

Some Comments on the Support of Renewables



Building Competence. Crossing Borders.

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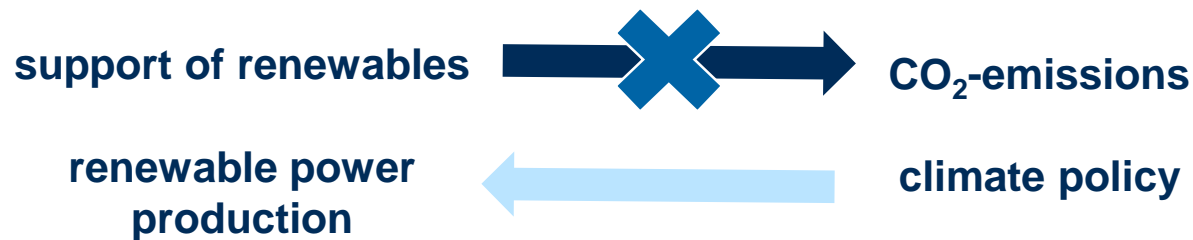
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Relation between power market and climate policy

There is an asymmetry between policies to promote renewables and climate policy!

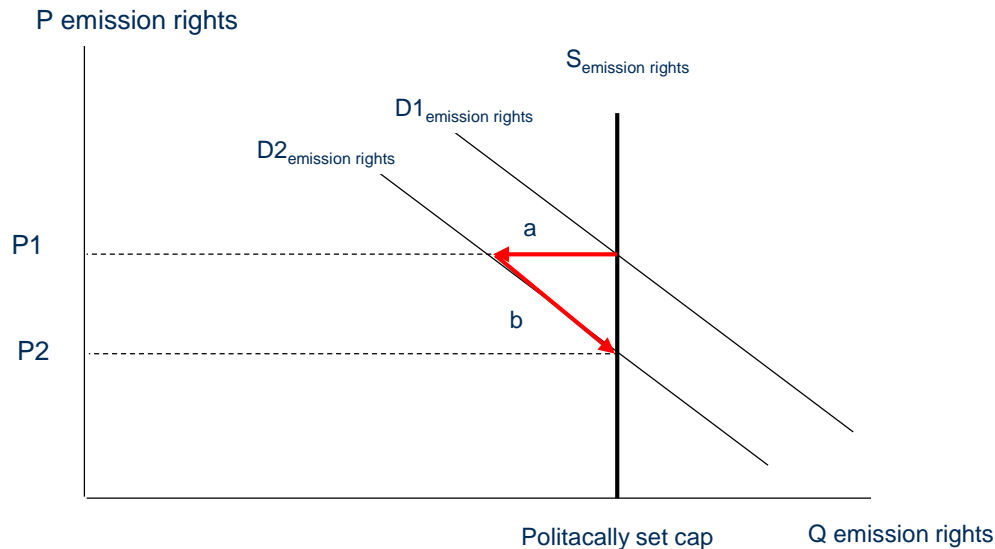


- More renewable power production does not reduce CO₂-emissions within the EU-ETS with a politically given emission cap (linking of Swiss- and EU-ETS is planned for 2020)
- Stricter CO₂-policy (lower CO₂-cap and higher CO₂-prices) enhance competitiveness of renewable power production considerably

Relation between power market and climate policy

The effect of more renewable power production on CO₂-price and –emissions within Europe

Market for CO₂-emission rights



More renewable power production

→ demand for emission rights shifts to the left

→ price for emission rights falls

→ more emission rights are demanded until original emission quantity

=> More renewable power affects price but not quantity of CO₂-emissions

Relation between power market and climate policy

Effect of CO₂-prices on variable cost of fossil power production

	emission-factor	emission-price EUR/t CO ₂	
	t CO ₂ /MWh power	EUR/MWh power	EUR/MWh power
		25	83
brown coal	1,15	29	96
hard coal	0,89	22	75
mineral oil	0,78	19	65
natural gas turbines	0,47	12	39
natural gas combined gas and steam turbines	0,38	9	31

Conclusion:

With an emission price corresponding to the Swiss CO₂-tax rate, fossil fueled power plants are hardly competitive

Relation between power market and climate policy

Conclusion

- The asymmetry between policies to promote renewables and climate policy results from the politically set CO₂-emission cap
 - With a quantity based instrument to promote the production of renewable power (such as a green certificate scheme) CO₂-prices would likewise have no impact on renewable power production
- => Within a cap and trade scheme for CO₂ in force, promoting the production of renewables is no second-best solution to reduce more CO₂-emissions

Supporting renewables versus taxing non-renewables: two sides of the same coin?

To promote renewable power production, the producer price for renewables must be raised

- Simplest model:
 - Closed economy
 - Non-renewable power production
 - Renewable power production
 - Two instruments:
 - Either: subsidizing renewable power at rate s
 - Or: taxing non-renewable power at rate t

=> The two instruments are equivalent, if:

- $s = t$
- Subsidy is financed by surcharge on end user or, respectively tax revenue is used to reduce power price for end user

Supporting renewables versus taxing non-renewables: two sides of the same coin?

Application: domestic renewable power versus imported grey power

Stylized numerical example for Switzerland

domestic renewable power production (TWh/a)	40
domestic power consumption (TWh/a)	60
imported power (TWh/a)	20
European wholesale market price (CHF/MWh)	50
support scheme	
subsidy rate (CHF/MWh)	60
producer price dom. renewable power (CHF/MWh)	$50+60=110$
subsidy expenditure (Mio. CHF/a)	$60 \cdot 40=2'400$
surcharge on price (CHF/MWh)	$2'400/60=40$
power price incl. surcharge (CHF/MWh)	$50+40=90$
tax scheme	
tax rate (import tariff rate) (CHF/MWh)	60
producer price dom. renewable power (CHF/MWh)	$50+60=110$
tax revenue (Mio. CHF/a)	$60 \cdot 20=1'200$
price reduction (CHF/MWh)	$1'200/60=20$
power price incl. price reduction (CHF/MWh)	$110-20=90$

Supporting renewables versus taxing non-renewables: two sides of the same coin?

Economic versus legal equivalence

- Discriminating tax on imports of grey power might violate international free trade agreements
- Discriminating subsidy in favor of domestic renewables was accepted by the European Court of Justice

See judgment in Åland Windkraft case:

Achieving national environmental targets (share of renewable power production) can justify deviation from free trade principle

=> Economically equivalent instruments might be judged differently from a legal point of view

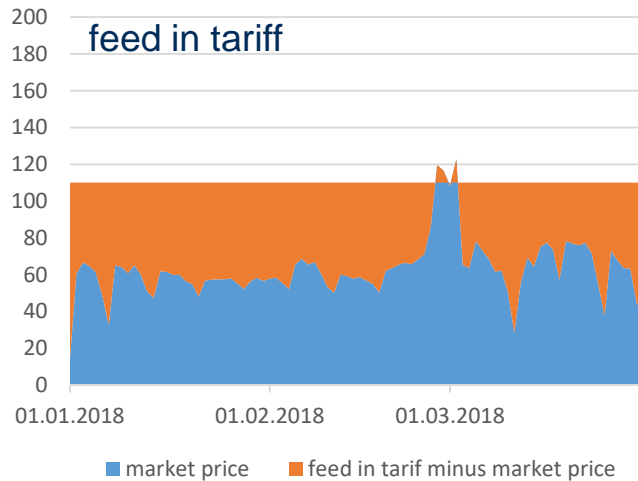
Instruments to support renewables and investment risk

Preliminary remarks

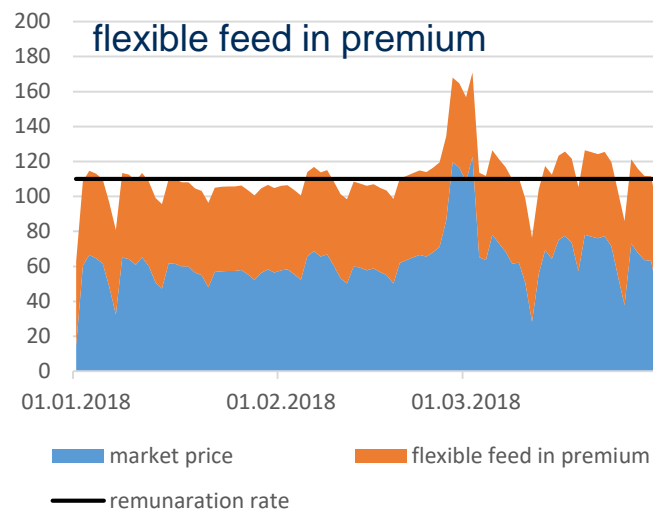
- Investment risk affects capital cost and, therefore, investment decision
 - Since production cost are usually known ex ante, investment risk is mainly revenue risk
 - Since revenue is the product of quantity and price, revenue risk consists of quantity and price risk
 - Quantity and price risk might be correlated

Instruments to support renewables and investment risk

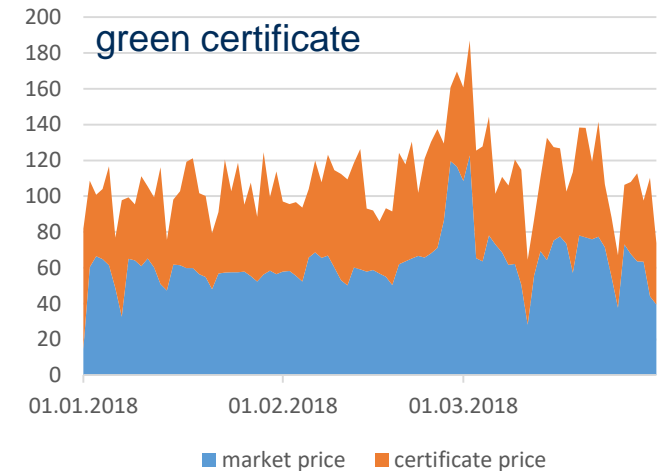
The price risk of different support schemes



No price risk due to given tariff
(No feed in incentives based on market price)



No price risk due to given remuneration rate
(Feed in incentives based on market price is retained)



Power price plus certificate price risk
Open question:
Correlation between power price and certificate price

Instruments to support renewables and investment risk

Price and quantity risk: flexible feed in premium versus one-off investment contribution
 (for the sake of simplicity: discount rate = 0)

		cases			
	expected value	1	2	3	4
market price (CHF/kWh)	0.05	0.03	0.07	0.05	0.05
power production(MWh/kWp)	15	15	15	12	18
flexible feed in premium					
contribution rate (CHF/kWh)	0.11	0.11	0.11	0.11	0.11
market revenue (CHF/kWp)	750	450	1050	600	900
premium revenue (CHF/kWp)	900	1'200	600	720	1'080
total revenue(CHF/kWp)	1'650	1'650	1'650	1'320	1'980
deviation from exp. value (CHF/kWp)	-	0	0	-330	+330
investment contribution					
market revenue (CHF/kWp)	750	450	1'050	600	900
investment contribution (CHF/kWp)	900	900	900	900	900
total revenue(CHF/kWp)	1'650	1'350	1'950	1'500	1'800
deviation from exp. value (CHF/kWp)	-	-300	+300	-150	+150

=> Investment contribution with (higher) price risk but lower quantity risk

Instruments to support renewables and investment risk

Correlation between quantity and price risk

- More renewable power production in one period tends to reduce power prices
 - ⇒ There is a negative correlation between quantity and price
 - ⇒ The correlation is the stronger the higher the share of renewable power production is
- If the correlation is strong enough, support schemes with a combined quantity and price risk (e.g. green certificates) might have a lower total revenue risk than support schemes with a quantity risk alone (e.g. flexible feed in premium)

(Bunn, D. and Yusupov T. (2015), The progressive inefficiency of replacing renewable obligation certificates with contracts-for-differences in the UK electricity market, Energy Policy 82)

Instruments to support renewables and investment risk

Assumptions:

- Price risk is higher than quantity risk
- Weak correlation between quantity and price risk

Overview on revenue risk

	quantity risk	power price risk	certificate price risk	total revenue risk
feed in tarif	yes	no	no	low
fixed feed in premium	yes	yes	no	medium
green certificate	yes	yes	yes	high
flexible feed in premium	yes	no	no	low
investment contribution	partly	yes	no	low-medium

Political implications

- Supporting renewables is no substitute for climate policy
- Promotion of renewables with subsidies seems legally less problematic than with taxes – although the two instruments might be equivalent economically
- A flexible feed in premium is an instrument with little investment risk while still maintaining dispatch incentives

Thank you very much.

