

Solar energy: What to do – and what not to do

Lessons from Germany

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President EUROSOLAR European Association for Renewable Energy
General Chairman, World Council for Renewable Energy

31 May 2017



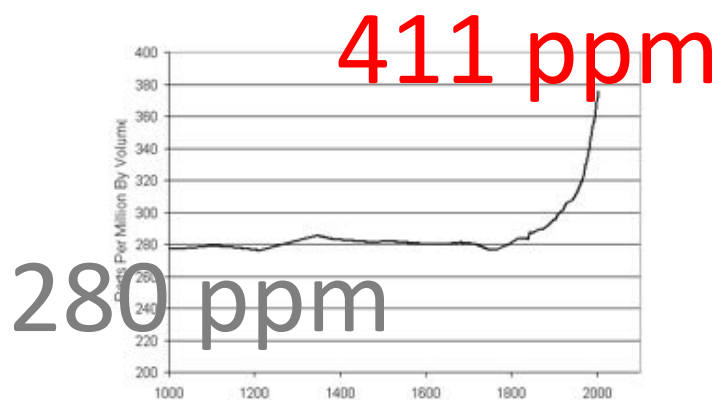
Global push factors





Annual fossil fuel consumption increased by 500% since 1950

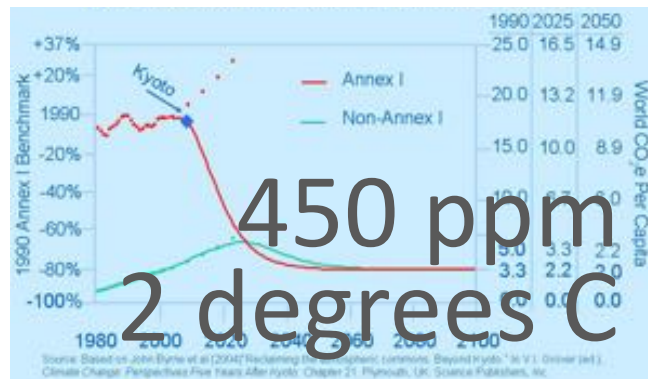
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Carbon dioxide concentrations in the atmosphere, 1000-2013 A.D.

Quelle: Scripps, ORNL und IPCC.

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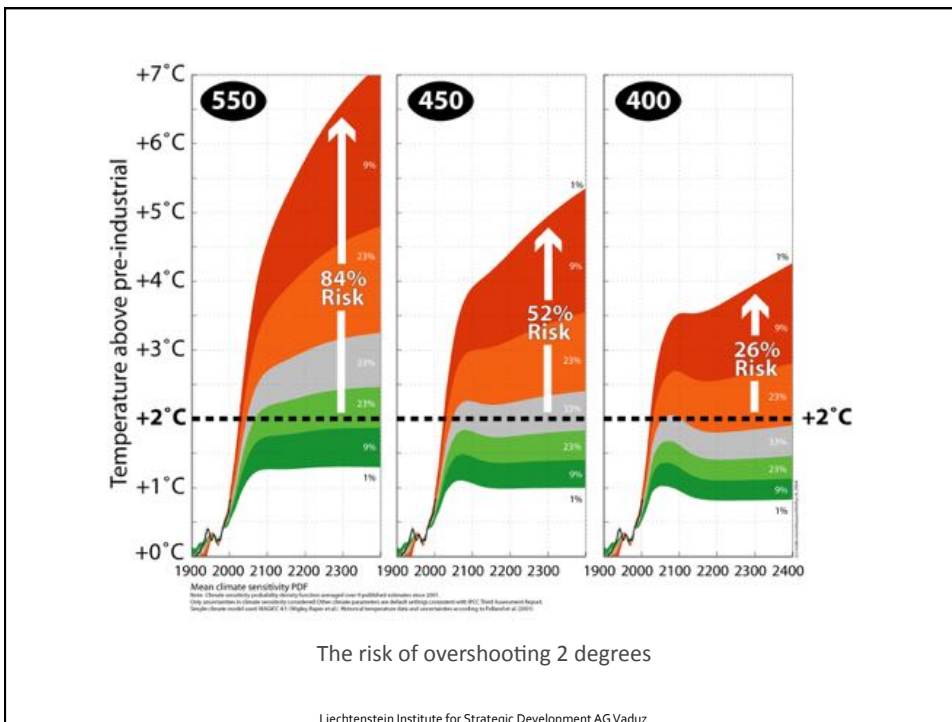


Conventional GHG emission reduction scenarios
 Quelle: Center for Energy and Environmental Policy, University of Delaware.

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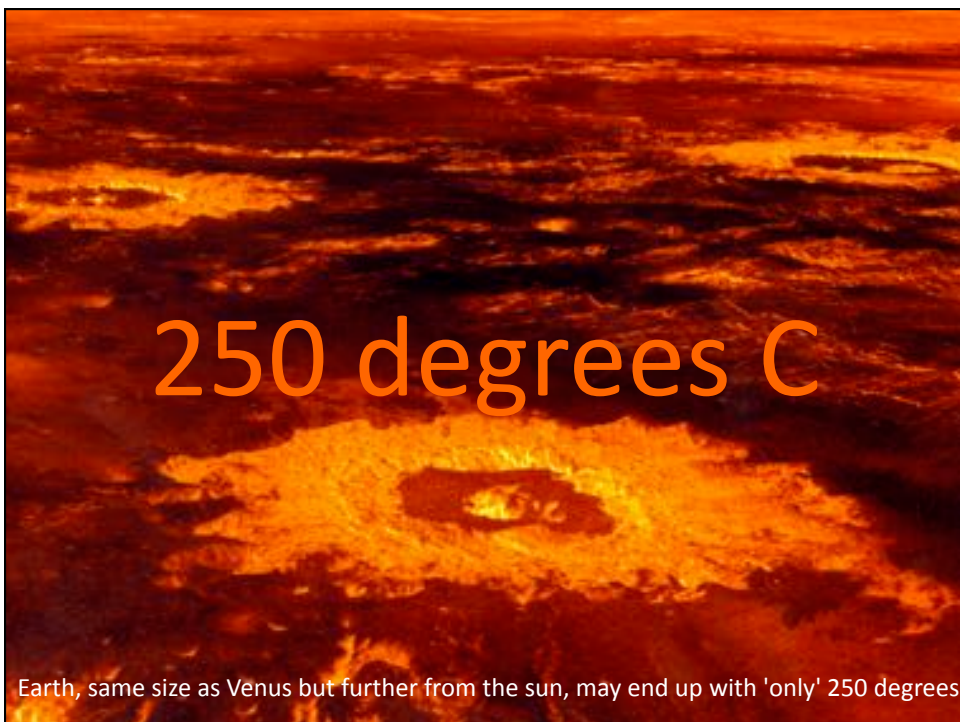


**Draining and Deforestation:
Moorlands of the
East Asian rainforests**

- Moorland draining releases 630 million tons of CO₂ equivalent annually
- Equals the overall emission reduction target of the entire Kyoto Protocol

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280 ppm
target

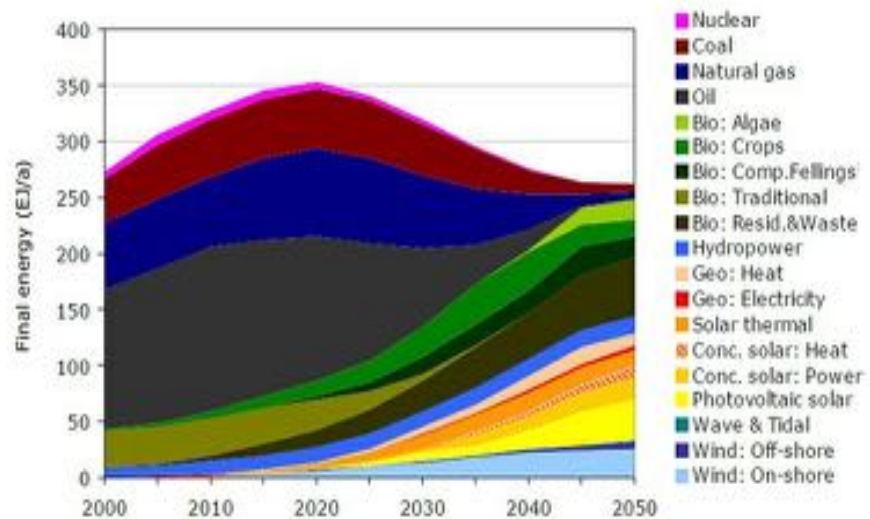
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2020
action horizon

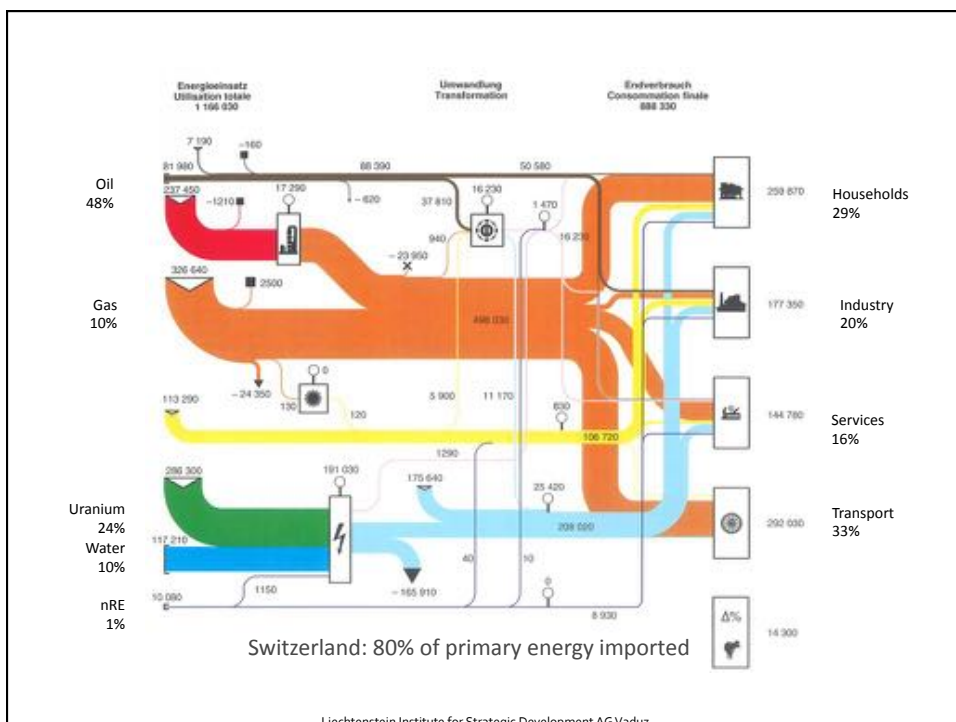
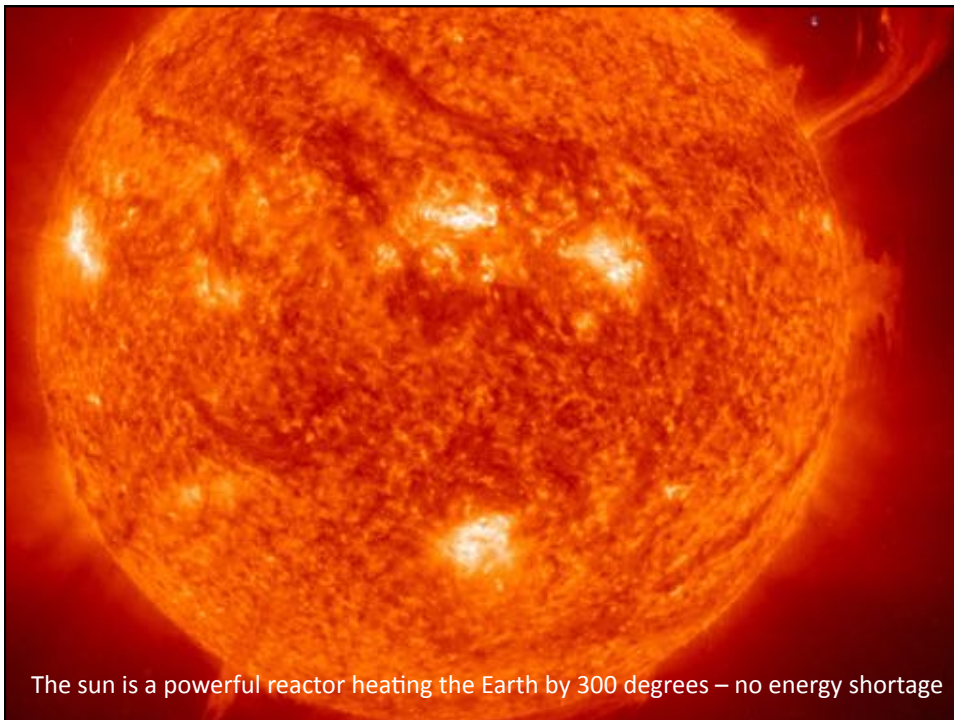
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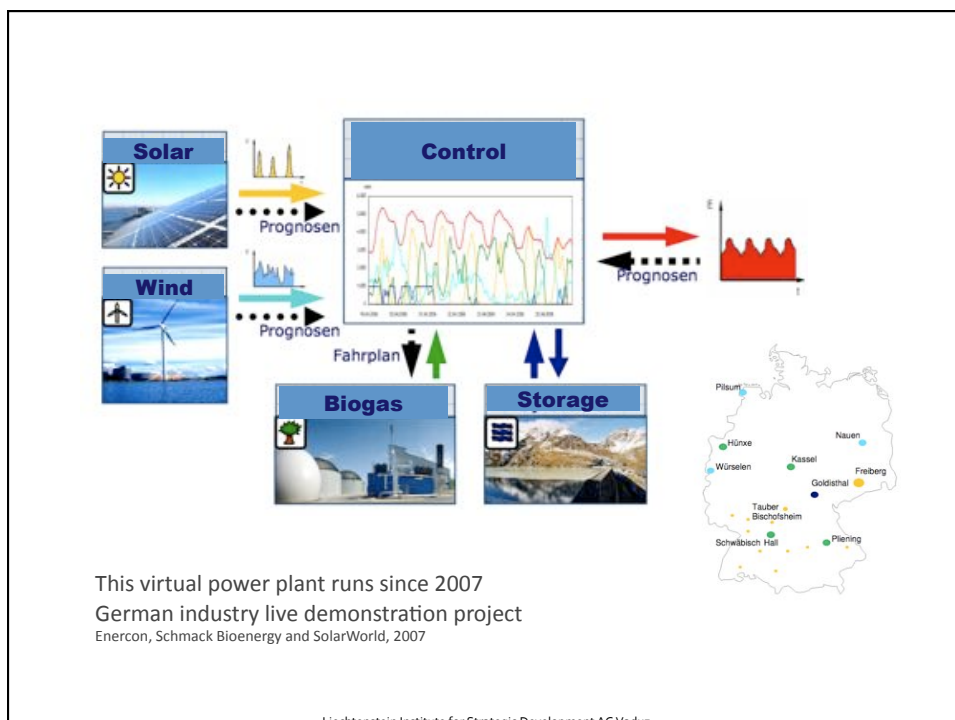
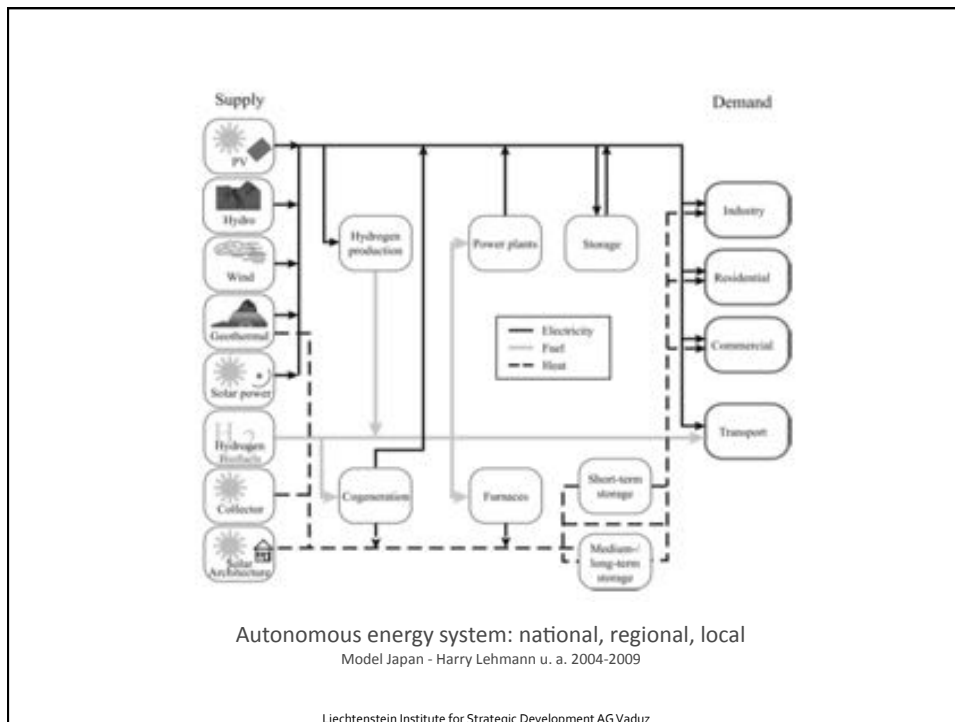
100% renewable

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National pull factors



until recently –
the FiT - global success:
applied in over 50 countries

German fossil fuel imports in 2011:
86 Billion €
doubled since 2000

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Net savings until 2040: 30 Billion
with external costs 352 Billion

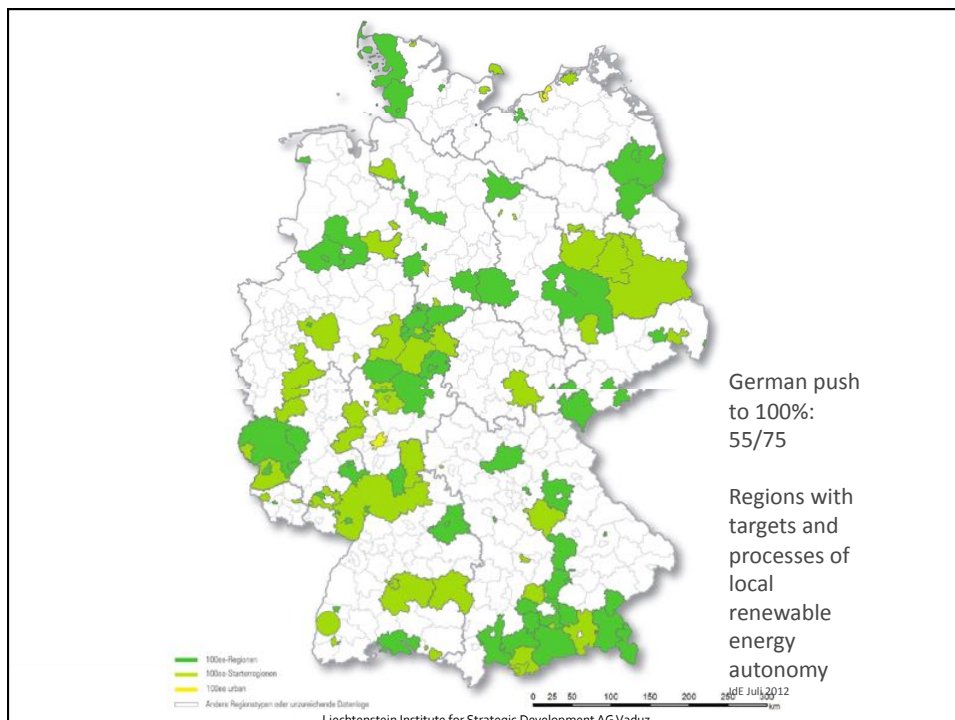
BMU 2012

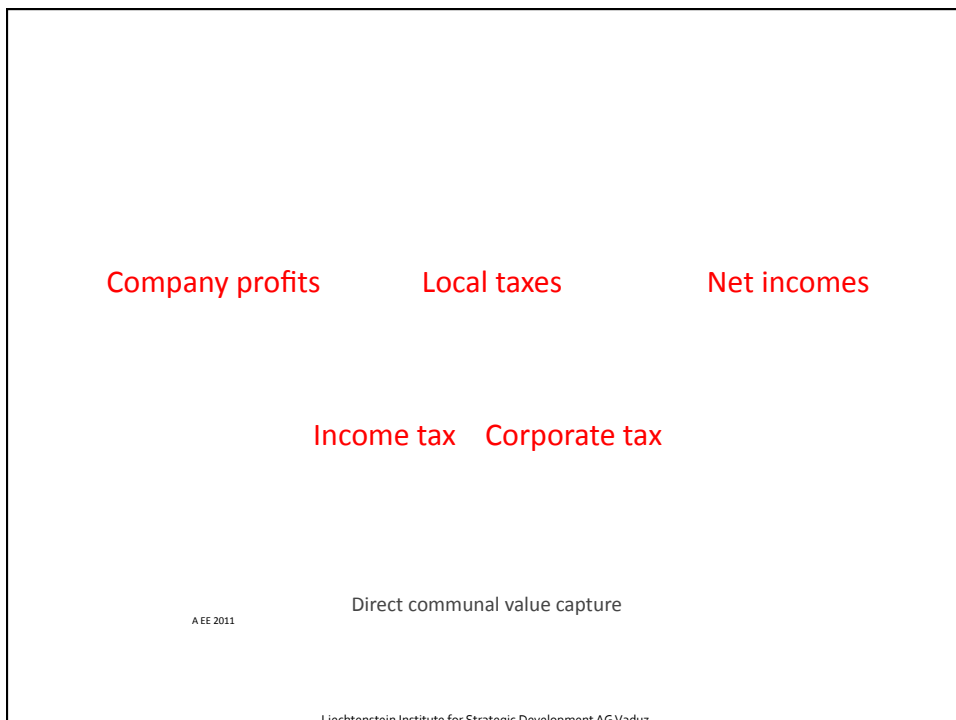
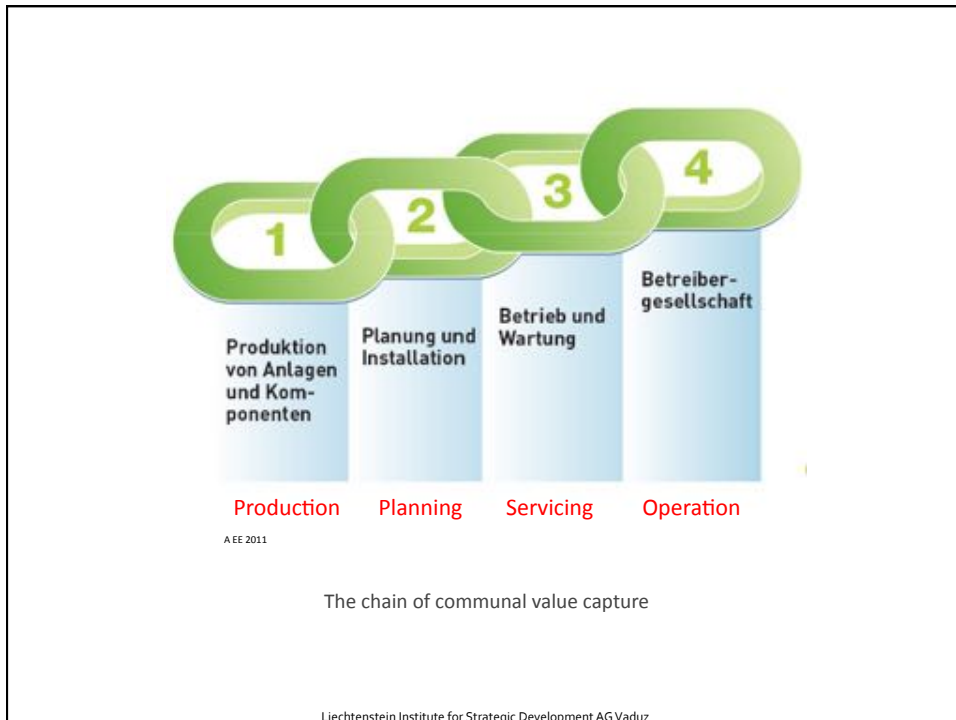
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Net savings until 2050: 578 Billion with external costs 918 Billion

BMU 2012

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Communal value capture through renewable energy
in Germany total

2009	6,7 Billion €
2011	8,9 Billion €
2020	13,2 Billion €

iÖW 2011

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Municipal investors: capacity to climate neutrality by 2020

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Germany's renewable capital precinct

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boer Bodensee-Mieminger
EnergieRegion

Internationale
Bodensee
Hochschule

Lake Constance Alpine Rhine Energy Region: BAERnet.org
International Lake Constance Region: 4 million people on 15'000 square kilometers

HOCHSCHULE
LIECHTENSTEIN

HOCHSCHULE FÜR TECHNISCHE
ANWANDTUNGSWISSENSCHAFTEN

HOCHSCHULE
FÜR ANGEWANDTE
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interreg IV

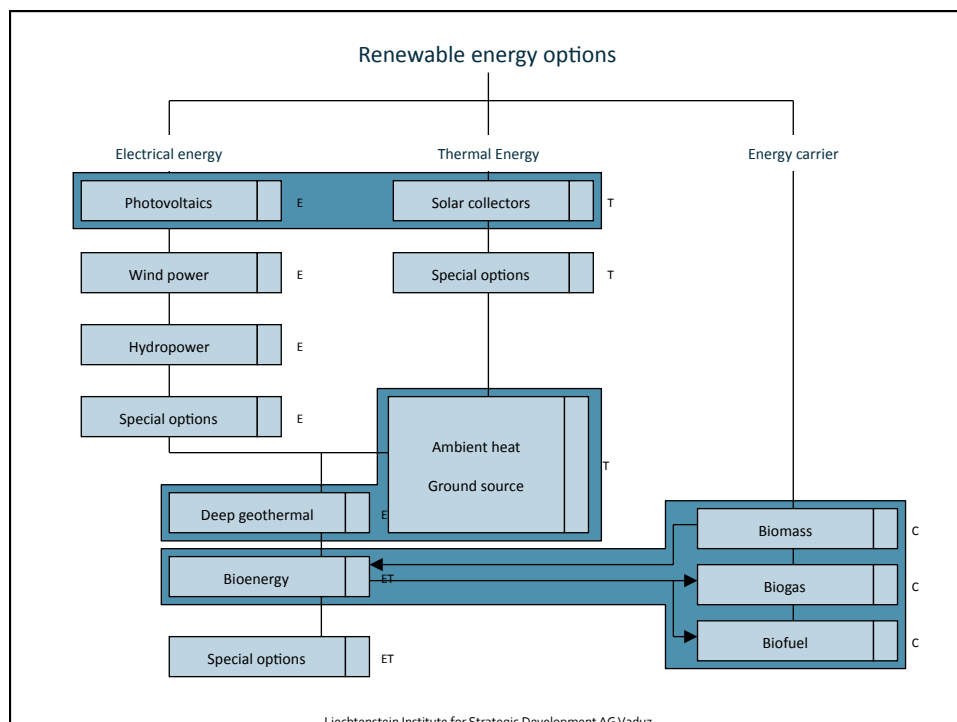
Barock-Kirche Birnau

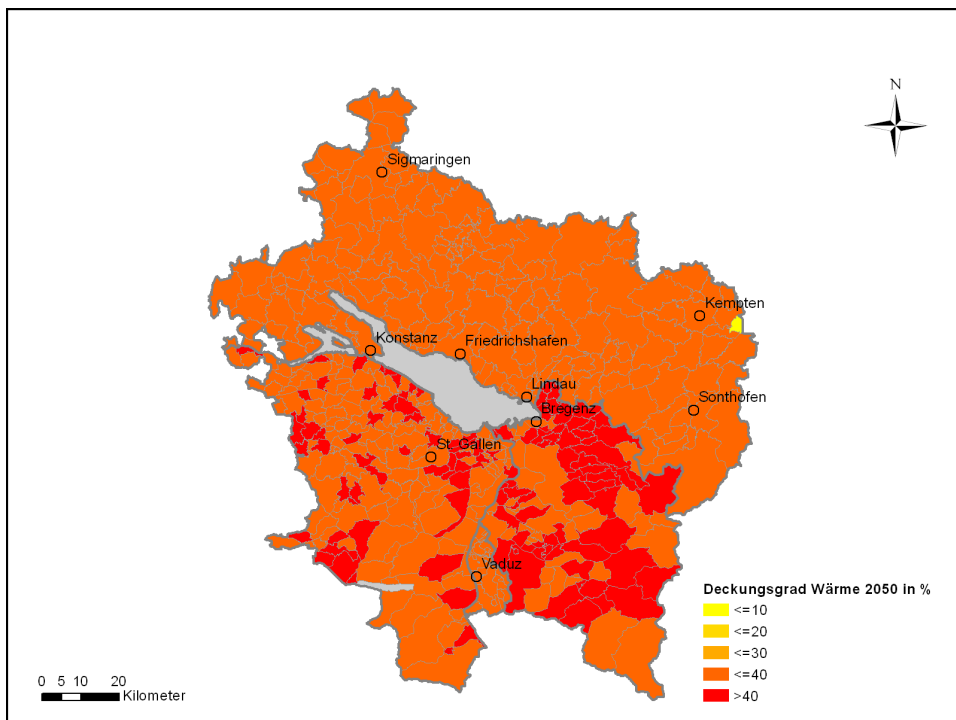
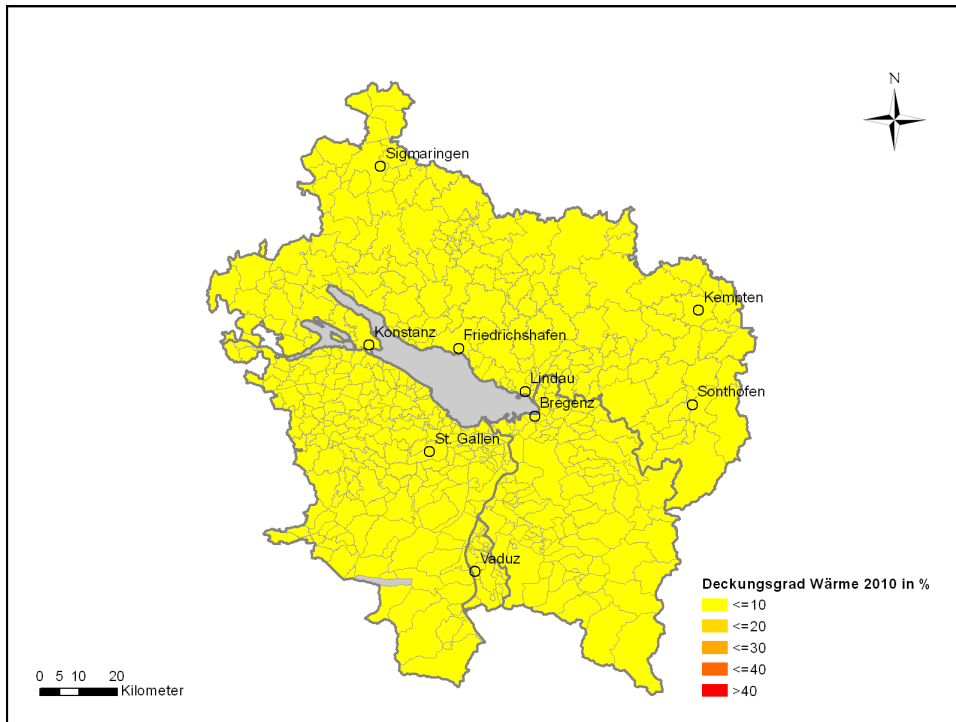
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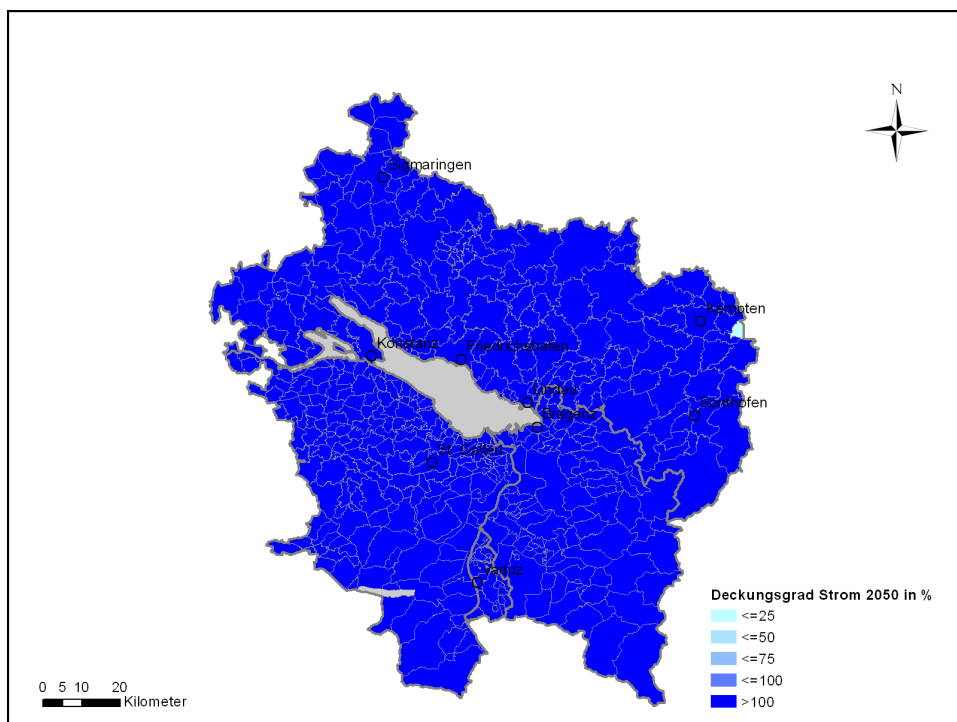
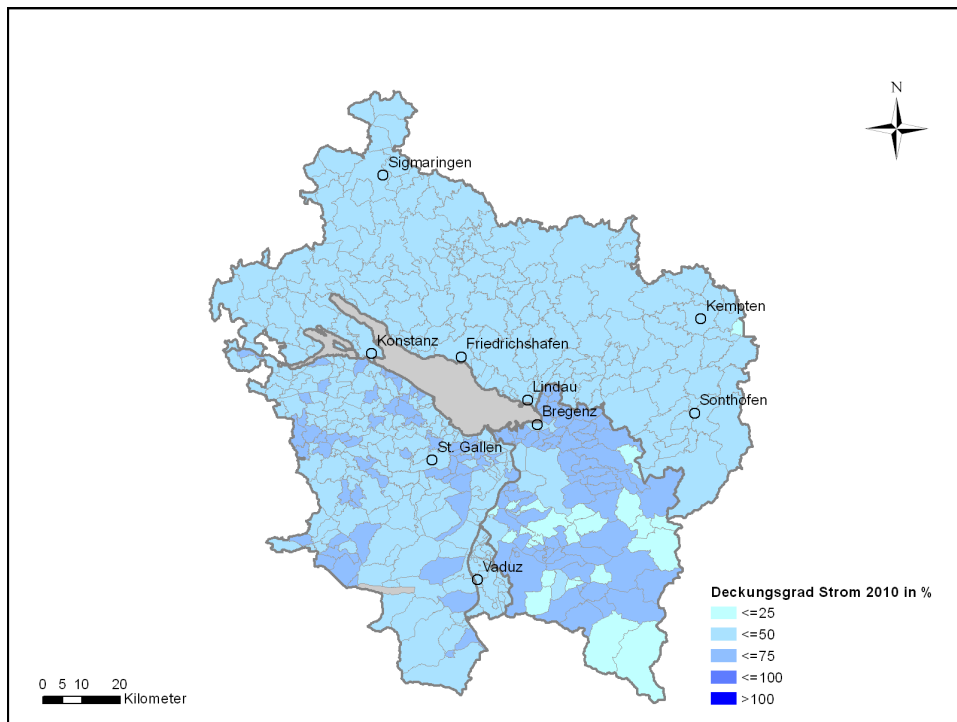


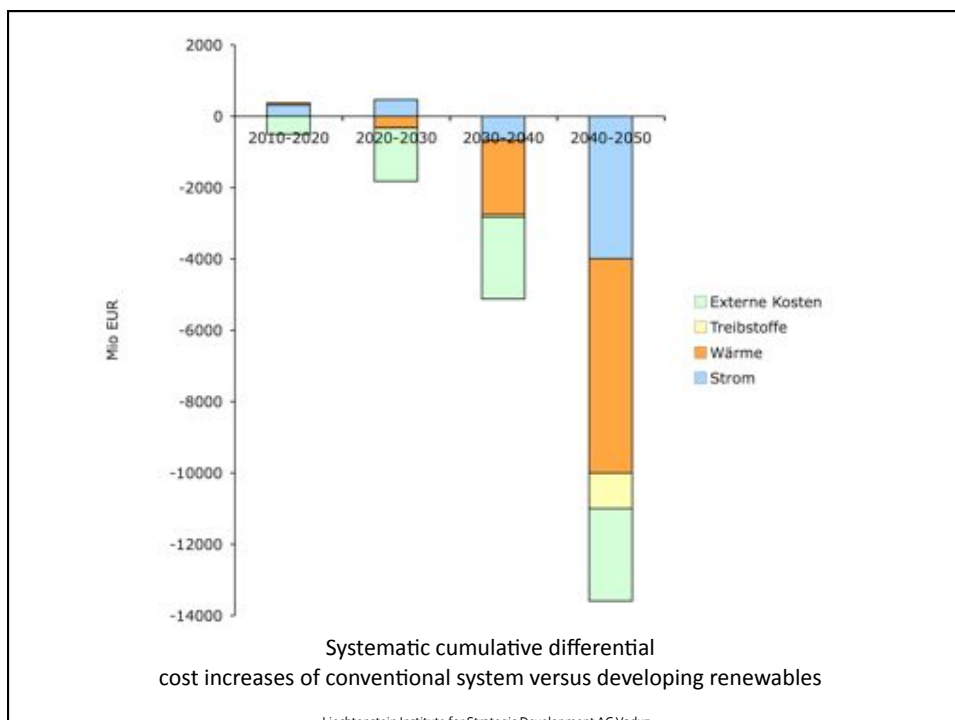
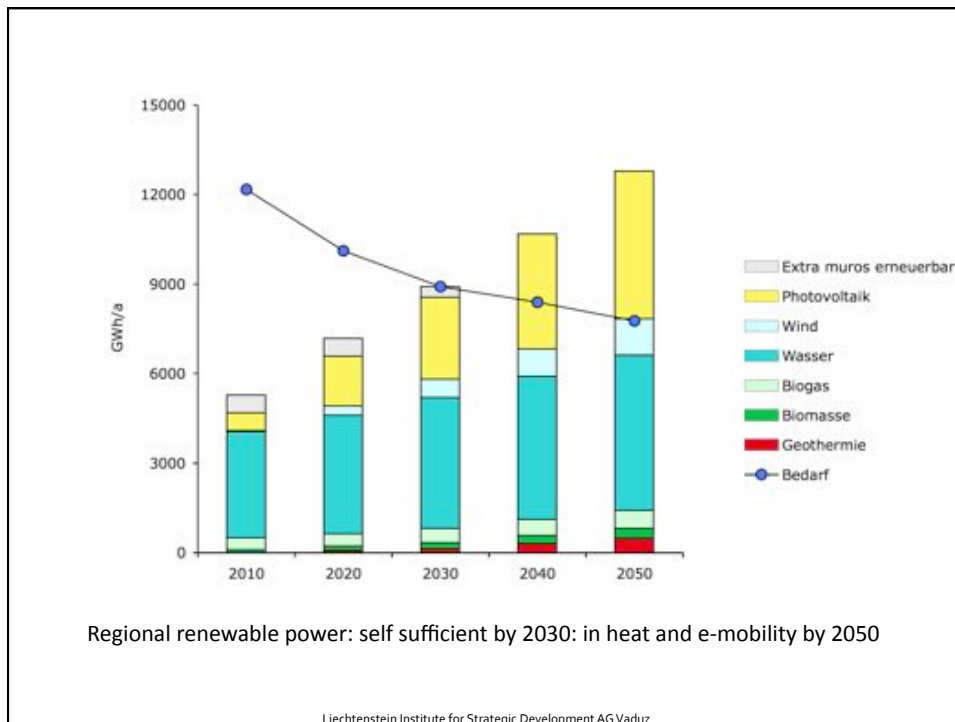
Constance

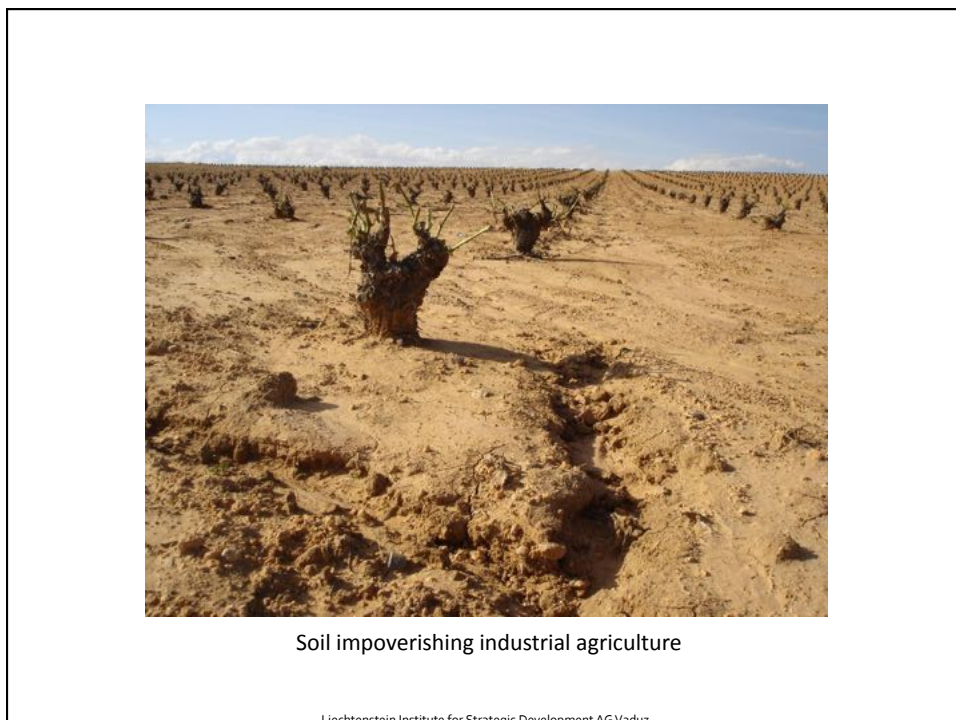
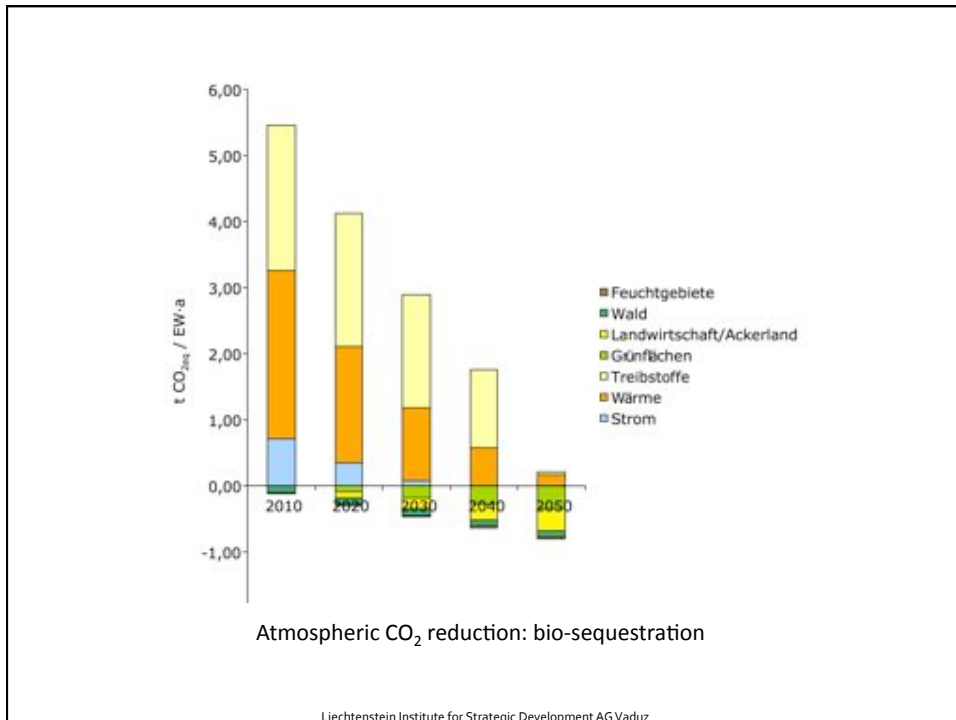
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Climate landscape

Climate stabilising: humus / biochar enriched and biodiverse

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Wood highrise
Bad Aibling
Bavaria
2012



Building materials
biochar & other
carbon stores



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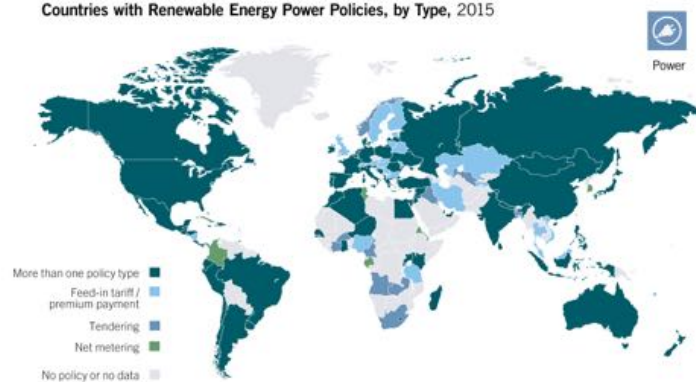
Global context



Power Sector

Electricity continues to dominate policy makers' focus

Countries with Renewable Energy Power Policies, by Type, 2015



Note: Countries are considered to have policies when at least one national or state/provincial-level policy is in place.

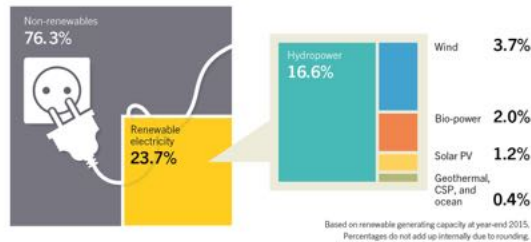
REN21 Renewables 2016 Global Status Report

Source: REN21 Policy Database



Power Sector

Estimated Renewable Energy Share of Global Electricity Production, End-2015



REN21 Renewables 2016 Global Status Report



- Renewables accounted **28.9%** of global power generation capacity and **23.7%** of global electricity demand
- Renewables made up for **60%** of net additions to global power capacity
- Total RE power capacity: **1,849 GW**, an increase of almost 9% over 2014

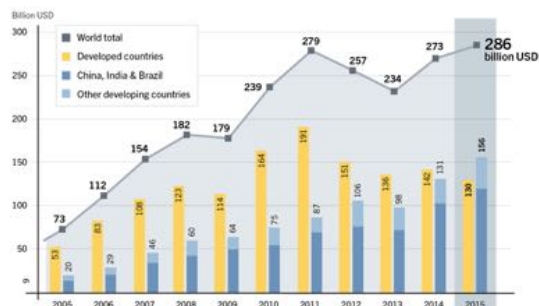
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Global Investment in Renewable Energy

Global new investment in renewables estimated at **USD 286 billion** in 2015

- A new **record high**
- Increase of **5%** from 2014
- Including hydropower: **USD 328.9 billion**

Global New Investment in Renewable Power and Fuels, Developed, Emerging and Developing Countries, 2005-2015



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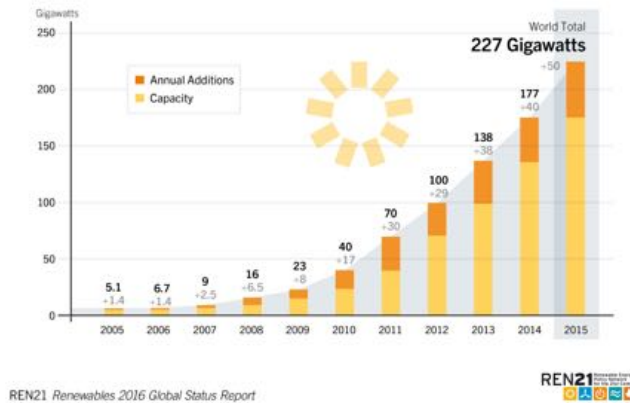
Solar PV

Capacity added:
+50 GW

Total capacity:
227 GW

Annual PV market in 2015 was nearly **10 times** the world's cumulative solar PV capacity of a decade earlier

Solar PV Global Capacity and Annual Additions, 2005–2015



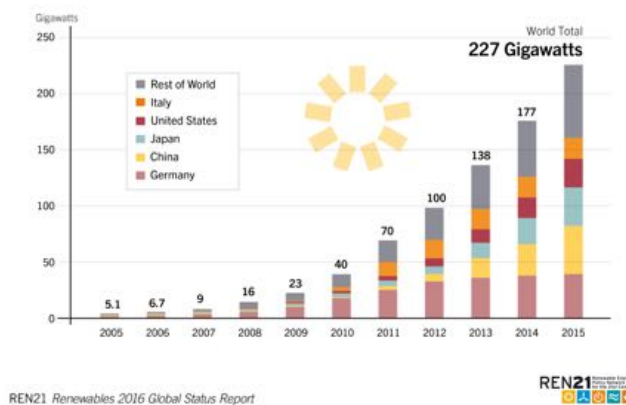
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Solar PV

22 countries had enough PV capacity at end-2015 to meet more than 1% of their electricity demand, with far higher shares in some countries

- Italy **7.8%**
- Greece **6.5%**
- Germany **6.4%**

Solar PV Global Capacity, by Country/Region, 2005–2015



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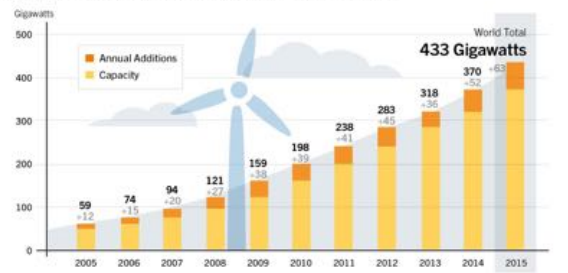
Wind Power

63 GW of capacity were added

Total capacity: **433 GW**

Offshore, an estimated **3.4 GW** of grid-connected capacity was added in 2015, for a world total exceeding **12 GW**

Wind Power Global Annual Additions and Capacity, 2005–2015



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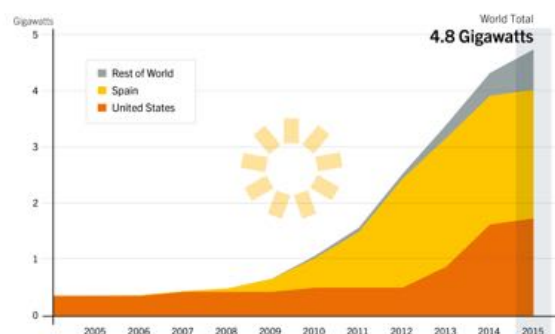
Concentrating Solar Thermal Power (CSP)

Total capacity: **4.8 GW**

With **+0.4 GW** added, this represents an increase of 10%.

Markets continue to shift to **developing countries**.

Concentrating Solar Thermal Power Global Capacity, by Country/Region, 2005–2015



REN21 Renewables 2016 Global Status Report



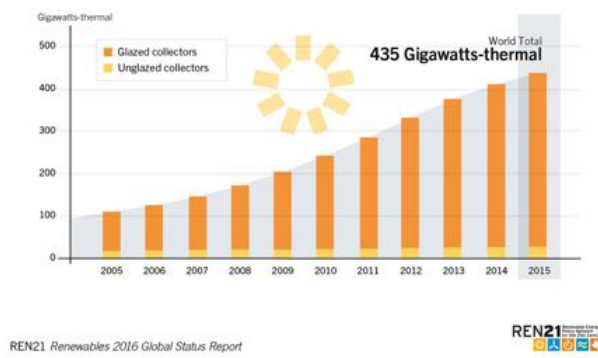
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Solar Thermal Heating and Cooling

Total capacity of water collectors increased by more than 6% in 2015, bringing operating global solar thermal capacity to about **435 GW_{th}**

The slowdown in market growth continued in 2015.

Solar Water Heating Collectors Global Capacity, 2005–2015

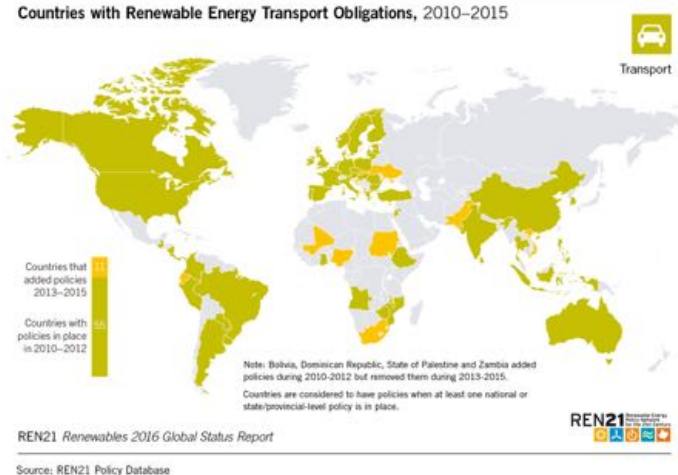


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Transport Sector

Renewable energy accounted for an estimated **4%** of global energy demand for road transport in 2013, up from **2%** in 2007

Countries with Renewable Energy Transport Obligations, 2010–2015



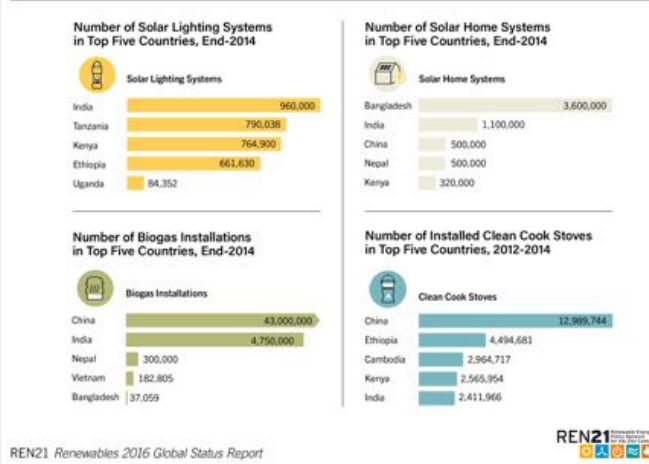
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Distributed Renewable Energy for Energy Access

Little quantitative information exists on **DRE markets**, but information available indicates that markets are significant

DRE solar PV markets continue to flourish:

- **44 million** off-grid pico-solar products sold
- Represents annual market of **USD 300 million**
- **70 countries** had off-grid PV capacity or programmes to support off-grid PV



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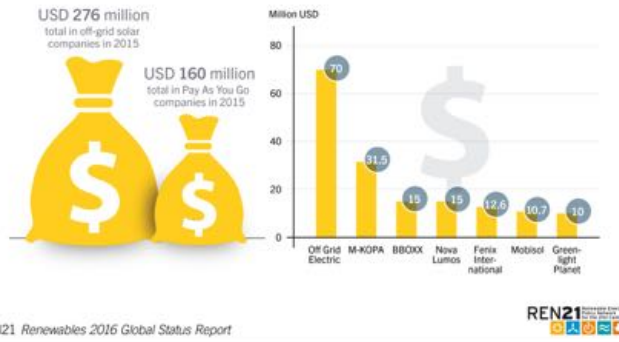
Distributed Renewable Energy for Energy Access

2015 saw **positive market trends** and **increased investment** in DRE

Innovative business models continued to mature and expand

DRE deployment in 2015 received **policy support** through a variety of policy types and incentives

Capital Raised by Off-Grid Renewable Energy Companies in 2015



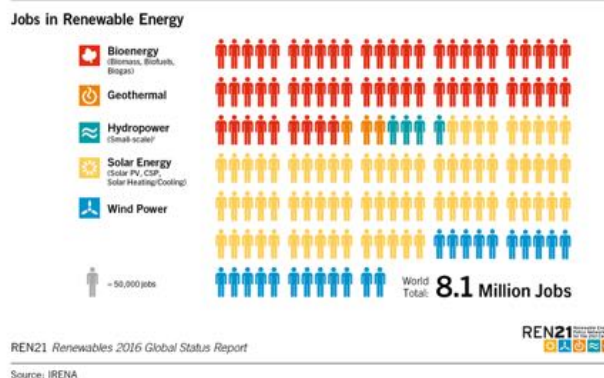
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Jobs in Renewable Energy

Global employment continued to increase by **5%** in 2015

An estimated **8.1 million direct and indirect jobs** in the renewable energy industry

Leading employers in 2015 were China, Brazil, the United States, and India



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City and Local Government Renewable Energy Policies

100% Renewable Energy movement expanded in 2015:

- Byron Shire, Coffs Harbour, and Uralla in Australia
- Oxford County and Vancouver in Canada
- US cities of Rochester (Minnesota) and San Diego (California)



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Feature: Community Renewable Energy

Consolidated data on community initiatives are very limited

Since 2008, there has been a marked rise in initiatives focused on community renewable energy, especially in **Europe**:

- Europe: more than **2800** energy co-operatives
- Germany: **772**
- The Netherlands: **500**



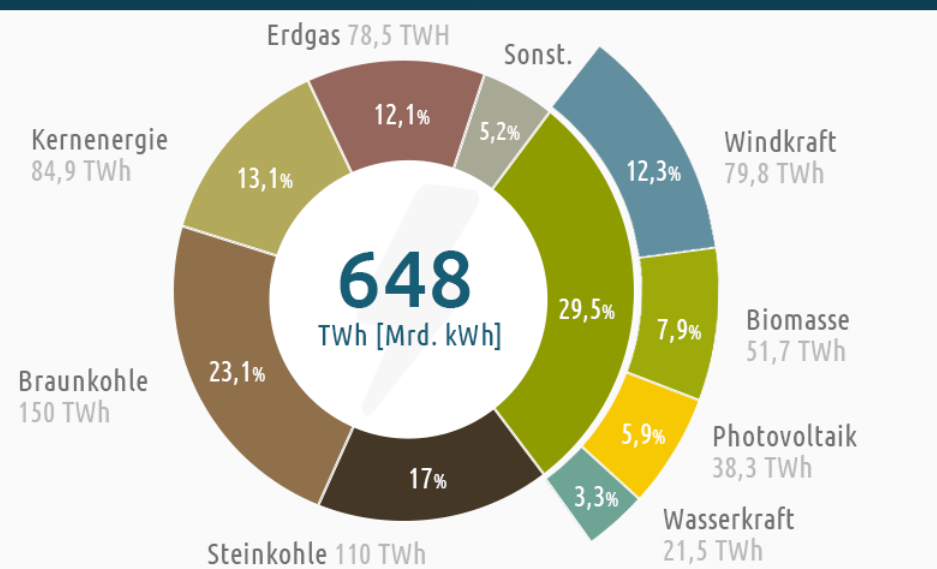
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German dynamics



DER STROMMIX IN DEUTSCHLAND 2016

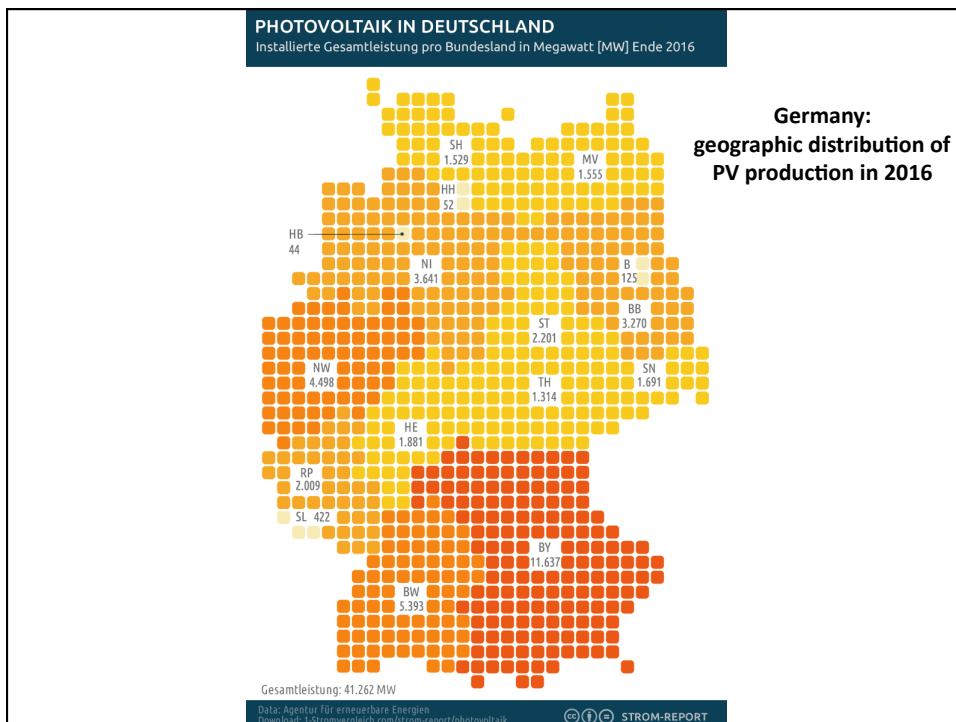
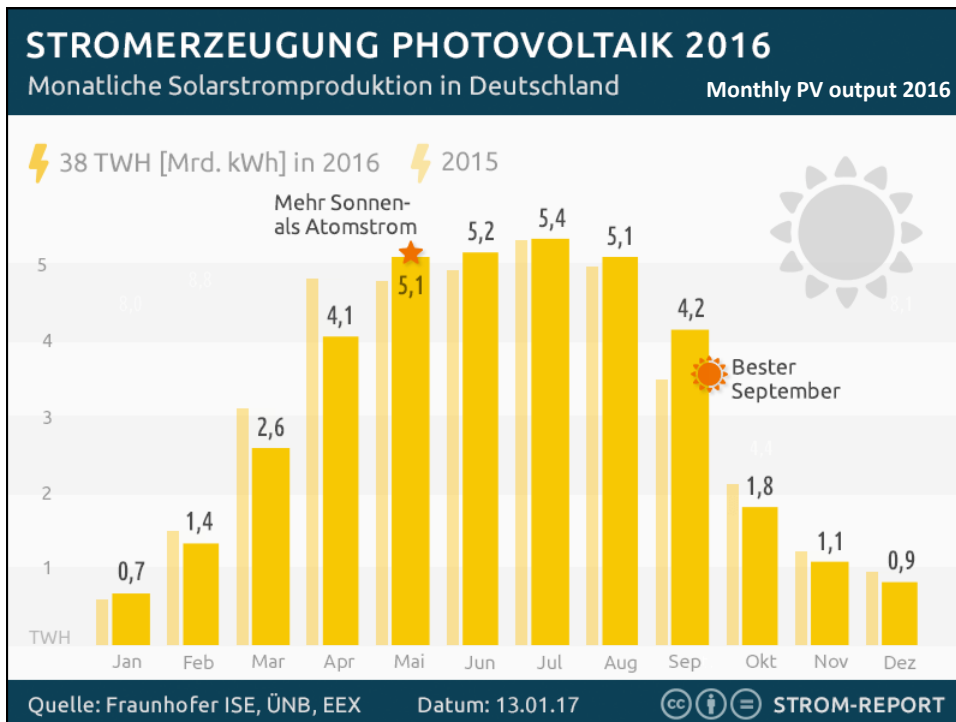
Anteil der Energieträger an der Bruttostromerzeugung in Deutschland

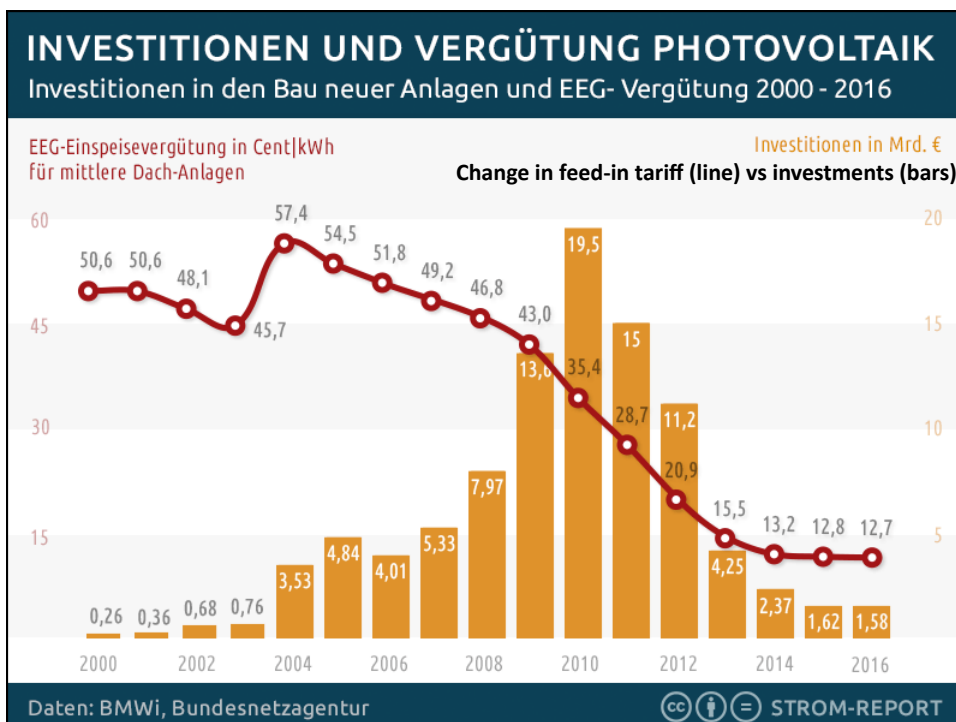
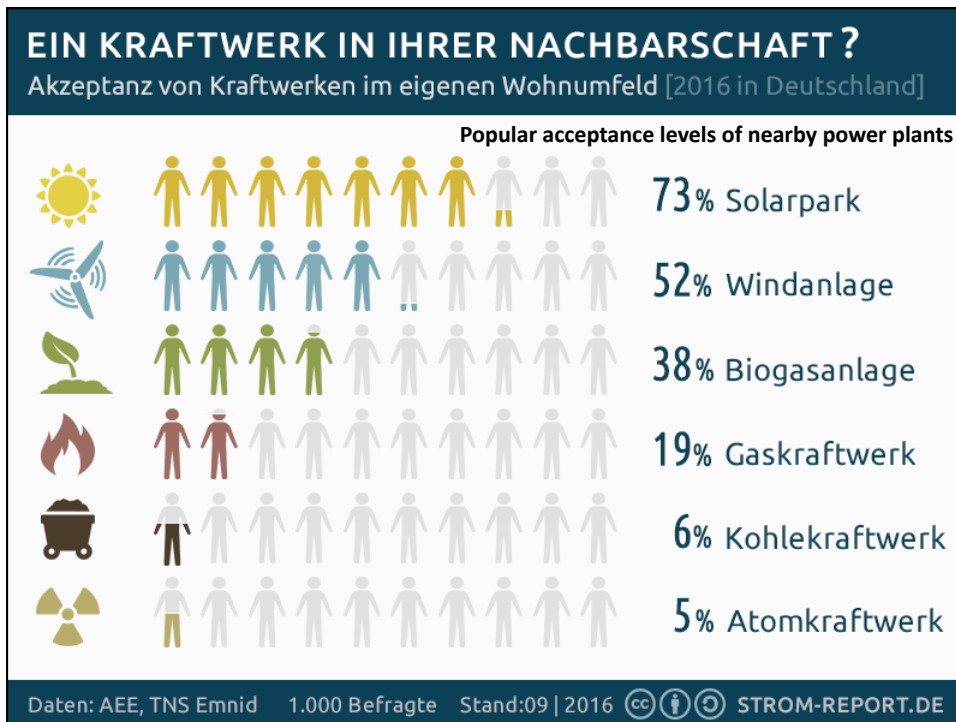


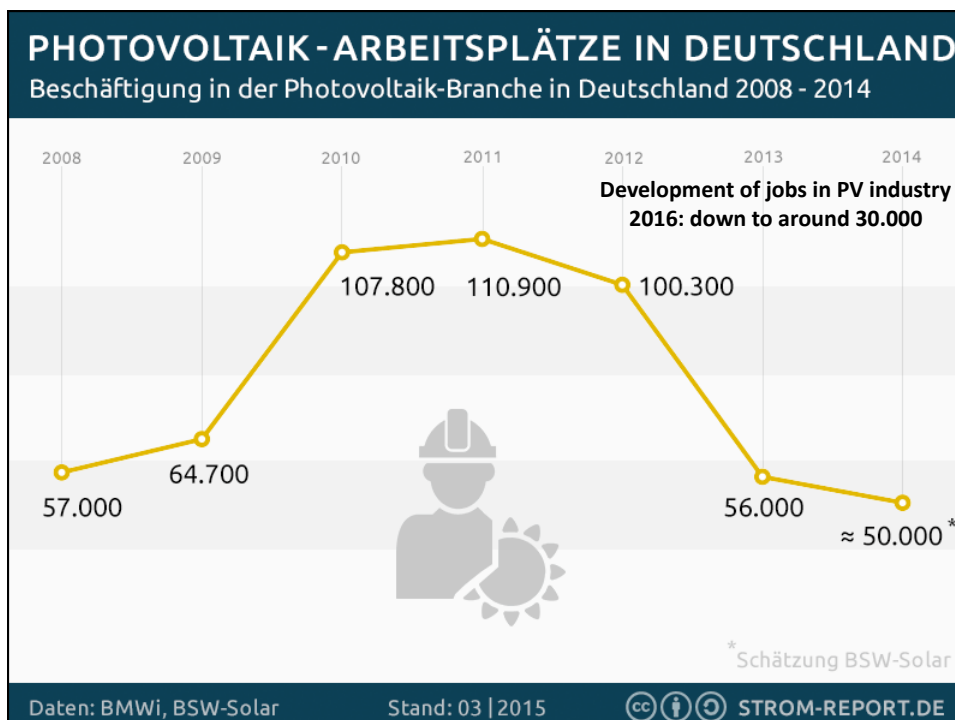
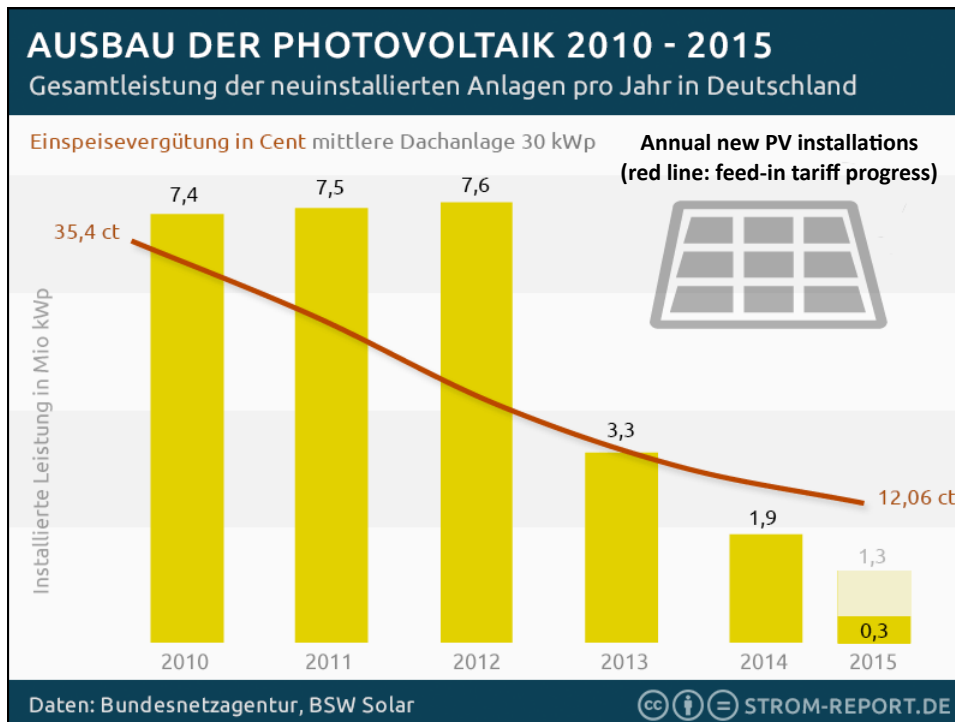
Daten: AGEB e.V.

German power mix 2016

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Conclusion: an equitable, clear and simple feed-in tariff is important for innovation, prosperity, employment and climate

EUROSOLAR
European Association for Renewable Energy – www.eurosolar.org



LISD

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Building sustainable infrastructure

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