Expansion of the Swedish Elcert certificates system to the Netherlands: a cost-benefit analysis

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Abstract: This paper investigates the net benefits of adjusting the Dutch renewable electricity support system from a feed-in premium (FIP) scheme into a hybrid renewable portfolio standard (RPS), i.e. an RPS on top of, and well-integrated with, the existing FIP. The alternative scenario envisages, moreover, the establishment of a joint support scheme with Sweden on the basis of the existing Swedish Elcert certificates system. The paper benchmarks the costs of the alternative renewable electricity support scenario against the baseline FIP scenario. A major limitation is the exclusion of network impacts. Moreover, the analysis of the economic impacts in Sweden is limited to distributional effects. The aggregate welfare impact for the Netherlands is robustly positive. In both countries major winners and losers are identified.

Keywords: *Hybrid RPS schemes, Joint support schemes, Bottom-up harmonisation of national support schemes*

1. Introduction

The paper draws on an ongoing study by the Energy research Centre of the Netherlands, ECN, into the social costs and benefits of readjustment of Dutch renewable electricity support from a feed-in premium system (FIP) into a FIP in combination with a renewable portfolio standard system (RPS), hereafter referred to as *a hybrid RPS system*. The RPS is endorsed by certificates (Elcerts), issued on behalf of qualifying renewable generators. The latter sell their certificates to electricity suppliers and certain end-users, who have to prove compliance with the mandatory RPS target with Elcerts. The RPS target implies that a certain calendar-year-specific minimum % of electricity deliveries (suppliers) or consumption (end-users) has to be sourced from qualifying renewable generation technologies. Some of these technologies need more support to become competitive on the electricity market. The FIP regulations may provide additional technology-specific support to the latter technologies, contingent on government decisions. The hybrid RPS system concept as a basis for EU support harmonization was introduced at meetings of a CEPS/ECN Task Force [1].

This paper focuses on a two-country hybrid RPS as an example of bottom-up harmonization of the (envisaged) national support schemes for RES-E (renewable electricity). The Netherlands and Sweden are considered to launch a joint hybrid RPS on the basis of the existing Swedish Elcert certificates system. The EU Renewable Energy Directive (RED), 2009/28/EU allows such bottom-up harmonization subject to certain conditions. It is to be an application of 'joint support schemes', i.e. one the 'cooperation mechanisms' in the RED.

The key driver towards potential market-based joint support schemes is to achieve higher cost-effectiveness in target compliance by capitalizing on the gains from trade. Expanding the domain of a well-designed joint support scheme may lead to a reduction of total RES-E generation costs to achieve the sum of the national RES-E targets[1] of the participating countries [2],[3].

[1] *The RED sets mandatory national targets for the share of renewables in final energy consumption.*

The goal of this paper is to evaluate the economics of a Dutch-Swedish joint hybrid RPS support scheme from a Dutch societal perspective. Towards that aim, it compares the latter support scheme as the alternative scenario with the existing Dutch FIP system as baseline. In the alternative scenario, the existing Dutch FIP system, henceforth referred to with the Dutch acronym SDE, is retained in the Netherlands in a fully compatible way with the joint hybrid RPS support scheme.

The baseline scenario consists of a continuation of the existing national support schemes: the Dutch SDE scheme and the Swedish Elcert certificates scheme respectively. The alternative joint hybrid RPS on suppliers is presumed to be launched as from the start of year 2014. Part of the additional RES-E consumed in the Netherlands might be produced by qualifying Swedish RES-E generators.

The analysis considers primarily the vantage point of Dutch society. Even so, it investigates distributional effects on major stakeholder categories in both the Netherlands and Sweden.

This paper is structured as follows. First the methodology is succinctly explained (Section 2). Research results are shown in Section 3. Section 5 winds up with conclusions.

2. Methodology

2.1. Baseline scenario background

2.1.1. Baseline scenario

To date, the SDE is the Dutch government's main subsidy instrument in support of the deployment of renewable electricity. It is a feed-in premium system, granting technology-specific production subsidies for renewable generators. It is attempted to set the SDE premium for an installation of a certain SDE category commissioned in a certain calendar at such a level to cover the so-called 'financial gap' without overcompensation.

The so-called *base rate* for an installation's SDE premium is determined by the installation's anticipated RES-E generation cost with some *adjustment factors*. Part of the anticipated premium is paid at regular intervals on the basis of actual production. After each calendar year settlement of last year's SDE subsidy is based on the difference between the base rate and last year's average baseload price. However, an electricity *price floor* and a corresponding maximum SDE subsidy rate is determined upon closure of the SDE subsidy contract.

Adjustment factors relate to:

- Insurance costs: to provide some hedge against the risk for the RES-E operator that the electricity price drops through the set electricity price floor.
- Transaction costs: anticipated transaction costs to sell electricity (especially for SDE categories with many small-scale RES-E operators).
- System imbalance charges: applicable for wind power, and PV.
- Profile costs: applicable to intermittent sources assuming a non-negligible share in the electricity fuel mix (relate to the downward 'merit order' effect on the power price and to the technology-specific time profile of electricity production which may yield below-average or above-average baseload prices).

The electricity price floor implies a non-negligible risk to the investor and his financers. If the electricity price is to drop below the set electricity price floor, the SDE subsidy rate will not suffice to provide full coverage of the 'financial gap' that needs to be bridged to render the RES-E power plants concerned financially viable. In practice, the adjustment rate for insurance against this risk does not give complete solace.

2.2. Baseline scenario design

The baseline scenario is taken from [4], a study also used for the design of the Dutch Renewable Energy Action Plan. The baseline scenario assumes an intensified continuation of the SDE feed-in premium scheme, so that a 35% in gross energy consumption will be achieved by 2020 completely based on (45 TWh) inlands renewable energy generation. Furthermore, the SDE is supposed to become financed through a surcharge on the electricity bill instead of being paid by government finances. As such, the SDE forms the basis for a stable investment climate, where energy companies can plan new renewable energy investments years in advance. This stable investment climate is a necessity for reaching high levels of renewable electricity in the short time period up to 2020.

The wind power capacity grows to 6000 MW onshore in 2020 and 6000 MW offshore slightly thereafter. Co-firing of biomass in coal fired power plants is supported through subsidies, and is projected to reach on average up to 20% co-firing, on energy basis, for all coal fired power plants in operation. The economic co-firing potential in 2020 is foreseen to be around 10 TWh. The baseline scenario includes a significant rise in electricity production from stand-alone biomass installation, up to 7 TWh in 2020. No options are limited by budget ceilings, except for solar PV. Figure 1 below indicates the total RES-E production, differentiated by technology, for the period 2012-2020.

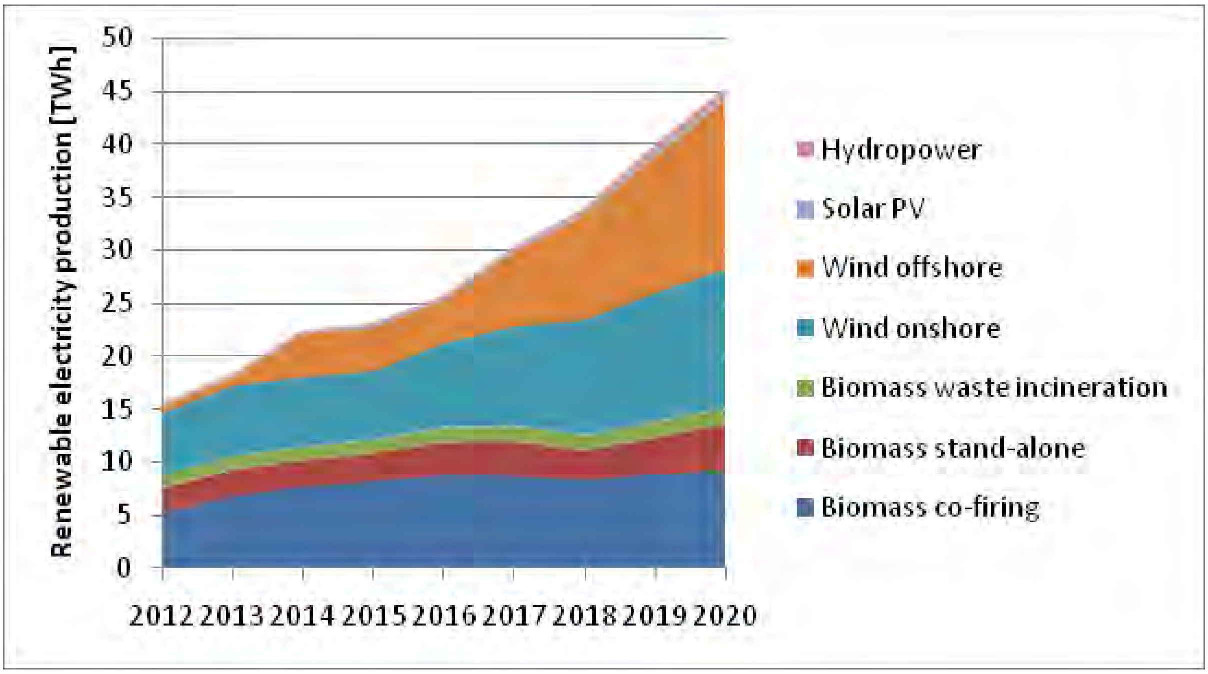

Fig. 1 Baseline scenario: Dutch RES-E production [TWh].

For reasons of containing the modeling complexity, we have refrained from accounting for the (in practice very small) negative impact of changes in the SDE surcharges on power demand.[2]

2.3. Alternative scenario background

The alternative RES-E stimulation scenario is predicated on the presumed realization of a joint support scheme with Sweden as per 1 January 2014. The basic idea behind such a scheme is that within a certificates-based joint RPS support scheme, in principle, each of the participating countries has the right to introduce additionally at the national level supplementary support measures. (Changes in) supplementary support measures can be adopted in close bilateral government-to-government consultation and in a way that is supportive to the well-functioning of the joint Elcert certificates market. In the case of the Netherlands this will be the existing SDE support scheme. The joint support scheme will be integrated into the SDE regulations.

In the absence of the SDE high-cost marginal Dutch RES-E generation options, notably offshore wind, would determine the – in that case potentially very high – Elcert price. Hence, given the steeply rising Dutch RES-E supply curve, supplementary Dutch support to high-cost renewable generation options is warranted to contain windfall profits in both the Netherlands and Sweden. Moreover, it provides an additional instrument to limit the net import volume of Elcerts from Sweden, should the joint Elcert market and the Swedish RES-E sector show signs to become overstretched.

The Swedish RPS, called "the electricity certificate system", requires all electricity suppliers and certain electricity users to purchase Elcert certificates equivalent to a pre-set target proportion of their respective electricity demand, set for each calendar year of the Swedish RPS scheme. The scheme became operational as per 1 May 2003 and is scheduled by law to last until the end of year 2030. Its main stated purposes are to help increase the production of renewable electricity and reduce emissions of greenhouse gases.

Information from the Swedish Energy Agency ([5], [6]) suggests that from both an effectiveness and a cost efficiency criterion, the Swedish RES-E support scheme appears to function well. The Swedish support scheme is well on track to meet its pre-set RES-E deployment objectives. RES-E support cost hover around €ct 3 / kWh of qualifying RES-E.
In a previous ECN study Sweden has been identified as the best fit for a joint hybrid RPS support scheme with the Netherlands [7]. Besides the well functioning of the Swedish support scheme, major reasons include:

- The quite diverse portfolios of RES-E resources between Sweden and the Netherlands, making for a large *gains from trade* potential.
- The scope for additional RES-E production in Sweden at relatively moderate cost on top of complying with Sweden's RES target in 2020 as laid down in the Renewable Energy Directive. In contrast, the Netherlands is only to meet its 2020 RES target completely inlands at quite high cost. This further strengthens the potential for win-win trade.

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[2] *For the same reason, the (small) negative impact of (changes in) the cost of Elcert certificates to be borne by suppliers/end-users on power demand has been disregarded likewise.*

2.4. Alternative scenario design

We assume that differences in market conditions facing RES-E project developers under the baseline and alternative scenario respectively, small differences in technology-specific generation costs will occur. Because of space restrictions, we refer to [8] for specific production costs for different production categories for both the SDE and RPS systems and further explanation of underlying cost factors.

It is assumed that the launching date will be beginning of 2014.[3] As explained in [8] certain regulatory costs have been assumed for the Dutch public sector, CertiQ as the Dutch Elcerts issuing and tracking agency as well as RES-E generators and suppliers. We note that the in practice important benefits of improved Elcert market functioning as a result of market domain expansion [3] have not been captured in our modeling exercises.

Our main modeling assumption regarding the evolution of the Dutch RES-E generation are the following ones. As a result of net import of Elcerts from Sweden corresponding to about 9 TWh in 2020, Dutch RES-E generation is projected correspondingly less than under the baseline scenario. This refers especially to high cost options wind offshore and (in the Netherlands) biomass stand-alone. In Sweden the extra 9 TWh are projected to be generated by primarily wind onshore.

3. Results

The cost-benefit analysis results are succinctly explained below. Once more we refer to [8] for more details.

3.1. The Dutch societal perspective

The annual cashflows of (positive or negative) net benefits to the Dutch economy of the alternative scenario over and above the baseline scenario are shown in Table 1. Positive (negative) figures indicate lower (higher) costs for the alternative support scheme than the corresponding baseline cost. The overriding factor determining the overall impact for the Dutch economy are the strongly positive net savings on differential RES-E cost to the Dutch economy. The savings on lower production by high-cost marginal RES-E generators in the Netherlands are dominating the extra costs of net import of Elcert certificates from Sweden. Also the projected slightly lower per unit technology-specific generation cost are relatively modestly explain these results.

Table 1. Shift to Alternative III: RPS SE - Annual incremental net benefits to the Netherlands [€$_{2010}$ million].

	2013	2014	2015	2016	2017	2018	2019	2020
Savings on differential RES-E cost		217	234	275	281	459	633	805
Savings on imbalance cost of wind power		0	0	0	0	6	14	21
Regulation cost public sector	-20	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
Regulation cost CertIQ	-1	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Regulation cost suppliers and RES-E generators	0	-1	-1	-1	-1	-1	-1	-1
Total (€ million)	**-21**	**214**	**232**	**272**	**278**	**464**	**645**	**824**

[3] *In practice, even in a smooth preparation process it might not be earlier than in 2015 or 2016.*

Table 1 (cont.)

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
757	698	629	612	629	568	522	497	329	280	275	198	55	-50	-153
21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
776	**718**	**648**	**631**	**648**	**587**	**541**	**516**	**348**	**299**	**294**	**217**	**74**	**-30**	**-134**

To bring out the more near-term impact of a change from the baseline scenario to the alternative scenario, we calculated the projected NPV of differential cash-flows for the period 2013-2020. More structural trends can be observed from the projected NPV pertaining to the period 2013-2035 and its difference with the one pertaining to 2013-2020. For the purposes of this study application of a *real* discount rate[4] of 2.5% would seem appropriate. Reasons are the relatively modest size of non-diversifiable project risks, whilst the cost risks of RES-E tend to be counter-cyclical with respect to macro-economic business cycles. In showing the sensitivity of the results to the discount rate applied, we have applied a 0% and 5% discount rate as well.

The resulting NPV values are shown in Table 3. Applying the recommended 2.5% discount rate, our projections indicate that a shift in 2014 from the baseline support scheme to the alternative one would reduce, in the period 2013-2020, the costs of RES-E support to the Dutch society by 2.4 billion Euros (at prices of year 2010). The resulting cost reductions for Dutch RES-E market stimulation as measured against the baseline benchmark are set to continue after 2020 reaching an aggregate level of 4.2 billion Euros in the period 2021-2035, whilst the projected upshot for the total analysis period 2013-2035 is 6.6 billion Euros saved on RES-E market stimulation. These results are insensitive in nature to the choice of discount rate within the (rather wide) 0-5%/a interval.

Table 3. Net benefits from a Dutch socio-economic perspective of a shift in year 2014 from the prevailing SDE support scheme to a joint hybrid Renewable Portfolio Standard support scheme with Sweden (RPS SE).

		Net present value in 2010 (€$_{2010}$ billion)					
Period		2013 - 2020			2013-2035		
Discount rate		0 %/a	2.5 %/a	5 %/a	0 %/a	2.5 %/a	5 %/a
Alt.Scen.	RPS SE	2.9	2.4	2.0	9.0	6.6	4.9

Source: authors' projections

3.2. Distributional effects upon Dutch stakeholders

Apart from the relatively limited cost to the *public sector* for introducing and supervising the demand-side RPS system, the shift to such a support scheme is budget-neutral. The distributional effect for CertiQ is slightly positive as this agency will be charged with the task of operating the Elcert certificates tracking system in the Netherlands, in close association with its Swedish counterpart. High-cost RES-E generators are set to be strongly adversely

[4] *A real discount rate is roughly equal to the projected nominal discount rate applicable to projected cashflows in current prices minus the projected rate of general price inflation. Our cashflow analysis is based on cashflows at a constant general price level of year 2010, i.e. "at prices of to-day". The recommended nominal discount rate with a projected rate of inflation of 2% would be for the present study: ≈ 2.5% + 2% , i.e. ≈ 4.5%.*

affected, whilst biomass co-firing thermal power plants will gain to a lesser extent. Also other non-RES generators stand to gain: they may fill part of the gap resulting from lower RES-E production volumes and benefit from a according to our modeling results very small upward power price effect as well. Power consumers are poised to lose initially but are indicated to win as from year 2019 to an increasing extent with savings on SDE cost surcharge on their electricity bill as the dominating underlying factor.

3.3. Distributional effects upon Swedish stakeholders

Exercises with the COMPETES model suggest that net Dutch imports of Elcerts up to a level of about 9 TWh is to lead to a maximum upward effect of the Elcert price of €ct 1.1/kWh to a level of €ct 3.49/kWh in 2020, after which year this upward effect will gradually dissipate. Remarkably the resulting extra RES-E production in Sweden is poised to have a much stronger downward effect on the average baseload price in Sweden, than the corresponding reduction in the RES-E production expansion in the Netherlands will have on the average Dutch baseload price in opposite (upward) direction. Differences in network topology, robustness and flexibility (also on the demand side) of the respective power network systems and the size of interconnections to evacuate surpluses and import national power deficits might be undercurrents of this result.

A strong winner will be the *Swedish RES-E sector* at large, most strongly the Swedish onshore wind sub-sector. The drop in baseload power prices in Sweden is good news for power users and bad news for notably *power generators that do not qualify for Elcerts* (including operators of pre-2003 hydro power plants). On average, qualifying generators will be more than compensated by extra revenues from Elcert sales. Assuming a zero price elasticity of power demand exercised by unprivileged consumers, the overall effect of the Alternative III scenario on Swedish power consumers can be disaggregated into the following underlying effects:

- A negative effect on account of the at least initially significantly upward reacting Elcert price. Contingent on company market strategy and competition circumstances on the Swedish retail market, Swedish suppliers will pass through their costs of acquiring Elcerts to comply with the Elcert system target more or less completely to their customers on a *pro rata* basis. The size of the effect depends on the Elcert price reaction and on the system target.
- A positive effect on account of the reaction of the wholesale market and its knock-on effect on the power price on retail market. This combi-effect regards all final power users.
- With a strong caveat for the crudeness of our modeling simulations of the Swedish distributional effects – our modeling outcomes suggest that the second effect is the dominant one. If this result can be confirmed indeed by more profound research, this will be good news for Swedish electricity consumers.

4. Conclusions

The main conclusion is that the Dutch economy would gain in a robustly positive way from the introduction of a joint hybrid RPS support scheme with Sweden. In the Netherlands, the largest distributional effects fall upon RES-E generators, other generators, and power consumers. On aggregate, Swedish renewable generators applying qualifying technologies for participation in the Elcert system are set to be clear winners and other Swedish generators clear losers. Less robust indications suggest that Swedish consumers may benefit.

Our quantitative analysis has focused on those effects that can be quantified with a fair amount of robustness. For example, in our quantitative analysis we have refrained from taking recourse to sweeping, speculative assumptions on the nature and volume of external effects of specific 'innovation pathways', the innovation dynamics of inter-technology competition, the strategic value of bottom-up harmonisation of national support schemes, etc. A major limitation is the exclusion of network impacts. Moreover, more elaborated research is needed to analyse the impacts of the joint Dutch-Swedish support scheme considered here on the Swedish economy.

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