Do we need a common support scheme for renewables-sourced electricity in Europe?

And if so, how could it be designed?

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Abstract

The static and dynamic efficiency of the deployment in the European Union of renewable energy sources for electricity generation is hampered by the fragmentation of market support schemes by national borders. Along with the fast penetration of renewable energy technologies as mandated by the renewable energy directive, the drawbacks of the existing fragmentation in terms of market inefficiencies and the incompatibility with the single market concept are of increasing significance. Bottom-up harmonisation based on a hybrid renewable quota system - i.e. with supplementary national support measures - could help to reverse this, whilst at the same time allowing for national concerns. This paper considers the case of a possible merger of the Norwegian, Swedish and Dutch support schemes. Norway and Sweden are elaborating a certificates-based joint support scheme, which is to be introduced in January 2012. As for the Dutch support scheme the proposal for support reforms by the Dutch association of energy suppliers, Energie-Nederland, is taken as point of embarkation.

Contents

1. Introduction

The EU and its member states have adopted quite ambitious mandatory targets to raise by 2020 the share of renewables in the energy mix to 20% for the EU, broken down by member state in a differentiated way. Moreover, the EU has set a non-mandatory target to reduce GHG emissions by 2050 with respect to 1990 by 80 to 95%. To bring these goals about, the electricity supply system in the EU and its member states has to evolve fast with renewables assuming a leading role in the electricity supply mix on longer term.

To make this happen, both Europe’s electricity system and its electricity market have to integrate fast. National transmission systems have to be integrated and strongly reinforced (notably interconnection capacity), whilst transmission system operations have to be harmonized. National electricity markets are broadly evolving into regional ones and ultimately have to transform into a genuinely single European market for electricity.

The envisaged important role for electricity from renewable sources implied by the EU energy and climate policy goals will warrant huge additional market stimulation costs and network reinforcement costs, running into several tens of billion euros per year. Contingent on due regard for dynamic efficiency and respecting the subsidiarity principle, market-based harmonization of the currently fragmented national markets for renewable electricity generation can bring substantial benefits to the EU in terms of significantly lower support costs. These result from *gains from trade, economics of scale* and *technological innovation* brought about by cost-reducing competition between technologies. In this respect, the envisaged start of a common Swedish-Norwegian renewable electricity certificates trading scheme is due to mark a significant first step on the way towards a pan-European renewable electricity support scheme.

This paper makes the central point that a wide-scale expansion among other EU member states of the imminent Norwegian-Swedish certificates-based market stimulation of electricity from renewable sources (RES-E) to other EU member states has to allow for (well-circumscribed) application of the subsidiarity principle regarding supplementary support measures to allow for national concerns and supply conditions. In EU member states providing production-based feed-in support, a trend from feed-in tariffs to feed-in premiums is emerging, for instance in Spain and more recently Germany (BMU, 2011). This would make a *hybrid renewable quota system* a serious contender for European RES-E harmonisation, where currently high-cost RES-E technologies could get additional support from national feed-in tariffs in countries wishing to implement such additional measures.

This paper briefly reviews the current European situation with regard to support to market deployment of renewable electricity in section 2. With regard to a possible harmonisation of broadly national support schemes on a wider European scale, it is argued that such schemes warrant both a common market-led component and supplementary national, technology-specific support instruments for high-cost renewable electricity generation technologies. Subsequently, in section 3 the concept of a hybrid renewable quota system (RQS) as joint support scheme is explained by the case of a possible hybrid RQS between Norway, Sweden and the Netherlands. The description of the hybrid feature is based on a proposal by the association of Dutch energy suppliers, *Energie-Nederland*. Section 4 presents the main findings of this paper.

2. The broader policy context

2.1 The fragmentation of support to market uptake of renewables in the EU

At present, in all of the 27 member states policy instruments with diverging detailed design are being applied at the national (or even sub-national) level. As a result, the EU market for renewable electricity is fragmented into (more than) 27 separate intra-EU areas. An operator of a renewable generating plant in anyone of these areas can only obtain market support (if the technology concerned is eligible for support) in the country/region where his plant is located. The (more than) 27 ring-fenced, intra-EU markets for renewable electricity constitute a very high barrier to realisation of the potential *economies of scale* in the development and deployment of renewable energy technologies throughout the whole EU area. Moreover, this fragmentation forecloses the full deployment of the lowest-cost renewable electricity generation technologies at the lowest-cost sites across the EU.

Diverging projections of potential savings of EU-wide harmonisation of renewable electricity support measures have been made. For example, projections have been made by EEG & Fraunhofer ISI (Resch and Ragwitz, 2010) of EU-wide cumulative support expenditures for new RES-E installations over the period 2006-2020 needed to achieve the envisaged contribution of renewable electricity towards the EU-wide RES target for year 2020. Their projections suggest that EU-wide cumulative support expenditures for new RES-E installations over the period 2006-2020 can diminish by 7-28 billion euros (€$_{2006}$). In obtaining this outcome, EEG & Fraunhofer ISI presuppose a scenario of harmonised *technology-specific feed-in premium system* as against a scenario of intensified existing fragmented support measures.[1] Conversely, EWI (Fürsch *et al*, 2010) suggests that over the same period *savings on support expenditure*s are possible to the tune of about 174 billion euros (€$_{2006}$), if a *certificates-endorsed technology-neutral renewable quota system (RQS)* is to be introduced. EEG & Fraunhofer ISI contend, however, that introduction of a common technology-neutral RQS would *drive support expenditures upwards* by 90 billion euros (Resch and Ragwitz, 2010). This would be triggered by windfall profits cashed in by operators of infra-marginal renewable power plants.

We are not in a position to assess these widely diverging results in detail. Yet some general observations can be made. The performance of harmonisation through a certificates-endorsed technology-neutral renewable quota system (RQS) depends on the slopes of the EU-wide renewable electricity supply curve and the corresponding demand curve.[2] As in the case of compliance with EU RES targets commercially immature renewable technologies are the marginal ones at the point of intersection, the demand curve is basically shaped by implicit policy mandates regarding the consumption of renewable electricity.[3] In a renewable quota system the total amount of final electricity consumption will be fixed by the system target. This boils down to a

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1 Formerly, EEG and Fraunhofer ISI promoted harmonisation based on feed-in tariffs. See e.g. (Klein *et al.*, 2008). However, renewable electricity supported by *feed-in tariffs* is more difficult to integrate in the electricity market than renewable electricity supported by *feed-in premiums*: in the latter as against the former case, the operators concerned might be sensitive to electricity price developments and will seek to minimise their impacts on system balancing operational costs.

2 In a seminal article, Martin Weitzman analysed the choice between *price instruments* and *quantity instruments* to mitigate a certain environmental impact in the case of market failures preventing the internalization of this impact, from a social-welfare perspective (Weitzman, 1974). If the (“well-behaved”) marginal cost curve of pollution damages is bending more (less) sharply upward than the (“well-behaved”) marginal social benefits curve of pollution abatement is bending downward in the point of intersection, price (quantity) instruments would be preferable from a sheer social welfare perspective. Patrik Söderholm applies Weitzman’s findings to support mechanisms for renewable electricity (Söderholm, 2008).

3 The RES directive mandates *explicitly* that some 20% of final energy consumption in the EU shall originate from renewable sources.

vertical demand curve. Then with a relatively gentle upwards slope of the supply curve for renewable electricity, a common certificates-endorsed and technology-neutral RQS will lead to *net savings* in support expenditures. Should however the electricity supply curve bending sharply upwards, *net increases* in support expenditures were to result. Other parameters being unchanged, the more ambitious the RQS system target is set, the sharper the upward curvature of the RES-E supply curve at the point of intersection with the RES-E demand curve. So far the economic theory perspective.

Let us now consider modelling imperfections, compared to the real-world complexities, in the two studies referred to above. We identify the following essential ones:

- EWI assumes a smooth deployment of renewable resource potentials. In practise, this depends mainly on prevailing permitting cultures in the face of the omnipresent BANANA[4] syndrome and competing land uses. For instance, notably but not only in the UK this syndrome is helped by complex multi-stage permitting procedures and is meeting weak countervailing top-down power to facilitate potential investors in realising new renewable electricity generating capacity. As a result, the UK's rich onshore wind power resource endowments are sparsely utilised. As a result of these kind of implementation hurdles, EWI appears to overestimate the elasticity of renewable electricity supply.
- EWI neglects the potential dynamic efficiency gains of (currently) high-cost renewable technologies. This neglect should be qualified, however, by the poor track record by public sector authorities in picking the winners through over-reliance on technology-specific support policies. For instance, the as such impressive indirect support by the German feed-in law does not appear to favourably affect the comparative advantage of the German manufacturers of PV modules as against their Chinese counterparts. In contrast, so far several German manufacturers of, for example, wind turbines are doing well.
- EWI neglects the problems in gaining public acceptance of completely EU-wide technology-neutral support. A certain extent of (temporary) technology-specific support based on subsidiarity might well be necessary.
- EEG & Fraunhofer ISI neglect the innovation and market dynamics of competition between technologies. As a result, EEG and Fraunhofer might well have under-estimated the elasticity of renewable electricity supply.
- EEG & Fraunhofer ISI tacitly assume that the public sector can perfectly project technology-specific levelised cost of electricity (LCOE) and correspondingly set the proper levels of technology-specific support. In practise, substantial windfall profits might result from over-reliance on technology-specific support policy. In practise, the capability of the public sector to set the 'right' technology-specific support levels is seriously hampered by the asymmetric information problem and by the impact of special interest lobbying. For instance, the massive investments in PV installations in Germany point at the difficulty facing the German government in setting the right feed-in tariffs (Frondel *et al*, 2010; BMU, 2011).
- EEG & Fraunhofer ISI neglect in their modelling calculations of support cost the infra-marginal windfall profits by lower-cost producers under technology-specific support systems within specific technology categories.
- By sheer necessity, both EWI and EEG & Fraunhofer ISI have to rely on imperfect 'realisable potential' projections.
- Both EWI and EEG & Fraunhofer ISI do not allow for the additional indirect cost of market and network integration of stochastic-output technologies as compared to conventional technologies. Renewable technology industries tend to exaggerate reductions in network cost of localised production without due regard of the substantial cost implications of both (stochastic) reverse power flows and the last-resort energy supply security services provided by the public grid.

[4] Build Absolutely Nothing Anywhere Near Anything.

We infer that, contingent on the approach taken, the benefits of harmonisation are substantial. Admittedly, this is hard to quantify with a fair amount of certainty. Yet under current conditions in Europe, support harmonisation that solely relies on a harmonised feed-in premium scheme as against harmonisation solely on a technology-neutral certificates-endorsed RQS both have their inherent weaknesses.

2.2 The RE directive

The EU has embarked upon an ambitious policy to promote production and use of energy from renewable sources. This is to support both policies to mitigate human-induced climate change world-wide and EU-wide supply security of energy services . Moreover, localised employment and social cohesion benefits are to result from the fast penetration of renewable energy. In fact, the two most important arguments to pursue a dedicated EU policy to foster renewable energy deployment in addition to the EU Emissions Trading System are:

- Technology dynamics: the presumed rates of future cost reduction through “technological learning” per unit of energy of renewable energy technologies as compared to conventional energy technologies tend to be higher.
- Supply security: renewable energy sources are amply available within the EU. Only for biomass energy a certain dependence might evolve on imported biomass feedstock. This stands in stark contrast to the high and further rising EU dependence on imported fossil fuels (oil, natural gas, coal).

The renewable energy (RE) directive 2009/28/CE mandates member states to achieve a member-state-specific minimum percentage share of *final energy consumption* to be covered by renewable energy sources in target year 2020. The member state targets have been set based on the corresponding actual percentage share in 2005, augmented by a flat rate of 5.5% as well as a member-state specific rate based on average national per capita welfare levels. The EU-wide RES target boils down to 20%. National RES targets can be achieved by national production of electricity, heat, and transport fuels from renewable sources and by making use of the co-operation mechanisms in accordance with specifications and procedures stipulated in the RES directive.

In determining the national RES targets allowance was made for differences in welfare levels rather than for the equalisation of marginal compliance costs. Hence, in principle efficiency gains are to be had from cooperation between member states to develop new renewable resources in lowest-cost locations. To that effect, the RES directive has defined the cooperation mechanisms:

1) Statistical transfers.
2) Joint projects between member states.
3) Joint projects between member states and third countries.
4) Joint support schemes.

The basic idea of what is framed in legal terms “statistical transfers” is that one member state transfers *ex post* negotiated quantities of target compliance units to the counterpart member state in the official transfer deal concerned. Confining ourselves to the intra-EU cooperation mechanisms, cooperation mechanisms (1), (2) and (4) respectively might be interpreted as denoting ascending forms of EU-level support harmonisation (Klessmann et al, 2010).

Compared to a baseline scenario in which the EU-wide RES target for 2020 is met by intensification of present-day fragmented support policies, substantial savings in support expenditures can be gained from support co-operation between member states. To illustrate this, we will focus on a case of the fourth co-operation mechanism: joint support schemes.

In principle, the mechanisms for cooperation between member states can be applied to the production of renewable electricity and renewable heat.[5] From the perspective of primary fossil-fuel-based energy substitution, the unit of account for target compliance, mandated by the RE directive - a specific unit, e.g. MWh or GJ, of final energy consumption- favours renewable heat as against renewable electricity (Segers, 2008). For example, for space heating the use of biomass to replace a unit of fossil fuels yields a factor 2.5 times the number of target accounting units, that would result when using it for electricity generation at a notional 40% conversion efficiency.[6] The same goes for biomass-based renewable heating as compared to electricity generated by ambient energy flows (wind, sun, marine power). Hence, the accounting advantage of renewable heat favours co-operation projects for renewable heat production.

Yet joint support schemes for renewable heat generation are rather difficult to establish from an accounting point of view. For example, so far no comprehensive renewable heat certificates system has been established in any member state.[7] We do not exclude the possibility of integration of renewable heat in joint support schemes on longer term. But for now, our focus is on joint support schemes for renewable electricity only.

2.3 Joint support schemes as a cooperation mechanism

In principle, for member states involved in joint support schemes two ways can be pursued to realise transfers in target accounting units. One is to make a '*statistical transfer* of specified amounts of energy from renewable sources', and the other is to set up a *distribution rule* by participating member states.[8]

The RE directive introduces the *statistical transfer* concept. A certain bi-laterally (or multi-laterally) negotiated amount of final energy consumption from renewable energy sources in one member state can be transferred ex-post 'statistically' - for the (target accounting) purposes of the RE directive - from one member state to another. This can be effectuated by application of an administrative procedure, stipulated by the RE directive for each *statistical transfer* transaction.

In the case of a joint support scheme based on a renewable quota system (RQS) endorsed by certificates it would seem straight-forward to apply the following *distribution rule*: each RQS certificate that was cancelled as proof of delivery (consumption) in a certain accounting year to (by) electricity end-users of renewable electricity counts to the target of the country in which the cancellation concerned took place.[9] The reason is that it is ultimately the consumers of renewable electricity, who by procurement *and* cancelation of RQS certificates have paid indirectly for the support of renewable electricity generation by the RQS scheme.[10]

The agreement regarding distribution rule between participating countries in the joint RQS scheme may also specify additional official payment by participating member states for cross-

5 In accordance with stipulations in Article 10 of the RE directive the third co-operation mechanism, joint projects between member states and third countries, can merely be applied to renewable electricity generation projects in third countries.
6 Neglecting heat losses for space heating and assuming the replacement of fossil fuels by biomass for electricity generation does not affect conversion efficiencies.
7 In contrast with electricity heat cannot be transported over long distances. Yet difficulty in physical exchanges of heat does not impact (de-linked) exchanges of renewable heat certificates.
8 See European Union, 2009: Art. 11(1).
9 The cancellations concerned can have taken place in the accounting year itself or within a pre-specified period (e.g. three months) thereafter. The latter 'reconciliation period' or 'true-up period' enables obligated actors (suppliers and possibly certain large consumers as well) to rebalance their fuel mix, so as to comply with the renewable quota obligation. Obligated actors that are long may sell RQS certificates to the ones that are short. Actors with a remaining compliance shortfall will be liable to a pre-defined incompliance penalty.
10 Consumers of renewable electricity under the RQS scheme (and/or their suppliers) also pay for the certificates transaction costs concerned, sometimes including indirect taxation such as value added tax.

border transfers of RQS certificates. Additional payment may be limited by the extent to which no or less than cost-effective network charges have been paid by renewable generators. To date, in most member states generators do not pay network charges at all for evacuating the power they have fed into the public grid. To the extent that this is also the case for the participating countries, an ex-post cost-reflective compensation for network services provided might be considered, to be paid by importing to exporting countries of RQS certificates. The net cross-border RQS certificates transfer volumes in the accounting year concerned as a compensation basis would seem straightforward, when in neither of the participating countries renewable generators are facing (variable, dependent on the volume of energy injected into the grid) use of network charges.[11] Governments of RQS certificates exporting countries may redistribute these cross-border network services compensations to their respective network operators in proportion to the volumes of RQS-supported renewable energy that were fed into their respective networks. It should be verified that such transfer redistributions are compatible with EU competition law.

In general, it would appear preferable that electricity markets of the participating countries in a joint support scheme are interlinked in advance of the start of such scheme. An example of interlinked national markets into a regional market is the current regional market made up by Germany, France, the Benelux countries and the Nordic countries (excluding Iceland), soon to be extended to the UK as well. Within this regional power market, hourly wholesale electricity prices tend to broadly converge. Only at hours when capacity constraints at interconnecting transmission lines occur, significant deviations might result between wholesale electricity prices at the sub-regional/national level. If countries with disjoint electricity markets participate in a joint support scheme, inefficient interactions between the respective markets power markets and the joint support scheme might occur (Ragwitz *et al.*, 2007).[12]

A pure feed-in tariff system or feed-in premium system as a joint (harmonised) support scheme requires the setting of respectively common feed-in tariffs or common feed-in premiums for each eligible technology category. Moreover such joint support schemes would require the establishment of a common support fund through which support to qualifying renewable power plants in the participating member states can be funnelled. Alternatively, electricity end-users or the government of the country wherein the renewable power plant is located will have to pre-finance support transfers to the plant. Importing participating countries of target accounting units would then have to compensate exporting countries *ex post* at pre-set unit prices.[13]

We consider the setting and implementation of agreed common feed-in premiums or tariffs and an agreed plan for common support financing to pose very high barriers to joint feed-in tariff/premium support schemes. The most difficult issues to tackle will be that such (non-market-led) joint schemes may be perceived to be at odds with tacit national industrialisation policies of some (potentially) participating countries with on the one hand high green industrialisation ambitions and relatively poor renewable energy resources on the other. Besides it might be difficult for the general public in importing countries of target accounting units to swallow outgoing money transfers without comforting prospects of lower support contributions in the consumer electricity bills. Indeed, efficiency gains through the political negotiation process of setting harmonised support rates are not straightforward. Moreover, the *ex post* compensation flows due

[11] Alternatively, compensation for network services provided in the exporting countries can be based on gross cross-border transfer volumes. This might for instance be applied in the case that use of network charges are paid by (renewable) generators in one or more but not all participating member states. See also (Klessmann *et al.*, 2010).

[12] It would seem that the interactions between power markets and joint support schemes are potentially somewhat less negative than brought out by the analysis by Ragwitz *et al.* (2007). Take the notional example of a country with relatively high power prices, say Italy, entering into a joint RQS scheme with another country characterised by relatively low power prices, say Sweden. Then *ceteris paribus*, unified RQS certificate prices in tandem with higher power prices provide a higher boost to deployment of renewable energy technology in Italy than is the case in Sweden. In turn, *ceteris paribus* this will make for higher downward impacts of renewable power generation from RQS-supported installations on power prices in Italy than in Sweden. Hence, to some extent joint support schemes may have dampening impact on differences in power prices among participating countries.

[13] See (Klessmann *et al.*, 2010) for some main accounting approaches.

might trigger credit risks. These implementation problems would seem inhibitive to the introduction of such joint support schemes on a wide multi-lateral scale.

Conversely, expansion of a joint RQS support scheme would seem neither easy but implementable in these respects. Its inherent support neutrality towards qualifying technologies avoids the cumbersome issue of setting technology-specific support values, whilst the cross-border transfers of financial support flows to renewable generators proceeds in a built-in automated fashion through the transfers of RQS certificates. As these transfers are market-based, they have an innate tendency to boost (static) cost-efficacy with respect to the choice of technology and the choice of location of renewable plants.

Yet, as explained in the first section, firstly pure RQS schemes will not lead to efficient results with regard to the minimisation of cost for electricity consumers if the renewable electricity supply curve in the RQS area will turn out to be inelastic. Second, a pure RQS joint support scheme may lock-out currently (very) high-cost technologies with a high potential for rapid[14] unit cost reductions. Third, it may lead to huge network problems in RQS certificates exporting countries if large imbalances in renewable electricity generation between participating countries cannot be checked by application of additional national support instruments by importing countries of RQS certificates. Fourth, it does not leave any leeway for ambitious governments with national industrialisation goals in renewable energy technology industries to foster inlands production volumes of specific high-cost forms of renewable electricity. A last consideration is that electricity consumers in exporting countries of RQS certificates benefit from the downward impact on the RQS certificate price of additional national support instruments in another participating country.[15]

Therefore, joint support schemes might well be considered on the basis of a common RQS system, supplemented - subject to certain pre-set conditions - with country-specific support instruments. For such schemes the following conditions are suggested to obtain:

1) Preferably, candidate members of a common RQS system do already participate in a joint regional electricity market.
2) Application of supplementary national support instruments by opt-in countries on a voluntary basis is possible under certain conditions; the opt-in countries have to finance the supplementary national support instruments themselves.
3) Supplementary support is to be applied only to bridge the financial gap between the high-cost technologies covered and lower-cost technologies that warrant support from the RQS system to become competitive; although based on subsidiarity, supplementary support should mainly cover those sites within the whole RQS region which are endowed with the most attractive renewable resources.[16]
4) Functioning of the RQS certificates market should be strengthened by market widening, increased diversity, and reduction of infra-marginal rents or, at the very least not be affected negatively.

[14] Compared to currently lower-cost technologies that can be profitably deployed by project developers when they merely obtain support benefits from the RQS system in addition to revenues from electricity sales. Promising high-cost technologies need a combination of R&D and market deployment support. Market deployment support is to be capped in volume, whilst support per unit of energy should not be in excess of unit cost, i.e. including an acceptable profit margin.

[15] On the other hand, generation of renewable electricity in participating countries with high resource endowments will be stimulated less by a joint support scheme with less well endowed countries if in one or more of the latter additional national support instruments are being used. Yet interactions of additional national support instruments with the - supposedly joint - electricity market may only result in effects on the electricity price if and when the overall regional renewable electricity portfolio is significantly changed by the use of such national instruments.

[16] Supplementary national support for high-cost technologies for which the renewable resource base is less attractive in the country concerned than in other participating countries should be modest: the potential efficiency loss of the hybrid system should be small.

5) Introduction/adjustments of supplementary support measures should be notified to, and approved by, the RQS supervisory board encompassing representatives of participating countries.
6) Continuation of existing supplementary support measures will be reviewed periodically on their compatibility with the proper functioning of the RQS market and will be contingent on positive assessment results.
7) Approval/rejection decisions by the aforementioned board are to be based on considerations under bullet points 2 and 3.
8) Applications of third countries to join the joint support scheme will be assessed on their impact on the RQS certificates market: any upward impact on the certificate price should be acceptable, which may warrant suitable supplementary support measures in applicant countries with limited lower-cost renewable energy resources.

Such introduction of supplementary national support measures brings in the following advantages to participating countries:

- Overly large imbalances in cross-border transfers of certificates can be mitigated by supplementary measures in participating countries with limited lower-cost renewable energy resources.
- Supplementary measures in a participating country exercise a downward pressure on the RQS certificate price and RQS-area-wide infra-marginal rents, which lowers the support contribution of electricity consumers in notably the other participating countries.
- Supplementary measures widen, and may diversify, the RQS certificate market with positive impacts on market functioning for electricity consumers in all participating countries.
- Better market functioning is coupled with a fair extent of flexibility to integrate national concerns on the basis of subsidiarity, which may positively affect public acceptance in the participating countries of the joint support schemes concerned.
- Such schemes might catalyse eventual EU-wide harmonisation of support for the market uptake of renewable electricity technologies: their hybrid features might increase public acceptance in member states, which currently apply technology-specific support instruments.

3. A case study of a joint hybrid RQS scheme for Norway, Sweden and the Netherlands

After a long period of on-off negotiations Norway and Sweden are set to finally introduce a joint support scheme as per beginning of year 2012.[17] This scheme will be a technology-neutral RQS scheme, patterned broadly after the Swedish Elcert system. Meanwhile, in the Netherlands plans have been floated to transform the current feed-in premium scheme into a hybrid RQS-premium system. This chapter explains the Dutch situation and considers under which conditions an expansion of the imminent Norwegian-Swedish joint support scheme to Netherlands and other EU member states can bring the highest aggregate socio-economic benefits.

3.1 Support instruments in the Netherlands

Over the last decade the Netherlands has experimented with several instruments to stimulate market deployment of renewable electricity. Nonetheless, given the relatively poor low-cost renewable resource base with a virtual absence of hydropower potential, the increase in the contribution of renewable electricity to net power consumption[18] in the Netherlands is noteworthy. The RES-E share increased from 2.5% (2.7 TWh renewable electricity out of a total 104.9 TWh of net electricity consumption) in 2000 to 9.1% (10.4 TWh out of 113.6 TWh) in 2010. Hence, according to these preliminary data the Netherlands achieved its non-mandatory target of 9% in 2010 as specified in RES-E directive 2001/77/CE. Main contributions to Dutch renewable electricity generation in 2009 included (CBS, 2010):

- Wind onshore: 3.3 TWh
- Biomass co-firing: 3.0 TWh
- Biomass waste incineration: 1.3 TWh
- Residual biomass incineration: 0.9 TWh
- Wind offshore: 0.7 TWh.

The current main instrument is called SDE+, which is a feed-in premium system applied to renewable electricity generation and green gas production. A staged application assessment procedure is applied that seeks to fill the available potential of lower cost renewable energy technology categories before proceeding to the next technology categories in ascending order of cost per unit of energy. In fact, the current administration seeks to meet the national target of a 14% share for renewables in final energy consumption by target year 2020, as specified for the Netherlands in RE directive 2009/28/CE in the most cost-effective way. For meeting the 14% target for renewable energy in aggregate final energy consumption[19], the share of electricity from renewable sources in Dutch gross electricity consumption should rise at least to a quite ambitious 35% in 2020. The Dutch NREAP (National Renewable Energy Action Plan) submitted to Brussels in 2010 even envisages a rise of this share to even 39% without any recourse being made to renewable generation abroad (Beurskens and Hekkenberg, 2011). The main marginal generation option for meeting such a target is offshore wind. Excluding near-shore wind power capacity, currently 228 MW of offshore wind has been installed in the Dutch exclusive economic zone of the North Sea. For reaching a renewable share of 35% in Dutch gross electricity consumption in target year 2020, approximately 5 GW of offshore wind is to be installed by then.

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[17] "*Norway, Sweden strike deal creating joint green tags market*". Platts Renewable Energy Report. Issue 234/ July 11, 2011. Pages 1 and 3.

[18] Including network losses but excluding own use by power plants.

[19] That is, the share of renewable energy in the sum of final electricity consumption, final heat consumption, and automotive fuels consumption.

To assist the Dutch government in reducing the cost to Dutch society in meeting the national target for year 2020, the association of Dutch energy suppliers, *Energie-Nederland*, has filed proposals to reform the Dutch support scheme with regard to renewable electricity. The proposed scheme is a *hybrid renewable quota system*. In first instance, this scheme is to be a national support scheme, but compatibility with a possible bottom-up market-based harmonized support scheme is one of its design criteria. The proposal is based on two studies, commissioned by *Energie-Nederland*, prepared by ECN (Jansen *et al.*, 2011) and Frontier Economics (2011) respectively. Meanwhile, in recent official communications the Dutch government has pointed out that it is considering the introduction of a renewable quota system by year 2015 (*inter alia:* EL&I, 2011).

The Dutch renewable electricity supply curve is rising relatively steeply. This implies that the introduction of a pure (technology neutral) RQS in combination with an ambitious national system target will result in high certificate prices. The consequential high infra-marginal rents for system participants with relatively low renewable electricity generation costs, such as operators of biomass co-fired power plants and onshore wind parks stand to assume non-acceptably high levels from a societal perspective. In order to minimize infra-marginal rents ('windfall profits') whilst at the same time retaining to a large extent the key advantages of a pure, technology-neutral RQS, *Energie-Nederland* proposes a hybrid RQS system marrying a renewable quota scheme (renewable electricity certificates trading system) with the existing Dutch technology-specific feed-in premium system for application to the promising but expensive renewable electricity generation technology categories. Projections by ECN (Jansen *et al.*, 2011) suggest that a *national* hybrid RQS system brings in modest net socio-economic benefits to Dutch society, when compared to a feed-in premium support system. As compared to the prevailing feed-in premium system, a hybrid RQS system enables project sizes which capture higher economics of scale. Moreover, hidden regulatory rents included in premiums under a feed-in premium system that result from the asymmetric information problem and lobbying by special interests can be mitigated under a hybrid RQS system. A major caveat of the latter is constituted by project permitting problems. These may occasion backlogs with respect to expected new renewable electricity capacity. This, in turn, could raise the RQS certificate price above envisaged price intervals. Hence, due flexibility in hybrid RQS system design, monitoring of permitting bottlenecks at lower administrative levels, and when needed active de-bottlenecking through interventions by the central government should be considered.

When the proposed Dutch support system could be merged with the existing Swedish RQS system into a joint hybrid support scheme, the net benefits to Dutch society stand to rise substantially.[20] Dutch electricity consumers would gain significantly by having to pay lower support costs on the electricity bill. The main reason is that Sweden boast significant lower-cost renewable electricity potential on top of levels that need to be harnessed to achieve Sweden's national renewable energy target for year 2020. The marginal renewable generation in Sweden will be mainly onshore (including near-shore) wind, whilst in the Netherlands it will be mainly the much more expensive offshore wind technology. In the margin, the Netherlands would have to pay lower support cost through net import of RQS certificates instead of supporting inlands generation by high-cost renewable technology. Moreover, due to system expansion the RQS certificates market will be more liquid and less volatile. Any market power problem, if at all existing in a national setting[21], will be further reduced. Also Sweden will benefit from the market efficiency benefits of RQS system expansion. Furthermore, the Swedish economy at large and its renewable electricity supply industry in particular stand to gain from net transfers from export of RQS certificates to Dutch obligated actors. For the Swedish electricity consumers the picture is mixed. Net demand for RQS certificates from the Netherlands has an upward impact on the certificate price, contingent on the steepness of the RQS-region-wide renewable electrici-

[20] See (Jansen *et al.*, 2011) for a detailed cost-benefit analysis.

[21] Analysis by Frontier Economics (2011) for the Netherlands and the SEA for Sweden suggest that market power is in issue of minor significance.

ty supply curve. A rise in the certificate price will be passed on to the electricity bill of non-exempted Swedish electricity consumers. On the other hand, the merit-order effect of higher renewable electricity generation in Sweden will translate into lower electricity prices, from which Swedish electricity consumers will benefit. Conversely, Swedish non-renewable electricity generators will be facing lower sales revenues.

As already pointed out in section 2.3 above, the issue of potential additional costs to Swedish network operators warrants special attention. To the extent that Swedish renewable generators do not pay cost-reflective use-of-system tariffs, these costs are not internalised. In that case, it could be considered that the Swedish government will receive an ex-post compensation from the Netherlands on the basis of net export volumes of RQS certificates. Subject to compatibility with EU competition law, this could be part of the distribution rule of target accounting units under the joint support scheme concerned.[22]

3.2 The imminent joint support scheme between Norway and Sweden: scope for system expansion

Norway and Sweden are set to introduce a joint RQS support scheme soon: as currently foreseen with effect of 1 January 2012. Will the foregoing analysis also apply to a merger into a joint hybrid RQS support scheme between the envisaged Norwegian-Swedish on the one hand and Dutch support systems in the other?

In fact, the net benefits on both sides will be higher. Although a supporting detailed study is still lacking, use of arguments deduced from international trade theory bears this out. Like the Swedish one, the Norwegian renewable resource base is much ampler and quite different from the renewable resource base of the Netherlands. This enhances the *gains from trade* by way of a joint hybrid RQS support scheme. Again, contingent on the supplementary the hybrid nature on mainly or exclusively[23] the Dutch side can both improve market efficiency (lower system-wide infra-marginal rents) and, if applicable, mitigate network problems. Through well-designed supplementary measures, such as the Dutch SDE+ (feed-in premium) instrument, net Dutch import volumes of RQS certificates lower and better managed. This will contribute to further market widening and supply-side diversification and will have a downward impact on the RQS certificate price, whilst reducing price volatility.

[22] This issue is discussed in some more detail in Section 2.3 above.
[23] Contingent both on subsidiarity and on meeting *ex ante* conditions to be defined by to be agreed upon system design.

4. Concluding observations

Main findings of this paper are the following:

- Substantial support cost savings can be realised on the EU-level by application of the cooperation mechanisms of the RE directive. This is especially valid for the fourth mechanism: *joint support schemes*.

- Joint support schemes *on a larger European scale* based merely on *technology-specific support instruments* such as notably feed-in premiums or, alternatively, merely on *technology-neutral market-led support instruments* such as a pure renewable quota system each have their specific inherent weaknesses in terms of market efficiency and feasibility of implementation.

- The Dutch association of energy suppliers, Energie-Nederland, has put forward a proposal to the Dutch government to introduce a hybrid renewable quota system (RQS). It is comprised of:
  - A renewable quota system such as the one currently applied in Sweden.
  - Acceptable *additional national support measures* to promising technologies that need more support than just the RQS system support to bridge the cost gap on the basis of the subsidiarity principle, allowing for national concerns.
  - *Acceptability* has to be decided on by a RQS supervisory body based on two key criteria: (i) the additional national support measures have to be in line with a well functioning RQS certificates market and (ii) they should not have a disproportional distortive market effect.
  - A closed-end (with budget ceilings) feed-in premium instrument is a suitable additional support measure for promising higher-cost technologies in the Netherlands.

- The concept of a *hybrid RQS* as a basis for joint support schemes on a larger European scale has been explained by a concrete case: a possible joint support scheme between Norway, Sweden and the Netherlands.

- The bottom line is that in the presence of the rather ambitious European RES target for year 2020 the European RES-E supply curve will be steeply bending upwards at levels required to meet this target. On the other hand, the single market concept will be more compelling the higher is the penetration of RES-E in the European electricity market. Therefore, a certificates-endorsed RQS is an attractive vehicle for achieving the cost-saving benefits from *gains for trade* and *economies of scale*, **provided this vehicle is complemented with acceptable national support measures for high-cost RES-E technologies**. The latter will improve market functioning, mitigate windfall profits, enhance the perspectives for improved dynamic market efficiency through greater technology diversity. Moreover, due allowance for technology-specific national concerns might improve the acceptance of a common market-based support scheme.

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