

Communication

How to promote renewable energy systems successfully and effectively

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Abstract

This paper summarises the major recommendations and conclusions of the third Forum of the European Network on Energy Research (ENER) which took place in June 2002 in Budapest. The major perceptions of this meeting as well as the most important conclusions and recommendations for energy policy makers are compiled in this summary. The statements compiled in the following represent a consensus within the ENER Network while on some questions differences in perception and analysis persisted.

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Keywords: Renewables; Strategies; Policy

1. Introduction

The main objective of the 3rd ENER Forum was to discuss the following core questions:

- What are the pros and cons of various promotion strategies?
- What are the criteria for successfully promoting electricity produced from renewable energy sources (RES–E)?
- What are the most promising future instruments for promoting RES in EU and in accession countries? In detail the following issues were tackled:
- Experiences with different types of instruments (FITs, bidding/tendering, tradable green certificates

- (TGC), rebates, Green Pricing, environmental taxes) depending on technologies and countries;
- Impact of different supporting schemes on public involvement in the RES businesses and, thus, on public acceptance; influence of different supporting schemes on the type of investor (large companies vs. small cooperatives vs. individuals);
- Future prospects of different types of strategy were discussed for single countries and technologies, and for Europe as a whole;

The major perceptions of the meeting as well as the most important conclusions and recommendations for energy policy makers are compiled in this summary. The statements compiled in the following represent a consensus within the ENER Network while on some questions differences in perception and analysis remain.

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2. Survey on strategies

In order to increase the market penetration of RES strategies have been implemented in various European countries in recent years. The core objective of strategies to foster RES-E is the substitution of sustainable energy use for non-sustainable energy forms, and thus a wider deployment of (active) RES capacities. Therefore, the major focus must of course always be to *trigger investment in new capacity*. But the maintenance, upgrading, and improvement of existing capacities has also to be borne in mind.

Objectives derived from this core objective are:

(i) to stimulate technological progress; (ii) to trigger learning effects with respect to investment costs; to minimise administration and transaction costs; to maintain public acceptance regarding RES technologies.

The debate on the promotion of RES focuses most on the comparison between price-driven, (e.g. feed-in-tariffs, FITs) and capacity-driven (e.g. Tradable Green Certificate-based quotas, TGC) strategies, see Table 1. These two approaches aim at the same target, but start from different points: in the first case the PRICE is set and the quantity is decided by the market; in the second case (which includes TGC-based quotas and bidding procedures) the QUANTITY is set and the price is decided by the market, see Figs. 1 and 2.

Table 1 provides a classification of regulatory strategies for encouraging the use of RES.

Table 1
Fundamental types of regulatory strategies

	Price-driven	Capacity-driven
Investment focused	Rebates Tax incentives	Bidding
Generation based	Feed-in-tariffs Rate-based incentives	Quotas/TGC

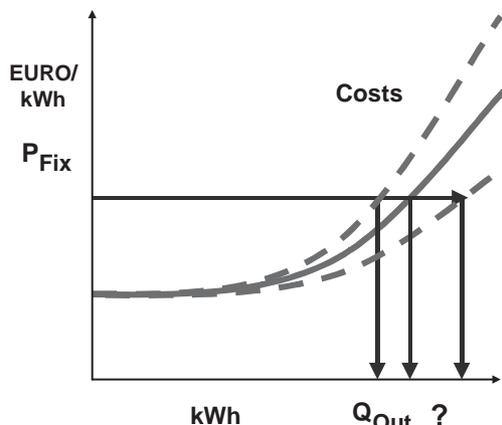


Fig. 1. How a feed-in tariff works.

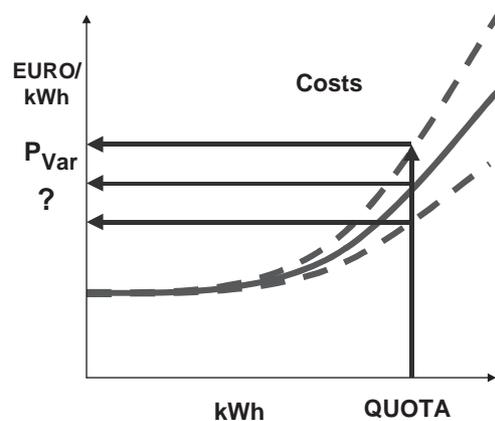


Fig 2. How a TGC-based quota works.

3. The state-of-the-art on currently implemented strategies

Currently in various European countries different strategies are in force. Table 2 provides an overview of strategies by country for the major technology categories addressed.

It can be seen from this table that FITs are currently the prevailing instrument, followed by rebates, tax incentives, tendering systems, and green tariffs.

An analysis by country reveals the patchwork on implemented strategies and ongoing changes.

In *Austria* currently no promotional system exists for electricity from large hydropower, municipal solid waste and sewage biomass. With respect to electricity from ‘new RES’ a quota not based on TGCs is implemented by law. It requires that 4% of final electricity consumption is generated from ‘new’ RES by 30 September 2008.

Currently, the promotional systems to meet this quota are different in the nine Austrian provinces and consist of mixes between FIT, rebates, and bidding systems. For small hydro-power a TGC based quota system was introduced in 2001, which so far has not fulfilled initial expectations. The major problems are that there is insufficient market liquidity and that the penalties (different in each of the nine provinces) are far too low at the margin to stimulate investment in new capacity. Currently, even the trade association of small hydro-power generators, which has initially demanded the TGC-based quotas is in favour of abolishing this system completely.

In *Belgium* up to 2002 RES-E generators benefit most from an add-on payment of 4.96 c€/kWh above the (low) price of about 2.75 c€/kWh average paid by the utilities for feed-in power. Also direct investment subsidies (e.g. in the Flemish region 75% of investments in PV in 2001 have been subsidised, but are limited to a small fund) co-exist as well as better feed-in conditions (only for PV a revolving meter is allowed). Flanders

Table 2

Past, current (2001) and in the near future planned regulatory promotion strategies for electricity from RES in EU and some NAS countries

		Large hydro	Small hydro	'New' RES (wind, PV, biomass, biogas, landfill gas, sewagegas, geothermal)	Municipal solid waste
Austria	Current	No	8% current quota	4% non-tradable quota until 2008 in combination with regional-specific FITs and other instruments (investment subsidies, bidding, etc.)	No
	Proposed	No	Non-tradable quota: 9% for small hydro in 2008, 4% for 'new' RES in 2008—in combination with national harmonised minimum FITs. In addition regional-specific instruments (investment subsidies, bidding, higher guaranteed FIT)		Biogenic fraction accounts to 'new' RES
Belgium		No	Flemish region: 3% quota (based on TGCs) in 2004 for RES (excl. MSW), escalating penalty (7.5 c€/kWh in 2002, rising to 12.5 c€/kWh in 2004); Wallonia: 5% quota (based on TGCs) in 2004 for RES and CHP; Brussels region: No support scheme yet		
Denmark	Current	No	Mix of strategies (FITs, tax credits, etc.)		No
	Proposed	No	Planned 200?: Quota system based on TGCs for RES		No
Finland		No	No	Wind: Investment subsidies by 30-40% (on a case-by-case basis) and tax refund (0.7 c€/kWh); Biomass: Tax relief (3.1 c€/kWh)	No
France		No	FITs: 5.5–6.1 c€/kWh	FITs, in more detail: Wind: 3.1–8.4 c€/kWh on a 15 year average ^a ; PV: 15.25–30.5 c€/kWh ^b ; Biomass: FITs in progress	4.5–5.0 c€/kWh
Czech Republic		No	FITs: 5.0 c€/kWh Inv. subsidies for selected projects	FITs, in more detail: Wind/Geothermal: 10.0 c€/kWh, Biogas/-mass: 8.3 c€/kWh, Solar/PV: 20.0 c€/kWh Investment subsidies for selected projects	No
Germany		No	FITs: 6.65–7.67 c€/kWh	FITs, guaranteed for 20 yr., in more detail FITs for new installations in 2002 are ^c : Wind: 6.1–9 c€/kWh; ^d PV: 48.1 c€/kWh, Biomass: 8.6–10.1 c€/kWh ^e ; Geothermal: 7.16–8.95 c€/kWh; Sewage-, Landfill- and marsh gas: 6.65–7.67 c€/kWh	No
Greece		No	FITs (at a level of 75–90% of the selling tariff, higher on islands, lower on the mainland) and a mix of other instruments (30% investment subsidies, tax credits, reduced loans, etc.)		No
Ireland		No	Bidding programme—Currently: AER V with technology bands and price caps for small and large wind, small hydro and biomass; Furthermore: tax relief		No
Italy			2% quota (based on TGCs) for all new RES (incl. large hydro and MSW)—with rolling redemption ^f (8 yr.), unclear penalty enforcement; Investment subsidies ('10,000 roofs-programme') for PV; structural funds for Wind		
Luxembourg		No	No	FITs and investment subsidies for Wind, PV and Biomass	No

Table 2 (continued)

		Large hydro	Small hydro	'New' RES (wind, PV, biomass, biogas, landfill gas, sewagegas, geothermal)	Municipal solid waste
Poland	Current	7.5% of RES electricity in 2010 starting from 2.4% in 2001, FITs 5–7 c€/kWh (voluntary—max. duration of 3–5 yr). Legal framework weak—only regulation, no Act (no long-term PPAs), no punishment = no stability for investors	7.5% of RES in total primary balance in 2010 and 14% in 2020 in RES Strategy—no sound legal framework		No
Portugal		No	FITs and investment rebates for wind ^g , PV, biomass, small hydro		No
Spain		< 50 MW: FITs on top of market price (premium!): 2.99 c€/kWh	FITs on top of market price (premium!), in more detail (only premium): Wind: 2.89 c€/kWh, PV: 18–36 c€/kWh, Biomass: 2.55–2.77 c€/kWh		FITs-premium: 2.15 c€/kWh,
Sweden	Current	No	< 1.5 MW: 15% Investment grant, 0.09 SEK/kWh operation grant	Biomass: 25% Investment grant; Wind: 10–15% Investment grant, 0.27 SEK/kWh operational support (0.09 SEK/kWh environmental premium + 0.18 SEK/kWh energy tax refund) on top of low market price (1.5 c€/kWh)	—
Netherlands	Proposed	No	Target 10 TWh increase by 2010 = 15.3% quota in 2010		
United Kingdom		Quota (based on TGCs) by 2010 for all RES (exc. large hydro and MSW); quota starts at 3% in 2002, rising to 10.4% by 2011—penalty set at 3 p/kWh (5 c€/kWh). Tax exemption ('climate change levy') for RES (0.66 c€/kWh). Investment grants for offshore wind (€ 68 Mio. For demo projects, plus € 16 Mio. from 'New Opportunities fund').	Mixed strategy (green pricing and tax exemptions ^h); Investment subsidies for wind		

^a 8.4 c€/kWh for the first 5 years and then between 3.1 and 8.4 c€/kWh depending on the quality of the site guaranteed for 15 years—project size limited to 12 MW.

^b 30.5 c€/kWh for corse and overseas departments.

^c For some RES, guaranteed FIT for new installations decrease over time: For biomass 1%/yr, for PV 5%/yr, for wind 1.5%/yr.

^d 9 c€/kWh for the first 5 years and then between 6.1 and 9 c€/kWh depending on the quality of the site.

^e The guaranteed FIT depends on the size of the biomass plant (8.6 c€/kWh for plants < 500 kW, 10.1 c€/kWh for plants > 5 MW); similar regulations are given for geothermal as well as sewage-, landfill- and marsh gas plant.

^f In general only plants put in operation after 1 April 1999 are allowed to receive TGCs for their produced green electricity. Moreover, this allowance is limited for the first 8 years of operation (rolling redemption).

^g E.g. wind producer receive a stepped FIT of 4.3–8.3 c€/kWh, plus investment grants up to 30%.

^h Customers of green electricity are exempt from paying the energy tax (currently about 5 c€/kWh).

enacted a TGC-system from 1 January 2002 onwards; Wallonia is planning for a different system.

Denmark more or less abandoned its FITs and tax-incentives system by the end of 2000 and announced to switch to a TGC-based quota system. This led to the fact that currently Denmark is undermining part of the technological and socio-economic progress it has made so far e.g. for wind turbines. Even more damaging is the fact, that the TGC system has not been implemented yet. The uncertainty is a high obstacle to investment.

In *France* until 2001 a bidding system for wind power (Eole, 2005) was in force, which turned out not to be very successful. In 2001 the system was changed towards a stepped FIT.¹

In *Germany* a FIT was adopted unanimously by Parliament in 1990. In 1991, the so-called ‘Stromeinspeisungsgesetz’ went into force. As a consequence of the German electricity market being fully liberalised in 1998, this law had to be adjusted, and it was replaced in April 2000 by the Renewable Energy Act. It is a federal law determining FITs by RE technology. This strategy has been very successful so far, making Germany the number one world wide in wind energy use, with a total installed capacity of 10,000 MW (on 8 August 2002). The financial ‘burden’ due to this strategy is equally distributed over all electricity customers.

While the EC was until 2001 very unhappy with this law a decision of the European Court of Justice confirmed that the German law is in line with the provisions of the EU Treaty, more specifically with the State Aid rules, since it does not constitute state aid given the fact that it is financed directly by the customers.

Italy after a decade under a fixed tariff scheme (CIP6 contracts, with a premium for 8 years to new RES-E projects admitted in a list, which will keep on until 2012), a portfolio has been created in 2002. All the production from fossil fuels, excluding CHP and small companies producing less than 100 GWh, and import of electricity, have an obligation to cover 2% of their sales with new renewable energy production. New RES-E projects came on line after April 1999. They have the right to receive the TGCs for the first 8 years of operation. The fulfillment of the obligation is facilitated by the creation of a Green Certificate Market in operation from 2002. Producers not complying with the portfolio requirement will have to pay a fine equal to 1.5 times the highest price paid in the previous year on the TGC market. The 2% quota will grow by 0.35%/yr from 2005 to 2012.

The oddest system is currently practiced in *The Netherlands*. While the principle is good the fact that

the import of green electricity from existing power plants is also allowed leads to the result that a huge amount of money is wasted for providing ‘windfall profits’ for German, Swiss, and Austrian hydro and wind power utilities.

In *Portugal* since 1998 FITs are in force for all RES except large Hydropower and Municipal Solid Waste (MSW). More recently, in 2001, very interesting FITs have been defined and the mandatory percentage of self-financing has been relaxed which explains the existing boom for wind energy projects. It is expected that the actual wind potential of 3000 MW will all be used by 2007.

In *Spain* in 1998 the ‘Real Decreto 2828/1998’ was established. It is based on FITs by technology. Although it is delivering good results in some technologies (it brought Spain into the Top 2 of European Wind generators within three years) it is not enough to overcome other barriers. The main barriers for RES development is essentially a lack of integrated political will, e.g. too low prices for biomass. A lack of transparency and objectivity in the grid connection framework and too different regional procedures make a global RES approach difficult.

In *Sweden* for the period 1 July 1997 to 30 June 2002 investment grants were available for electricity from wind power, small-scale hydro-plant and biomass. The highest investment grants are available for biofuel-fired CHP. Subsidies of around (358 €/kW) are granted for investments that provide a new contribution to electricity generation, but may not exceed a maximum of 25% of the investments. Grants for wind power and environmentally friendly small-scale hydro plants were available amounting to 15% of the investment for new facilities over 200 kW capacity.

In addition, two other mechanisms exist for supporting small renewable energy projects in Sweden. The first is guaranteed power purchase contracts with local utilities. Prior to electricity market reform, holders of regional power concessions were required to purchase electricity at the utility’s avoided cost from all small power projects with generation capacities of up to 1500 kW. This requirement continues to exist under the new law, in which local distribution utilities must still purchase all electricity generated by projects of less than 1500 kW within their service territories. The price now paid to small generators is equal to the residential tariff plus a credit for reduced transmission and distribution losses minus reasonable costs for utility administration and profit.

The other support mechanism is an environmental bonus paid from the government. Small-scale RES-based electricity production is favoured by lower or zero energy taxation. In addition biofuels are exempted from sulphur taxation.

¹The terminology ‘stepped FIT’ will be explained in Section 4.

In the UK until 2000 tendering systems have been used to promote RES. The most well known of these promotion strategies is the Non-fossil Fuel Obligation (NFFO) in England and Wales. Similar schemes have been set up for Scotland (Scottish Renewables Order—SRO) and Northern Ireland (NI–NFFO). This strategy was changed and renamed so as to increase the amount of renewables capacity.

In April 2002, the UK replaced the NFFO with a TGC-based quota system. The quota rises from 3% this year to 10.4% in 2011. Also, large hydro and MSW schemes are not eligible for the renewables obligation, and are therefore excluded.

4. General conclusions

From the presentations and discussions the following recommendations and conclusions for EU policy makers are most important:

1. Without additional policy measures, many EU member countries are likely to fail to reach the national targets for electricity from renewable energy sources (RES-E) indicated in the EU Directive (2001/77/EC). In case of new accession states (NAS) it is necessary to start to create their policy framework in order to be well prepared for the adaption of the Directive.
2. Sufficient prices for RES electricity, long-term stability of support mechanism, fair and easy access to the electricity grid and clear building codes are very crucial factors to be addressed by successful RES support mechanisms.
3. There is no single, universally applicable ‘best’ support mechanism or policy for the bundle of different technologies known as RES. A mix of policy instruments needs to be tailored to the particular RES and the specific national situation to promote the evolution of the RES from niche to mass markets. This policy mix needs to evolve with the technology.
4. More important than the choice of the system is the proper design and monitoring of the support system adopted; in this respect the functionality, stability and continuity of a policy-support system are crucial features.
5. Not all RES are at the same level of development. They are not all sitting on the shelf ready to be plugged into the electricity system. Some RES, such as wind, are almost competitive in mass electricity markets. Others are viable in niche markets, like PV, biomass, while others are still in the early stages of technological evolution, e.g. wave power. Support mechanisms should take this into account by permitting larger producers’ surpluses in earlier stages of market introduction to make possible manufacturers’ investments in R&D as well as in manufacturing facilities. In later market stages, these surpluses should be reduced. At the same time excessive (windfall) profits should be avoided. Given that no major uncertainty is introduced that could displace investment a stepped FIT provides such an incentive. Stepping FITs (e.g. by decreasing the FITs over time according to the expected learning curve and economies of scale and scope effects of both new renewable and conventional energy technologies, and/or the discriminating of the feed-in tariffs according to some technology performance indicators) can lead to comparable cost reductions with FITs as model calculations show.
6. It is important that a promotional system makes the proper distinctions between existing (fully depreciated) and new capacities, and that the distinctions are suited to the technology segment of the RES-market. Depending on the development targets of the particular RES-technology and depending on the promotional instruments in use, the distinction is of more or lesser importance. Thus for a quota system, the quota should preferably be applied to new capacities, and for a TGC system, primarily certificates for new systems should qualify for trading.
7. The support mechanism of any instrument should be guaranteed for and restricted to a certain time frame, e.g. 10 years.
8. FIT, RES quotas and bidding systems are all exclusively governing the relation between the RES generator and the electricity supplier. That means in principle that competition among RES plant manufacturers exists regardless of the choice of support mechanism.
9. In case of new RES technologies it is likely that the procedures set-up by the authorities and the legal framework are not adequate enough to deal with a lot of small energy generation projects. Therefore it is necessary to harmonise the authorising process in the particular country.
10. With a given target of a certain amount of RES at a certain time, neoclassical economic theory predicts an EU-wide quota exclusively for new RES installations with an accompanying international trading scheme (further to be referred to as ‘RES quota’) to be the most efficient approach in terms of minimising additional costs. Does an EU-wide harmonised promotion strategy make sense? If so under which conditions? For European wide trade of certificates with maximum efficiency gains an EU-wide harmonisation is undoubtedly necessary for an European RES quota. Currently, however, it appears unlikely that such

- a harmonised strategy will be implemented in the short-term because
- a. trade in certificates will not contribute to national CO₂-reduction unless it is closely co-ordinated with an emission quota-system—even then it is the emission quota which give the CO₂-reduction;
 - b. the value of CO₂-reduction will not be included in the price of TGCs. Thus the only reason to track TGCs is to enforce the development of sustainable long-term technologies;
 - c. presently the TGC-systems introduced in EU-MS are very different. To introduce a harmonised system will be very difficult.
11. Moreover, FIT can easily be changed towards an international RES quota if the quota refers to new capacities only. Yet, strong efforts will be needed to adapt/harmonise existing national RES quotas towards an international RES quota! Currently the support systems are rather diverging than getting harmonised.
 12. Regarding the argument that for FITs and rebates subsidies are provided while the exertion of market forces drives quota-based TGC systems it has to be stated that with all promotion strategies it is the public which ultimately pays! In voluntary programmes some people pay more, some people pay less. If cost-driven strategies are implemented these subsidies (rebates, FITs) are paid by the electricity users and the same applies for capacity driven strategies. The major goal for policy should be to find strategies which minimises public costs.
 13. If a (national) support scheme exists fostering reasonable market development of RES-E at reasonable (not too high) compensation costs it cannot be recommended to change the (national) system! Efficiency gains possibly incurred with a change are unlikely to outweigh risks due to insufficient implementation and policy uncertainty in that case. Therefore, this choice of a strategy has to take into account the current state of promotion and the possible future dynamics for retaining the current system vs. changing to another system!
 14. When switching from one support system to another, the increase in investors' risk caused by regulatory uncertainty should be taken into consideration. In this respect a clear commitment by policy-makers, and excellent planning of the transition phase and design of the new system is absolutely crucial.
 15. In the scientific discussion trade within RES quotas are usually modelled with spot markets. However, this seems to be inappropriate since long-term investments in RES power plants will be secured by long-term power purchase contracts in most cases—as Transaction Costs Economics predicts. Preliminary experience with RES quotas in Texas and Australia confirms this prediction. Thus, efficiency gains from tradable RES quotas in comparison with a fixed FIT might be not as large in practice as envisaged by Neoclassical Economics.
 16. Incentive-based promotion schemes alone are insufficient to create a sustainable RES-E market development; innovative regulation and institutions fostering institutional change and training and education of the relevant actors are also of high importance; in this context a systemic perspective proves useful, which allows one to identify and tackle the important barriers and latent drivers simultaneously and in a comprehensive way.
 17. Organising bidding auctions, verifying RES power plants, issuing and redeeming certificates as well as adapting and tuning continuously RES regulation are causing transaction costs. A proper comparison of promotion mechanisms has to take into account these transaction costs when making an appraisal of the effectiveness. Moreover, operators of small RES power plants are more vulnerable to high transaction costs than operators of large RES power plants.
 18. Finally, empirical evidence has shown that in a real world with 'real politicians' carefully designed stepped FITs are the preferable instrument for a mature technology (e.g. wind).