Economic Impacts of Renewable Energy Promotion in Germany - Lessons Learned?

Christoph Böhringer (UOL)

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Outline

- Policy
- Reality Check
- Conclusion

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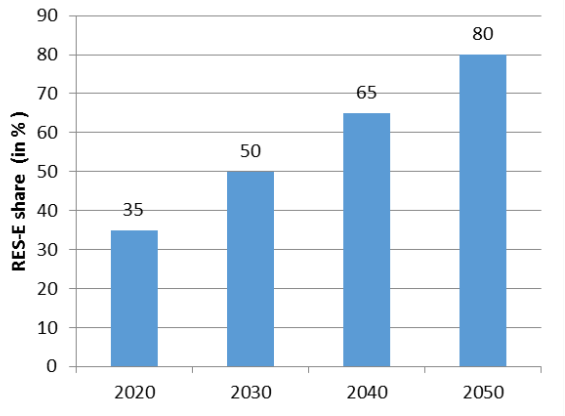
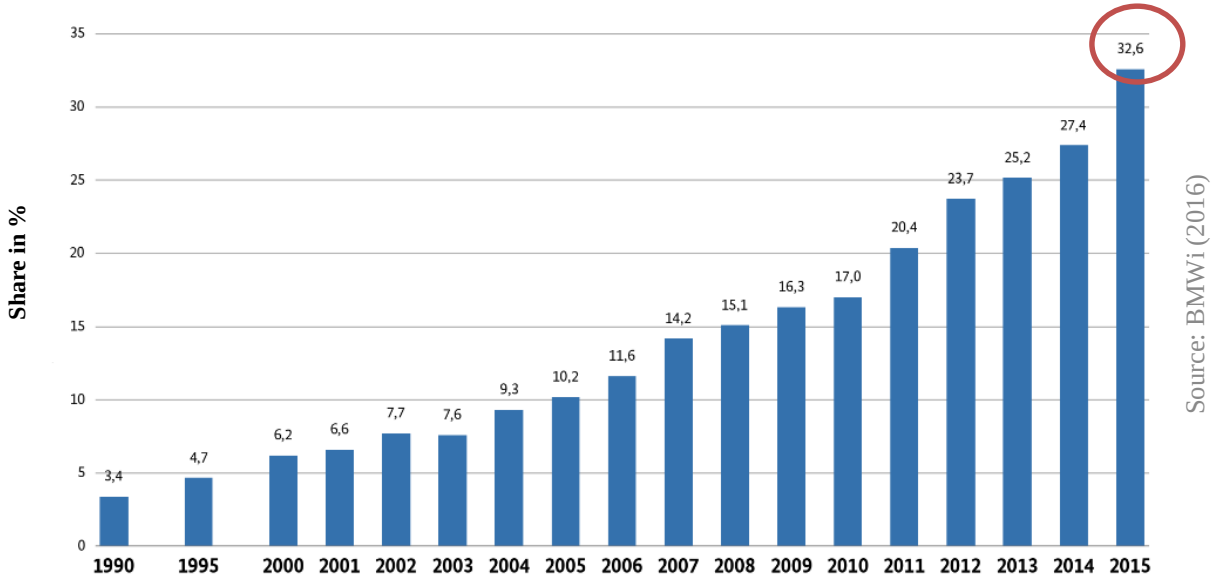
Policy Target and “Power Statistics”

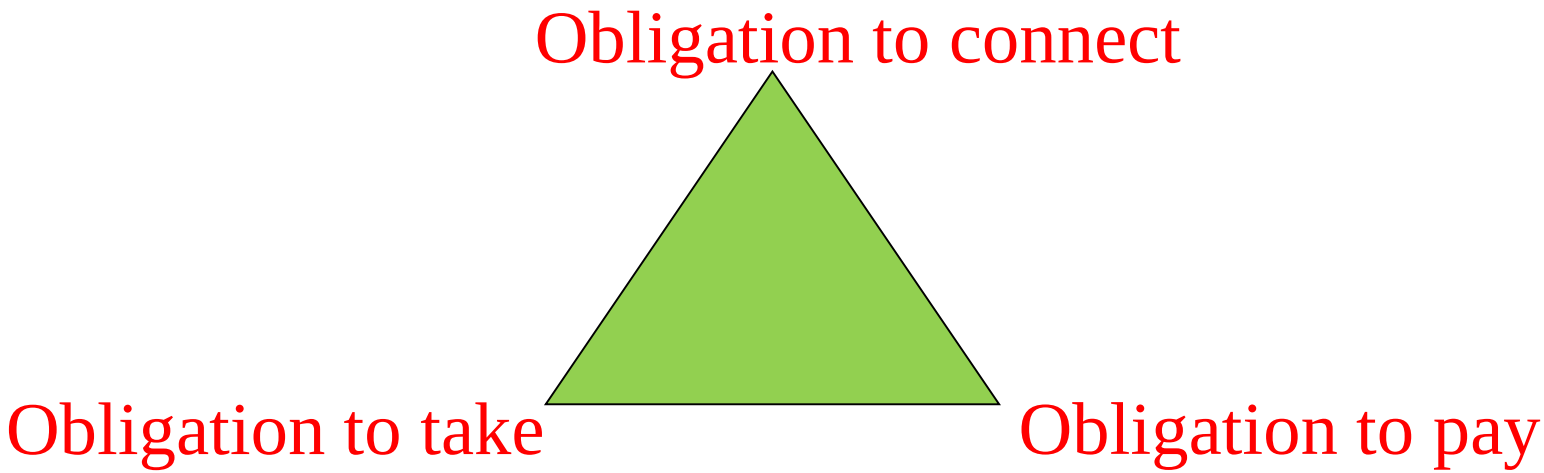
Targets for electricity from renewable energy sources (RES-E)



Development of RES-E from 1990-2015



EEG == CaC^3



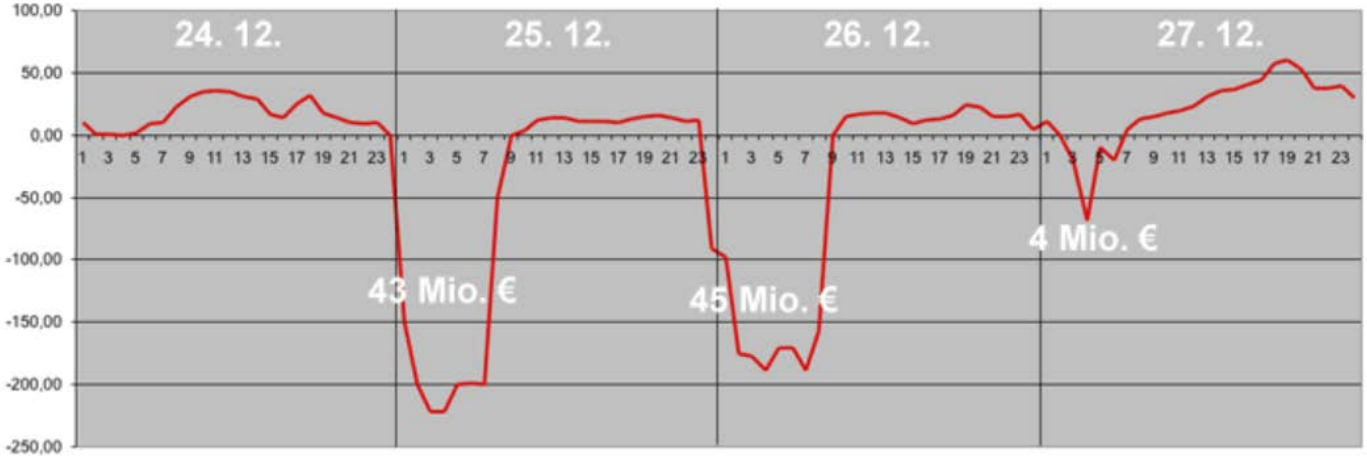
Take-and-pay RES-E mandates:

- 1991-1999: SEG (Electricity Feed-in Law) / *Stromeinspeisungsgesetz*
- Since 2000: EEG (Renewable Energy Sources Act) / *Erneuerbare-Energien-Gesetz*
  - Technology-specific feed-in tariffs*
  - Reallocation charge for electricity consumers to finance the difference between feed-in tariffs and the electricity market price

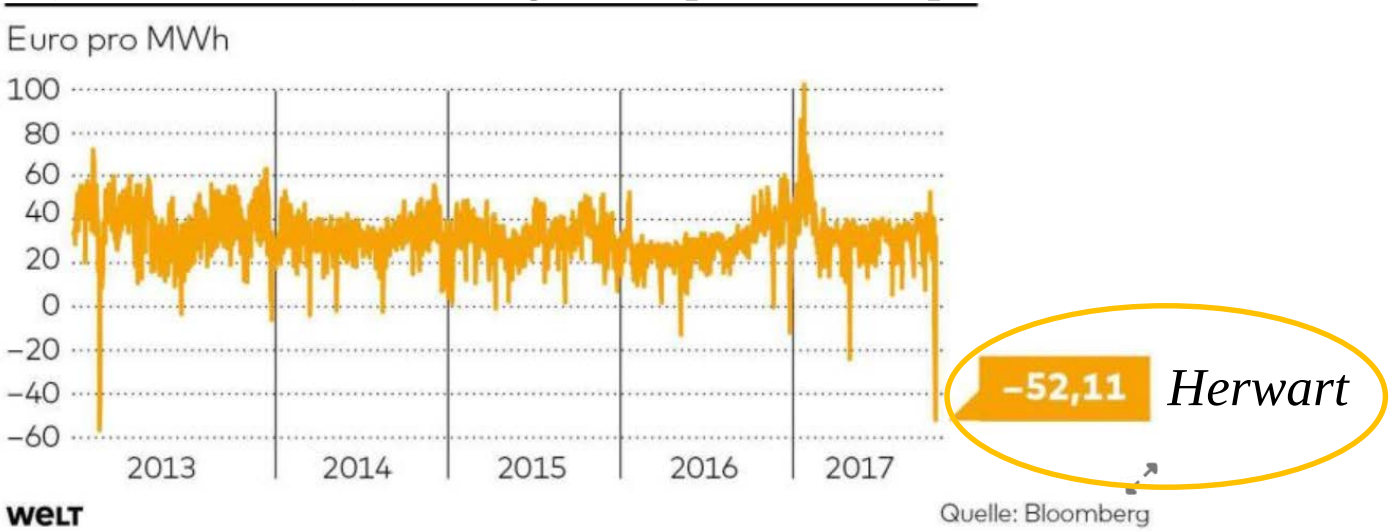
*2014: 34 euro cents per kWh for photovoltaics, 20 euro cents per kWh for biofuels, and 13 euro cents per kWh for wind

Market Outcome of Non-Market-Based Regulation: Power Prices Can Go Negative

Silent night, expensive night: Negative spot market prices around Christmas (2013)



Storm *Herwart* (October 2017) and negative spot market prices



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The Policymaker's Promise

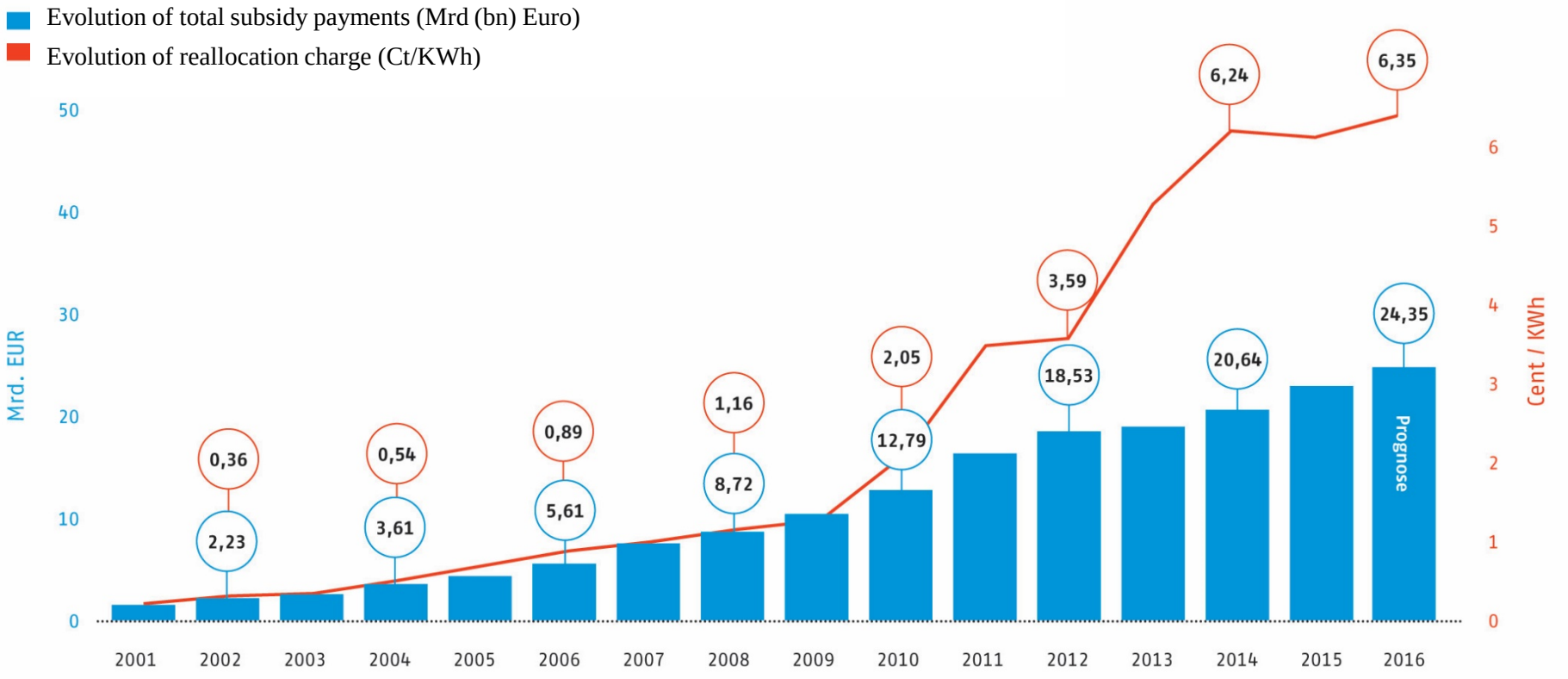
„The promotion of renewable energy will continue to cost the average household just 1 Euro per month – not more than a scoop of ice cream.““

[Minister of the Environment Jürgen Trittin, July 2004]

EEG and Cost

Lesson 1: The EEG is quite expensive.

Development of subsidy payments and reallocation charge



Quelle: Bundesministerium für Wirtschaft und Energie, netztransparenz.de, Berechnungen des VKU

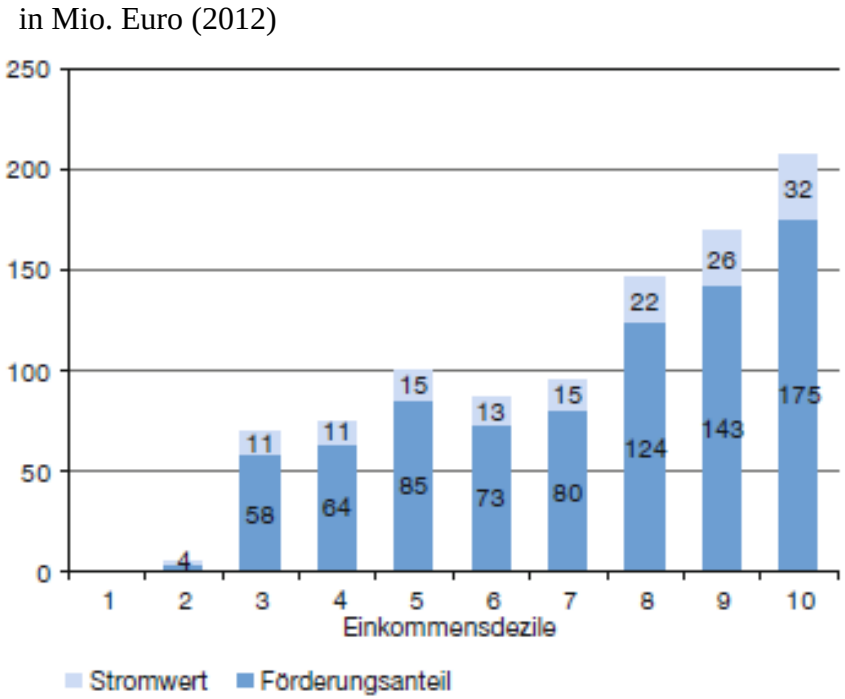
EEG and Incidence

Lesson 2: The EEG is regressive.

Distribution of reallocation charge (3,53 C/KWh) across income deciles in 2011

Einkommens-dezile	Durchschnittliche monatliche EEG-Umlage in Euro	Anteil der EEG-Umlage am Einkommen des jeweiligen Dezils in %
1	5,85	0,94
2	5,66	0,55
3	5,75	0,46
4	5,77	0,40
5	5,77	0,35
6	6,18	0,34
7	5,99	0,29
8	6,37	0,27
9	6,31	0,23
10	7,20	0,17

Profits from private PV installation across income deciles in 2011

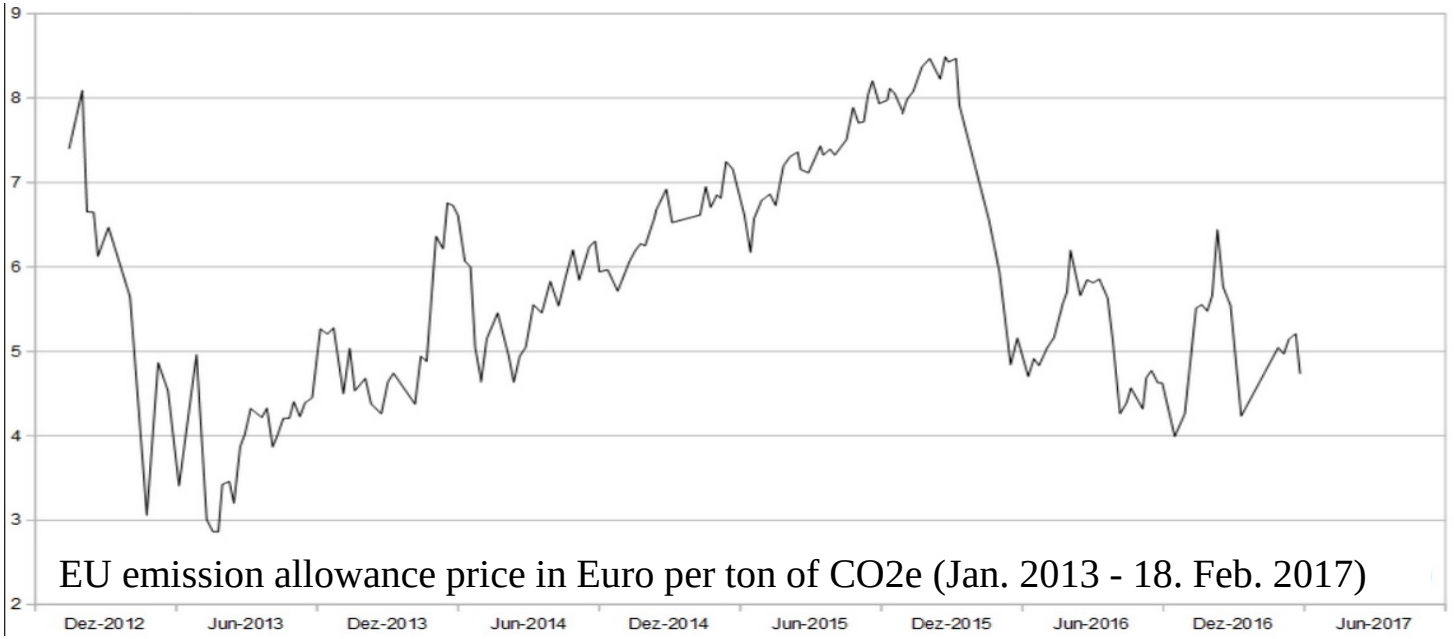


Source: Techert et al. (2012)

EEG and Climate Policy

Lesson 3: For EU Climate Policy (ETS) the EEG is ineffective.

- Costly emission shift from German power sector to other industries and countries – no overall CO_2 emission savings.
- RES-E promotion depresses CO_2 emission price:
  - Subsidization of emissions abroad
  - „Green serves the dirtiest“



EU emission allowance price in Euro per ton of CO2e (Jan. 2013 - 18. Feb. 2017)

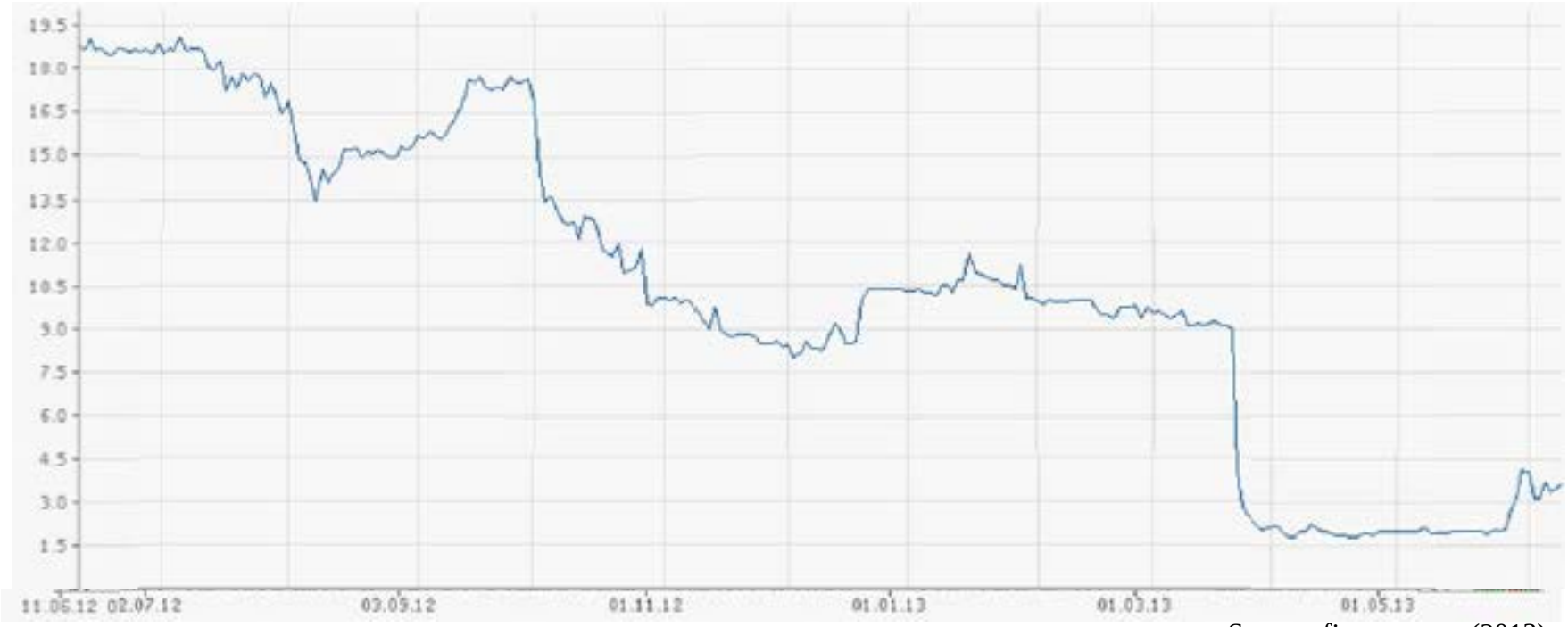
Source: EEX (2017)

Tinbergen rule: With the ETS in place additional RES-E targets are either redundant or costly.

EEG and Industrial Policy

Lesson 4: The EEG doesn't work out as industrial policy.

Stock price : Aleo Solar AG (in €)



Source: finanzen.net (2013)

EEG operates as a „non-discriminating" production subsidy:

- Incentives for foreign companies (e.g. imports of solar modules)
- No first mover advantage nor lead market effect

EEG and Employment

Lesson 5: Net employment impacts may be negative.

Effects of RES-E promotion in Ontario

Table 11: Impact of Alternative Renewable Energy Policies

	OFIT	SUB	ONDFIT	DCRRPS	WSAR
Renewable electricity market share (%)	15.54	15.54	15.54	15.55	12.20
Change in total electricity demand (%)	-2.09	-0.32	-1.61	-2.07	-0.16
Change in electricity price (%)	12.63	0.01	9.73	12.50	0.01
Change in unemployment rate	0.32	0.31	0.25	0.32	0.11
Change in employment (%)	-0.28	-0.31	-0.24	-0.28	-0.07
Change in green employment (thousand employees)	11.07	9.39	8.45	11.03	11.01
Jobs lost in other sectors per green job gained	1.97	2.27	2.09	1.96	1.26
Change in welfare (%)	-0.41	-0.35	-0.29	-0.41	-0.18
Change in welfare ($B)	-1.11	-0.95	-0.77	-1.11	-0.47
Real Wages (%)	-0.54	-0.53	-0.42	-0.54	-0.19

Source: Böhringer et al. (2012)

EEG and Innovation

Lesson 6: The innovation impacts of the EEG are limited.

Dependent variable: PAT-FAM	(NB1)	(PO1)	(NB2)	(PO2)
Public R&D$_{t-1}$	0.01360	0.04107	0.03669	0.04413
	(0.10699)	(0.07982)	(0.11446)	(0.08438)
Global RET patent$_{t-1}$	0.62942***	0.64481***	0.51697***	0.48441***
	(0.11802)	(0.16642)	(0.11889)	(0.15571)
Growth rate of OECD cap$_{t-1}$	0.00069***	0.00090***	0.00066***	0.00074***
	(0.00022)	(0.00017)	(0.00021)	(0.00021)
EEG dummy	0.16902	-0.09456	0.05042	0.07455
	(0.37524)	(0.35819)	(0.32544)	(0.40305)
FIT$_{t-1}$	0.21233***	0.18610***		
	(0.05831)	(0.06502)		
EEG FIT$_{t-1}$	-0.15248**	-0.05913		
	(0.07346)	(0.07005)		
Capacity$_{t-1}$			0.03438*	0.03823**
			(0.01894)	(0.01510)
EEG Capacity$_{t-1}$			-0.00871	0.00223
			(0.02115)	(0.01063)
No. of observations	168	168	168	168
No. of technologies	7	7	7	7
Log likelihood	-674.4	-734.8	-676.7	-725.5
Pseudo-R^2	0.298	0.9366	0.2964	0.9374

Robust standard errors (clustered at the technology level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns include technology- and year-fixed effects. Models (NB) and (PO) denote negative binomial and Poisson fixed effect estimation, respectively.

Source: Böhringer et al. (2017)

- Compared to the SEG which has been much less costly the EEG does not foster more innovation.
- R&D quota of German solar industry declined since the introduction of the EEG from 4% in 2001 to 1.6% in 2008.

Alternatives to EEG

Lesson 7: There are better ways to greening electricity.

Incidence (HEV in % across income quartiles):

	DIFFRACX	*UNIRAC*	*UNIVAT*
1st quartile	-2.07	-1.77	0.04
2nd quartile	-1.98	-1.68	-0.39
3rd quartile	-1.71	-1.43	-0.57
4th quartile	-1.36	-1.09	-0.34

Source: Böhringer et al. (2018)

DIFFRACX: **DIFF**erentiated feed-in tariffs, **R**e**A**llocation **C**harge with industry e**X**emptions

UNIRAC: **UNI**form feed in tariffs, **R**e**A**llocation **C**harge (without exemptions)

UNIVAT: **UNI**form feed in tariffs, **V**alue-**A**dded **T**ax (instead of reallocation charge)

Pareto improvement against current EEG policy practice (*DIFFRACX*) by

- equalizing marginal cost of green power promotion
- broadening the base for subsidy financing

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Conclusion: Market-Based Regulation

EEG reform in 2017

- Bidding competition for renewable capacities
- Bids for feed-in-tariffs/market premium per KWh over 10-20 years

Higher cost-effectiveness via green quota

- Cross-country competition for cheapest generation options
- Ideally: equalization of marginal generation cost

Cost incidence

- Reduction of electricity tax or value-added tax
- Critical review of industry exemptions from remuneration charge