Comparing different types of support systems for renewable electricity

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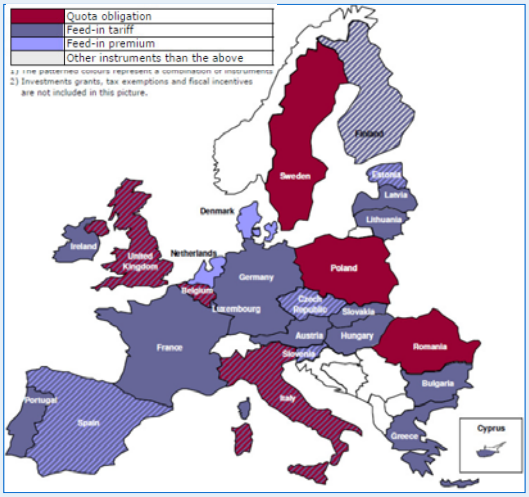
Agenda

1. Introduction and background information
2. Model characteristics and methodology
3. Results of the scenario analysis
4. Conclusion

1. Introduction and background information

Renewable electricity in the European Union

- The electricity sector plays a decisive role in reaching the overall EU target for 2020 of 20 % renewables in gross final energy consumption.
- In the EU, different support instruments for renewable electricity have been introduced.
- Currently strong preference for feed-in tariffs/premiums



Source: de Jager et al. 2011

Feed-in tariffs

- price-based
- usually technology-specific

Advantages

- Promotion of less developed technologies / higher diversity
- Planning security
- *Reduced cost burden on consumers?*

vs.

Quota systems

- quantity-based
- usually technology-unspecific

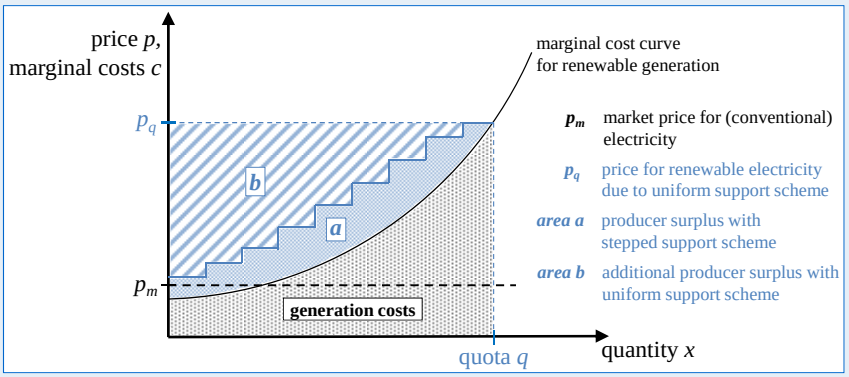
Advantages

- Higher cost-efficiency
- Greater compatibility with conventional power markets
- Coordination with other policy instruments (esp. emissions trading) is easier

The issue of public costs

Apart from overall cost efficiency, **public costs** of support instrument need to be taken into account (producer surplus should be limited such that cost burden on consumers is limited as well).

→ **Stepped (technology-specific) schemes are preferable.**



Source: own illustration based on Ragwitz et al. 2007

Analysis: The case of Germany

Background

- Fixed (technology-specific) feed-in tariffs for renewable electricity introduced in 2000, financed through a levy on electricity prices
- Highly successful in promoting renewable electricity, but growing criticism due to rising costs

Research questions

- How does the FIT system perform in terms of energy system costs, electricity prices, etc. compared to different types of quota systems?
- Can the cost burden on consumers associated with a uniform quota be reduced in the case of a technology-specific quota system?
- Can the over-subsidization that might arise under a FIT system be limited with the help of a technology-specific quota system?

2. Model characteristics and methodology

The German TIMES model: TIMES-D

- Technology oriented bottom-up model with perfect foresight
- Representation of the German energy system (one region) with detailed description of the demand sectors (industry, residential, commercial/agriculture and transport), public & industrial electricity and heat production, refineries and other fuel conversion
- Inclusion of exchange processes with neighboring countries
- Potentials of renewable energy sources
- GHG: CO_2, CH_4, N_2O and pollutants: CO, NO_X, SO_X, particles
- Model horizon 2000-2050, 32 time slices
- Flexible representation of the EU ETS

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Modelling of the German FIT system

Payment side

The tariffs are modelled using the TIMES parameters for subsidies. Additional, special features of the FIT systems are taken into account:

- Annual degression rate
- Limitation of the payment period
- Tariff reduction due to inflation

Demand side

*EEG apportionment = (Ø-EEG tariff – Ø-wholesale electricity price) * EEG quota*

→ depends on model results
→ **Iterative process** of several model runs to adjust FIT payments and the FIT apportionment to one another

Both the expansion of renewable electricity and the effects on electriciy prices and consumption are determined endogenously

Modelling of quota systems

As quota systems are quantity-based measures, the modelling approach is comparatively straightforward:

The target values for the renewable shares in electricity generation can be integrated into the model with the help of user-defined constraints (uniform or technology-specific).

↓

In the optimization approach, the cheapest generation options are chosen to fulfil the quota.

↓

The shadow price of the user constraint can be interpreted as the certificate price in the trading system and directly impacts electricity generation cost.

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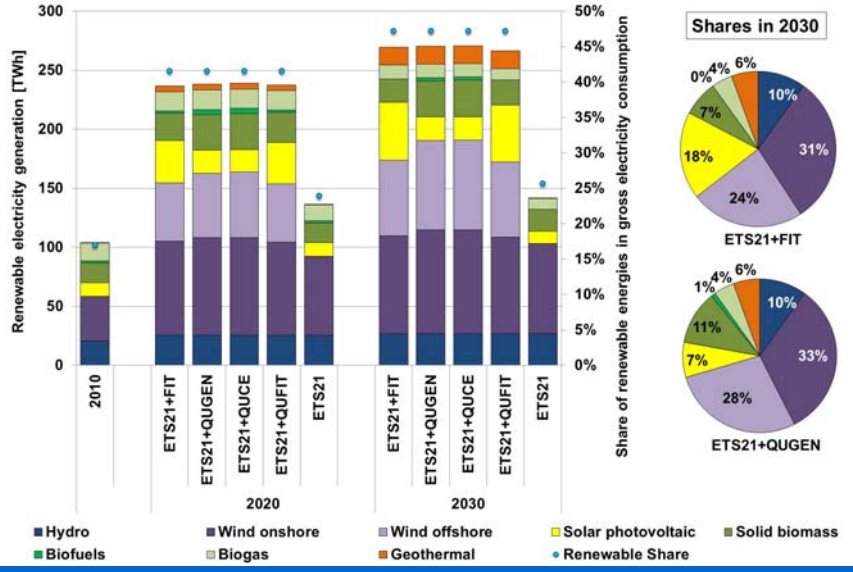
Scenarios

→ Contrasting the German FIT system with different types of quota systems

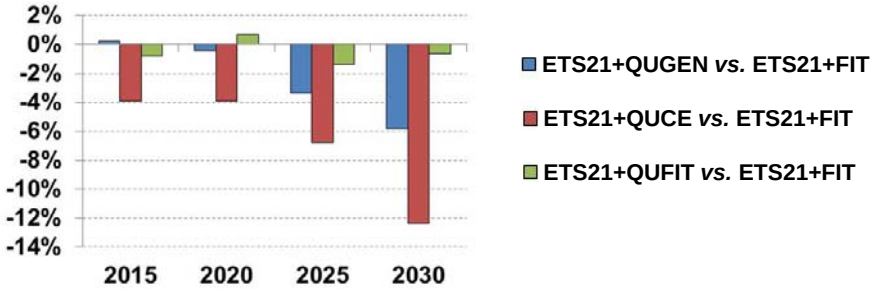
→ Taking into account the ETS emission reduction target of 21 % to 2020 compared to 2005

Scenario	Support scheme for renewable electricity
ETS21+FIT	The German FIT system (as of 2012)
ETS21+QUGEN	**"General quota"** (Technology-unspecific quota reaching the same overall share of RES in electricity generation as with FIT)
ETS21+QUCE	**"Cost-efficient specific quotas"** (Technology-specific quota reaching the same shares for each RES in electricity generation as with QUGEN)
ETS21+QUFIT	**"Specific quotas reflecting the FIT"** (Technology-specific quota reaching the same shares for each RES in electricity generation as with FIT)
ETS21	-

3. Results (1): Renewable electricity generation



Results (2): Electricity prices



→ Cost-efficiency of the uniform quota systems leads to reduced electricity prices compared to the FIT system.

→ Technology-specific quotas result in an additional reduction in electricity prices, if they are set cost-efficiently.

→ No clear indication for an over-subsidization under the FIT system

Results (3): Electricity consumption

TWh	2030			
	ETS21+FIT	ETS21+QUGEN	ETS21+QUCE	ETS21+QUFIT
Industry	233	223	223	228
Tertiary Sector*	112	117	120	112
Residential	126	134	135	125
Transport	30	30	30	30
Sum	**501**	**504**	**507**	**495**

*incl. Agriculture

→ In general, very small changes in electricity consumption; flexibility of the model needs to be increased.

→ Special provision for the energy-intensive industry under the German FIT system (reduced levy) leads to higher electricity consumption in industry compared to quota systems.

Results (4): Energy system costs

	Cumulated energy system costs 2013-2030	
... vs. ETS21+FIT		
ETS21+QUGEN	-10.87 Bn €$_{2010}$	-0.16%
ETS21+QUCE	-13.78 Bn €$_{2010}$	-0.20%
ETS21+QUFIT	-2.72 Bn €$_{2010}$	-0.04%
ETS21	-63.62 Bn €$_{2000}$	-1.36%

→ A technology-specific quota system promoting the most cost-efficient generation technologies would entail the lowest increase in energy system costs, if the target was to support renewable electricity generation.

→ The ETS emission reduction target could clearly be reached in a more cost-efficient manner, if no additional support instrument for renewable electricity generation was implemented.

4. Conclusion

Comparison of support instruments

- Feed-in tariff systems currently dominate in Europe, but quota systems might produce substantial benefits in terms of cost-efficiency.
- These benefits would be even more pronounced in case of a EU-wide system.
- The cost burden on consumers can be reduced with the help of a technology-specific system.
- Apart from cost-efficiency, the decision for the appropriate support instrument will be guided by issues like the market integration of renewables or the target to promote technology diffusion.
- Even if the optimal support instrument is found, the question remains whether there is a clear justification for the specific promotion of the adoption of renewable technologies.

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Thank you for your attention!

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This analysis is part of the ongoing
ETSAP project "Integrating policy instruments into the TIMES Model"
Reports are available on **www.iea-etsap.org**