SUPPORT MECHANISMS FOR WIND ENERGY

POLICY PERSPECTIVE ON INVESTMENT RISKS | 16 APRIL 2012
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To address the challenges of climate change and energy security, EU and its member states have adopted policies to reduce emissions of greenhouse gases and foster growth of domestically produced energy sources. Renewable energy delivers on both objectives and is expected to grow in importance in the coming decades. For power generation, it is mainly the potential dependency on a few external suppliers of gas that has raised policy concerns. The EU has adopted a specific 20 per cent targets for renewable energy as a share of total energy supply by 2020. Power generation accounts in most projections for the bulk of expansion as wind power and biomass appear to be the lowest costs options to realise the renewable energy target.

Within this context, Vestas has asked Copenhagen Economics to provide a study that explores what can be done to reduce the potentially very large policy risks associated with investing in renewable energy over the coming decades. Market forces alone – such as rising coal, gas prices and oil prices – cannot deliver the agreed move towards a low carbon and secure energy production. Policy support mechanisms deemed credible by investors are needed.

The focus is on wind energy and the power sector. The study is combining desk research with interviews of investors, not the least the increasingly important financial and institutional investors.

Our main conclusions in this study are the following:

Support mechanisms will be required to reach the EU’s renewable energy targets for 2020, even if the EU ETS adopted much more stringent targets. This has been clear since the adoption of the twin targets of greenhouse and renewable targets in 2009. Realistic levels of ETS allowance prices are far too low to make required and nationally projected levels of power from renewable energy viable without additional support mechanisms. However, both analytical work as well as views from stakeholders underlined that more stringent targets, i.e. larger emission reductions, as well as longer commitments periods for the ETS, could be seen as confirming longer term climate and energy policy goals and lead to a more uniform and market-based system for encouraging low carbon technologies, including renewables.

There is also a wide agreement that financing the huge amount of investments needed requires the tapping of financial investors to a much larger degree than today. In this context, the reduction of investment risks of current and future deployment of wind power installations is important for at least two reasons: 1) wind power accounts for a major share of the projected expansion of renewable energy, and 2) up front capital costs are very substantial relative to operating costs, so investment premia have a particularly high impact on overall cost of energy.
To reduce investment premia and financial costs, support mechanisms need to be firmly anchored with long-term targets and legal certainty. In this perspective, policy choices have a strong role to play. We have outlined what that implies for the different types of support mechanisms currently in play in the EU. The study stresses that both feed-in tariffs and tradable green certificates (or quota systems) can deliver. However, getting the design right and maintaining a stable policy framework is paramount. We highlight in this context both good and bad practice, drawing also on our interviews.

While there is a substantial amount of common ground with respect to what is required, we also note some differences between different kinds of investors. Financial investors, with less in-depth energy market understanding, prefer simple and transparent mechanisms with preferably no exposure to power market volatility. Their focus is on the financial risks associated with deployment of a given set of installations, i.e. they have a project based perspective. Utilities are better able to manage power market exposure as well as integrating risk from individual installations within a larger portfolio of investments. They, along with the rest of the wind power supply chain, are also more focused on long-term targets for future installations as they have substantial pre-deployment risks associated with research, innovation and the construction phases.

Finally, we outline some specific policy recommendations for the EU as a whole as well as for Member States individually:

It is underlined that reducing investment risks of individual installations is not the sole policy objective for renewable energy policies. Competition among low carbon technologies should be nurtured to drive down costs of meeting climate and energy security policies. This point is particularly relevant for the widening range of technologies with generation costs that are getting closer to fossil fuel based sources. In short, there is a trade-off between risks to individual projects and promoting competition between technologies. The ETS plus broad based market support mechanisms can be central drivers, with a proper balance between investment risk and competition.

By contrast, less mature technologies such as offshore wind need to be supported by more specific instruments with the specific aim of driving down generation costs. The key work here is learning costs: by deploying technologies in actual use over a longer period of time, the whole chain of suppliers becomes better at mastering the technology. This could be combined with a targeted and guaranteed, but also overall capped, demand to reduce pre-deployment risk, also associated with investments in innovation: an overall cap is needed because the returns from learning are sharply falling with each additional unit of production of a given vintage of technology.

We note that the Member States accounting for the bulk of the expansion in wind power – onshore and offshore – are expected to rely on domestic compliance with RE targets towards 2020. Hence we recommend that Member States in the near term focus on measures that
improve their national support mechanisms with a strong focus on reducing investment risks along the lines suggested in this report, i.e. more focus on long-term targets, legal certainty and overall stability. At the same time, the options for joint implementation of RE targets between Member States should be explored. However, this needs to be done in a manner that does not undermine investor confidence now, with the risk of holding back investments in deployment and innovation in new technologies.
Before discussing how support mechanisms influence investors’ risk perception, we want to highlight some basic features of the economics of wind power, the risks that investments in wind power entail as well as typical financing models for wind power investments.

First, we highlight that wind power, along with most other relevant renewable energy sources, cannot yet compete on the direct generation costs of conventional power alternatives, such as coal and gas-based power plants. Substantial policy measures are needed to correct for market failures (socialised health, environmental and other indirect costs from conventional alternatives) and reach renewable energy targets (section 1.1).

Second, wind power is characterised by having high upfront capital costs compared to variable costs, as well as the remuneration for wind being more exposed to volatility in power markets than most other relevant energy sources (section 1.2).

Third, we summarise the different types of risks that a wind installation faces all the way from the drawing board to its last year of operation, namely market, operational and policy risks. The typical role for different types of investors in terms of sharing and splitting these risks is described (section 1.3).

Fourth, we describe the different types of financial investors that may enter into investments in wind installations, and the characteristics of the different financing models (section 1.4).

1.1. GENERATION COSTS OF WIND AND OTHER TYPES OF POWER GENERATION
The power generation sector in the EU and other countries will be transformed in the coming decades. The EU’s long-term goal of reducing its CO\textsubscript{2} emissions by 50 to 80 per cent by 2050 relative to its 1990 level will imply a massive introduction of renewable energy sources, especially in the power sector.

The current EU emission reduction target is far too low to drive up carbon prices consistent with the prices needed to reach the 2020 renewable energy target, cf. Figure 1.1. The power price from coal based plants in 2020 is expected to be just below € 40 per MWh (with a GHG emission reduction target of 20%). With a GHG reduction target of 30 per cent the power market price may reach € 60 per MWh. Assuming that the roll-out of renewable energy supply in the power generation sector takes place most cost-efficiently measured by direct costs (fuel, capital cost, etc., but excluding indirect costs like health, etc.), a price around € 100 is required to make enough RE power production viable without specific support. cf. Figure 1.1. The required price will in fact tend be even higher, since Member States have

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1 Some cases like New Zealand and the Caribbean, wind power has however been shown to compete with conventional power sources, due to e.g. the high wind factors.

2 Power price from coal plants at 20 and 30 per cent reduction of GHG is based on a carbon price of € 30 and € 17 per ton, cf. European Commission (2010). The carbon price is added to the electricity price from a marginal coal power plant, assuming cost effectiveness.
largely chosen not to cooperate on deployment, thus leaving low cost sources in some locations untapped. Since even this low-estimate ETS price is not going to be realised based on the existing policy baseline, deployment of renewable energy will not be driven alone by the ETS system.

Figure 1.1 Stylised supply curve for output from power generation in the EU by 2020

![Supply Curve Diagram]

Note: The figure shows generation cost per MWh net of externalities. The EU RES target in 2020 is app. 1070 TWh.

Source: Eurelectric (2008) and Copenhagen Economics calculations

Recent evidence suggests that renewable sources are becoming less costly over time than previously expected. Since a very large share of power generation costs are associated with the capital costs of constructing the installation, more effective construction methods may lower the generation cost of electricity. This is indeed the case when a technology is so developed that efficiency improvements start to take place in the supply chain etc. For onshore wind e.g., new studies show that the levelised cost of electricity of new built onshore turbines have declined from around €85 per MWh in 2008 to around €67 per MWh in 2011. This suggests that earlier (2008) estimate for the cost of onshore wind in 2020 has already been reached by now.

1.2. **UPFRONT CAPITAL COSTS AND POWER MARKET EXPOSURE**

**Upfront investment cost in wind energy is high relative to operational costs**

Wind power has basically no operational costs once deployed, besides maintenance costs. This is in sharp contrast to e.g. power plants where there is a price for each unit of input (coal, oil etc). This implies that the lion’s share of the costs associated with deploying a wind installation are related to upfront investment costs. In fact, while just 53 per cent of the life-
time costs of a coal-driven power plant are fixed, 100 per cent of the lifetime costs of an onshore wind installation are fixed, cf. Figure 1.2. For offshore wind installations, operational costs are larger.

**Figure 1.2 Fixed and variable costs for wind and coal power generation**

Wind owners earn less than conventional power sources per MWh

Wind power differs from conventional power plants in the sense that production is fully determined by whether the wind blows or not. Whereas conventional power plants can adjust production according to the expected price of electricity and cost of fuel inputs, this is not the case for wind producers. This means that while conventional power plants can reduce production in response to a low expected price (e.g. during the night where demand is low), wind installations produce power even when the price is low. This implies that the revenue per unit of electricity is lower for a wind installation than a conventional power plant. This is illustrated in Figure 1.3, which depicts that wind generally is remunerated with a lower electricity price than the average power source. This factor will be compounded as expansion of wind power may lead to longer periods of low power market prices where fossil fuel generators will stop production. In support schemes with exposure to power market prices in particular premium feed – this will reduce investment returns.
1.3. TYPES OF RISK OVER THE LIFETIME OF A WIND INSTALLATION

For investors, the risk associated with an investment is of crucial importance. For wind installations (as well as most other renewable energy installations) there are different phases, starting with plans on a drawing board to the operational phase. In each phase, there are different risk elements affiliated, cf. Figure 1.4.

Source: Copenhagen Economics, partly inspired by Ecofys (2008)

Figure 1.4 Risks associated with different stages in the deployment process

Note: The electricity spot price has been weighted by wind production on an hourly basis, in order to calculate average monthly prices. The simple average monthly price is a measure for the average price earned by the average producer, where the weighted average monthly price is a measure of the average price earned by wind producers.

Source: Copenhagen Economics based on data from Energinet.dk and Nordpool
These risks determine to a very large degree at which phase investors will find it attractive to invest in deploying wind. Different investors will most likely perceive risks associated with the different phases differently. A utility for example has much more knowledge about issues related to permitting/licensing and connection issues to the grid than e.g. a pure financial investor. Hence, an optimal risk-reducing strategy would be to let the investors most comfortable with the different risk elements join the investment at those corresponding phases.

While the phases in Figure 1.4 are generic for both on- and offshore installations, the risk levels are not. Since onshore is a relatively more mature technology than offshore, more risk is inherently associated with offshore installations. This is exacerbated in especially the construction and operation phase, where challenges that may be minor on land can be more costly in terms of both actual maintenance costs (need helicopters instead of trucks) and downtime (repairs are more complicated due to access issues among others).

Primarily one feature pulls in the opposite direction, and that is risks associated with the permitting/licensing procedure. In countries with substantial deployment of onshore installations, it has become increasingly difficult to obtain permits to deploy more installations as available land has become scarcer. Moreover, in some countries onshore installations are licensed locally by municipalities, while offshore installations are licensed by the state. This may make offshore installations perceived as less risky and facing fewer obstacles during the planning/development phase than onshore. This has been a strong factor in pushing forward the UK and Germany’s offshore production despite this being a higher-cost technology.

1.4. Financing structures for wind power projects

While classic utilities have typically been financing all renewable energy investments from their own balance sheets, the massive deployment needed to meet ambitious climate targets requires increased involvement from different types of financial investors. These investors have different investment models and hence different perceptions of risks. The investors of our particular interest are utilities and financial investors such as banks, institutional investors (pension funds, insurance companies) and private equity investors. These investors typically apply different investment instruments, cf. Table 1.1.
### Table 1.1 Investment instruments of typical investor types

<table>
<thead>
<tr>
<th>Investment instrument</th>
<th>Usually applied by this investor type</th>
<th>Investment characteristics</th>
<th>Main concern</th>
<th>Required cost of capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>Banks, institutional investors</td>
<td>Fixed-income product. Least risk and lowest returns. Often require contractual arrangements to protect from delays and cash-flow fluctuations</td>
<td>Default risk of investment</td>
<td>Low</td>
</tr>
<tr>
<td>Balance Sheet Equity</td>
<td>Utilities</td>
<td>Equity investment largely from one investor. Bears lion’s share of risk</td>
<td>Risks related to all project phases: development, construction, operation</td>
<td>Medium</td>
</tr>
<tr>
<td>Project Finance Equity</td>
<td>Utilities, institutional investors, private equity investors</td>
<td>Smaller equity investments often supplemented by other equity investors and debt.</td>
<td>Venture capital: development stage, obtaining relevant licences Other private capital: construction and operation phase. Risk of construction delays, and compensation through the electricity price</td>
<td>Medium-High</td>
</tr>
</tbody>
</table>

Source: *Copenhagen Economics, inspired by Climate Policy Initiative (2011a)*

**Debt instruments** are typically applied by banks, but also by institutional investors. A debt product generates a fixed-income and has seniority to equity capital. This implies that debt creditors are not exposed to fluctuations in a project’s profitability, as long as the project generates sufficient revenue to service the debt requirements. Moreover, debt products are typically associated with complementing contractual agreements which can protect the creditor from delays in deployment and cash-flow fluctuations. Debt creditors are therefore basically only exposed to the default risk of the investment, and therefore require a relatively low cost of capital to compensate for the relatively low risk they incur.

**Balance sheet equity** describes a large equity investment mainly from one investor, which typically is a classic utility operating on home ground. Such an investment is exposed to risks associated with all phases of a project, including development, construction and operation, and the investor in question bears the lion’s share of risk. While this exposes the investor to large risks, the required cost of capital is most likely of medium size. This is because the utility in question is able to raise capital that is not tied up on the specific investment, but instead on the profitability of the company as a whole.

**Project finance equity** is a relatively new financing type when it comes to renewable energy investments. It describes a smaller equity investment often supplemented by a utility or other equity and/or debt investors. Such investments are typically made by institutional investors and private equity investors. Investment risks are contingent on the phase of the project. Early stages, such as the development phase, are typically associated with higher risks since there is a non-negligible chance that the project may not be deemed viable due to lack of granting of required permits, unsuitable construction conditions, among others. This implies that early stage investors, such as venture capitalists, require a relatively high return on their capital. In later stages, such as the operation phase, investment risks are dependent on the revenue generated by the installation which is determined by the price of electricity (in-
cluding the pass-through of the ETS price), the specific support mechanism, and the wind speed and capacity factors. While institutional investors may be involved all the way from the development phase of the project alongside a utility, it is more typical for private equity investors to become involved at a later stage of the project, where risks are lower and more tangible. Unlike balance sheet equity investments where the return on capital is not tied up to the specific investment, the return to project finance is very much tied up to the specific investment. This implies that the required cost of capital is relatively high.
Chapter 2 TREATMENT OF RISKS: INVESTOR PERSPECTIVES AND POLICY IMPLICATIONS

Meeting the 2020 targets of renewable energy deployment as set in EU law requires substantial support mechanisms, inter alia because the ETS system is not capable of driving the deployment on its own, as demonstrated in Chapter 1. In order to achieve this deployment in a cost effective manner, it is important that the cost of capital required by investors is not inflated by poor policy choices. Cost of capital is determined by several risk elements associated with renewable energy investments, and one of the primary risk elements is the support mechanism in place. In this chapter we discuss how different support mechanisms address different risk, and how different investor types perceive these.

We will introduce four key issues: first, what do investors consider as the key criteria to be embedded in an investment friendly support mechanism (section 2.1)? Second, what do these criteria imply for the functioning of the main support mechanism in place in the EU and their implications for different types of risks from investments in wind power (section 2.2)? Thirdly, we will evaluate the different investors’ perception of the interplay between risks and support mechanisms. We will here draw on views expressed in six interviews we have conducted with utilities and financial investors (section 2.3). Fourthly, we will discuss what potential policy trade-offs are involved in designing support mechanisms in the period running up to 2020 (section 2.4).

2.1. KEY CRITERIA IN INVESTMENT-FRIENDLY SUPPORT MECHANISMS

Support mechanisms offer a higher and typically more stable remuneration to a renewable energy installation than is obtainable via the power market price. Support mechanisms are therefore crucial to the expected profitability of a specific investment. Support mechanisms basically have three main characteristics: 1) Is the supported period long enough? 2) Is the support level high enough? 3) Is the support period and level going to be changed? Each of these characteristics affects investors’ perception of risk and thereby the investment premium they require. A good policy mechanism must address all three characteristics, and can be summarised as fulfilling the “three L’s”: long, loud, and legal.¹

Long:

Wind energy installations typically have higher up-front capital costs than conventional power generation and e.g. biomass, cf. Figure 1.2.² This implies that the large up-front payment will have a long payback period, typically of around 15 years or more.³ Consequently, such investments are exposed to risks over a longer-term. In order to cover this risk, support mechanisms should offer support for a sufficiently long period of time, preferably covering the payback period or the entire lifetime of the installation.

¹ Hamilton (2009b). See also IIGCC (2011) for investor views on generic good policy design
² See also e.g. Hamilton (2009b)
Support mechanisms for wind energy

**Loud:**
Most renewable investments are not yet able to compete with fossil fuel energy production without support and a suitable framework (priority grid access, etc.). One study finds that policy support is crucial in order to attract investors, and that 36-55 per cent of the cost of electricity from a selection of wind installations is provided by policy support. In order to incentivise the development of renewable energy sources, the size of support mechanisms must therefore be sufficiently large.

**Legal:**
Support mechanisms must build up confidence that they are stable and can provide the basis for long-life investments. Simply making loose political statements about longer-term ambitions are not credible for investors. The more support mechanisms can be legally established frameworks based around binding targets, the more cash flow uncertainty will be reduced, and consequently the lower the cost of capital will be.

**Striking the right balance**
A good support mechanism must strike the right balance between these three elements. This can be illustrated by a mechanism that offers a very substantial level of support, thus fulfilling the **loud** criteria. However, in times with sovereign budget concerns, concerns about industrial competitiveness and pressure on real income growth, a **loud** support mechanism may be perceived as more vulnerable to policy adjustments due to burdens on (1) public budgets if financed by taxes or (2) industrial and private energy consumers if financed over the electricity bill. Hence, a mechanism (over-) satisfying the **loud** criteria may compromise the **legal** criteria.

2.2. **How support mechanisms deal with generic investment risks of wind energy**
In this section we evaluate how the different risk elements that are present primarily in wind investments are addressed in the different types of support mechanisms. Our evaluation of support mechanisms in this section is based upon 2 principles:

**First**, our central focus is not on the level of support – the **Loud**. Rather it is about how the structure of a specific support mechanism can be designed so as to minimise the investors’ perception of policy risk. This is essentially a “bang for buck” concept.

**Second**, we want to highlight policy measures that can help reduce such investment risk by doing well on the concepts of “**long**” and “**legal**”. We want to avoid yet another sterile comparison of e.g. green certificate mechanisms versus fixed tariff mechanisms, and instead focus on each policy mechanism and in what respect each of these types of instruments can either do well or not so well in relation to reducing investment risks. In order to illustrate how dif-

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8 Climate Policy Initiative (2011a)
ferent variations of the same type of support mechanism have led to different perceived investment risks, we will present different practices in EU countries to illustrate.

When investors evaluate support mechanisms, two overall considerations are taken into account: 1) conditions making a deployed installation profitable and 2) conditions that ensure investors that a future installation will be profitable at the time of deployment. Different support mechanisms may affect these two considerations differently. Basically, it is a question of whether the mechanism is transparent and credible. A transparent mechanism makes it easier to predict the revenue flows of a concrete installation. A credible mechanism makes it easier to trust that an installation in the pipeline will receive the expected remuneration.

*Deployed installation*

There are primarily two issues related to a deployed wind installation that support mechanisms affect: covering high up-front capital cost, and addressing exposure to volatile power market prices. These issues will be discussed in depth below. In addition to these two issues, an important aspect for investors is the operational risk inherent in renewable investments. However, since support mechanisms objective is to provide sufficient remuneration of renewable energy investments, covering operational risk will not be the focus in this study.

Studies show that the required return on equity for investors in a specific installation can be about 3 percentage points lower for a Fixed feed-in tariff (FIT) versus a tradable green certificate mechanism (TGC), cf. Figure 2.1. This suggests that a FIT is perceived as the instrument that offers investors the lowest risk pr. return for a given installation.

Moreover, Figure 2.1 also shows that there is a significant potential for reducing the investors’ risk premia by enhancing the different support mechanisms (going from “generic” to “advanced”). In fact, the risk premium can be reduced by 4-6 percentage points depending on the specific mechanism. An “advanced” mechanism is defined as a mechanism that e.g. specifies the duration and the level of support, includes technology differentiation, and varies according to differences in cost structures over time.
Future deployment of installations

While a specific support mechanism may be good at providing a certain revenue stream for a deployed installation, it may perform differently with respect to ensuring this revenue stream for an installation that will be deployed in the near future. For complicated installations such as e.g. offshore wind parks, the lead-time from the planning and development phase to the operation phase can take several years. In this context, the risk premium demanded is crucially depending on how investors perceive the expected remuneration in the short/medium term. Since the expected remuneration is very much a matter of the credibility of medium term political targets and ambitions, the effectiveness of the support mechanism is basically a matter of ensuring credibility in the overall climate policy framework.

How to improve support mechanisms

The question we address in this report is how a good design of policies can mitigate investment risks, for a given level of support (keeping loud fixed)? We are looking mainly at three typical support mechanisms in the EU, namely fixed feed-in tariffs (FFT), premium feed-in tariffs (PFT) and tradable green certificates (TGC).

All three types of support mechanisms can be tweaked in order to boost the “long” and “legal” criteria. In the following we evaluate the support mechanisms according to the elements relevant for both deployed installations and future deployment of installations, cf. Table 2.1.

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9 Several European countries have indicated interest in or applied an auction mechanism. An auction mechanism is however a variant of a feed-in tariff where the remuneration is determined by the market actors willingness to pay instead of a political decision.
Table 2.1 Important features to minimise risk perception

<table>
<thead>
<tr>
<th>Risk element</th>
<th>Fixed feed in tariff</th>
<th>Premium feed in tariff</th>
<th>Tradable green certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployed installation</td>
<td>Support period should cover a substantial period of the project’s lifetime</td>
<td>Full exposure in case of no price floors and ceilings. Price floors will reduce investors’ risk by transferring it to the public.</td>
<td>Policy period should be sufficiently long. Certificates should be bankable. Exposure to short term volatility in power market price. However, the TGC price will move in opposite direction of structural power market fluctuations, thus offering a hedge. Obligation to surrender certificates should be predictable, and adjustments should be based on transparent criteria in order to secure a stable TGC price.</td>
</tr>
<tr>
<td>High up-front capital cost</td>
<td>No exposure to price volatility</td>
<td>Credible medium- to long-term targets. Price shall reflect these targets. Regular review clauses with adjustments based on transparent objective criteria in line with overall climate ambitions.</td>
<td></td>
</tr>
<tr>
<td>Transparency of remuneration (exposure to volatile power market prices)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future deployment of installations</td>
<td>Long-term certainty about demand for renewable energy (credibility)</td>
<td>Certainty to be embedded in policy. Absence of “legality” due to need for flexibility. Instead, policy credibility to be earned over time. EU binding targets may support national targets.</td>
<td></td>
</tr>
<tr>
<td>Future deployment of installations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Copenhagen Economics

High up-front capital cost

Since a wind installation has high up-front capital costs, the initial investment must be recuperated over a long period a time. This places much higher demands on the net future cash flow, since a wind producer cannot scale down (or up) production over time in response to varying input prices or power market prices.

This implies, both in terms of FITs (FFT and PFT) and TGC, that credibility in the duration of the support mechanism is of importance. For a FIT, the duration of the specific tariff should be long enough to cover a substantial part of the lifetime of the investment. This may well be the whole of the investment project’s lifetime. The level of support to a vintage of installations – say offshore wind power installed in 2011 – would remain constant over the period while new installations could be adjusted downwards in view of technological progress.

For a TGC mechanism, it is important that the time horizon for the market is sufficiently long. E.g., if there are no credible commitments, that the market will continue to exist after 2020, the net future cash flow of installations will be exposed to much risk, since wind installations deployed today have a lifetime well beyond 2020. In order to ensure that quota obligations are in line with long-term targets, scheduled reviews could take place at a regular basis, with transparent and objective evaluation criteria.\(^\text{10}\)

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\(^{10}\) See e.g. Copenhagen Economics (2011)
Exposure to volatility of power market and volatile TGC prices

For a FFT there is no direct exposure to power market volatility during the period of coverage. This reduces investors’ perceived risk related to the revenue stream, and also has the added benefit of being simple. In some cases however, the FFT cannot cover all risks related to remuneration. This is the case in the hours where the price of power gets below zero in which case some FFTs do not offer support. While this is an unusual case it becomes more and more relevant, as high levels of wind are introduced in the power system, and some generators, such as atomic power plants, have higher cost of shutting production down than getting a negative price. In countries such as Denmark and Germany there has been an increased focus of regulators on this challenge, which may be mitigated by the ability of wind turbines to shut down during such off-peak hours.

From an investor perspective, it is not the short term spot price that matters, but rather long-term trends. In Germany, Spain, Italy and Sweden, this has been upwards sloping from 2002 to 2008, cf. Figure 2.2. Since then, the crisis has led to substantial falls in all four countries.

Figure 2.2 Power market spot prices, 3 month average

![Graph showing power market spot prices](Source: Energinet.dk, Nord Pool Spot, CESAR elcertifikat, OMIE, Gestore Mercati Energetico)

With both a PFT and TGC, the total remuneration is a sum of the power market price and the policy “part”. The exposure to power market volatility is thus unavoidable and intended. Volatility in power market prices are driven by changes in demand and changes in prices of marginal energy sources, primarily gas and coal. So during a weakening economy, where power market prices fall, producers of electricity from coal, gas and biomass plants also see their fuel costs going down, thus compensating for the reduced revenue, as has been the case
in the most recent years cf. Figure 2.3. This is not the case for wind power where all costs are linked to the initial investment. Consequently, while a PFT may be effective in e.g. incentivizing biomass producers to regulate production as power market prices change, this incentive is ineffective for wind producers since production is only determined by actual wind capacity.

**Figure 2.3 Commodity fuel prices and power market prices**

![Graph showing commodity fuel prices and power market prices](image)

*Note: Commodity Fuel (energy) index, 2005=100. Includes Crude oil, Natural gas and Coal price indices. Source: International Monetary Fund and Energinet.dk*

For a TGC there is also exposure to power market volatility. Unlike with a PFT, the TGC provides a hedge against structural shifts in power market prices.\(^{11}\) This is because the TGC price is determined as the difference between the expected future marginal costs of renewable energy covered by the mechanism and the expected power market price, cf. Figure 2.4. Hence, a lower *structural* power market price will drive up the price of TGC, thus protecting renewable energy investors from receding revenue. In contrast, purely *short term* volatility in power market prices should not affect the price of TGC due to the stabilising effect entailed by the possibility of banking.\(^{12}\)

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\(^{11}\) Structural shifts are medium/long-term price changes, as opposed to "random" volatility in the price caused by e.g. unexpected wind patterns.

\(^{12}\) Pöyry (2011)
Due to this hedging property, the TGC is in itself able to mitigate much of the risks associated with power market volatility. What is required then to ensure a high level of certainty is a regulatory regime that ensures a predictable pattern of quota obligations going forward and covering a long period. Moreover, scheduled reviews of quota obligations could make adjustments based on transparent and objective criteria such as projected costs of new renewable energy sources and expected lead time from initial project planning to deployment. Also, to control for unexpected yearly oversupply/undersupply and to keep prices stable, TGC should be bankable between periods/reviews. The Swedish TGC mechanism has shown largely stable prices, with a somewhat upward sloping power market price, cf. Figure 2.5.
Thus, seen from an investors’ point of view, both TGC and FFT provide a natural hedge against fluctuations in power market prices. The FFT may appear superior since the support level is fixed. This is accentuated in countries with less well functioning power markets since power market fluctuations are particularly difficult to predict. A comparison of the UK ROC system against the Swedish TGC is instructive in this respect. Power market prices in Sweden are determined within the setting of the regional electricity market Nordpool, which, for many years, has provided a competitive and transparent determination of power prices in countries with strong legal unbundling between utilities and TSOs. By contrast, a large number of reviews have suggested that the UK market, characterised by a degree of vertical integration, makes it much more difficult for non-utility investors to hedge against power market uncertainty, precisely due to the lack of transparent market prices.

**Long-term certainty over future deployment**

Both a FFT and PFT is from a legal point of view to be seen as sequential one year legal commitments to provide fixed or premium tariffs to particular vintages of technologies over a given number of years. Both tend, in their advanced form, to be based on ongoing reviews of support levels in view of the expected cost-reduction progress of the covered technologies. Some countries run indicative demand levels for different technologies’ market shares but they are typically not legally binding. Due to the potentially long lead time of e.g. wind installations from project planning to time of remuneration, investors may fear that expected support level will change before actual deployment. Countries may in fact change the relative support levels between different technologies as well as backtrack on longer-term goal com-
mitments. Within the EU this uncertainty is at the national level mitigated somewhat by the legally binding EU targets. However, since these targets cover renewable energy as a whole and not a specific technology, this does not offer strong credibility. Consequently, credibility of specific support mechanisms is very difficult to programme legally with either a FFT or a PFT and is something that needs to be earned over time.

A well designed TGC system has inherently less scope for political interference with actual remuneration through the TGC prices. This is since the forward setting of prices is partly embodied in the TGC market, as prices are the direct consequences of quota obligations covering years in advance. If regular reviews are envisaged with transparent and objective price readjustments according to actual deployment, this will create confidence in the long-term TGC price. One key aspect of the increased scope for credibility is that setting up a market based mechanism such as a TGC creates a strong lock-in effect for policy makers. It is most likely perceived as much more difficult to tamper with the rules of an existing market, than it is to change the level of next year’s support in a FFT. Moreover, a TGC also offers scope for cooperation between several countries. In addition to being a very good step in the direction of deploying renewable energy in Europe in the most cost-efficient manner, a multi-national TGC also enhances the lock-in effect, thus making it even more difficult to backtrack on commitments.

**Good and less good practices within the EU**

Within the EU, there are groups of countries that have been capable of providing strong “long” and “legal” characteristics to their support mechanisms, and some countries that have performed less well.

Within the “strong” group we would like to point to Germany and Sweden. The FIT mechanism in Germany has been widely recognised as being successful in delivering renewable energy deployment. The German target for renewable energy in electricity for 2010 at 12.5 per cent was exceeded already in 2007 reaching a total of 14.3 per cent. Especially the deployment of wind energy has witnessed the largest growth. The success has mainly been attributed to the high investment certainty inter alia caused by the long duration and the stability of the mechanism. The support is guaranteed for 20 years, and the tariff is well known throughout the whole period, which scores high on both “long” and “legal” and thus provides a transparent investment climate. In addition, the German support mechanism is an integral part of Germany’s overall climate change policy framework, which makes the system score even higher with respect to “legal”.

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13 See e.g. IIGCC (2011) and Green X (2004b)
14 BMU (2011)
15 See e.g. BMU (2011)
16 European Commission (2008)
17 IIGCC (2011)
In many comparisons of feed in tariffs versus tradable green certificates, the Swedish system is often overlooked or omitted since it is a relatively young system in a small country (initiated in 2003). However, the Swedish system has in fact been quite successful in securing investor certainty in the system and thus deploying renewable energy investments. As shown in Figure 2.6, the price of certificates in Sweden has been both relatively stable and quite low as compared with both the UK and Italian system. Important elements in obtaining these stable prices have been the long time horizon envisaged (obligations are set until 2035 as a yearly percentage of electricity use), and the possibility of banking certificates for future redemption, in order to counteract fluctuations in the market.

Figure 2.6 Price of green certificates in IT, UK and SE

Note: In some months before August 2007 there were no trade of Italian certificates and hence no observed price. This was from April-September 2006, and June/July 2007. These observations have been averaged out in the figure.

Source: Svensk Kraftmäkling AB, www.e-roc.co.uk, and Mercato Elettrico

The UK support mechanism has been much less stable than e.g. the German and Swedish. In 2006 the UK changed its Renewables Obligation mechanism; four years after its introduction. While the change may have improved the mechanism in itself, it gave rise to substantial uncertainty of the stability of the ROCs, and contributed to what was described as an “investment chill”, where the market slowed down considerably. The uncertainty was associated with inter alia the price of the certificates and whether or not projects would be “bankable”. From an investors’ point of view, this does not score particularly high with respect to “legal”.

Some existing mechanisms have however, been deemed even more lacking with respect to both “long” and “legal”. In this respect both Spain and Italy has gathered some attention:

18 Hamilton (2009b)
The Italian green certificate system was initiated in 2002. Several amendments were introduced from 2008 onwards, including an increase in the time period an installation receives certificates (from 12 to 15 years), and introducing technology conditional certificate entitlements. Moreover, the national TSO was required to buy unsold certificates at a reference price, effectively creating a price floor. In 2010 however, it was proposed to abandon the price floor which created major uncertainty among the actors, leading to large price reductions. More importantly however, such sudden policy changes spur massive uncertainty with respect to the stability of the mechanism in the years to come, thus scoring very low with respect to the "legal".

Prior to 2009, the Spanish system was greeted for achieving a large deployment of renewable energy, and even deemed the most effective and efficient system in Europe. Surveys back in 2004, however, also showed that Spain was considered as one of the riskiest countries for renewable energy investments. The uncertainty was mainly attributed to there being no guarantee of the tariff level of individual installations over the time period. Moreover, the system was underfunded to such a large extent that Spain has accumulated a state-backed debt (the so called tariff deficit) of about EUR 26 billion. While the deployment of renewable energy was substantial, especially in 2008 cf. Figure 2.7, deployment was dramatically reduced in 2009. This followed from a change of the system in 2008 induced inter alia by constrained government budgets and an overall increase in expenditure on support due to the increased amount of renewable energy installations. The intervention retroactively reduced the tariff to solar energy by 30 per cent and capped the overall market size. Not only did this affect incentives to invest in Spain in the near future, it has probably reduced confidence in Spanish support mechanisms for a very long period to come, and moreover also affected confidence in European support mechanisms in general. This does not score high with respect to "legal".

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19 See e.g. Watson et al (2008)
21 Green X (2004b)
22 See e.g. PWC (2011)
23 See Hamilton (2009b) attributing the adjustment to both poor tariff design and unsustainably high tariff levels
2.3. INVESTOR PERCEPTIONS: INTERPLAY BETWEEN RISKS AND SUPPORT MECHANISMS

Our analysis has identified a number of risks associated with investments in pre-deployment and deployment phase. These risks are spread unevenly across different type of investors, somewhat depending on the specific finance structure as described in section 1.4.

We have conducted a number of interviews with investors in deployment, and will provide an overview of the main learning points from these interviews. In addition we will add the perspective of supply chain operators. The learning points are based upon interviews based on the questionnaire contained in Appendix 1. We asked them four key questions:24

- Views on ETS system as a driver of renewable investments
- Likely policy development and policy risks for renewable energy the next 5-10 years
- Pros and cons of different support mechanisms and their design
- Exposure to power market prices and risk management

**View on the EU ETS system**

All respondents agree that with the current price levels of ETS allowances, the EU ETS will not drive renewable energy deployment. In the near future, the role of EU ETS is limited for renewable energy. More generally, the ETS is hampered by two elements: (1) the inability of the EU to commit to a long time horizon (beyond 2020) and (2) uncertainty for investors of medium/long term price developments. More specifically:

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24 We also asked whether the interviewees perceived the answers to be different for different investor types.
Financial investors:

- Noted that the ETS is to some extent a substitute for national support mechanisms. Only relying on ETS would expose investors to power market volatility, which is prevented with a FFT.

Policy developments

All respondents agree that the economic crisis has shown policy risk materialising. Focus will be on reforms in a national context, with limited likelihood of countries moving in the direction of joint implementation of renewable energy targets as allowed under the RE directive. There was support for the idea that having groups of countries signing up to joint implementation could better lock-in and stabilise systems as well as creating larger and more transparent markets, which reduce investment costs. However, it would need to be carefully managed to ensure smooth transfer from national to more common systems. If not, investment may be held back until it was clear what system finally emerged. Unexpected changes to support mechanisms increase investor risk. However, there were some differences between groups of investors:

Financial investors:

- Underlined in particular that retroactive changes (affecting already deployed installations) are the worst type of policy intervention. This has caused some investors to increase risk premia of renewable investments, and to simply stop all future investments in Spain.

Utilities:

- Stated that they are used to act in political environments with changing policies. The risk of policy back-tracking has thus not increased actual risk premia significantly so far (while lower support rates have obviously slowed investment).

Pros and cons of different support mechanisms

All agree that a long-term policy framework with a high legal certainty that is both transparent and credible is key requirements for a good support mechanism. For the two main types of system mechanisms (FIT and TGC), there was agreement about the main ingredients required for the two main types of systems to be seen as long and legal, backing up our criteria outlined in Section 2.1. However, there were some differences between financial investors and utilities as regards preferences. They were partly a consequence of the way specific countries had operated these systems, and partly a consequence of their differences in modes of operating and experience with energy markets.

Financial investors showed a preference for:

- Simple mechanisms, and specifically prefer a FFT. They require a lower risk premium because the revenue flow is more predictable and more certain.
- Changes in TGC particularly in Italy (but also the UK) had led to changed remuneration to existing installations.
There is probably also a strong, far from finished, learning phase for financial investors: particular offshore wind farms have substantial operational as well as potential policy risks. Getting investment premia down and getting the right financial structures in place is a process that is still progressing.

The utilities (non-incumbents) have a more balanced view on support mechanisms.

- Some mention that a TGC is perceived as having lower policy risk. This is because it is more difficult to policy makers to change the rules of a market based system, than it is to change a number in a FIT. Even the German FFT, which is commonly commended for its transparency and stability allow quick and unexpected changes to e.g. support levels. The more differentiated a system becomes (differentiating between e.g. different technologies) the more bureaucracy is established.
- While a FIT provides more certainty of the revenue stream for a deployed installation, it may be very uncertain what a particular un-deployed installation with significant lead-time will earn after deployment, since FIT levels is likely to change over time (utilities more exposed to pre-deployment risks than financial investors).
- Some noted that when supported volumes grow it is important to minimise the distortion of the market and introduce competition even for supported production, by applying market elements to the mechanisms.
- Some noted also that it is very difficult to achieve several objectives with only one support mechanism. E.g. the market based system is good to facilitate competition between different technologies, but not good to spur innovation in one particular technology. Vice versa for FIT’s
- Finally, some noted that it would reduce the risks related to TGC if there were credible (public) predictions of both the expected short, medium and long-term TGC price and power market price (as e.g. in the US). This would also reduce the price of hedging products. Introduction of price floors in TCG could further reduce investment premia.

Exposure to power market prices and risk management

All respondents note that exposure to power market volatility requires an increased risk premium. More transparent and well-functioning wholesale power markets may help reduce such volatility.

Financial investors

- It is very difficult to hedge against power market fluctuations.
- It is possible to buy financial products that provide the equivalent of a FIT, but these products are very expensive and introduce counterparty risk against the insurer.

Utilities:

- Requires a lower premium since they are able to diversify power market volatility in different markets and between different power sources (RE as well as conventional power).
• Are better at evaluating these risk elements than e.g. financial investors, which may be more reluctant to invest in technologies that also have significant operational risk (a lot of downtime)

2.4. WIDER POLICY OBJECTIVES AND CONSTRAINTS

The discussion so far has focused rather narrowly on specific aspects of support to renewable policy that can help reduce risk premiums for a given level of ex-ante policy support. We have in the study highlighted that any support mechanism for renewable energy should be focused on providing long-term stability for investors. We stress what elements are required in the operation of respectively quota (or TGC) mechanism and feed in tariffs to reduce investment risks based upon both analytical as well as interviews with different type of financial investors.

However, instrument design needs to be seen against wider policy objectives and constraints. This may entail a number of important trade-offs to be made between minimising financial risks to individual installations of renewable energy such as wind power generators and such other objectives. We will just highlight two issues that are important for the overall policy design issue:

• Competition and innovation
• National or joint implementation of targets

Competition and innovation

There is a wide consensus on the need to provide a wide palette of support instruments to encourage more low carbon technologies to reach long-term climate policies as well as energy security objectives.

For mature technologies such as onshore wind in good locations and some biomass costs of generation, stringent carbon prices plus broad market-based support instruments such as TGC could be an effective combination. While the fixed feed-in tariff is best to reduce policy-related uncertainty to individual installations, it is more difficult to combine with competition between different technologies in meeting deployment targets for renewable energy. The whole idea of fixed feed-in tariffs is to set remuneration at a level that allows them to viable vis-a-vis production from existing fossil fuel-based generation. This is a process that will, nearly by definition, stifle competition between different sources of mature technology to meet renewable energy targets at low costs.

For more costly and less mature technologies - such as offshore wind and possibly PV solar - fixed feed in tariffs combined with guaranteed but also overall capped demand could be a more effective support instrument. The idea here is as much to encourage substantial reduction in future costs of generation as replacing current emissions of greenhouse gases. By providing a sufficiently high level of support and, as importantly, guaranteeing demand for future installations for a substantially long period, the entire wind industry can develop a
longer-term strategy. Finally, more pure research funding is required to develop promising but yet to be developed technologies to achieve much steeper reductions in future emissions of greenhouse gases. This mapping of mature of technology with choice of instruments is outlined in Figure 2.8 and explored and explained in a number of studies.

Figure 2.8 From research to market deployment: instruments tailored to maturity of technology

![Figure 2.8](source)

Source: Copenhagen Economics based on IEA (2008)

National versus wider European implementation of RE Targets

Evaluated on the basis of the national action plans to meet renewable energy targets, there seems limited appetite for joint implementation of renewable energy targets as allowed by the RES directive. For the countries accounting for the vast bulk of the projected expansion as well as future share of wind power generation in the EU, namely Germany, the UK, France, Spain and Italy, all countries expect to meet their renewable targets entirely by their own production cf. Table 2.2. In other words, they do not expect to use the co-operation mechanism. Only Sweden, joining up with Norway, has revealed a willingness to make use of this mechanism.

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25 A combination of focused technology policies such as R&D support, demonstration projects as well as learning effects can be an effective driver in reducing future generation cost.

26 Copenhagen Economics (2011a) and (2011b)
Table 2.2 Installed capacity of renewable energy in power generation

<table>
<thead>
<tr>
<th></th>
<th>RE share in power generation 2010</th>
<th>Onshore wind (pct. of RE)</th>
<th>Offshore wind (pct. of RE)</th>
<th>Expected RE share in power generation 2020</th>
<th>Share of increase in RE due to onshore wind</th>
<th>Share of increase in RE due to offshore wind</th>
<th>Share of total wind capacity in the EU, 2020</th>
<th>Intends to use joint mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>17</td>
<td>51</td>
<td>0</td>
<td>39</td>
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</tr>
<tr>
<td>Spain</td>
<td>29</td>
<td>46</td>
<td>0</td>
<td>40</td>
<td>47</td>
<td>10</td>
<td>18</td>
<td>No</td>
</tr>
<tr>
<td>UK</td>
<td>9</td>
<td>34</td>
<td>12</td>
<td>31</td>
<td>37</td>
<td>40</td>
<td>13</td>
<td>No</td>
</tr>
<tr>
<td>France</td>
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<td>17</td>
<td>0</td>
<td>27</td>
<td>46</td>
<td>21</td>
<td>12</td>
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</tr>
<tr>
<td>Italy</td>
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<td>21</td>
<td>0</td>
<td>26</td>
<td>38</td>
<td>4</td>
<td>6</td>
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</tr>
<tr>
<td>Sweden</td>
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<td>0</td>
<td>63</td>
<td>88</td>
<td>4</td>
<td>2</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: ECN 2011 - Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States

We expect then that Member States will in the near future, say in the next five years focus on increasing the effectiveness and cost-efficiency of support mechanism from a national perspective. Over a longer-term horizon, cost-efficiency as well as wider aims of boosting innovation and competiveness may call for a more joint EU approach to support mechanisms.

Our reading from this is that Member States and the EU Commission in the coming years should focus on the following two elements of reform.

First, reforms of national support mechanism should be more focused on reducing investment premia and financing costs. If official projections of the substantial offshore wind are to be realised, reducing risk premia is of particular importance as stated earlier, given their still high generation costs, operational risks, high capital costs, long time lag between planning and actual deployment and many years of operation. In terms of overall policy design, we would encourage a move towards more market based competition between mature technologies combined with specific support mechanisms for offshore wind.

Second, reform should at the same time pave the way for a future more EU oriented approach to joint implementation. That would include strengthening the internal electricity market to ensure more equal power market prices: this is a precondition for the use of more harmonised EU support mechanisms, in particular TGC and premium feed-in tariffs. This requires more investments as well as better management of grids and interconnectors. Moreover, we would encourage more countries to exploit the opportunities for joint co-operation in the RE directive. For mature technologies, this could build on the experiences of the emerging Norwegian and Swedish TGC mechanism. For offshore wind, the present work in the context of North Sea countries could be expanded to more explicit co-operation on de-
fining crediting rules against national targets for wind power produced in the waters in the North Sea and Baltic Sea. Such planning is particularly beneficial when designing the grid system from wind installations to the shore as well as interconnectors between the countries particularly in Northern part of the EU.
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Financing Gap.
Theoretical evaluations of different support schemes have been the focus of much work over
the past few years. In order to pursue a more empirical angle to such an evaluation, we have
conducted interviews with five selected stakeholders that either have or are considering in-
vesting in wind energy projects. Investments in wind installations have typically been under-
taken by classic utilities, but over the coming years traditional financial investors will need to
play a much bigger role in financing renewable energy installations. We have therefore inter-
viewed five European investors that cover both classic utility companies and more traditional
financial investors. The investors we interviewed were: E.ON, Vattenfall, DONG Energy,
Allianz Specialised Investment, and ATP.

Three of the interviews were conducted as phone interviews of 1-2 hours duration, while the
remaining two were physical meetings. All interviews were based on a questionnaire, cf. Ap-
pendix 2, which the investors received beforehand.

The outcome of these interviews have been summarised into learning points, which are
summarised in Section 2.3. The learning points are not quotes or specific statements from
any investor, but the conclusions we have drawn from our overall impressions of all inter-
views. All of the interviewees have been asked to review our summary, and have accepted our
representation of their views.
Copenhagen Economics is conducting an analysis for the Danish wind turbine producer, Vestas with the objective of clarifying how different renewable energy support mechanisms influence different investors’ incentive to invest in renewable energy. This understanding will be used in a political regulatory context in order to encourage “clever” support mechanisms. The objective of this study is not to draw the obvious conclusion that “more support will result in more investments”, or argue for more support, but to understand how support mechanisms should be designed to facilitate the most investments pr. euro of support. This interview constitutes an essential element in obtaining a thorough understanding of investors’ perception of the different support mechanisms.

Background
In order to meet the EU’s renewable energy targets, substantial deployment of renewable energy capacity is necessary. Such massive deployment requires a level of investments greatly surpassing previous and current levels. Intensified involvement of private investors is crucial in this respect, which is also recognised in e.g. the report on mobilizing climate finance prepared for the G20 Finance Ministers.

The current lack of private investor involvement may be caused by several factors. The most likely cause is that expected returns on investments simply do not match perceived risks. Unlike classic investment undertakings, returns on renewable energy investments are to a very large extent driven by various support mechanisms. And the uncertainty associated with such mechanisms, both related to the revenue side and the risk side may not be trivial to assess. Understanding the risks and returns of such mechanisms is essential in order to design the mechanisms optimally and thereby facilitate increased private investments in renewable energy projects.

Objective of the analysis
The objective of our analysis is to get a thorough understanding of the various risk elements associated with the different phases of a renewable energy investment as perceived by investors. Moreover, and equally important, is to get an understanding of how the structure of different types of mechanisms affects these risk elements seen from the private investor’s point of view, and thus the required return on capital. Our focus is on wind energy investments. We will in this context also consider how such support mechanisms co-function with other policies such the EU ETS system, functioning of power markets etc.

The structure of the questionnaire
During the meeting, we expect to ask the questions stated in the questionnaire below. These questions will be grouped into 5 different categories. In each category, we begin by outlining our preliminary understanding of the issues at stake. Each category concludes by stating some questions relating to these issues. We will attempt to guide our discussion along these categories. Your verbal as well as written answers to these questions are much appreciated.
FROM INVESTMENT RISK TO POLICY DESIGN

The discussion so far has focused rather narrowly on specific aspects of policy support to renewables that can help reduce risk premiums for a given level of ex-ante policy support. However, instrument design needs to be seen against the wider objectives pursued.

Support for renewable energy is based on addressing the challenges of climate change and energy security. The first challenge requires abatement of greenhouse gases, in casu CO$_2$ emissions. The latter requires the replacement of imported fossil fuels from potentially unstable political regions with more “home grown” energy sources. In a longer-term perspective, attaining anything close to the EU’s climate and energy policy objectives requires much more substantial reductions in GHG emissions, in turn requiring much higher carbon taxes/increase in ETS allowance price. This will by itself boost the economic viability of renewable energy sources over a much wider scale in particular as the gap in generation costs between fossil fuel-based production and low carbon sources is steadily being reduced.

However, over the next 10 years, attaining RE targets will require additional support to renewable energy. In some studies in 2020 this reaches a yearly level of about €80 - 100 billion. Obviously this situation suggests that the investors’ evaluations of size and uncertainty of policy related support will be crucial. For offshore wind, accounting for the bulk of expansion of wind power in countries such as the UK and Germany, in excess of 60 to 70 per cent of remuneration is expected to come from policy support. Moreover, as documented in a number of reviews, new sources of finance must be tapped as the balance sheets of the traditional main sources, energy utilities, can no longer provide but a much smaller fraction.

1. Assessment of policy outlook and focus of policy reform

Our preliminary findings

The EU has committed itself and its Member States to a policy of expanding the share of renewable energy in total energy production. In so doing, Member States are to attain specific legally binding minimum shares by 2020. Most of the expansion is expected to be in power generation, with biomass and wind power to provide the bulk of renewable energy. The present set of policies to achieve this aim is the EU ETS as well as national support for renewable investments. Currently, rather weak incentives are provided by the ETS system, with allowance prices below € 20 per ton of carbon for over a year now. Most estimates suggest that reaching the 2020 targets will require additional support of about € 80 - 100 billion on an annual basis.
Your view: Focus of Policy Reform

Do you share our assessment of the need for strong support to reach targets?

Are technologies that require a very high level of support by definition seen as more risky, consequently requiring more upfront and legally secured support in order to avoid excessive investment premia?

How important would a more stringent ETS system (higher allowance prices) be for your inclination to invest in renewable energy in the EU?

Is support through the ETS immaterial since Member States have in any case promised to deliver the RE-targets?

If changes should be made to the ETS to strengthen investors’ belief in sufficiently high carbon prices, what would be the preferred option:

- 30 per cent reduction target in 2020
- Commitment to legally binding targets beyond 2020

Have you made any quantified analysis of the importance you attach to improvements in the ETS?

2. Overall assessment of likely policy changes next 5 to 10 years

Our preliminary findings

There are no strong signals of major moves over the next five years towards neither more harmonised EU mechanisms nor major co-operation between selected groups of Member States. The EU review of RES directive in 2014 will provide an opportunity to take some stock of the scope for a more common EU approach. A main exception to the largely national approaches to support mechanisms is the Norwegian-Swedish co-operation on a green certificate mechanism. In addition to this, a minimum level of co-operation linked to the planning of offshore grid investments has been seen.

For the major EU economies accounting for the bulk of expansion (UK, France, Germany, Italy and Spain) reforms of national support will be the focus in the next 5-10 years. Given the scale of the economic crisis and its impact on public finances, it is to be expected that the focus on the actual cost of support will increase, especially due to the envisaged large scale deployment. Consequently we see a likely attempt to trim and refocus existing national policies. This will entail more focus to get as much out of potential low cost national sources as possible (biomass and onshore wind) while putting maximum pressure on driving down costs for higher cost technologies such as offshore wind.
Your view:

Do you share our assessment?

What moves towards more international co-operation and legally binding co-operation between groups of Member States or at the EU level can reduce or increase investment uncertainty?

Under what circumstances would it increase/reduce investment risks?

Have the economic climate and the risk of policy back-tracking already led to increased policy risks from your perspective?

Has that increased concrete risk premia associated with renewable energy investments?

3. Pros and cons of different support mechanisms

Our findings

The investor community describes effective support mechanisms as covering a long period and providing the support with high legal certainty. In addition, the actual level of support naturally also affects investment incentives.

EU Member States are currently applying mainly three types of support mechanisms: Fixed Feed-in Tariffs (FFT), Premium Feed-in Tariffs (PFT) and Tradable Green Certificates (TGC). Auctions have also been used to determine a specific tariff. We identify some characteristics which will reduce the policy risks for investors associated with both FTT and TGC:

- FFT: long periods with legally locked rates, transparent mechanism for setting future FFT so as to ensure investors about longer-term trends
- TGC: long period of commitments, bankability of non-used allowances, and clear and transparent criteria for setting targets to maintain price stability.

On the contrary, lack of these characteristics will drive up risk premia.

Your view:

Do you share the above assessment about what is required to make support mechanisms credible for investors for different types of mechanisms?

Do you have a preference for particular mechanisms and if so why?

Do you have formalised investment models that capture how much your risk premia and ex-ante required rates of return are affected by different type of support schemes?

4. Exposure to power market uncertainty

Our findings

Both TGC and PFT split remuneration into two parts: remuneration for green power and remuneration from the power markets. On the contrary, FFT provide a level of remuneration that is independent of the power market prices. This provides an additional level of un-
Support mechanisms for wind energy

certainty for the first two instruments. This uncertainty may in particular apply to power markets with lack of transparent pricing in wholesale markets, for example in countries such as UK, with strong vertically integrated energy companies. The TGC provides though a hedge: lower power market prices should in principle drive up the price of TGC as their value is determined as the difference between required remuneration to reach a renewable energy target and expected/actual power market price.

Your view:

<table>
<thead>
<tr>
<th>Do you share this assessment of the risks associated with exposure to power market fluctuations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would you, all things being equal, require a higher expected return to compensate for exposure to power market fluctuations?</td>
</tr>
<tr>
<td>If so, is this related to concerns about your ability to hedge against such fluctuations which may be impeded by weak transparency of wholesale power markets?</td>
</tr>
</tbody>
</table>

5. Investor type

Our findings
All evidence suggests that new sources of finance in much larger numbers need to be tapped in the coming years to finance the large required investments in renewable energy. Energy companies and banks will have to be supplemented by e.g. institutional investors with different investment criteria: such institutions are usually required by fiduciary obligations to get a risk adjusted market-based return on every single investment project while energy companies can take a longer portfolio-oriented approach and thereby take a longer-term perspective.

Your view:

<table>
<thead>
<tr>
<th>Do you share this assessment of the need to attract new investors with somewhat different investment criteria?</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent is your assessment of risks of support schemes and its consequences on risk premia shaped by the type of investors you represent (domestic energy company operating in own markets/ operating abroad, or financial investor)?</td>
</tr>
<tr>
<td>Will different types of investors evaluate the same underlying policy risk differently?</td>
</tr>
<tr>
<td>To what extent is this a consequence of the investors’ ability to hedge against risks to returns for example through power market volatility as well as non-transparent wholesale power markets?</td>
</tr>
<tr>
<td>Should the government engage in new funding mechanisms (repackage risks) to match investment profiles of new investors or should the private actors do this themselves?</td>
</tr>
</tbody>
</table>