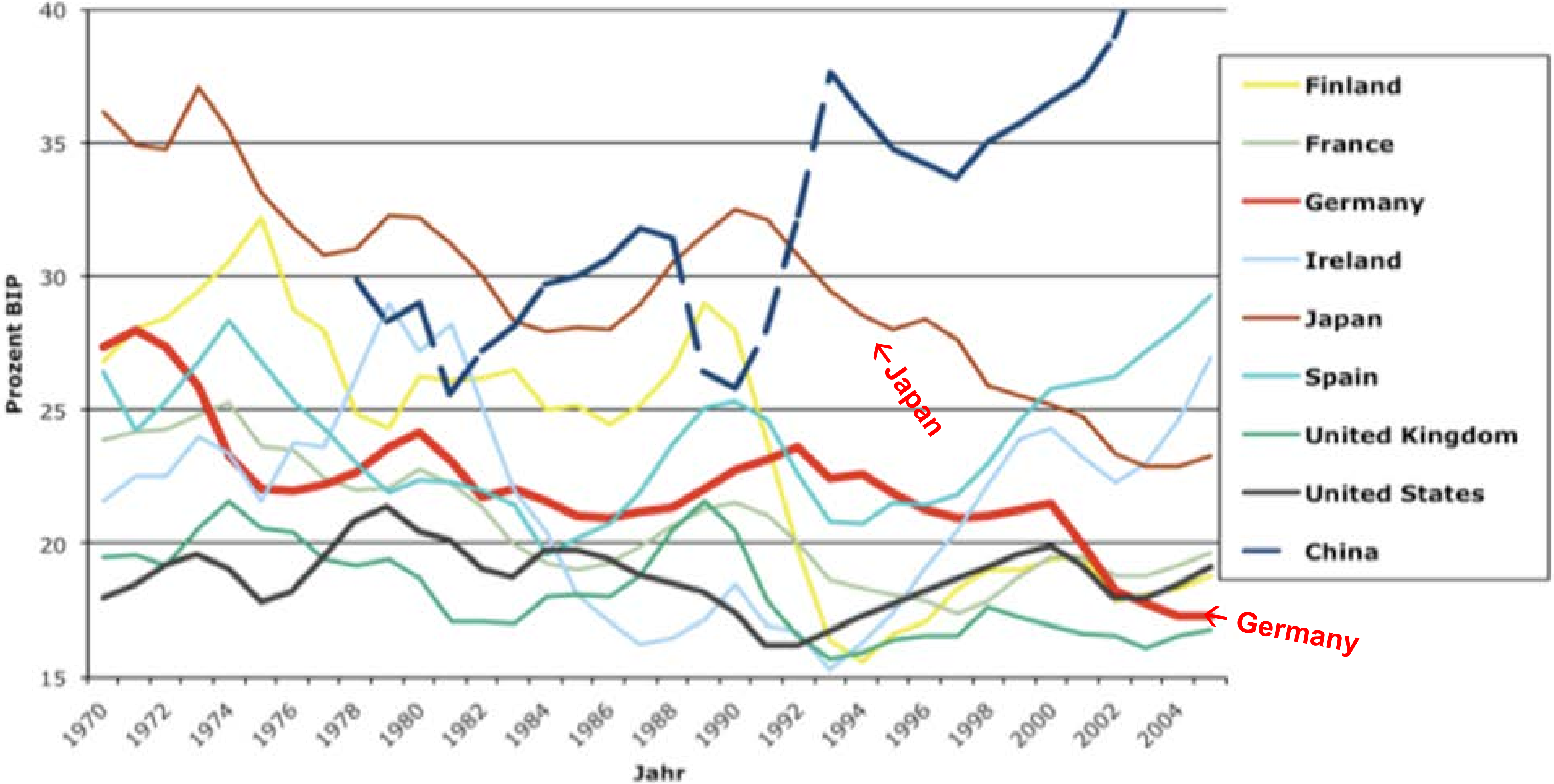


Source: Henning 2016.

Additional investments in climate and resource protection –

A core strategy to raise the investment and innovation rate

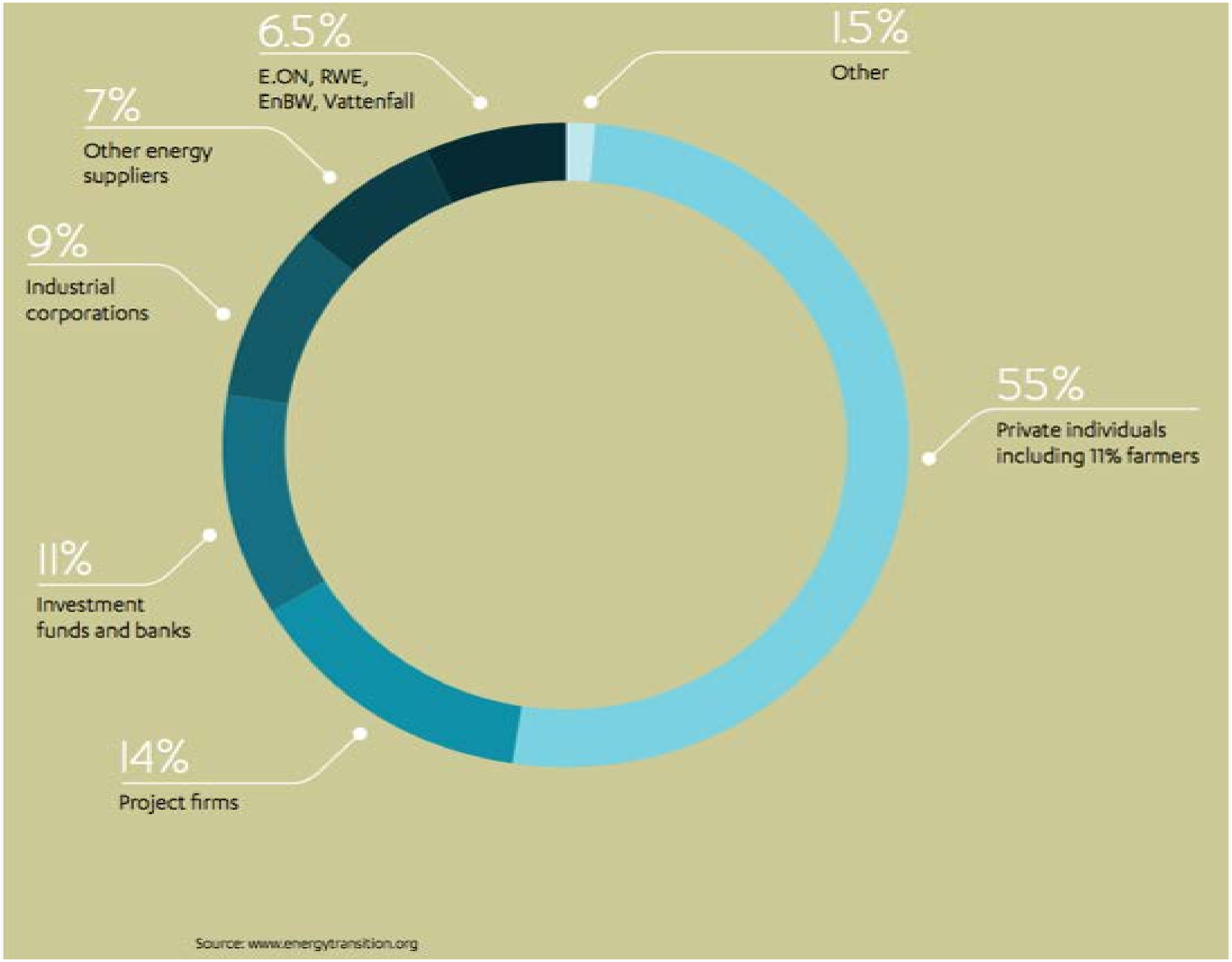
International comparison of gross investment rates (1970-2006)



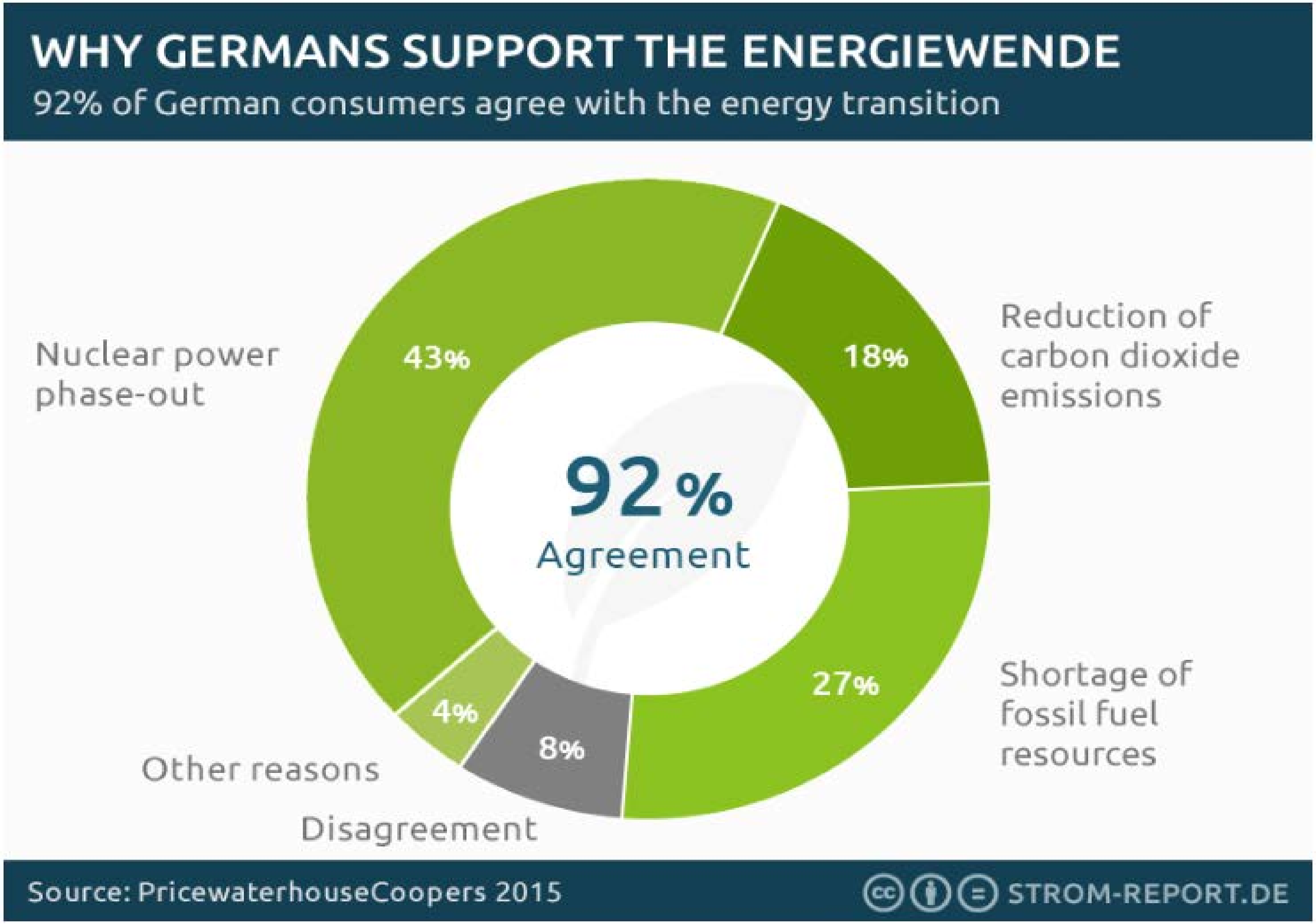
Source: C. Jäger, PIK, 2009.

Decentralized ownership of installed renewable power capacities

in Germany 2010



Source: Greenpeace International 2013.


WHY GERMANS SUPPORT THE ENERGIEWENDE
92% of German consumers agree with the energy transition
Nuclear power phase-out
43%
18%
Reduction of carbon dioxide emissions
92 %
Agreement
27%
Shortage of fossil fuel resources
4%
8%
Other reasons
Disagreement
Source: PricewaterhouseCoopers 2015
STROM-REPORT.DE

The split of E.ON: “A matter of survival”

FR 12.03.2015: “Tottering giants. Billions of losses for RWE and E.ON”!

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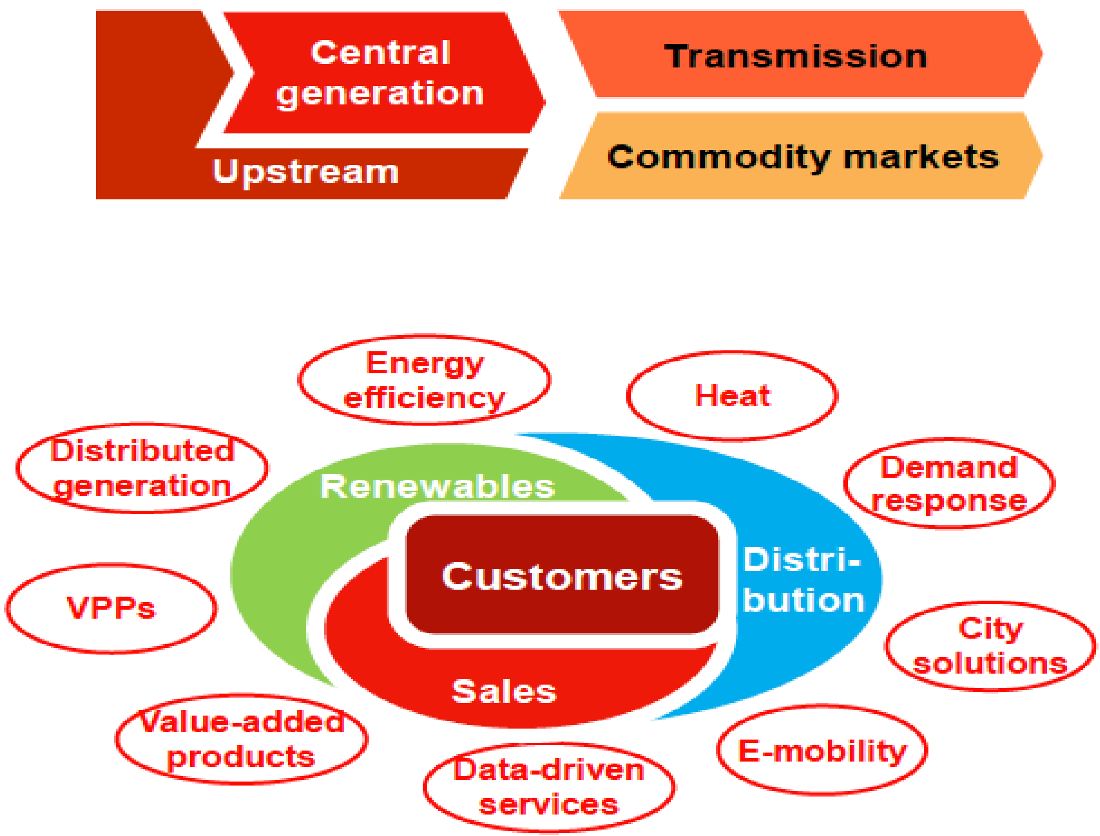
Two very different energy worlds emerging



Conventional energy world

- System-centric
- Security of supply
- Global/regional perspective
- Large scale, central
- Conventional technologies

New energy world

- Customer-centric
- Sustainability
- Local proximity
- Small scale, distributed
- Clean technologies

2

Unsolved problems of the Energiewende
have to be discussed frankly…..

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- Costs: How much, how long, for whom?
- Security of power supply vs. system integration of intermittent power?
- Roadmap for phasing out coal – protecting regions and jobs?
- System transformation of heat and transport sector?
- How to close the implementation gap for energy (resource) efficiency?
- Decentralized vs. centralized power structures (off shore; grid)?
- Citizens participation and democratization?
- Lifestyle changes: sustainable consumption and production?
- Political Leadership: Management and responsibilities?

Large implementation gap

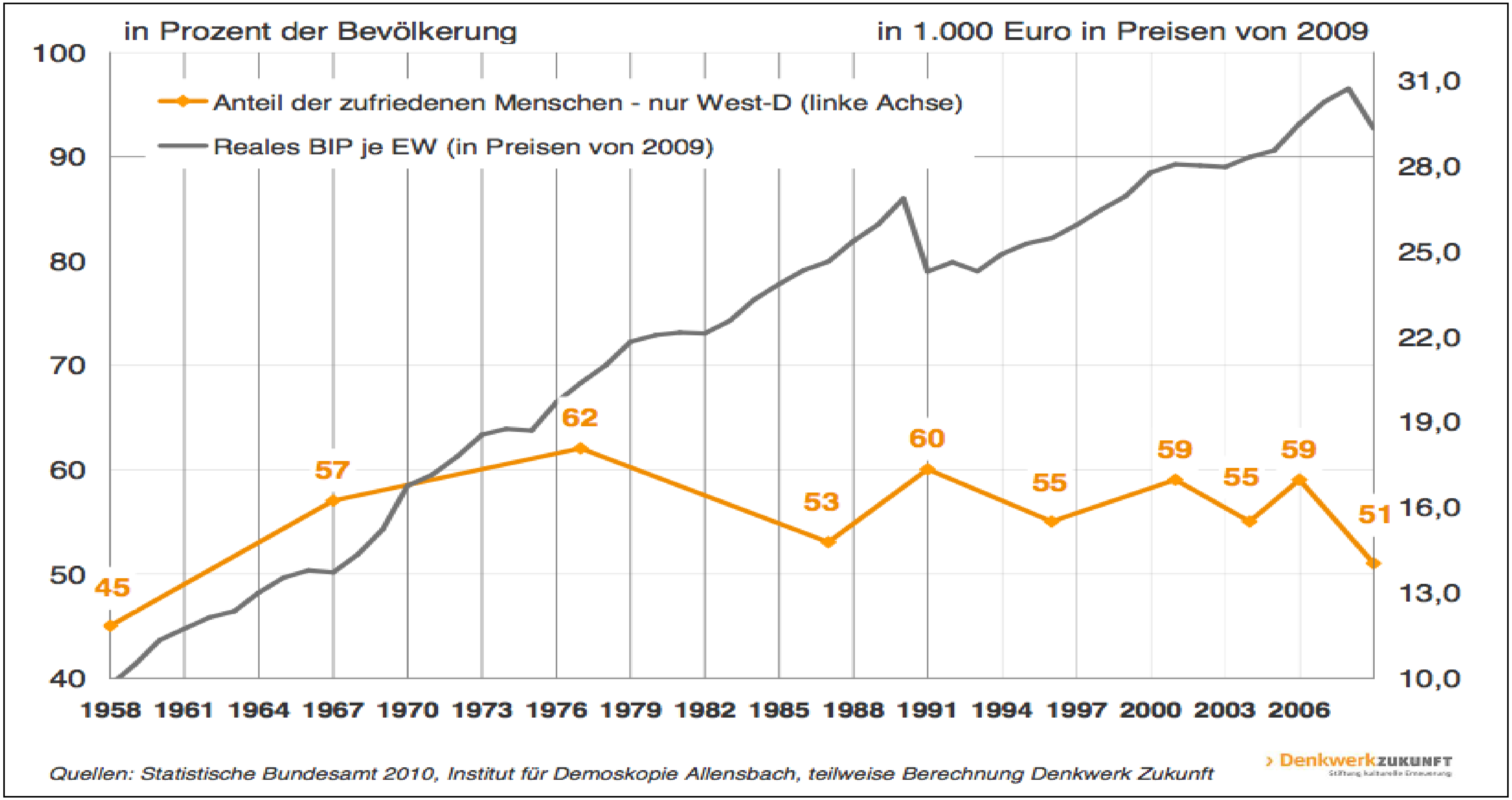
- especially concerning energy savings

Indicator	Target 2020	Target 2050	Level of implementation 2014
Primary energy consumption (compared with 2008)	-20%	-50%	8.3%
Gross electricity consumption (compared with 2008)	-10%	-25%	-4.2%
Final energy productivity	2.1% per annum (2008–2050)		1.6% per annum (Average 2008–2014)
Primary energy consumption in buildings (compared with 2008)	–	in the magnitude of -80%	-14.8%
Heat consumption in buildings (compared with 2008)	-20%	–	-12.4%
Final energy consumption in transport (compared with 2005)	-10%	-40%	+1.1%

Source: The Energy of the Future: Fourth "Energy Transition" Monitoring Report, updated.

GDP decouples from life satisfaction

GDP per capita and life satisfaction in Germany 1958-2009

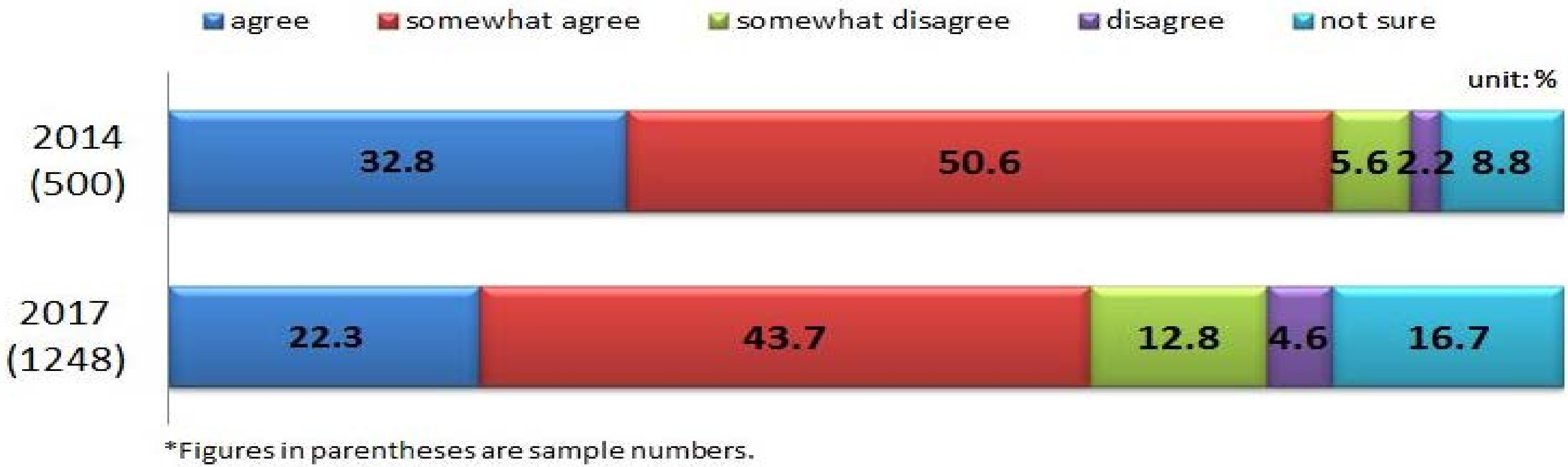


Quelle: Denkwerk Zukunft (2010)

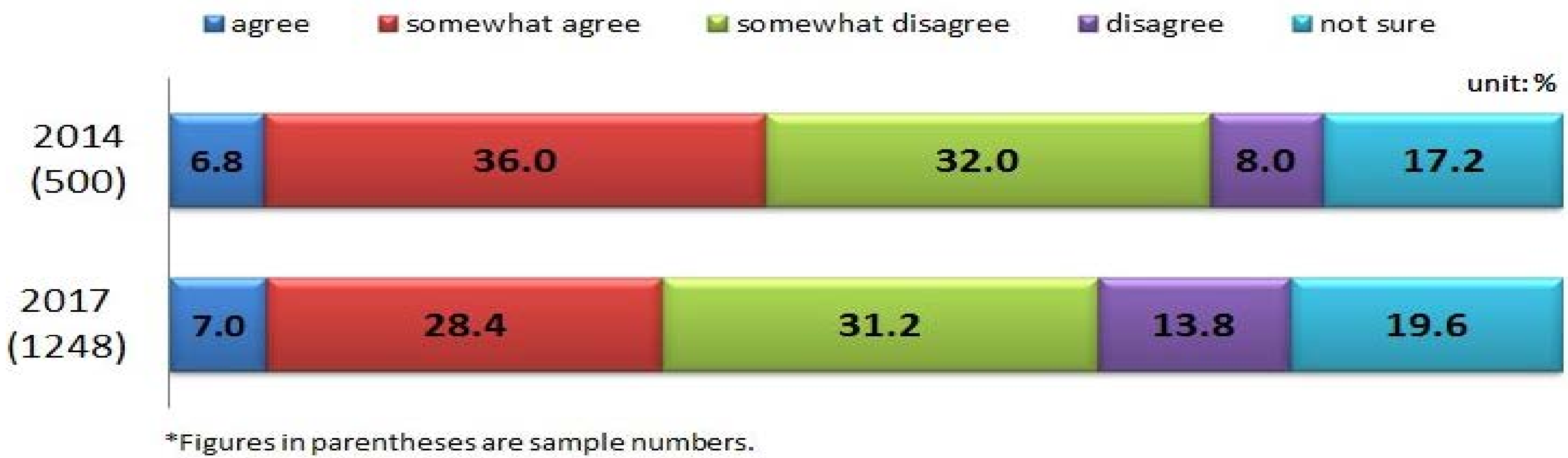
German - Japanese comparison

of socio-economic perceptions would be interesting!

Do you believe that Japan needs a continuos growth of GDP?



Do you believe that Japan´s GDP will grow?



Prof. Dr. Peter Hennicke

Thank you for your attention!

Publication: Sonnenschein/Hennicke (2015): The German Energiewende, Lund.

Available under www.wupperinst.org/info/details/wi/a/ad/3319/

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