Design aspects of TGC schemes in the 2030 framework

The Federation of Finnish Technology Industries

Final Report

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Content

1. Foreword

This report has been commissioned by Federation of Finnish Technology Industries from GreenStream Network. The report has been written between August and September 2015, and thus reflects the situation and available information at that time. The authors of the report are Juha Ollikainen and Roland Magnusson.

2. Introduction

The EU's Renewable Energy Directive[1] sets EU's renewable energy target for 2020. The EU's common target is that 20 % of final energy consumption is from renewable sources by 2020. This target has been further allocated to EU countries. Today's renewable energy support schemes in Europe aim mainly at fulfilling these targets.

EU countries have already agreed on a new target; the aim is that at least 27% of final energy consumption in the EU is from renewable sources by 2030. It has been agreed that the target will be binding on the EU level and fulfilled through contributions of EU countries[2]. The European Commission will propose a new renewable energy package in 2016-2017.This package will include proposals for a Renewable Energy Directive for 2030, best practices in renewable energy support schemes and bioenergy sustainable policy[3]. Guidelines on state aid for environmental protection and energy will be reviewed in 2017-2019[3].

The European Commission's "summer package", launched in July 2015, is a part of the EU's Energy Union strategy that is supposed to deliver the 2030 climate and energy targets. The package launched a public consultation that on its part relates to the renewable energy support schemes in the 2030 context. Following the public consultation on energy market design, the commission will prepare legislative proposals in the second half of 2016. These legislative proposals may consist of amendments to the internal market legislation and the Renewable Energy Directive.[4]

The purpose of this study is to support the Federation of Finnish Technology Industries in forming its position on the future support schemes for electricity from renewable energy sources (RES-E) that will be used in achieving the 2030 targets. The subject of the study is selected aspects of Tradable Green Certificates (TGC) as on the context of the EU and the 2030 targets.

Given that most EU countries have existing schemes promoting RES-E, the question of an EU-wide scheme is effectively a question of harmonising existing schemes. It is useful to think about the harmonisation in terms of the benefits and costs and how the

[1] Directive 2009/28/EC on the promotion of the use of energy from renewable sources

[2] European Council conclusions 24.10.2014 (EUCO 169/14)

[3] European Comission's communication on a Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM(2015) 80 final, COM(2015) 80 final ANNEX 1)

[4] European Commission's press release 15.7.2015 (http://europa.eu/rapid/press-release_MEMO-15-5351_en.htm)

benefits and costs are divided between individual member states. Jacbosen et al. (2014)[5] make a division between primary and secondary benefits.

The primary benefits are the reduced target compliance costs. Compliance costs are reduced as a consequence of a country with high marginal RES-E deployment cost deploying RES-E in a country with low marginal RES-E deployment costs. The secondary benefits include all other benefits from RES-E deployment, among others employment and corporate tax effects, and security of electricity supply.

Valuing the primary benefits is possible, with a certain margin of error. Valuing the secondary benefits is much more difficult, if not impossible, e.g. it is often claimed that some RES-E technologies such as biomass create more permanent jobs than the number of jobs that they replace in conventional generation, see discussion in Jacbosen et al. (2014). Thus, the value that countries put on secondary benefits is a political decision.

3. Renewable energy targets and support schemes in 2030 framework

In October 2014, the European Council agreed [6] on the 27% renewable energy target for 2030. It was also agreed that the target will be binding at EU level, but it will not be translated to nationally binding targets. The target will be achieved by member states contributions guided by the need to deliver collectively the EU target without preventing member states from setting their own more ambitious national targets and supporting them. The targets will be achieved while fully respecting the member states' freedom to determine their energy mix.

Earlier, in January 2014, the European Commission's communication on the 2020-2030 framework [7] outlined a new governance process for managing the delivery of the targets. In the process, each EU country would do a national plan including among others the country's commitment on EU's 2030 renewable energy target and the related support

[5] Jacobsen, Henrik Klinge, Lise Lotte Pade, Sascha Thorsten Schröder, Lena Kitzing (2014) Cooperation mechanisms to achieve EU renewable targets, Renewable Energy 63, 345-352

[6] European Council conclusions 24.10.2014 (EUCO 169/14)

[7] European Commission's communication on A policy framework for climate and energy in the period from 2020 to 2030 (COM(2014) 15 final)

mechanisms. The Commission will review the plans and assess whether they are sufficient from the perspective of the EU's overall target. If a plan is deemed insufficient, a deeper iterative process would take place with the country concerned with the aim of reinforcing its content. The governance of the 2030 framework is developed as a part of governance system of the EU's Energy Union Strategy [8].

The commission's "summer package", launched in July 2015, is a part of the EU's Energy Union strategy that is meant to help to deliver the 2030 climate and energy targets. The package launched a public consultation on the new energy market design[9]. With regard to the renewable energy support schemes the communication recognises, among others, that:

"The support schemes for renewable energy are almost always national in scope. A more coordinated regional approach to renewable energy – including support schemes – could deliver considerable gains, among others by promoting cost-efficient development of renewable generation in optimal geographic locations".

The commission's questions directly related to the support schemes are:

> *7) What needs to be done to allow investment in renewables to be increasingly driven by market signals?*
>
> *9) Should there be a more coordinated approach across Member States for renewable support schemes? What are the main barriers to regional support schemes and how could these barriers be removed (e.g. through legislation)?*

Following the public consultation on energy market design, the commission aims to prepare legislative proposals in the second half of 2016. The proposal may include amendments e.g. to the RES directive and internal market legislation.

Basically, when looking at the questions of this consultation, discussion on the possibilities of an EU-wide TGC scheme could be topical again. An EU-wide scheme for TGCs was discussed in preparation of the RES directives in 2001 and 2009. The European Commission and number of EU countries supported this type of scheme during the preparation of the 2009 RES directive. It was believed that the common TGC scheme would encourage harmonisation of the European electricity market and the supporters of the scheme saw also that different national support schemes would lead to market distortions. Eventually the idea did not go through and the renewable support remained in their current fragmented form.[10] In the preparation of 2030 framework, there seems to be less discussion on the EU-wide TGC scheme.

[8] European Comission's communication on a Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM(2015) 80 final)

[9] European Commission's communication on launching the public consultation process on a new energy market design (COM(2015) 340 final)

[10] Tosun J., Biesenbender S and Schulze K (2015). Energy Policy Makin in the EU: Building the Agenda

From certain perspectives such scheme could fit well to the 2030 framework where the binding target is set on EU-level, but not divided further to the EU countries. The common TGC scheme would remove the need of the iteration processes between the Commission and the member states on the national plans and commitments concerning renewable electricity. It would also respond the need for coordination, market orientation and cost effectiveness of renewable electricity support. A top down approach is not the only way towards the multinational TGC scheme in Europe. An alternative path is gradual harmonisation of the national schemes as has been seen in the case of the joint Swedish-Norwegian TGC scheme. TGC schemes have been introduced in several EU countries including Belgium, Italy, Poland, Romania, Sweden and U.K[11]. The schemes of Sweden and Norway were combined from the beginning 2012 and this is the first and until today the only example where the chance for joint support schemes defined in the 2009 RES directive[12] has been applied.

4. Design aspects of TGC schemes

4.1 The basic principle of a TGC scheme

The basic principle of a TGC scheme is simple. Electricity users are obligated to purchase green certificates for certain proportion of their electricity use. This quota obligation reflects the renewable energy target of the area. The producers of renewable electricity are given green certificates on each unit of electricity produced. Once the quota obligation and rules for earning the certificates are set, market is allowed to define the price of certificate and consequently the support for renewable electricity. In an efficient market, the certificate price reflects the marginal cost of RE deployment. It has been many times argued in literature (see e.g. Aune et al 2010)[13], that TGC scheme provides a cost effective achievement when the target is to secure a certain share of renewable in final consumption (Figure 1 illustrates the basic principle of a TGC scheme).

[11] del Rio P., Ragwitz M., Steinhilber S., Resch G., Busch S., Klessmann C., de Lovinfosse I., Van Nysten J., Fouquet D., Johnston A. (2012): Key policy approaches for a harmonisation of RES(-E) support in Europe - Main options and design elements

[12] Directive 2009/28/EC on the promotion of the use of energy from renewable sources

[13] Aune et al. (2010). Implementing the EU renewable target through green certificate market. Statistics Norway, Research Department.

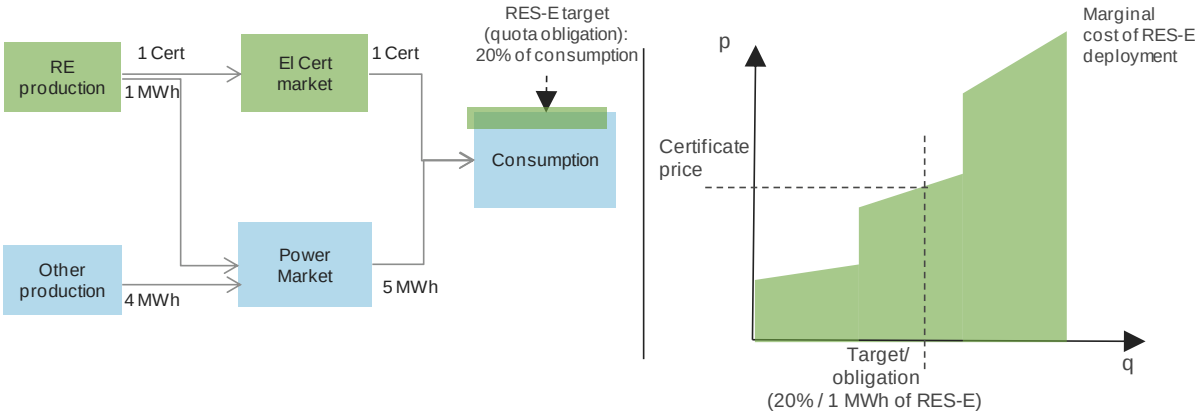

Figure 1. Basic principle of a TGC scheme (in this illustrative example electricity consumption is 5 MWh and RES-E target 20% of consumption).

While the basic principle of a TGC is relatively simple, in practise there is a plethora of design options. These design options and the consequences for the operation of the scheme have been discussed among others by del Rio et al. (2012).[14] The primary design elements are presented in Table 1. In addition to these elements, there is a long list of other design options of secondary importance. These include among others, the following: role of domestic schemes[15], floor price, price ceiling, sanctions, banking, borrowing, headroom, duration of support for individual installations. Here, the focus is on the primary design elements, and especially the geographical coverage and banding.

[14] del Rio P., Ragwitz M., Steinhilber S., Resch G., Busch S., Klessmann C., de Lovinfosse I., Van Nysten J., Fouquet D., Johnston A. (2012): Key policy approaches for a harmonisation of RES(-E) support in Europe - Main options and design elements

[15] The question is that are states allowed to run overlapping support schemes alongside a supranational scheme?

Table 1. Primary design elements of TGS for RES-E in the EU context.[16]

Main design element	Subelement	Effect on costs of achieving a given RES-E expansion target	Effect on income redistribution
Coverage	Sectoral: RES-E, -H, and –T	Larger coverage lowers costs	Larger is more prone to cause redistribution
	Geographical: national, international, EU-wide	Larger coverage lowers costs	Ambiguous
	Eligible generation technologies	Larger coverage lowers costs	Ambiguous
	Minimum threshold for installation size	Larger coverage lowers costs	Ambiguous
	Role of existing plants	Larger coverage lowers costs	Including exiting plants will have redistributive effects
Banding	Multipliers	Bandning reduces static costs efficiency	Banding can reduce redistribution caused by the scheme
	Carve-outs	Bandning reduces static costs efficiency	Banding can reduce redistribution caused by the scheme
Purchase obligation	Obliged party, e.g. electricity supplier or someone else?	No effect	No effect
	In a supranational scheme, how to split the purchase obligation between states?	Ambiguous	Ambiguous

4.2 Geographical scope

A TGC scheme with a wide geographical scope is more cost-efficient than a TGC scheme with a narrow geographical scope. The higher efficiency is because a wider scheme is likely to include a wider range of new RES-E potential than a narrow scheme. A TGC scheme will realise the potential in the order of lowest to highest cost. As a consequence, compliance costs are smaller in the scheme with a wider geographical scope. It follows that EU-wide TGC scheme is more cost-efficient than running separate national TGC schemes.

Figure 2 illustrates the principle of running two separate schemes versus running a joint scheme. Note that the green certificate price is lower for Country 2 (with the high cost potential) in the joint scheme, but higher for Country 1 (with the low cost potential) and that investment activity is redirected from Country 2 to Country 1 as a result of running a joint scheme.

[16] RES-E refers to electricity, -H to heat and –T to transport. Current RES-T technologies are related to biofuels.

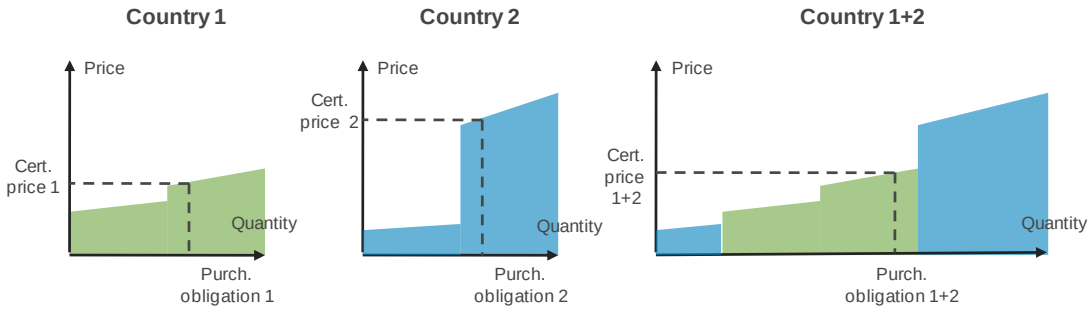

Figure 2. The principle of running two separate schemes versus running a joint scheme.

Aune et al. (2010)[17] report that an EU-wide TGC scheme would cut the cost of achieving the EU's 2020 renewable target by 70% compared to a situation with strictly domestic schemes. They recognise that *"a potential system that fully exploits the benefit from a cost effective distribution of renewable energy production is an EU-wide green certificate system".*

In the absence of an EU-wide scheme, member states could follow the example of Sweden and Norway, and cooperate with each other.

The joint Swedish-Norwegian green certificate scheme has been in operation since 2012. Experiences from it highlight two key issues for joint schemes. First, how to split the purchase obligation between participating countries? In the Swedish-Norwegian scheme, the purchase obligation is split equally between Sweden and Norway[18]. As a consequence, electricity consumers in Norway face a different cost per MWh for financing the joint scheme than electricity consumers in Sweden. Second, how are RES-E investments distributed across countries and technologies in the joint scheme? In the joint Swedish-Norwegian scheme, the majority (between 80-85%) of new eligible generation has been on Swedish soil.[19]

4.2.1 Are transmission bottlenecks a problem for running a joint TGC scheme?

An argument presented against a joint TGC scheme in a market with transmission bottlenecks is that it may promote investment in the wrong locations, locations that are not able to consume or export the electricity.

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[17] Aune et al. (2010). Implementing the EU renewable target through green certificate market. Statistics Norway, Research Department.

[18] Swedish Energy Authority. En svensk-norsk elcertifikatsmarknad – Årsrapport för 2014. Source: https://www.energimyndigheten.se/PageFiles/51999/2014-7585%20En%20svensk-norsk%20elcertifikatsmarknad%20-%20%C3%A5rsrapport%20f%C3%B6r%202014.pdf

[19] Swedish Energy Authority. Elcertifikat: Kvartalsrapport nr 2/2015. Source: http://www.energimyndigheten.se/Global/F%C3%B6retag/Elcertifikat/Kvartalsrapporter/Kvartalsrapport%20nr%202,%202015.pdf

In a TGC scheme eligible electricity generators have two sources of income, income from the electricity market and income from the market for green certificates. The price of electricity is location dependent whereas the price of TGCs is not. In fragmented electricity markets such as Nord Pool, with 15 price areas, it is perfectly natural that the price in one region is zero, or even negative, while the price in a neighbouring region is strictly positive.

A TGC is able to cope with transmission bottlenecks because of the location dependent electricity price. Overcapacity in one area will push the area price to zero and deflect future investments to other areas, with more demand or idle transmission lines. This is illustrated in Figure 3 below.

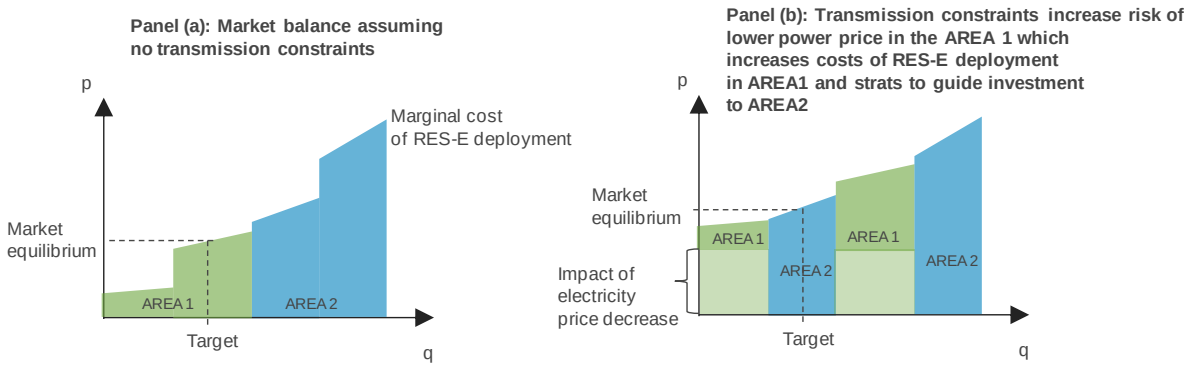

Figure 3. An example how the market mechanism works in the case of transmission constraints

The two panels in the figure show the certificate market of Area 1 and 2 with different transmission capacities. Panel (a) assumes that transmission capacity between the two areas is unlimited. In Panel (a) all RES-E generation takes place in Area 1 as there cost of RES-E deployment is lower than in Area 2. In Panel (b) transmission capacity is limited, and smaller than the amount of electricity exported from Area 1 to 2 in Panel (a). Assuming inelastic demand in Area 1, to balance supply and demand, the electricity price in market 1 must drop. As a consequence, the marginal cost of RES-E in Area 1 is shifted upwards, with an amount that exactly offsets the drop in electricity price.

However, this feedback mechanism only works as long as the electricity price is significant relative to the TGC price. With very low electricity prices, the income from the electricity market loses it significance and investors pay less attention to the location of new capacity. At least in theory, there could appear situations where RES-E deployment costs are so much lower in an area than other areas that electricity price difference does not guide investments away from the area even if it becomes oversupplied. Regulation could be necessary to prevent this risk. The state aid guidelines[20] require that there are measures, also in TGC schemes if technically possible, to ensure that generators have no incentive to generate electricity under negative prices. Such measures would further

[20] Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01)

guide investments away from the potentially oversupplied areas. A specific measure would be that no certificates would be given for production at negative prices.

Thus, the market for TGC is not crippled by transmission bottlenecks.

4.2.2 Is jurisdictional competition a problem for a joint TGC scheme?

Another argument presented against a joint TGC scheme is that interjurisdictional competition for investments distorts the market.

Assume that a rogue country awards additional support for domestic RES-E generation. The additional support is paid on top of the TGC price. The rationale for the additional support is to attract RES-E investments and the secondary benefits that come with the investments. These secondary benefits include, among others, employment effects. The rogue country reaps the secondary benefits but must cover the cost for the additional support, in one way or another.

The electricity price is reduced in the rogue country and possibly also in neighbouring countries, depending on availably of transmission lines. The electricity price is reduced because of the merit order effect (for an explanation of it see e.g. Sensfuß et al.[21]).

The TGC price is reduced for sure, which not only benefits the rogue country but all countries that are part of the joint TGC scheme. The TGC price reflects the value of the primary benefit.

Thus, the market works even in a situation where a rogue country awards additional support for domestic RES-E generation on top of the TGC price of the joint scheme.

Sven-Olof Fridolfsson and Tangerås (2012)[22] has noted in the context of Swedish electricity policy that ”maintaining municipal veto rights and allowing municipalities and investors to negotiate construction permit fees might improve the efficiency of RES-E investments”.

4.3 Technology banding

As outlined, among others, by del Rio et al. (2012)[23] the support level can be differentiated across technologies either through carveouts, through credit multipliers or through exclusion of certain technologies or fuels.

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[21] Sensfuß, Ragwitza, Genoeseb. (2008). The merit-order effect: A detailed analysis of the price effect of renewable electricity generation on spot market prices in Germany. Energy Policy, Volume 36, Issue 8, pp. 3086–3094

[22] Fridolfsson, Sven-Olof och Thomas Tangerås (2013). A Reexamination of Renewable Electricity Policy in Sweden. Energy Policy 58. pp. 57–63.

[23] del Rio P., Ragwitz M., Steinhilber S., Resch G., Busch S., Klessmann C., de Lovinfosse I., Van Nysten J., Fouquet D., Johnston A. (2012): Key policy approaches for a harmonisation of RES(-E) support in Europe - Main options and design elements

Under carveouts, multiple quotas and multiple TGC are established. At the minimum two quotas are established: one for the mature technologies and one for non-mature technologies. Carveuots lead to a fragmentation of the TGC market. A fragmented TGC market is likely to suffer from lack of competition, even if it were EU-wide and exhibit at times symptoms of this, such extreme TGC prices for some technologies. Under credit multiplies, immature technologies are awarded a higher number of TGCs per generated MWh than mature technologies. Exclusion is a special case of multipliers in that the multiplier is zero for the excluded technologies and fuels.

Banding, in its all forms, represent an additional layer of regulation that prevents the market from reaching its full potential. With the wrong parameters banding will be counterproductive. The challenge is to get the parameters correct.

In the Swedish-Norwegian market there is no banding. The benefit of no banding is a lower TGC price, which benefits the obliged parties, typically the electricity consumers. A lower TGC price also means smaller market distortions. The disadvantages of no banding are a larger potential for wind-fall profits and that a low TGC price only benefits the mature technologies. The immature technologies are likely to require additional support to enter the market. An argument presented in favour of banding is that it improves dynamic efficiency, by making immature competitive in the future.

4.3.1 Is there market based solution for separating the support?

In theory, a clever auction design could reveal the volumes and costs of new RES-potential, which are by assumption private information to the electricity producers. The regulator could utilise this information as to differentiate support, either by carveouts or by credit multipliers. Effectively, it would allow the regulator to expropriate producer surplus, implying no windfall profits and lowest possible cost for mobilising a certain mix of new capacity expansions. This approach faces number of informational problems. First, the regulator does not know what the optimal mix of new capacity is over time. Second, the volumes and the costs of new RES-potential may not be known to the electricity producers themselves.

State aid guidelines on technology banding

The state aid guidelines[24] has two mutually exclusive principles on technology banding - technological neutrality and prevention of overcompensation (Box 1).

Box 1: State aid guidelines on technology banding

On overcompensation (para 136):

- **Support is essential to ensure the viability** of the renewable energy sources concerned
- Support **does not**,
    - for the scheme in the aggregate, **result in overcompensation** over time

[24] Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01)

and across technologies, or
- **in overcompensation** for individual less deployed technologies in so far as differentiated levels of certificates per unit of output are introduced

On technological neutrality (paras 126 and 137):

- **no differentiation** in support levels through green certificates may be applied **unless**….
- …..process **can be limited to specific technologies** where process open to all generators would lead to a suboptimal result which cannot be addressed in the process design in view of, in particular:
  (a) the longer-term potential of a given new and innovative technology; or
  (b) the need to achieve diversification; or
  (c) network constraints and grid stability; or
  (d) system (integration) costs; or
  (e) the need to avoid distortions on the raw material markets from biomass support

4.4 Price stability

Support in a TGC scheme is, in principle, volatile and changes continuously in accordance with supply and demand. The price volatility is well illustrated by the price history of the joint Swedish-Norwegian scheme (Figure 4).

Figure 4 El Cert spot price, weekly average (the Swedish-Norwegian scheme)[25]

A volatile support offered by a TGC scheme may be seen to have certain drawbacks:

[25] SKM – Swensk kraftmäkling (http://www.skm.se/priceinfo/history/)

1) When investors are exposed to the price risk of the support, they require higher return of investment to compensate for the risk. Due to this, the average support may need to be higher to trigger the same investments that would have taken place under a fixed priced scheme. This may lead to higher cost of RES-E deployment than under a fixed priced scheme. However, there is also the other side of the coin: under a fixed priced scheme, it is the scheme (eventually tax payers or electricity users) who guarantee the support and are exposed to the associated risk. Their risk realises if the support is set unnecessarily high in the first place or if the cost of RES-E deployment reduces during the fixed priced commitments.

2) Uncertainty on the support level can affect the availability of loan finance in the extend that investment can only be executed by large companies capable on balance sheet financing[26].

3) If the support level is floating, it's more difficult to estimate the costs of the scheme

Fortunately, a TGC can be tweaked to take these concerns into account.

First, a TGC scheme can be designed to provide the desired level of price stability. The price risk for investments can be reduced by setting a floor price [27]. The costs can be kept under a desired level by setting a price cap. However, regulating the price to a tight range may not be appropriate for a TGC scheme *(If the price floor and the cap are close to each other, there is no room for market to work but the scheme is virtually a price premium scheme where fixed support is set by regulator).*

Second, the market participants in green certificates market can hedge the price risk in the market. For example *investor hedges the support level by selling certificates with long fixed-price contract to an electricity user who hedges the costs by the same contract.* In addition to OTC deals, market for standardised futures and other derivates will develop once there is enough demand. For example Nasdaq OMX offers trading with 5 next year's forward contracts of El Certs of the Swedish-Norwegian scheme [28]. Also market based hedging may have its shortcomings. These could include lack of counterparties to really long sales contracts (>10 y) that would make the price stability comparable to the fixed priced schemes. There are also collateral and counterparty requirements that may prevent participation of the smaller actors.

It can be assumed that the market can best price the cost of RES-E deployment and the risk related to the support, provided that the quota policy is consistent and predictable. If this is the case, there should not be reason to intervene in pricing process, but rather remove barriers for market based hedging. Bases for all price formulation and existence of reasonable priced hedging instruments is consistent and predictable quota policy.

[26] European Commission guidance for the design of renewables support schemes (SWD(2013)439 final)

[27] European Commission guidance for the design of renewables support schemes (SWD(2013) 439 Final)

[28] Nasdaq (2015): http://www.nasdaqomx.com/transactions/markets/commodities/markets/electricity-certificates

Finally, a moderate floor price could still have its benefits. Guaranteeing explicitly even a very moderate floor price could improve bankability of projects and lower the hedging costs significantly as it would remove the risk of extreme price drops that have been seen in markets of environmental commodities, where the demand is dependent on political decisions (see e.g. 1 st phase of EU ETS and CDM).

5. Effect on energy intensive industry

The costs of renewable energy support are typically paid from the state budget or collected from the electricity users. In the TGC schemes they are typically electricity users or retailers who are obliged to buy certificates. Allocation of additional costs to the internationally competing industries distorts its competitiveness and may lead to relocation of industries to the countries where similar costs do not exist. For this reason, the position of the internationally competing electricity intensive industries are often alleviated in renewable energy and climate policy schemes, examples including in the German feed-in-tariff scheme (EEG), the common green certificate scheme of Sweden and Norway (El Cert) and the European Union Emission Trading Scheme (EU ETS).

5.1 State aid guidelines on reduction of cost of funding renewables

The European commission's state aid guidelines for environmental protection and energy[29] set a framework for exceptions from the funding of RES support. The current form of the framework is summarised in Box 2. As mentioned the commission has scheduled the next revision of the guidelines to 2015-2017 [30].

Box 2: State aid guidelines on reduction of costs of funding renewable energy

- **Reductions can only be granted if:**
  - A company belongs to the **predefined sectors** (listed in Annex 3 of the Guidelines), or
  - The company's ***electro-intensity[31] is at least 20%*** and it belongs to a sector with ***trade intensity of at least 4%*** at EU level[32]

[29] Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01)

[30] European Comission's communication on a Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM(2015) 80 final ANNEX 1)

[31] Electro-intencity is calculated as quotient of company's electricity costs and gross value added (see detailed calculation from Annex 4 of the guidelines)

- The companies that are eligible for reductions shall pay at least 15 % of the additional costs without reduction (***max 85% reduction***)

- The costs can be further **capped** as follows:
  - **4%** of the gross value added of a company
  - **0.5%** of the gross value added of a company if company's electro-intensity **at least 20%**

(The above applies fully for reductions admitted from 2019 onwards. For the period prior 2019 there are transitional provisions allowing gradual adjustment of the reductions)

In their current form the guidelines include aspects that may limit possibilities to develop renewable energy support schemes that would not distort the global competitiveness of the European industry:

The guidelines allow only partial exemption for electricity intensive industries which may risk global competitiveness of the industry especially if the costs of RES support become high.

The guidelines set only maximum levels of cost reductions; otherwise the support level is on the discretion of the EU countries. A coordinated approach to the minimum level of exceptions would decrease risk of competitive distortions between companies from the different EU countries.

The guidelines are not coordinated with the framework of compensation of the EU ETS costs to the energy intensive industries (see Section 5.4.) The cost of RES-E support is levied on top of the electricity price increase induced by the EU ETS. It would be reasonable to manage the total cost increase in a coordinated way and cap the impact at a level where global competitiveness of the industry would not be distorted.

The singular threshold (electro intensity at least 20%) separating the significantly different cost caps is potential source of competitive distortions between companies being close to the threshold but other sides of it.

5.2 Case 1: German EEG scheme and reductions from surcharge

In the German EEG scheme, renewable electricity has been earlier supported by fixed feed-in-tariffs that are differentiated across technologies. From 2014 onwards, new support is granted by tendering processes that will be gradually opened to operators from the other EU countries (up to 5% of the tendered capacity will be opened to installations located in EU countries having a cooperation agreement with Germany). The costs of the EEG scheme are collected from the German electricity consumers as a surcharge that is added to the electricity price. The

[32] Annex 5 of the guidelines lists mining and manufacturing sectors not included on the predefined list having an extra-EU trade intensity of at least 4 %. However, the test (20% electro-intencity and 4% trade intensity) can be applied as well to service sector companies.

surcharge is calculated beforehand for each year based on estimated financing need of the scheme. In 2015, the surcharge is 61.7 EUR/MWh and forecast for 2016 is 56.6-72.7 EUR/MWh[33]. The sum can be considered significant compared to the average wholesale price of electricity (30-50 EUR/MWh in the recent years[34]) or the total electricity price for industrial companies (in the range of 150 EUR/MWh[35]) (see Figure 5).

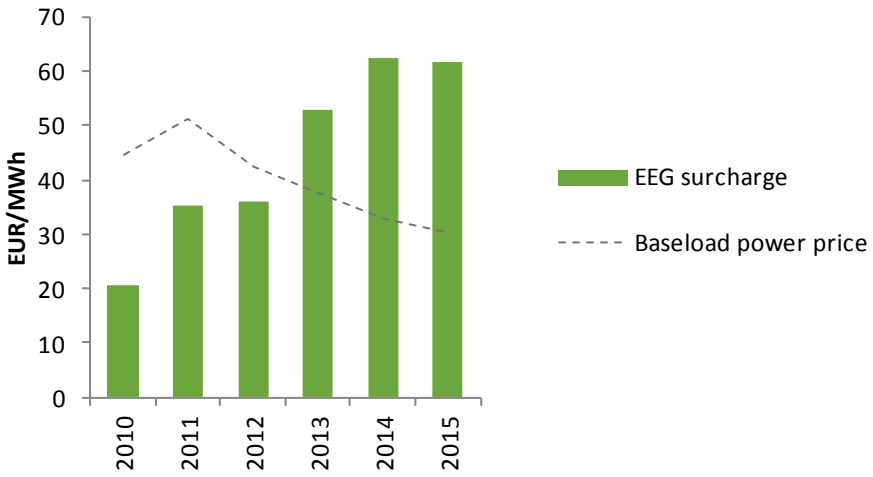

Figure 5. EEG surcharge and electricity wholesale price in Germany

Energy intensive industries can apply for reductions on the surcharge. The European commission investigated the EEG 2012 law and approved the majority of reductions in November 2014 (A limited portion of the reductions exceeded what is permitted under EU state aid rules and had to be paid back)[36]. Under the new EEG 2014 law, reductions given for energy-intensive industries follow the sectors and mainly the maximum levels allowed by the state aid guidelines and were approved by the European commission in July 2014.

The related Commission's decision[37] includes an interesting detail on administrative costs of cost reduction application. According to the decision the minimum threshold for the reduced surcharge (1 GWh at the relevant consumption point) has been introduced for administrative

[33] INFORMATIONSPLATTFORM DER VIER DEUTSCHEN ÜBERTRAGUNGSNETZBETREIBER (2015): https://www.netztransparenz.de/de/Jahres-Mittelfristprognosen.htm

[34] Morison R (2015). Why do Germany's Electricity Prices Keep Falling: http://www.bloomberg.com/news/articles/2015-08-25/why-do-germany-s-electricity-prices-keep-falling-

[35] Eurostat (2015): http://ec.europa.eu/eurostat/statistics-Eurostat explained/index.php/File:Electricity_prices_for_industrial_consumers,_second_half_2014_(%C2%B9)_(EUR_per_kWh)_YB15.png

[36] European Commission (2014). State aid: Commission approves German aid scheme for renewable energy (EEG 2012); orders partial recovery: http://europa.eu/rapid/press-release_IP-14-2122_en.htm

[37] European Commissions decision on EEG 2014 (C(2014) 5081 final)

simplification. Germany has explained that the application for a reduced surcharge also implies a certain amount of administrative costs for the companies concerned (gathering the relevant information, preparation of the file, verification by an accountant), administrative fee for the submission of the application and costs linked to the energy-efficiency improvement system.

The Commission's decision states that the experience based on the past reduction systems have shown that costs and benefits are in a balanced relationship for companies having a consumption of around 2.3 GWh per year. Finally the decision concludes that the 1 GWh threshold is justified for administrative simplification.

One justification being that consumption below 1 GWh would incur more costs from requesting the reduction than without it. Based on this, a simple back of the envelope calculation indicates that the administrative costs (of a cost reduction application) is assumed to be in the range of 100 000 EUR/a (2300 MWh/a * 50 eur/MWh * 85% = 97750 eur/a).

5.3 Case 2: Swedish-Norwegian TGC and the exception from purchase obligation

In the common TGC scheme of Sweden and Norway (El Cert) electricity suppliers and selected electricity end-users are obligated to buy electricity certificates corresponding to a certain proportion of their electricity sales or usage[38]. The cost to the electricity users can be defined as the product of quota obligation and the certificate price. The cost has been in the range of 1-6 eur/MWh of consumed electricity and according to the current future prices the cost would remain under 4 eur/MWh (Figure 6).

[38] Norwegian Water Resources and Energy Directorate on Electricity Certificates (http://www.nve.no/en/Electricity-market/Electricity-certificates/)

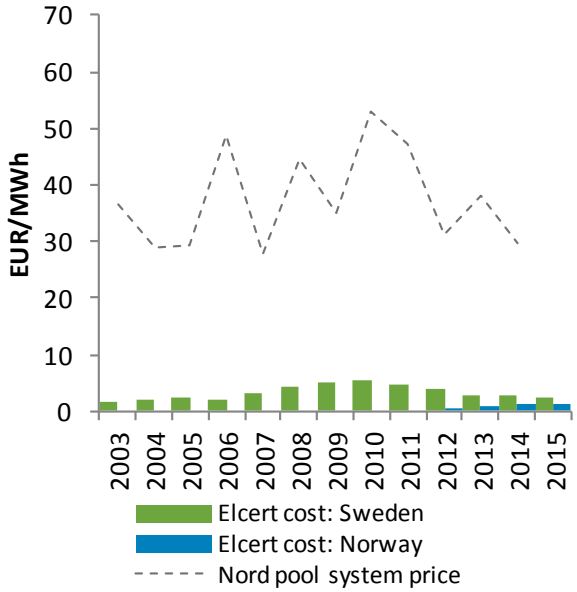

Figure 6. Certificate cost per MWh of consumed electricity in the common TGC scheme of Sweden and Norway and the wholesale electricity price (note that the scale is the same as in Figure 5 on EEG).

Electricity that is used in manufacturing processes of electricity intensive industries is exempted from the purchase obligation in Sweden and Norway. In accordance with the Swedish El Cert law[39], company or its part is counted to belong to electricity intensive industry, if it consumes at least 190 MWh of electricity per value added of million SEK.

5.4 Case 3: EU ETS and compensation for increased electricity costs

The concern that costs of renewable energy support distort competitiveness of the European industry is closely related to the risk of "carbon leakage" discussed in the context of the EU ETS:

> *"'carbon leakage' describes the prospect of an increase in global greenhouse gas emissions when companies shift production outside the Union because they cannot pass on the cost increases induced by the EU ETS to their customers without significant loss of market share"*[40]

[39] Swedish law on electricity certificates (Lag 2011:1200)

[40] European Commission's communication on GUIDELINES ON CERTAIN STATE AID MEASURES IN THE CONTEXT OF THE GREENHOUSE GAS EMISSION ALLOWANCE TRADING SCHEME POST 2012 (C(2012) 3230 final)

Under the ETS Directive [41], the carbon leakage risk is managed by giving two exceptions to sectors or subsectors that are exposed to a significant risk of carbon leakage:

1) These sectors shall receive more free allowances than other sectors, and
2) Member states are allowed to compensate to these sectors increases in electricity costs resulting from the EU ETS, as long as the compensation measures are in accordance with the state aid rules

In particular the framework of compensations of increased electricity costs has relevancy from the perspective of the RES-E support design. This framework is briefed in Box 2.

Box 2: Compensation of the increase of electricity costs due to EU ETS

Eligibility thresholds and list of sectors eligible for compensation:

According to the ETS Directive, a sector or sub-sector is deemed to be exposed to a significant risk of carbon leakage if:

- Direct and indirect impacts of EU ETS causes cost increase of at least 5%; and
- the trade intensity[42] (imports and exports) of the sector with countries outside the EU is above 10%

or

- Direct and indirect impact of EU ETS causes cost increase of at least 30%; or
- the trade intensity with coutries outside the EU is above 30%

(The cost increase is calculated as a proportion of the gross value added taking into account direct and indirect impacts of the EU ETS)

Based on the above criteria, the European Commission determines a list of the sectors exposed to a significant risk of carbon leakage (and are thus eligible for potential compensations) in every five years. Moreover, the commission may, at its own initiative or at the request of a member state, add a sector or subsector to the list, if it can be demonstrated, that this sector or subsector satisfies the relevant criteria. The commission published the second "carbon leakage list"[43] applying for the years 2015-2019 in October 2014.

Level of compensation:

[41] Directive 2003/87/EC on establishing a scheme for greenhouse gas emission allowance trading within the Community

[42] Trade intensity is defined as "the ratio between the total value of exports to third countries plus the value of imports from third countries and the total market size for the Community (annual turnover plus total imports from third countries)"

[43] European Commission decision of 27 Oct 24 determining a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage, for the period 2015 to 2019 (2014/746/EU)

The commission's guidelines related to compensation of the electricity costs are given as a part of the *Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012*[44]. These guidelines give framework for defining the maximum compensation for an installation that may be granted by a member state due to costs relating to greenhouse gas emissions passed on in electricity prices. The definition of the maximum compensation can be outlined as follows:

Maximum Aid = Electricity Consumption * Electricity Price Increase (due to EU ETS) * Max Aid Intensity

In the formula, electricity consumption is not defined as actual power consumption of an installation but is calculated based on benchmark values reflecting the most electricity-efficient methods of production of the product in question. Thus the aid can consider the costs increase only until the benchmark level of unit electricity consumption.

Maximum aid intensity is defined in the guidelines and is as follows (% of eligible costs):

- 2013-2015: 85%
- 2016-2018: 80%
- 2019-2020: 75%

According to the guidelines the aid must not fully compensate for the costs of EUAs in electricity prices and must be reduced over time, in order to minimise competition distortions in the internal market and preserve the objective of the EU ETS to achieve a cost-effective decarbonisation.

Electricity price increase is calculated as a result of power emission factor and the market price of emission allowance (power emission factors are given in guidelines and EUA price is taken from market).

Note that the thresholds of compensation for the EU ETS are not directly comparable to the ones of RES-E support as in the context of EU ETS the thresholds include also the direct impact of EU ETS. Furthermore, in the context of RES-E support, there is no reason to limit the cost reductions based on the weakening guidance effect as the purpose of a RES-E support scheme is to increase RES-E generation, not to guide electricity consumption by additional fees.

5.5 Remarks on effects to energy intensive industry

As indicated by the German EEG scheme, RES-E support can cause very significant cost to the electricity users. The new renewable energy support schemes should be designed in a way that the cost for export industry is predictable and remains on a sustainable level that does not distort its competitiveness on the global market.

[44] Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (C(2012) 3230 final)

At the first place, the scheme should meet its primary target (increase of renewable electricity) cost efficiently, which means lower costs to all of the financers of the scheme. As discussed, market based mechanisms with wide geographical scope and a significant extend of technological neutrality are likely to create grounds for cost efficiency.

Even a scheme were cost effective, the cost of RES-E support can be significant and reduce competitiveness of the industry. Furthermore, the cost needed to achieve the RES target cannot be known beforehand creating uncertainty to the financiers. The new RES-E support schemes should include additional elements to prevent distortions in competitiveness of export industry.

In their current form, the state aid guidelines allow cost exceptions in certain extent, but they also seem to have drawbacks that should be avoided in design of the new RES-E support schemes:

1) The guidelines allow only partial exemptions which may risk the global competitiveness of the industry especially if the costs or RES-E support become high. On the other hand, there are the cost caps that are relative to gross value added and which can be used to bring predictability effectively by fixing the maximum cost per unit of production.

2) The guidelines set only maximum levels of cost reductions; otherwise the support level is left to the discretion of the EU countries. A more coordinated approach to the minimum level of exceptions would decrease uncertainty of the export industry and also reduce possibility of competitive distortions between companies in different EU countries.

3) EU ETS already increases the electricity costs and cost of RES-E support comes on top of this. The guidelines are not coordinated with the compensation framework of the EU ETS costs. It would be reasonable to have a coordinated approach to ensure that the total cost increase (due to EU ETS and RES-E support) remains on a level that does not distort competitiveness of the export industry.

4) The singular thresholds for support eligibility and the caps are potential source of competitive distortions between the relieved and the other companies

5) Application of partial exceptions may lead to complexity and high administrative costs to the companies and the scheme. Simple approaches should be preferred and ensured that the administrative burden of companies remains on appropriate level. Complete exceptions could be a solution at least for smaller companies for simplicity.

The joint Swedish-Norwegian TGC scheme offers an example of a relative simple approach for exceptions. In the scheme, production processes of electricity intensive industries have been completely exempted from the purchase obligation. Threshold for

exceptions is defined as electricity cost per value added. The approach could be still simplified, from the companies' perspective, by offering predefined lists of exempted sectors and a threshold giving possibility to apply exemption from outside of the listed sectors (of this part, the similar approach as in the state aid guidelines and EU ETS cost compensation framework).

6. Effect on raw material markets of forest industry

RES-E support schemes have potential to distort the raw material market of the forest industry. Typically support for power producers increases their willingness to pay for biomass fuels. The risk of competitive distortions arises when the support concern biomass types that are already used in large extent by the forest industry. The risk is naturally higher the higher the support is.

For example Finland amended its feed-in-tariff law in March 2015 to prevent the effect on markets of wood raw material. The support for electricity generated from wood chips that are produced from wood, originated from timber areas of stout wood, that would be suitable to be processed as stem wood or fibre was reduced to 60% of the support paid in the case of other wood chips[45].

Risk of raw material market distortions cannot be completely prevented by actions of a single country. Biomass can be transported over the borders, and the RES-E support schemes of neighbouring countries can equally distort the market. From this perspective a more coordinated approach to RES-E support would be beneficial. The European Commission will propose new policy for sustainable biomass as a part of the new renewable energy package in 2016-2017 [46], which potentially provides further EU level coordination for treating biomass in RES-E support schemes.

According to the state aid guidelines[47] the need to avoid distortions on the raw material markets from biomass support is one of the five reasons to differentiate support between

[45] Finnish law on feed-in-tariffs (Laki uusiutuvilla energialähteillä tuotetun sähkön tuotantotuesta 30.12.2010/1396)

[46] European Comission's communication on a Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM(2015) 80 final)

[47] Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/1)

renewable energy technologies under a TGC scheme. As discussed in Section 4.3, there are several options for differentiating support in a TGC scheme. These approaches could be applied to prevent distortions on the forest industry's raw material market:

Credit multipliers: Fewer certificates per unit of electricity for electricity produced from biomass (or certain types of biomass). The support would be lowered, which would decrease the risk of raw material market distortions. However, the support would not be capped, but dependent on the certificate price development, which would be a risk to the raw material market. To definitely secure the market, the credit multiplier would need to be dependent on the certificate price – in a way that the support is capped on a level that does not compromise the raw material market.

Carveouts: Separate purchase obligation for biomass (or certain types of biomass). Benefit of this approach is the simplicity of setting price cap for the separate "biomass certificates". A drawback is the difficulty of setting the quota on correct level. If the price is capped low enough, failure in setting the quota obligation will not harm the raw material market. The regulator would however face the risk that the biomass electricity target and consequently the total target would not be met.

Exclusion: Biomass or certain biomass types not to be included in the TGC scheme at all. Other measures could be needed e.g. to support the harvesting chain of unexploited biomass types.

It should be noted that, in practice, traceability of biomass origin may limit possibilities to differentiate support levels between different types of biomass.

All in all, design options of a TGC scheme offer a rich set of alternatives for limiting the effects of RES-E support on raw material markets and the forest industry. If correctly applied, there are is a high probability to limit the negative effect under a TGC scheme as under any other type of RES-E support scheme. A scheme with a wide geographical coverage could help to avoid the distortions on the raw material market. It would offer framework for a coordinated approach for supporting biomass based electricity.

7. Conclusions

As indicated by existing schemes, RES-E support can cause very significant cost to the financiers of the schemes that are typically electricity users or tax payers. From many perspectives it could be seen reasonable that the RES-E support schemes fulfilled their primary objective (increase of RES-E) with minimal costs and market distortions. A

market based scheme with wide geographical coverage and large extent of technological neutrality is likely a good candidate for meeting these targets. On the other hand, under such scheme the EU countries would not have control on the location of investments (including their co-benefits) and technological selection, but they would be guided by the market mechanism to the most cost efficient locations and technologies.

RES-E support has potential to distort the raw material market of forest industries. The basic design options of TGC schemes include tools to limit effects of RES-E support on the raw material market. A common scheme with wide geographical scope could create grounds for more coordinated approaches for energy use of biomass than fragmented national schemes.

To avoid distortions in the global market, the export industry should be exempted from financing of the RES-E support. The exemption procedure should avoid complexity and high transaction costs. The EU ETS causes also burden to the export industry and has its own cost compensation framework. The costs of RES-E support and EU ETS should be co-ordinated in a manner that their combined impact does not risk competitiveness of the export industry.