Center for Geopolitics of Energy and Raw Materials
(CGEMP)

In partnership with:

French Association of Energy Economists

Power in Germany: The turning point of 2011

One year later, lessons for neighbouring countries

Economic impacts from the promotion of renewable energy technologies

Prof. Dr. Colin VANCE (Rheinisch-Westfälisches Institut für Wirtschaftsforschung – RWI - Essen),

Economic impacts from the promotion of renewable energy technologies

Lessons from the German power turnaround, June 21-22, Paris

Prof. Colin Vance
RWI, Jacobs University Bremen

Motivation

- An increasing number of industrialized countries back public financing of renewable energies.
- Germany's support scheme, based on feed-in-tariffs (FITs), is often cited as a role model, one that sets “a shining example in providing a harvest for the world” (The Guardian, 2007).
- We reviewed the Germany's FIT, focusing on its costs, its impacts on job creation, climate protection and energy security.

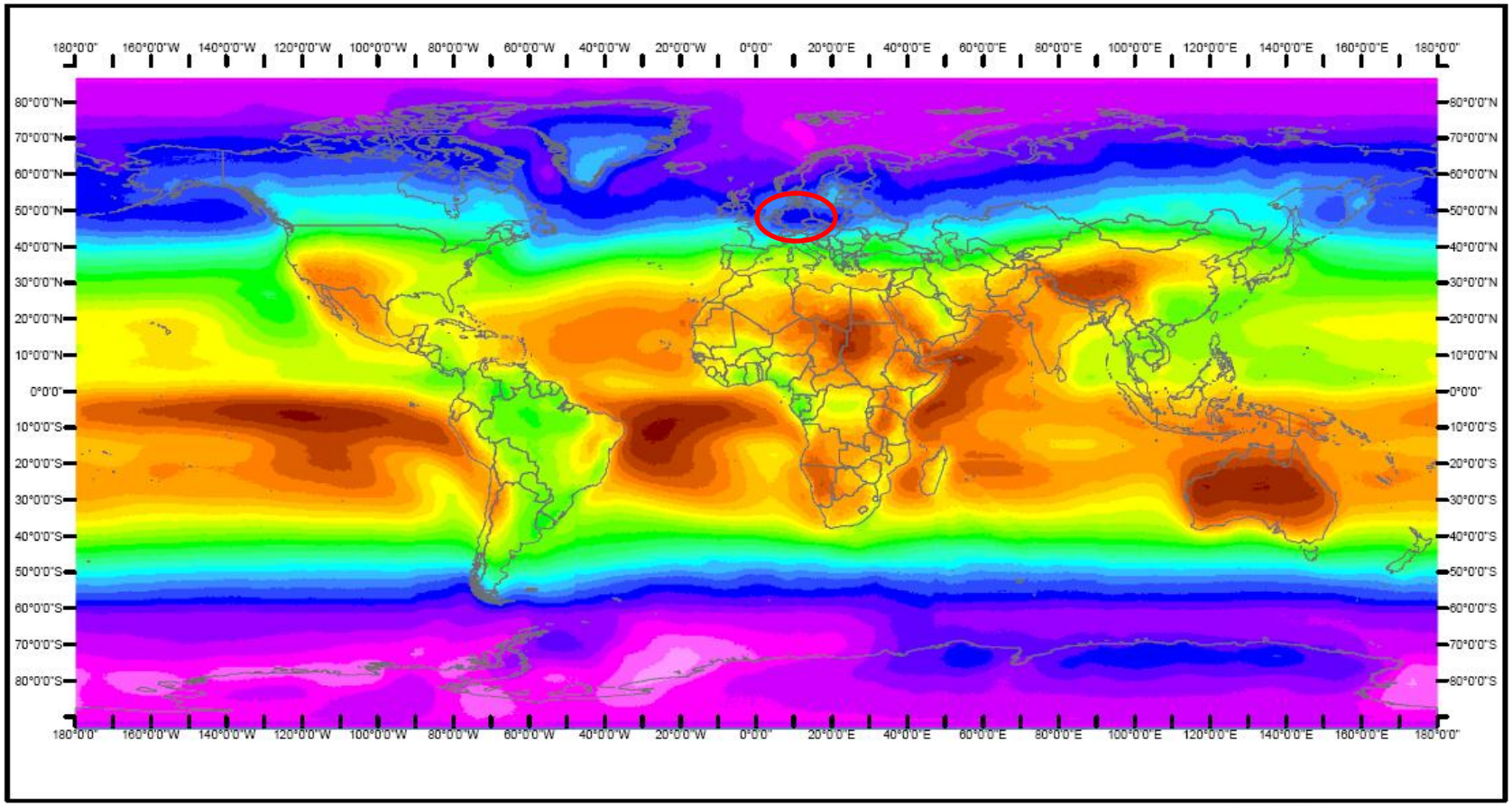
Preview of findings

Our analysis suggests that Germany's support scheme is:

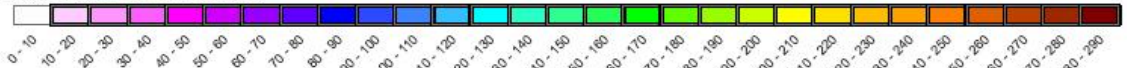
- expensive,
- neither creates jobs,
- nor reduces emissions,
- and does not contribute to energy security.

Germany's endowment with sun

Averaged Solar Radiation 1990-2004



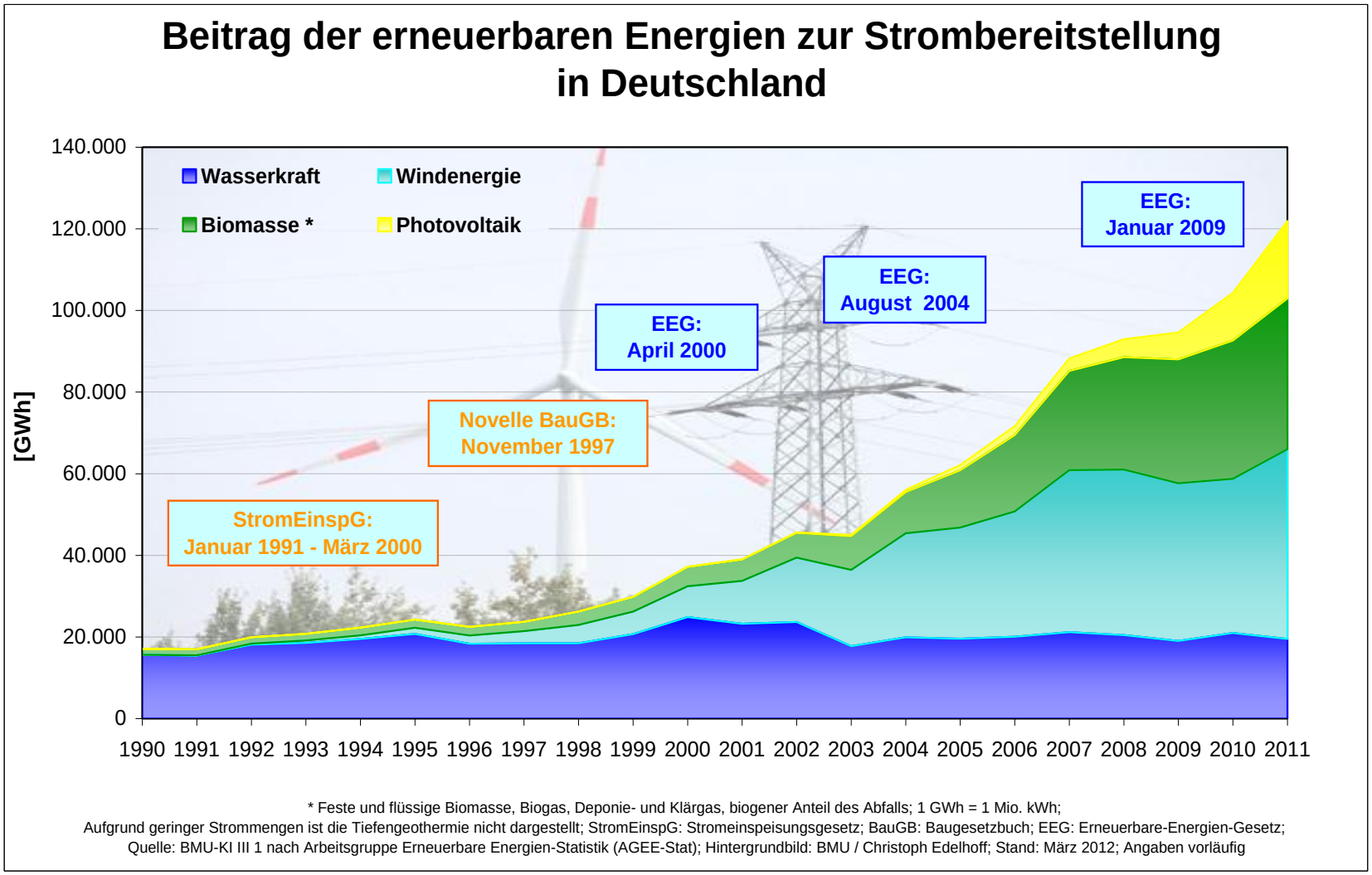
Yearly Mean of Irradiance in W/m²



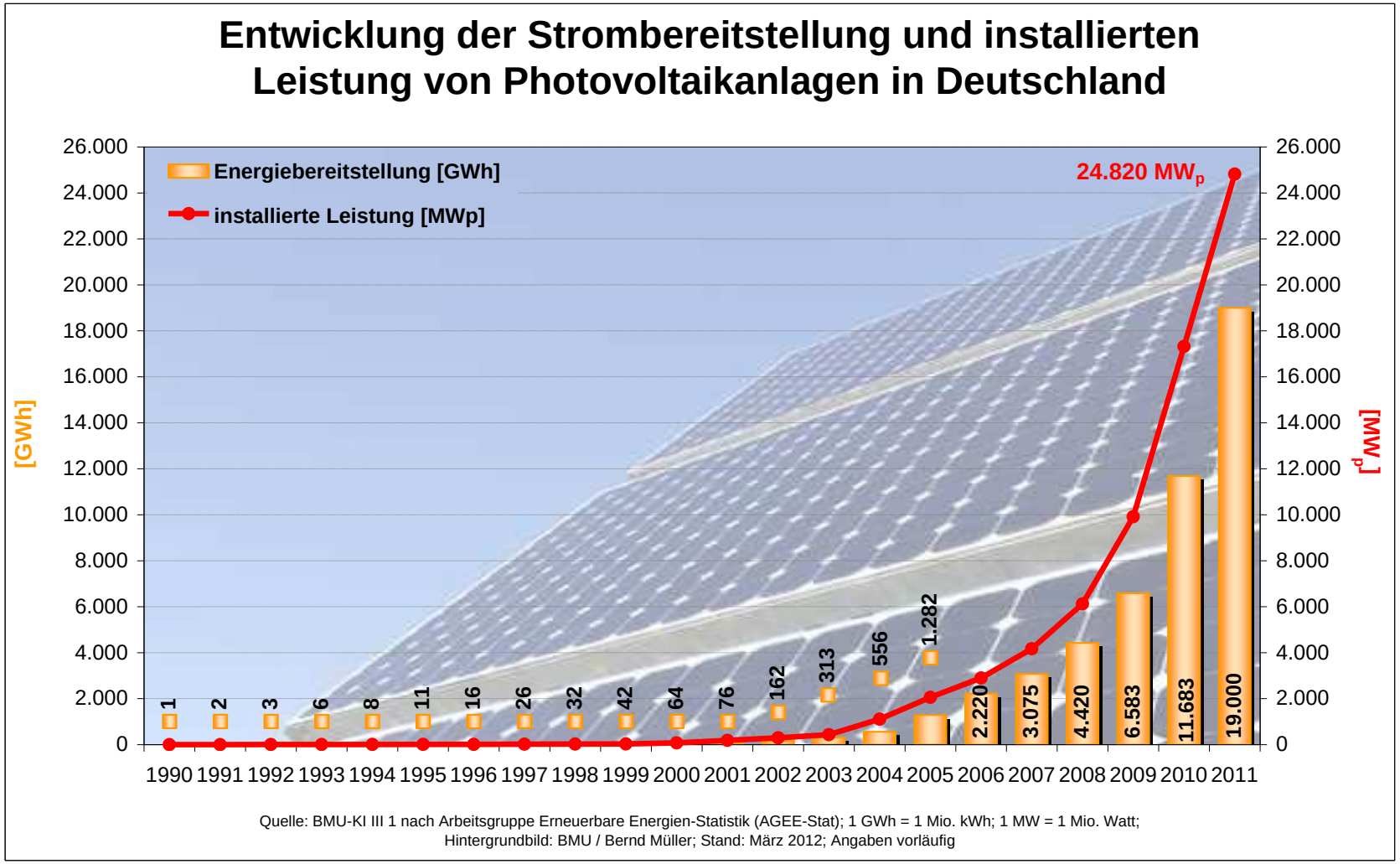
MINES PARIS

Realized by Michel Albuisson, Mireille Lefèvre, Lucien Wald.
Edited and produced by Thierry Ranchin. Date of production: 23 November 2006.
Centre for Energy and Processes, Ecole des Mines de Paris / Armines / CNRS.

RE contribution to electricity generation

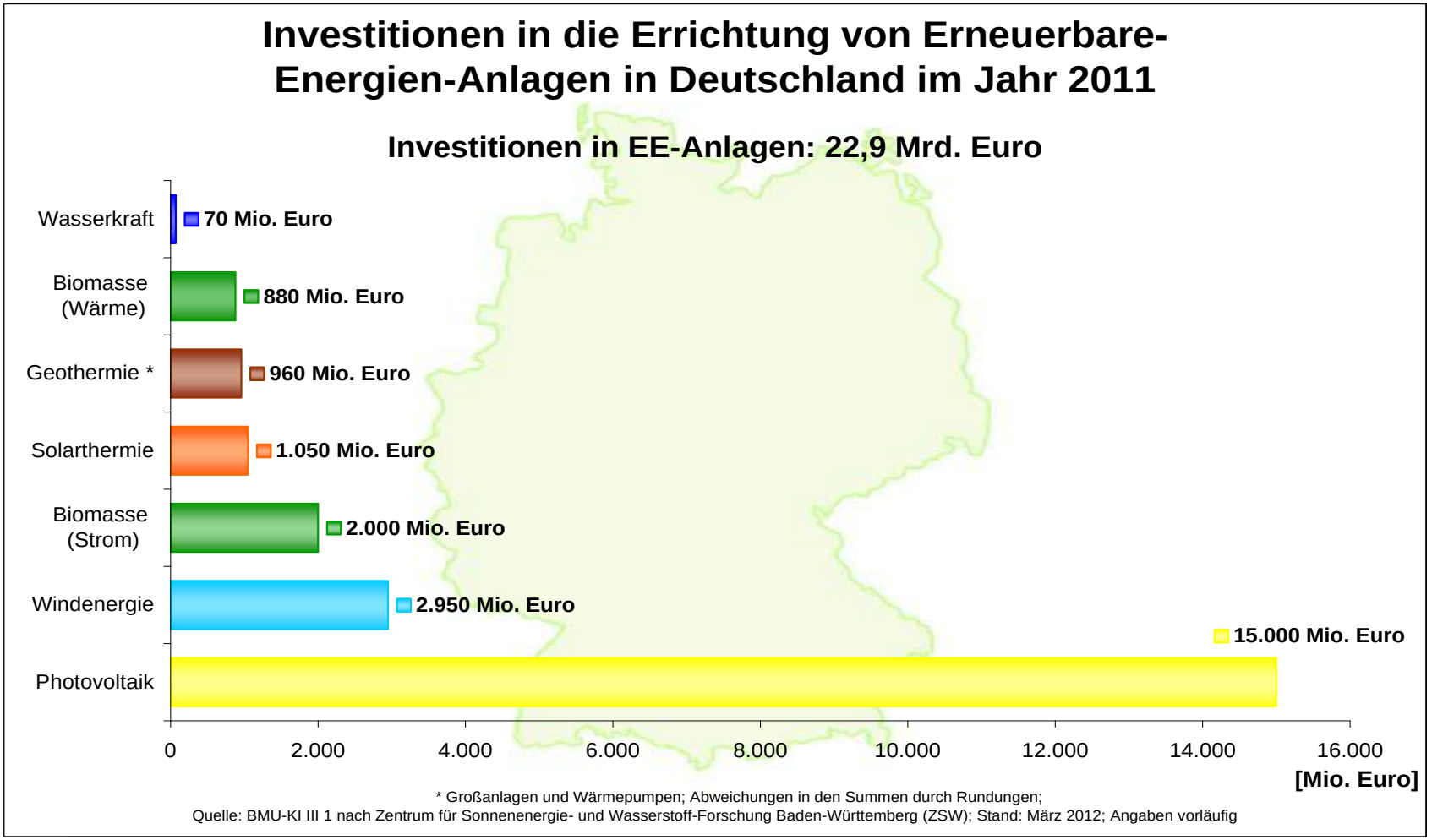


PV development

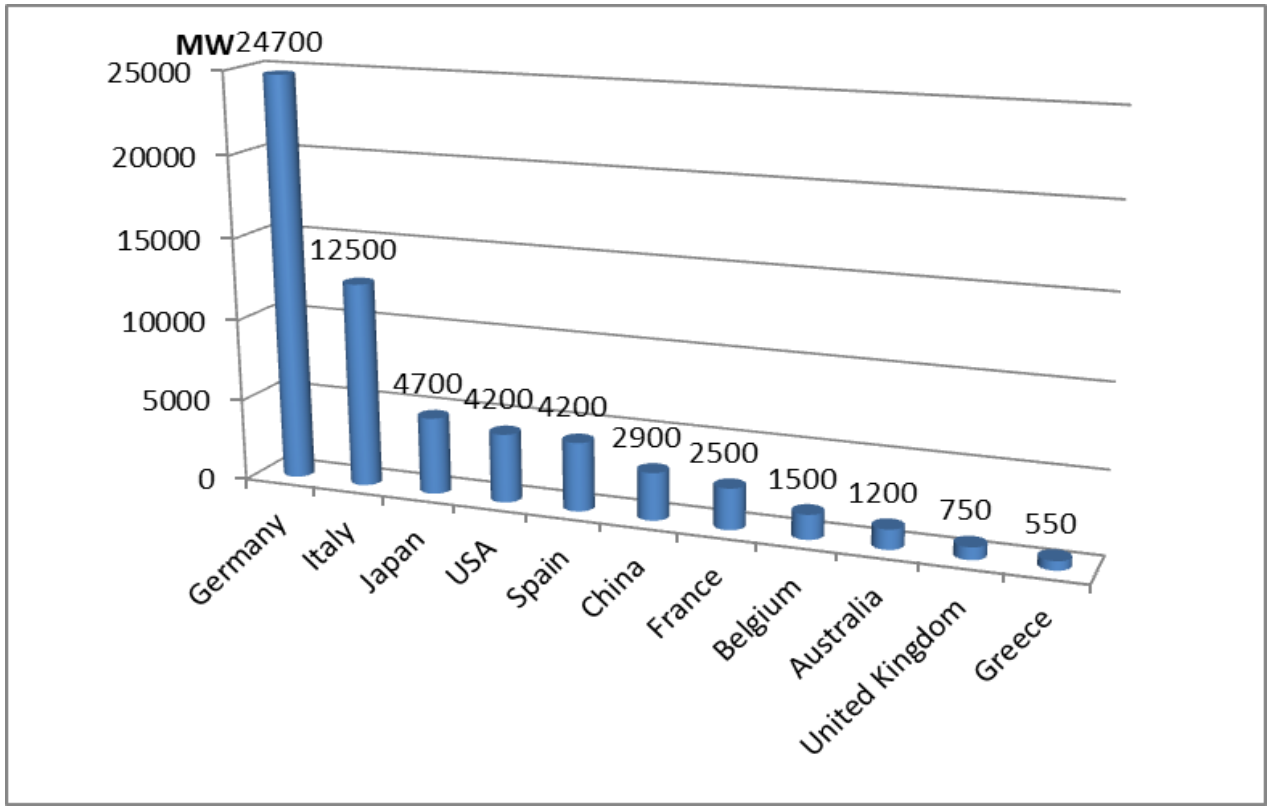


Quelle: BMU-KI III 1 nach Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat); 1 GWh = 1 Mio. kWh; 1 MW = 1 Mio. Watt;
Hintergrundbild: BMU / Bernd Müller; Stand: März 2012; Angaben vorläufig

Investment


Investitionen in die Errichtung von Erneuerbare-Energien-Anlagen in Deutschland im Jahr 2011
Investitionen in EE-Anlagen: 22,9 Mrd. Euro
Wasserkraft
70 Mio. Euro
Biomasse (Wärme)
880 Mio. Euro
Geothermie *
960 Mio. Euro
Solarthermie
1.050 Mio. Euro
Biomasse (Strom)
2.000 Mio. Euro
Windenergie
2.950 Mio. Euro
Photovoltaik
15.000 Mio. Euro
0
2.000
4.000
6.000
8.000
10.000
12.000
14.000
16.000
[Mio. Euro]
* Großanlagen und Wärmepumpen; Abweichungen in den Summen durch Rundungen;
Quelle: BMU-KI III 1 nach Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW); Stand: März 2012; Angaben vorläufig

Total PV capacity in 2011



Facts & Figures

- Under German law, renewables receive guaranteed technology-specific feed-in-tariffs for all electricity produced over 20 years.
- Technologies are effectively supported based on their (lack of) competitiveness: the less competitive, the higher the tariff.

Technology-Specific Feed-in Tariffs in Euro Cents per kWh

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Wind On-shore	9.00	8.90	8.70	8.53	8.36	8.19	8.03	9.20	9.11	9.02	8.93
Wind Off-shore	9.00	8.90	9.10	9.10	9.10	9.10	8.92	15.00	15.00	13.00	13.00
Photovoltaics	48.09	45.69	57.40	54.53	51.80	49.21	46.75	43.01	39.14	28.74	24.43
Biomass	10.13	10.03	17.50	17.33	17.16	16.99	16.83	11.67	11.55	11.44	11.32
Average tariff	8.91	9.16	9.29	10.00	10.88	11.36	12.25	13.57	15.63	---	---

Sources: EEG 2000, 2004, 2009. Biomass: IWR (2007), BMU, own calculations.

- In comparison: conventional electricity production cost are between 2 and 9 Cents per kWh.

Facts & Figures

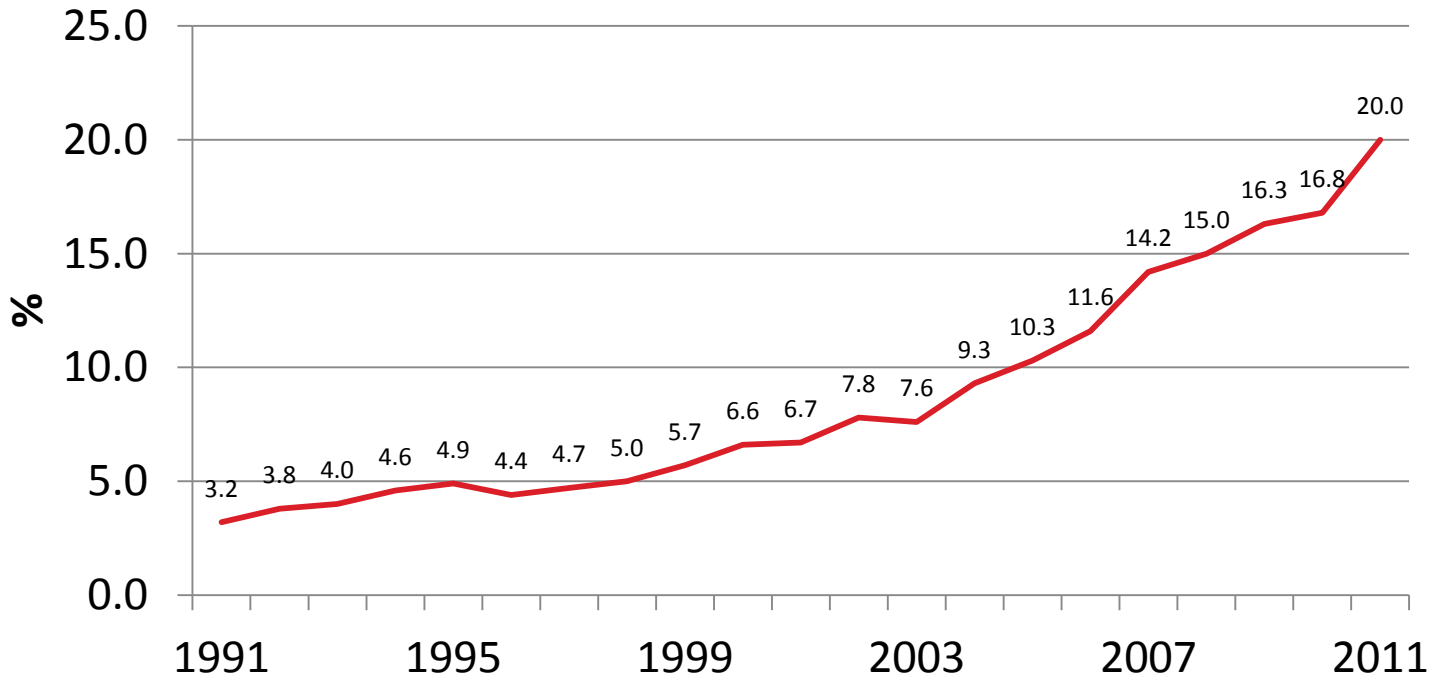
- In 2002, the total amount of feed-in-tariffs was roughly €2.23 bn.
- In 2010, it was €13.2 bn; in 2012, the estimate is €17.9 bn.
- While PV receives more than 38% of feed-in tariffs, it accounts for only about 14.5% of renewable electricity.

Share of Feed-in Tariffs by Technology

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Wind Power	64.5%	65.1%	63.7%	54.3%	47.1%	44,5%	39.5%	31.5%	25.4%
Biomass	10.4%	12.5%	14.1%	17.7%	23.0%	27.4%	29.9%	34.5%	32.2%
Photovoltaics	**3.7%**	5.9%	7.8%	15.1%	20.3%	20.2%	24.6%	29.3%	**38.6%**
Total in bn. €	**2.23**	2.61	3.61	4.40	5.61	7.59	9.02	10.8	**13.18**

Sources: BDEW (2002-2010) and own calculations

Contribution of RE to electricity in %

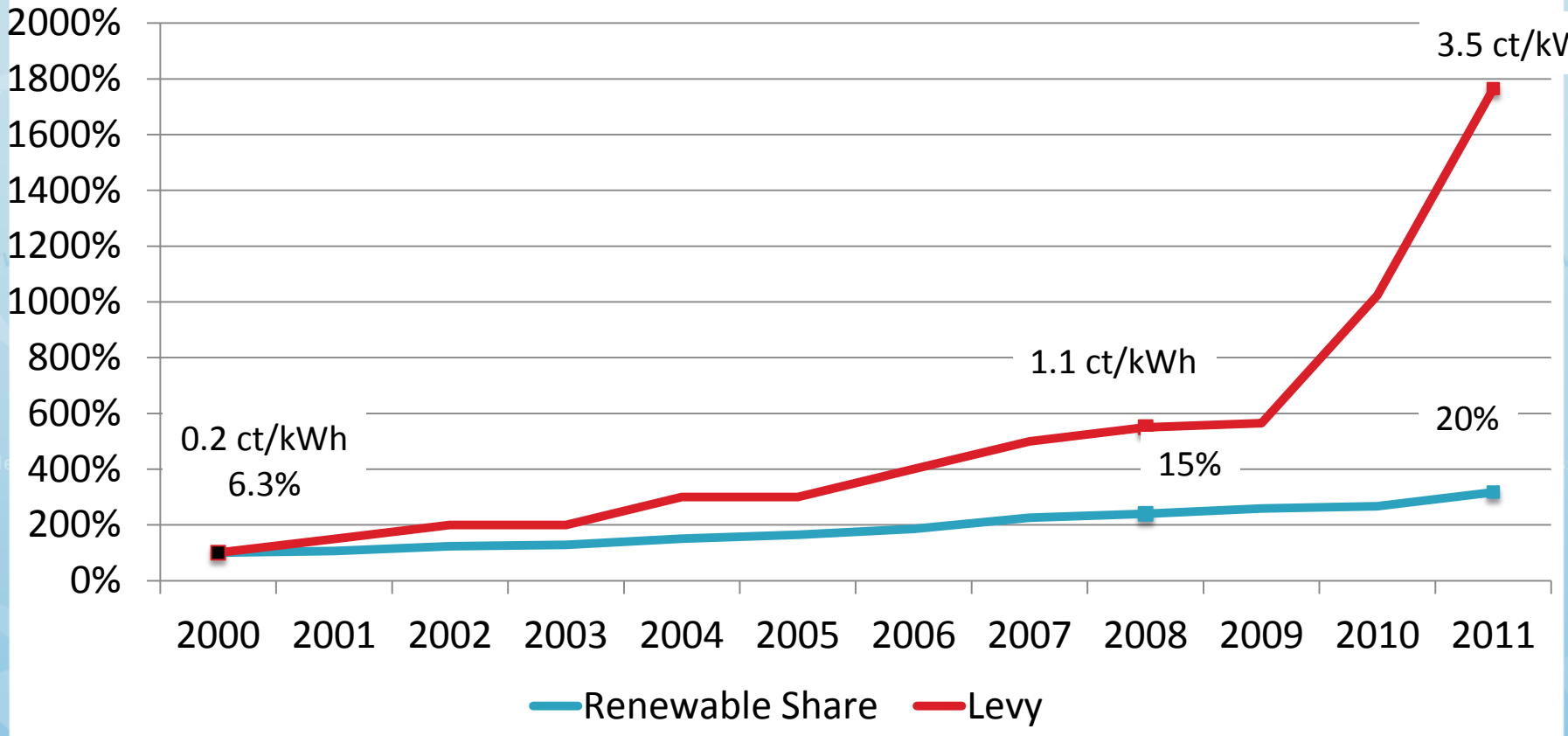


Transfers in 2012 (estimate)

subsidy payments:	17.9bn €	(including administrative cost)
revenues:	4.9bn €	
gap:	13.0bn €	

Grösche and Schröder, 2012

Renewable share and levy, 2000-2011

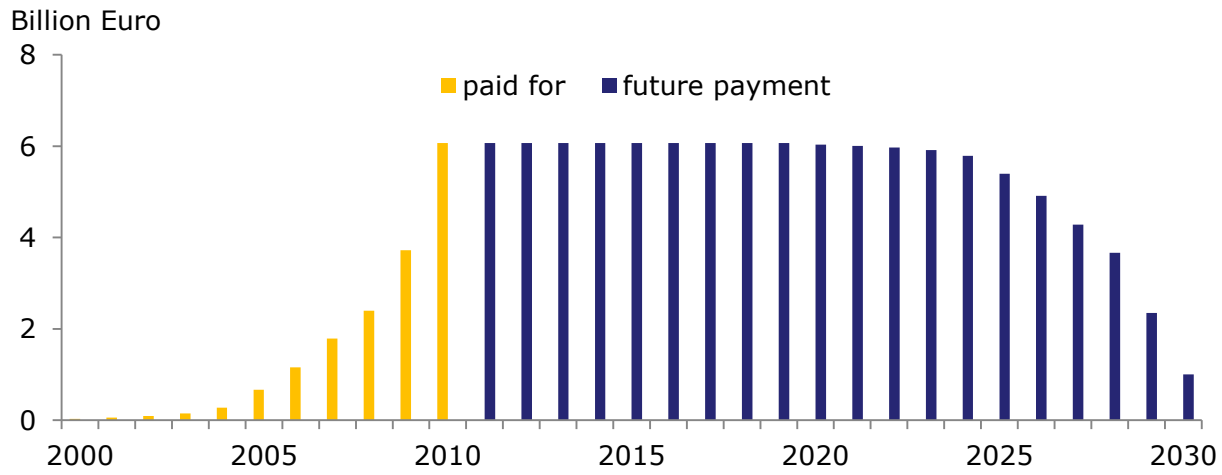


Grösche and Schröder, 2012

Looking ahead

- Because of the 20 years of guaranteed feed-in tariffs, the German support scheme for renewables has long-lasting consequences.
- Even if the subsidization regime had ended in 2010, electricity consumers would still be saddled with charges until 2030.

Annual Amount of Feed-in Tariffs for PV for the cohorts 2000 through 2010



Cost Assessment

Any **assessment of the real net present cost** of the feed-in tariff scheme needs information on:

- The volume of renewable electricity generation.
- The feed-in tariffs.
- The difference between feed-in tariffs and market prices.
- The rate of inflation.

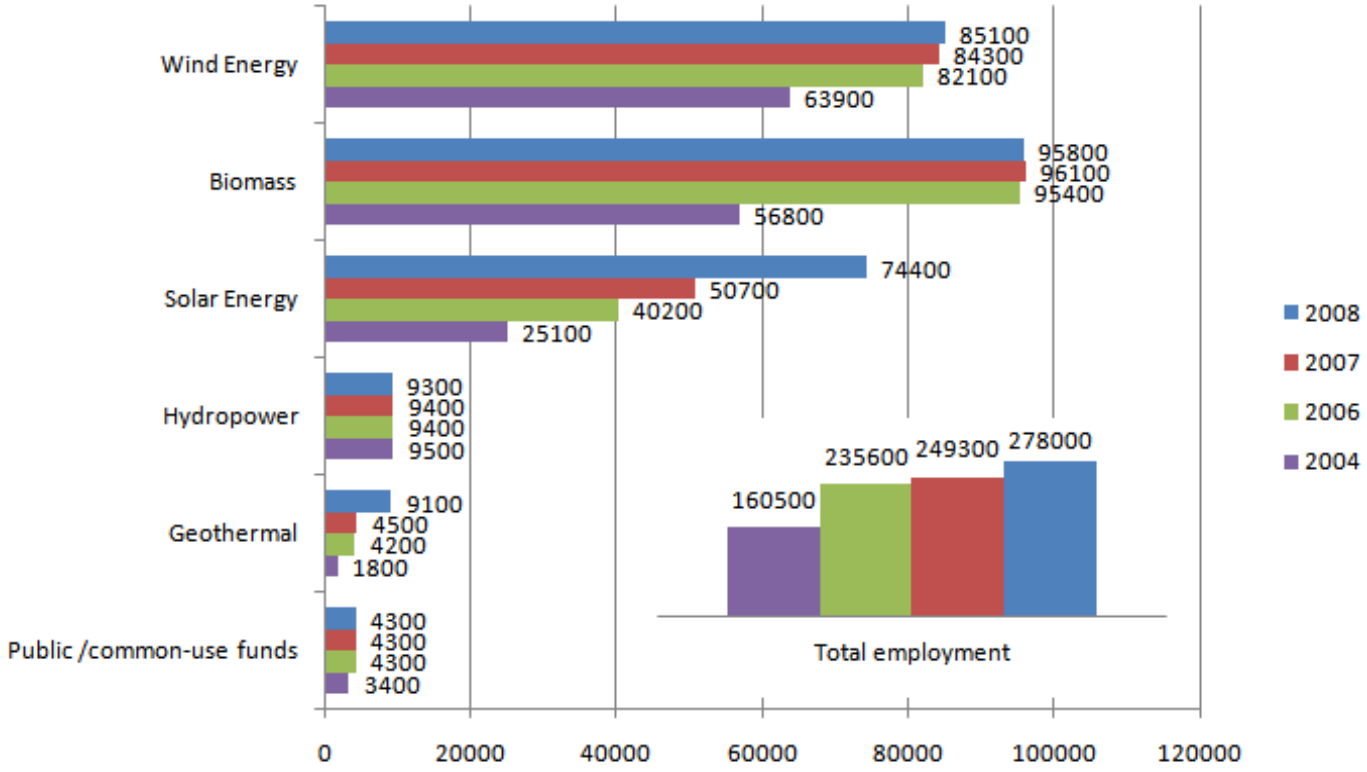
Putting these numbers together, the estimated net present cost for all PV-modules installed between 2000 and 2011 is about € **100** Bn. The corresponding figure for wind is € **20.5** Bn.

Cost effectiveness

- PV is among the most expensive greenhouse gas abatement options.
- Given the net cost of €0.42/kWh for modules installed in 2008, and assuming the PV displaces conventional energy generated from a mixture of gas and hard coal with an emissions factor of 0.584 CO2/kWh, yields an abatement cost of €**716**/tonne.
- The IEA has estimated an abatement cost from PV of €**1000**/tonne.
- Since the establishment of the European Emissions Trading System (ETS) in 2005, the price of certificates has never exceeded €**30**/tonne of CO2.

Gross employment in the renewable energy sector 2004 to 2008

Renewable energy promotion is frequently justified by the associated impacts on job creation.



Source: O'Sullivan et al. 2009:9

Employment

- The gross number of employed says little about net job creation.
- Referencing gross figures obscures the broader implications for economic welfare by omitting any accounting of offsetting effects:
  - New green jobs are filled by workers who were previously employed.
  - Germany's feed-in tariff scheme increases electricity prices, thereby crowding out jobs.
  - The support scheme diverts funds from alternative and possibly more beneficial investments, thereby preventing job creation elsewhere.

Employment

- Estimating net job creation is tricky, because it requires comparing the situation with subsidies to the counterfactual situation had there been no subsidies.

- Nevertheless, the simulation studies that have explored this issue (e.g. IWH, 2004; RWI, 2004; Hillebrand et al., 2006) generally find that the employment effects from the EEG are zero or negative over the long-run.

- Moreover, the per worker cost of the subsidies far exceed average wages. RWI (2010) has estimated the per worker subsidies for the PV sector to be €175,000.

Employment

- One of the justifications underpinning the FIT was to establish Germany as a major exporter of photovoltaic technology, with attendant benefits for job creation.
- The reality has instead been job creation elsewhere, mostly in Asia.
- According to a study by the School for Technology and Economy in Berlin (HTW), German imports of solar cells and modules amounted to €11.6 billion in 2010, over double the €5.5 billion in value that the country exported.
- China accounted for about €5.9 billion of Germany's photovoltaic imports in 2010.

Climate Impact Assessment

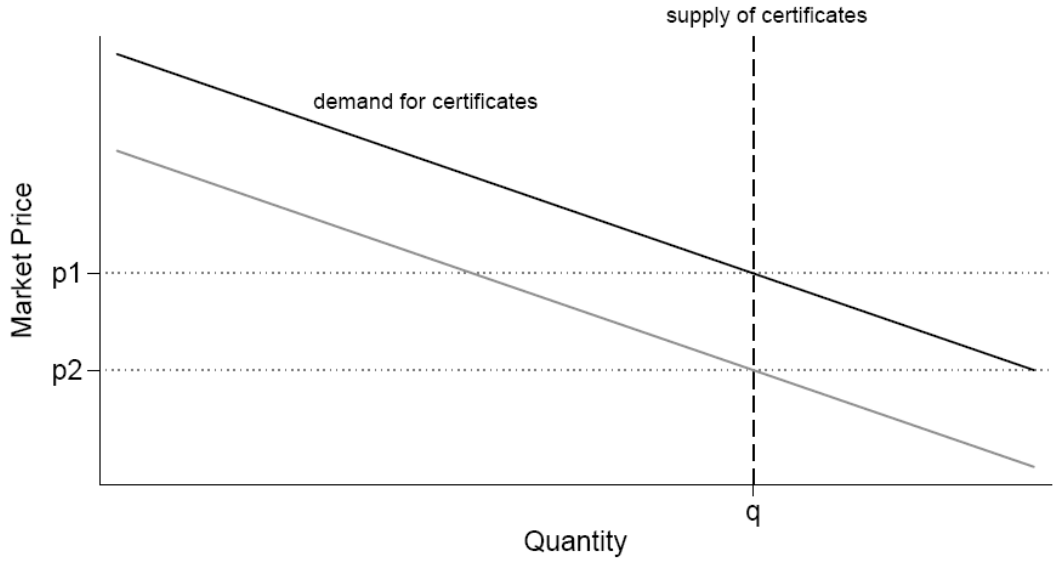
- It is important to recognize that other instruments to reduce CO2 are already in place in Europe, making the FIT redundant.

- Specifically, the European emissions trading scheme (ETS) determines the total amount of CO2 emissions.

Climate Impact Assessment

- The promotion of renewable energies reduces the emissions of the electricity sector but, by lowering demand for CO2 allowances from this sector, thereby lowers their price.

- Other sectors in the ETS can thus buy allowances more cheaply so that they reduce less. This leaves the total amount of emissions unchanged, rendering the FIT a completely ineffective measure for reducing CO2.



Energy security

- As sun and wind is highly intermittent in Germany, back-up energy systems must be in place to ensure against blackouts.
- Moreover, these systems rely on fossil fuels, principally gas, which must be imported to meet domestic demand.
- In 2010, 39.2% of German gas imports originated from Russia.

Burden on policy-makers

- In general, skepticism is warranted of the government's ability to pick winners and losers via the setting of tariffs for different energy sources.

- *A priori,* it remains an open question of whether any adjustment to the FIT adequately reflects past and future reductions in production costs.

- Policy-makers find themselves in an on-going game of catch-up in their attempts to repeatedly recalibrate the tariff structure based on their understanding of the latest turn in market developments.

Policy recommendations

- Nevertheless, government intervention can serve to support renewable energies through other mechanisms that harness market incentives or correct market failures:
  - ETS
  - Carbon taxes
  - Funding for R&D

Additional Information

- Frondel, M., Ritter, N., and Vance, C. (2010). "Economic impacts from the promotion of renewable energy technologies: The German experience." *Energy Policy*, 38(8): 4048-4056.

- The associated working paper, which contains detailed information on the cost calculations, can be downloaded from: http://repec.rwi-essen.de/files/REP_09_156.pdf

- Grösche, P. and Schröder, C. (2012) On the redistributive effects of Germany's feed-in tariff http://econstor.eu/bitstream/10419/49291/1/66579133X.pdf