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The impact of risks in renewable energy investments and the role of smart policies

Final report

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Executive summary

The European Union has set itself a binding target of "at least" 20% renewable energy in final energy consumption by 2020. To meet this target, considerable investments are required. Total annual investments are estimated at €60-70 billion per year[1]. These investments will have to come from investors, bankers and equity providers.

In contrast to investments in conventional electricity generation, investments in renewable energy sources (RES), such as wind and solar power, require large upfront investments, but low working/operating capital. Most investments are to be made upfront, before the system becomes operational. From an investor's perspective, this means that the overall investment risks increases. To compensate for this risk, investors require a higher rate of return on their investments, leading to increased cost of capital for RES investments.

Before investing in a renewable energy project, investors indeed perform a risk analysis to decide whether to invest or not. If investors perceive an investment as risky, they will demand a higher fee for making capital available. The cost of this compensation – the cost of capital - must be paid from the revenues of the projects and, thus, directly influences the cost structure of the project. If the investment is perceived as risky, the cost of capital increases. Due to the capital-intensiveness of renewable energy projects, the cost of capital is a crucial element in every renewable energy investment decision and can significantly influence the business case of a project.

To address these risks and, thus, lower the cost of capital, RES policies are designed to create more certainty in revenues and expenditures of RES projects. In case policies fail to address uncertainties, the increased cost of capital might cause a decrease in the number of RES projects actually realised, as only highly profitable projects will be implemented. This makes the cost of capital a crucial and decisive factor for RES investments and, subsequently, for meeting the EU 2020 RES target.

The DiaCore project aims at providing an estimation of the current cost of capital for wind onshore projects across the EU and assessing the impact of policy design changes on cost of capital.

According to our findings, the Weighted Average Cost of Capital (WACC) **significantly varied across EU Member States between 3.5% in Germany and 12% in Greece for onshore wind projects in 2014.**

[1] Financing Renewable energy in the European Energy market, Ecofys, Ernst & Young, Fraunhofer ISI, TU Vienna, 2010.

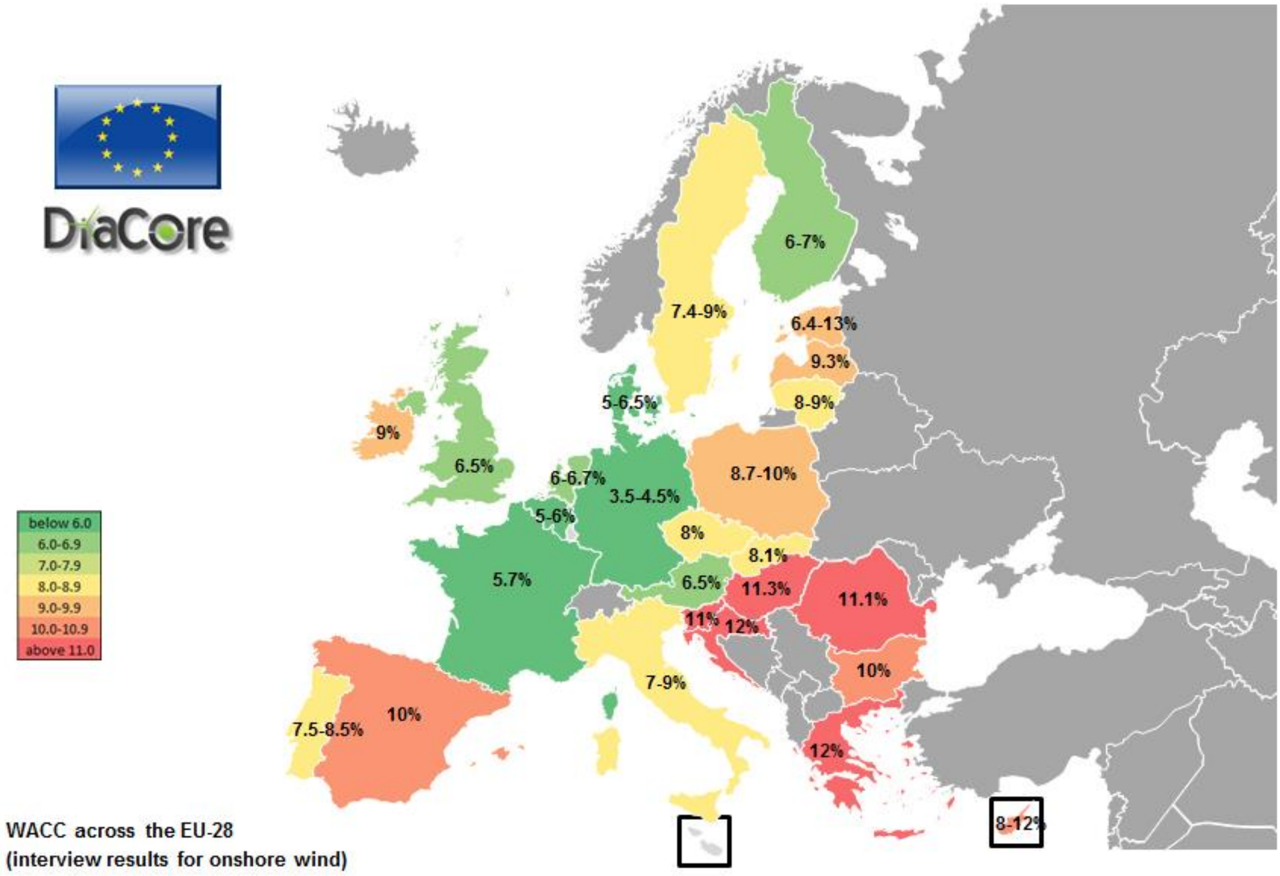


Figure 1: WACC estimations onshore wind

Looking specifically at the cost of equity, which is the remuneration for equity providers for making capital available, we also see significant differences in the EU. **The cost of equity for onshore wind projects ranged between 6% (Germany) and more than 15% in Estonia, Greece, Latvia, Lithuania, Romania and Slovenia in 2014**. The level of cost of equity is often influenced by risk perception of investors. In countries such as Germany where renewable energy policy is anchored in the renewable energy act, approved by law, and proved to be very reliable and credible over a long time period, the cost of equity is low. In economically and politically less stable countries where renewable energy is not yet mainstream or embedded in a reliable support policy, the cost of equity is higher.

Finally, **the cost of debt** (which is the remuneration for debt providers - such as banks - for making capital available) **varied between 1.8% in Germany and 12.6% in Greece in 2014.** According to investors, the main factors for the cost of debt value are the general country risk, the specific renewable investment risks and also the (lack of) competition between debtors.

These results shed light on a growing gap among EU Member States, where varying cost of capital can lead to significant cost differences in the development of similar renewable energy projects between the Member States.

The risk perception of investors can be influenced by several factors e.g. policy design, sudden policy changes, permitting procedures, grid access etc. Within the DiaCore project, specific risk categories were identified, which will impact wind onshore projects throughout their duration. We only analysed those risks that can be mitigated by RES policies. **Across all EU Member States, the risks induced by policy designs is perceived as most pressing.** This includes the choice of the policy scheme implemented by the Member States (e.g. Feed-in tariff, Feed-in Premium, Quota etc.). This choice determines the level of certainty for project developers. It also includes special design elements for existing policies such as the level of support, payment, and type of financing.

Policies have a role to play in mitigating investment risks, leading to additional savings. Governments potentially have a big role in mitigating risks, for instance by providing clarity on grid procedures and processes, implementing long-term stable policy schemes, improving structure and quality of the public administrative system and providing financial risk-sharing. As Member States show great variety in regulatory frameworks supporting renewable energy, in the maturity of the market, the availability of capital, and the involvement of governments, each of the measures should be tailored to fit the needs of individual Member State and mitigate risks efficiently and effectively. Policy designs stimulating RES, while keeping a good balance on cost-effectiveness, are important to **avoid windfall profits of high government or societal expenditures**. We drafted a policy toolbox providing a starting point for mitigating investment risks and lowering the cost of capital for RES investments.

Calculations based on the Green X Model show that if all countries would have the same renewable energy policy risk profile as the best in class, EU Member States could reduce the policy costs for wind onshore by more than 15%. A reduced country risk could lead to greater savings.

Methodology:

The methodology consisted of two parts: identifying renewable energy investment risks and formulating policy measures to mitigate RES investments risks.

In Part 1, insights were gained in the cost of capital for investments in renewable energy sources (RES). In order to estimate the Weighted Average Cost of Capital (WACC)[2], a theoretical model was constructed. In this model, an **estimation of the cost of equity** was made for **onshore wind projects** in each EU Member State based on the fluctuation of RES industries' share values compared to average fluctuations in share values. Secondly, the WACC was estimated for each Member State based on the modelled result of the cost of equity, information on the cost of debt as well as the debt, and equity ratio for onshore wind projects.

[2] Nominal post-tax, at financial closure.

After estimating the financing parameters, we gathered information on risks influencing the RES investments. These risks influence the cost of equity and cost of debt for RES and, thus, the WACC of RES investments. Based on reports, previous studies, and databases, an overview was created presenting the **most important risks** for each EU Member State.

The outcomes of the theoretical model were evaluated and tested during interviews with over 80 financial experts from 26 Member States[3]. Based on these interviews, both the financial parameters and the ranking of the risks were adapted and used to draft **country risk profiles** for each EU Member State.

In Part 2, the focus was to assess the impact of policy design changes on the cost of capital and to formulate policy measures to mitigate RES investments risks. First, **a survey was conducted focusing specifically on the role of policy design**. The respondents were asked to indicate how the interest rate, equity share, and the expected return to equity would change if policy design elements were changed. The results show how the WACC changes when switching from one policy design to another.

Finally, an assessment was made on how policy measures can influence the risks impacting onshore wind energy investments. In general, there are four risk control strategies: avoid, mitigate, transfer/share, and accept. For this study, mitigate and transfer/share are most relevant. During the interviews with financial experts, information was gathered on how policies could mitigate investments risks. The results were used to prepare the **policy toolbox**.

[3] For Luxembourg and Malta no interviews could be conducted.

Table of Contents

Figures

Tables

Introduction

1.1 The DiaCore Project

The Renewable Energy Directive 2009/28/EC lays down the legislative framework for renewable energy sources (RES) until 2020. The aim of the DiaCore project is to ensure a continuous assessment of existing renewable energy policy mechanisms and to establish a stakeholder dialogue for future policy needs.

DiaCore aims specifically to:

1. Facilitate convergence in RES support across the EU.
2. Enhance investments and coordination between Member States.

DiaCore will complement the EC's monitoring activities of how Member States are progressing towards 2020 and builds on approaches applied in previous Intelligent Energy Europe (IEE) projects, including amongst others OPTRES and RE-Shaping.

It offers detailed cross-country policy evaluations, presented in an interactive RES policy database. Future consequences of policy choices were analysed using the Green-X model, highlighting policy needs for 2020 target achievement and contributing to 2030 discussions.

A key focus of the project is **to improve the conditions for financing RES investments**.

1.2 Improving the conditions for financing RES Investments

In order to meet the 2020 EU targets on renewable energy, considerable investments are required from all Member States. For the EU, the total annual investments is estimated at €60-70 billion per year[4]. From previous years, we know that this is possible, yet annual investments show a declining trend. In 2011, European[5] investments in renewable power and fuels added up to almost €115 billion, but then decreased to €86 billion in 2012 and €48 billion in 2013 (REN21, 2015).

The specific investment costs of most renewable energy options are higher compared to fossil alternatives. The investment costs of wind energy projects, for instance, account for about 80% of the total costs, whereas investment costs for gas power represent about 15% (Waissbein, et al., 2013). As investments are required upfront before any income is generated, investors perceive these investments as risky.

[4] Financing Renewable energy in the European Energy market, Ecofys, Ernst & Young, Fraunhofer ISI, TU Vienna, 2010.
[5] Including non-EU countries and Russia.

Due to market failures (hidden subsidies, externalities), the market price of energy is not covering the full cost of renewable energy (RE) technologies. Therefore, policy support is required to make RES competitive with fossil alternatives. As a result of the financial crisis and changed political focus, renewable energy support has decreased in many of the Member States.

In several countries, the policy support has been decreased to a minimum or totally abolished, sometimes even retrospectively. As policy support is a very important condition for the business case of renewable energy, (sudden) policy changes impact the risk perception of investors. If investors see a high risk, they will ask a higher return for their investment, driving up the costs for renewable energy.

Policy support is not the only factor that has an impact on renewable energy investments. Permitting procedures, public perception, grid access etc. can influence investment decisions of financiers and be perceived as a risk. Understanding the risks and estimating their impact on renewable energy investments is therefore important to decrease the costs of renewable energy projects and enhance investments.

The effect of increased risk perception by investors is that they will demand a higher return on their investments, increasing the costs of financing and thus the total costs for renewable energy projects.

Investment risks vary between European Member States (e.g. as they are influenced by country-specific conditions). Therefore, individual risks assessments can help identify the most important risks in renewable energy investments. Obtaining insights in these risks at Member State level helps to mitigate these risks, enhance investments in renewable energy and achieve the 2020 targets.

Against this background, the DiaCore project aims to respond to the following questions:

- What risks influence RES-E investment decisions?
- What is their impact?
- How do they differ among EU Member States?
- What are effective policy options to mitigate these risks, thereby reducing the costs of capital and increasing capital availability?

1.3 Objectives of the report

This report takes a closer look at the **role of risk** influencing RES investments. It focuses on identifying barriers and solutions to **enhance investments** in the RES sector.

It assesses the relevance and severity of risks in EU Member States, focusing on **policy-related risks**.

It provides insights in the most important renewable energy investments risks per Member States (**country risk profiles** for each Member State).

Furthermore, it offers policy options for mitigating investment risks by preparing a **policy toolbox** providing input and guidance to develop country specific measures for mitigating investment risks.

2 Approach

The project consists of two parts:

- Part 1 focuses on identifying renewable energy investment risks.
- Part 2 focuses on mitigation of investments risks.

Figure 2 below provides an overview of the project:

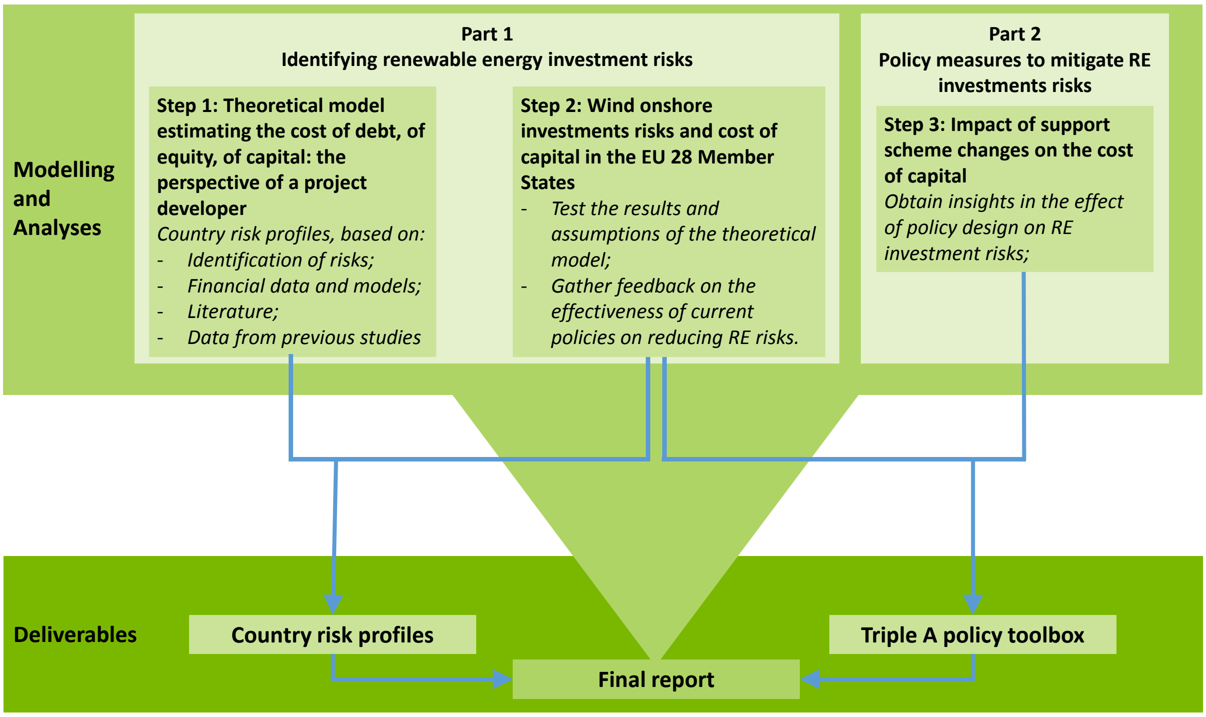


Figure 2: Approach

Within the two parts, three steps have been defined:

Step 1 – Theoretical model estimating the cost of debt, equity, and capital: the perspective of a project developer: as a first step, a theoretical model is constructed to estimate the influence of risks on renewable energy investments for individual Member States. This model helps provide insights in the scale of the investment risks per Member State (MS) and which risks are perceived as most relevant. This step results in a first version of the country risk profiles. In order to construct these profiles, we have:

a. Identified risk categories influencing investment decisions (mainly based on literature);
b. Obtained insights in financial models and parameters that influence investment decisions. For each Member State, the model estimates the cost of equity, reflecting the investment environment;
c. Divided the cost of equity over the risk categories (based on literature and studies), resulting in a ranking of risk categories for each MS.

Step 2 – Wind onshore investments risks and cost of capital in the EU-28 Member States: the results of the theoretical model are tested and evaluated per Member State. By sharing the results with financial experts, feedback is gathered on the completeness of risk categories, the influence of the risks, the role and effectiveness of policy in reducing investment risks. Furthermore, assumptions used to construct the model are tested.

Step 3 – Impact of support scheme changes on the cost of capital: the role and influence of policy on decreasing investment risks is analysed in more detail. To gain insights in the role of policy, an online questionnaire was created in which respondents were asked how financial parameters will change under different policy schemes. The reference case is a typical onshore wind project supported by a Feed-In Premium (FIP) policy scheme. By changing the policy scheme to non-sliding FIP, fixed FIP, tender with policy, and Feed-In Tariff, insights are obtained in the influence of policy schemes on cost of capital (i.e. cost of debt, cost of equity, Weighted Average Cost of Capital (WACC)).

The approach and methodology of the three steps are described in more detail in the subsequent parts.

Part 1:
Identifying renewable energy investment risks

3 Methodology on assessing cost of capital

The methodology of Part 1 consists of two main steps:

1. The creation of a theoretical model to estimate the risks.
2. The evaluation/validation of these findings in interviews with financial experts in Member States.

The following chapter is outlined as follows:

1. Providing the theoretical background to identify renewable energy investment risk categories. This helps us gain insight into the perspective of an investor.
2. Constructing a theoretical model to estimate the cost of equity, cost of debt and cost of capital. This helps us gain insight into the perspective of a project developer.
3. The evaluation of the model by interviews.
4. The creation of the country risk profiles.

3.1 Theoretical background to identify renewable energy investment risk categories

Investments and risks are inextricably linked to each other. Investment risks refer to the probability of factors occurring that can influence the return on investment. The *probability* of these factors occurring and their *impact* determine the scale of risk. These two aspects form the basis of risk perception. Prior to their decision, investors make an estimation of the factors that can influence their investments. However, not all factors are known upfront or it might not be possible to estimate their probability. This will add uncertainty to the investment decision. If uncertainty grows, investors will become more reluctant to invest. The second aspect relates to the impact of risks. For some risks, it is quite certain that they will occur, but as long as the impact is not substantial, it will not have a large effect on the investors. It is therefore the combination of probability/uncertainty and effect/impact that will determine how much risk is perceived by investors.

To estimate whether an investment is financially viable, investors will calculate the Net Present Value (NPV) based on the estimated future income and expenses of the investments. An important factor in this calculation is the Internal Rate of Return (IRR). In order to be profitable, the NPV should be positive. The IRR that is needed to obtain this positive NPV reflects the return investors will receive on their investment. To decide whether the investment is financially interesting, the resulting IRR is compared to a hurdle rate or discount rate. If the IRR exceeds the discount rate, investments are regarded as financially viable[6]. This trade-off between risk and return is the basic

[6] Under the condition that also the NPV>0.

framework for financial decision making. Additionally, the size of the losses is an important aspect in the decision making.

The discount rate is determined by the investor upfront and varies depending on the type of investment and the associated risk. A high discount means that investors aim to receiver a high return on their investment to compensate for the risk of investing in the project. In this study, the discount rate is therefore used as a proxy for risk. Although risks can have both a positive and negative impact, in the context of this study, the focus is on the negative deviation of the actual returns from the expected returns.

3.1.1 Risks categories

From an investor's point of view, the main goal of investing is to maximise the return. In general, investors strive to minimise risks, but are willing to accept risks if these are compensated with a higher return rate.

Risks associated with RES development are widely described in literature: Ecofys (2008), Justice (2009), Waissbein, et al. (2013), Ragwitz, et al. (2007), IEA-RETD (2010).

These studies identify and categorise possible sources of risk that can influence future results and thus investor’s decisions about whether or not to invest in RES projects. Based on these studies, nine risk categories have been identified, namely: country risk, social acceptance risk, administrative risk, financing risk, technical & management risk, grid access risk, policy design risk, market design & regulatory risk and sudden policy change risk. These nine categories describe a large array of risks, covering the development process of RES projects, as presented in Figure 3.

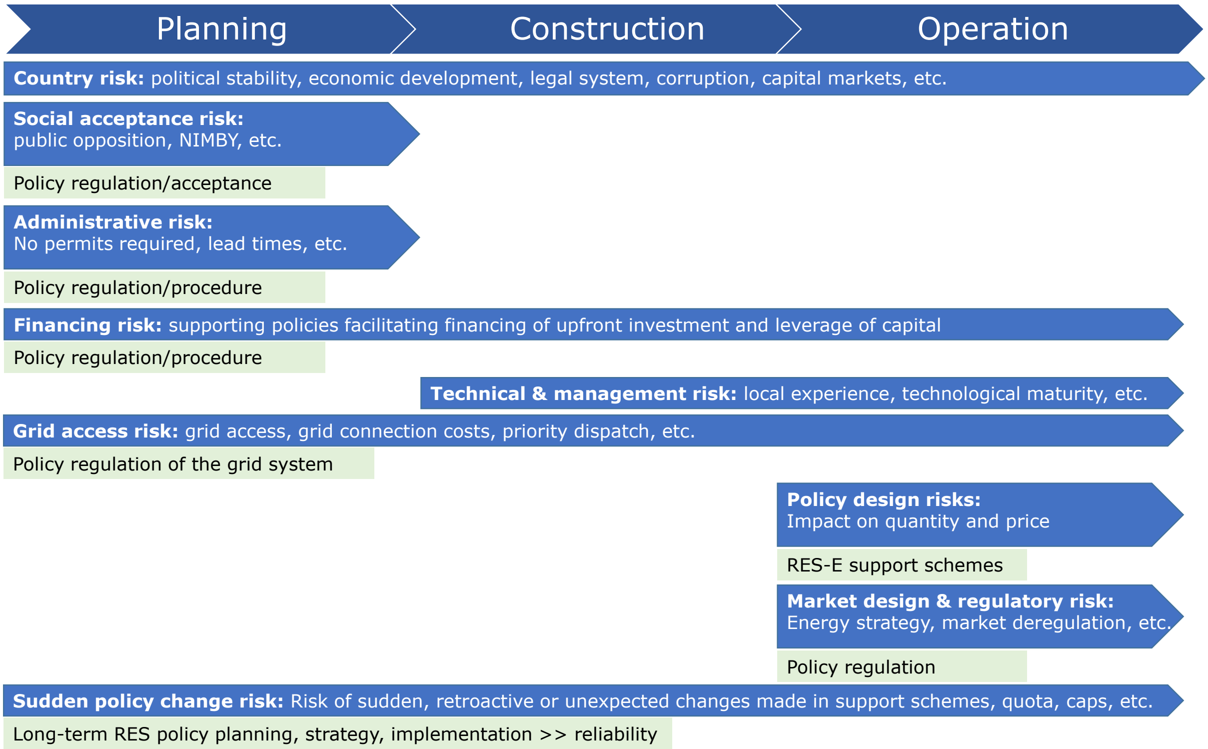


Figure 3: Risks related to RES projects

The figure above shows the development of a RES project distinguishing three phases[7]: project planning, construction and operation (Enzensberger, et al., 2003). At every phase, the project is influenced by different risks (Breitschopf & Pudlik, 2013). Social and administrative risks occur in the planning phase, technical & management risks in the construction and operation phases, and finally, grid access, policy and market design & regulatory risks during operation. Financing risks as well as grid access and sudden policy change risks influence the project in all phases.

In the table below, the risks are described in more detail:

Table 1: Overview and description of risk categories

Risk category	Description
Country risk (baseline rate)	Country risks refer to a set of factors that can adversely affect the profits of all investments in a country. These factors include political stability, level of corruption, economic development, legal system and exchange rate fluctuations. Although it constitutes an important risk factor, there is no uniform way to quantify it. Therefore, we use sovereign debt rating to reflect country risks and compare countries with each other.

[7] Decommissioning is not included here, as (discounted) costs and risks during this phase are typically negligible for RES.

Risk category	Description
Social acceptance risk	Lack of social acceptability of renewable energy investments can cause investment risks. Mostly, this is related to negative impacts on RES installations from NIMBY (Not-In-My-Backyard) effects, but it can also depend on whether local communities benefit from the project or the lack of awareness on the positive effects of renewable energy. This can be contradictory as well: while local communities could be in favour of the benefits derived from sustainable energy, they are opposed to wind farm installations close to their residence. Moreover, resistance could arise due to increasing costs of RES paid by final consumers. Overall, social acceptance risks are defined as risks of refusal of RES installations by (a part of) civil society.
Administrative risk	In order to construct and operate a power plant, developers must obtain several permits. The total time required to obtain these is referred to as administrative lead time. Among the Member States, administrative procedures can vary depending on the complexity and time required to get permits and licences[8]. For instance, as reported by EWEA (2010) administrative lead times to obtain permits can vary significantly, depending on the country and the project, ranging from 2 to 154 months. Increased lead times could be due to the absence of clear, structured procedures and mechanisms, but also to corruption. Additionally for offshore wind, factors that increase lead time are the lack of experience and of communication with other sea users (EWEA. 2010). Administrative risks are defined as investment risks related to approval needed from the authorities.
Financing risk	The infrastructure required to generate power from renewable sources is capital intensive. For renewable energy, almost all investments take place in the first stage of development. This requires the availability of capital such as equity, but also public financing support such as grants and soft loans enabling investments in the Member States. If this is not available, this can lead to capital scarcity. Main reasons for capital scarcity are under-developed and unhealthy local financial sector or global financial distress. Furthermore, limited experience with renewable energy projects combined with tighter bank regulations (Basel III) could result in inability of developers to finance their projects. Risks that arise from the scarcity of available capital, are called financing risks.
Technical & management risk	Technical & management risks refer to the availability of local knowledge and experience and to the maturity of the used technology. Uncertainties arise due to the lack of adequate resource assessment for future potential or the use of new technologies. The probability that a loss will incur due to insufficient local expertise, inability to operate, inadequate maintenance of the plants, lack of suitable industrial presence, and limitation of infrastructure are parameters that are included in technical & management risks.
Grid access risk	To become operational, the RES projects should be connected to the electricity grid. This process includes the procedure to grant grid access, connection, operation and curtailment. The convenience of connecting is influenced by different factors, such as the capacity of the current grid, the possibilities for expansion, planned reinforcements and whether the connection regime allows for RES priority. If this is all well-regulated, new RES projects can be connected to the grid at low risk. However, in the case that the conditions are less convenient and grid connection lead times are long and the connection procedure is unclear, grid access risks can seriously affect the project. Often, these risks are due to an inadequate grid infrastructure for RES, suboptimal grid operation, lack of experience of the operator, and the legal relationship between grid operator and plant operator.

[8] For more information, please refer to the following websites: PV LEGAL (http://www.pvlegal.eu/nl/home.html), PV GRID (http://www.pvgrid.eu/home.html) and wind barriers (www.windbarriers.eu)

Risk category	Description
Policy design risk	Support mechanisms are needed for renewable sources to be competitive, as there is still a cost gap between renewable and conventional energy technologies. Each Member State individually decides on its support mechanism. Policies aim to mitigate risks mainly related to electricity price and demand. The design characteristics of a policy indicates the degree of effectiveness of this risk mitigation. Uncertainties arise when the policy design does not account for all revenue risks, such as wind yield, demand and price fluctuations.
Market design & regulatory risk	Market design & regulatory risks refer to the uncertainty regarding governmental energy strategy and power market deregulation and liberalisation. Fair and independent regulation implies that electricity market regulation safeguards that RES-producers have non-discriminatory access to the market. Examples of risk-increasing barriers are legislation hindering participation of independent power producers (IPPs), incomplete unbundling, and a lack of an independent regulatory body.
Sudden policy change risk	Sudden policy change risks refers to risks associated with drastic and sudden changes in the RES strategy and the support scheme itself. In the worst case, this could imply a complete change or abandoning of the present RES support scheme or retroactive changes in the RES support scheme. Sudden policy change risks are defined as risks of unexpected, sudden or even retrospective changes to policies or policy design features.

The focus in this study is specifically on risks that are related to investments in RES. Although country risk are among the most pressing risks, they are not specifically related to RES investments. In the remainder of this study, the focus will therefore be on the other eight risk categories.

3.1.2 Influence of risks on investment decisions

Investors, depending on their risk preferences, will choose to invest in riskier or safer projects. As explained above, investors estimate these risks by setting discount rates. The height of these discount rates is important in the investment decision. With a high discount rate, only projects with a high IRR will be eligible for investments. This increases the costs for attracting capital, and thus the costs for renewable energy projects. If the discount rate is set too high, chances are that the IRR of renewable energy projects will not meet the discount rate, meaning that there will be no investments at all and renewable energy development will come to a standstill. Understanding how the risk of projects is determined and the how it can be influenced is therefore central to this study.

3.2 Constructing a theoretical model to estimate the cost of equity, cost of debt and cost of capital

In the previous section investments were described from the perspective of the investor, focusing on risks, IRR and discount rate. In this section, the perspective changes to project developers. Where investors have the objective to increase revenues, project developers have the objective to lower costs. The costs of attracting capital are an important aspect in the financial profitability of the project.

There are two important sources of capital for project developers: debt and equity. Debt is provided by banks and financial institutions, equity is obtained by (private) investors.

The costs for attracting the investments are indicated by cost of debt and cost of equity. Both are expressed as an interest rate against which the money is attracted. As the discount rate and cost of equity are closely related, cost of equity can also be used as a proxy for investment risks: when equity can be attracted at lower costs, investors perceive low risk.

To create more insights in the size of investment risks, a theoretical model was constructed to estimate the cost of equity for investing in renewable energy projects in each EU-28 Member State. To make the assessment more specific, the model focused on the development of **onshore wind projects**. In order to provide insight in what risk categories are most pressing, a break down into the nine risk categories has been provided (see Table 1). The results of the theoretical model were tested during interviews with financial experts.

To estimate the scale of the risks, the cost of equity (CoE) of onshore wind projects has been estimated per Member State. For this, existing financial models were used together with data from literature and financial information[9]. To break down investments risks in nine categories, insights per Member State were obtained on the importance of each category (see section 3.2.2 for details). For this, a database on RES barriers was used[10].

3.2.1 Project finance and financial parameters

To estimate the CoE for each Member State, the Capital Asset Pricing Model (CAPM) was used[11]. This model is based on the relationship between risk and return, and takes explicitly into account the level of risk. It can be applied to any investment with or without dividends regardless of the growth rate (Sharpe, 1964; Lintner, 1965). Finally, by adjusting the inputs for every country, the cost of equity among countries becomes comparable.

[9] See section below on Project finance and financial parameters.
[10] See section on Risk quantification.
[11] A more extensive description of the CAPM, including formulas and assumptions can be found in Annex B.

Based on the CAPM, the cost of equity is estimated for wind onshore investments in the Member States. The results are presented in the graph below:

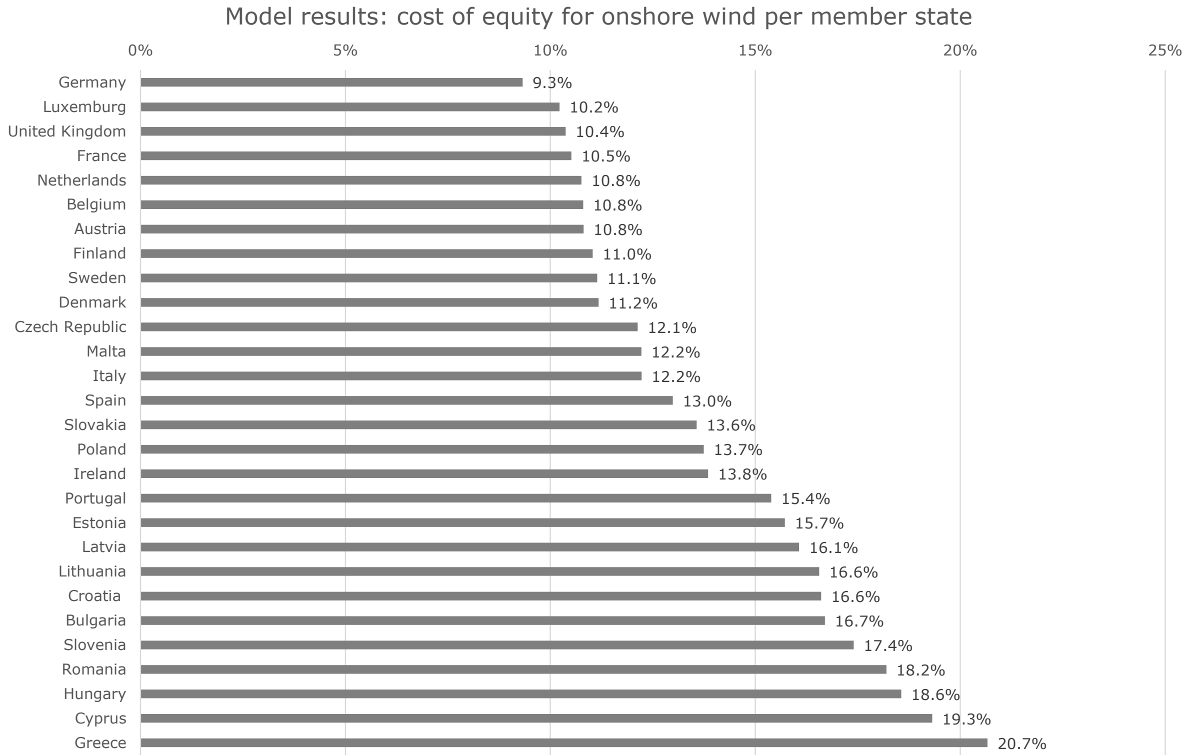


Figure 4: Model results cost of equity

As the CAPM is based on estimations relying on historical data, the derived results have been validated using financial experts interviews (Step 2 of the approach).

In order to get a more complete picture of the project finance, the cost of debt was estimated using a similar approach. Using a calculation based on existing studies (Bloomberg, 2011; Eurelectric, 2012), the cost of debt (CoD) for onshore wind investments could be estimated per Member State. The results are presented in the graph on the next page.

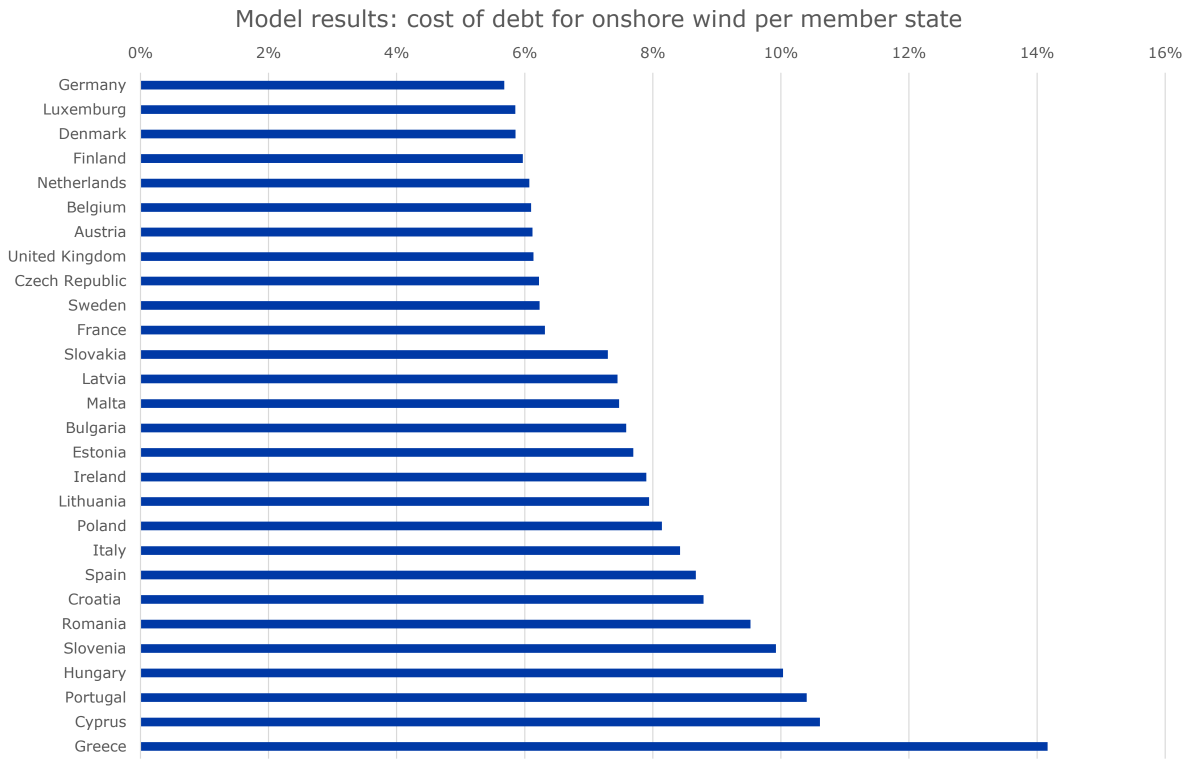


Figure 5: Model results cost of debt

An extensive description of the calculation methodology and backgrounds can be found in Annex C.

Based on the estimations of cost of equity and cost of debt, the Weighted Average Cost of Capital (WACC) can be estimated[12]. This ratio is important, as it gives insights in the total costs of project funding from both equity and debt. To estimate the WACC, the cost of equity and cost of debt are needed and the ratio between them. This debt/equity ratio is estimated based on observations of recently developed projects and is for all Member States set at 70-30, meaning that 70% of the projects is funded with debt and 30% with equity. The results are presented in the graph below:

[12] In this study, a nominal post-tax WACC is estimated at financial closure.

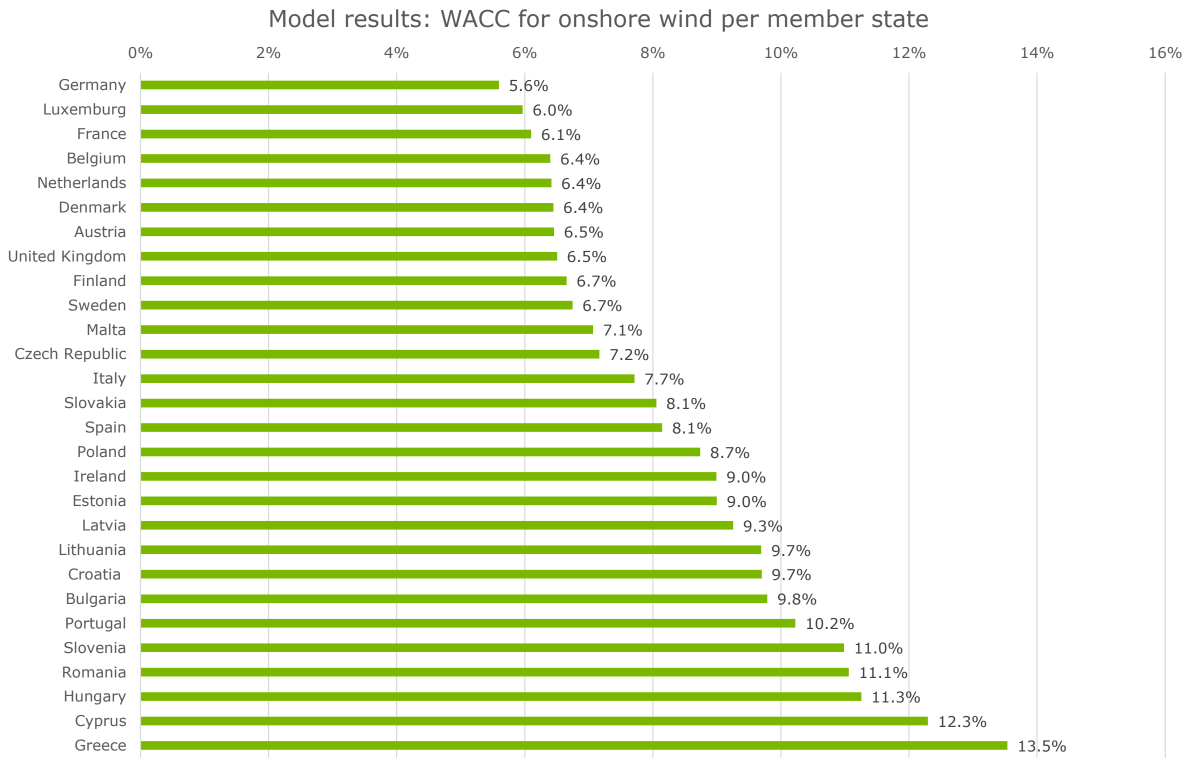


Figure 6: Model results WACC

More information about the WACC and its calculation can be found in Annex D.

The estimated financial parameters (CoE, CoD, WACC and debt/equity-ratio) based on modelling and assumptions have been evaluated and validated during the interviews with financial experts.

3.2.2 Ranking investment risks

Now that the investment risks of RES projects per Member State are estimated based on the calculated cost of equity, the next step is to determine which investment risks (see Table 1) are perceived as most important.

This is done by using a unique risk database and several risk indicators documented in literature. Country risks are reflected in the graph by varying the baseline rate. We consider the respective government bond as a risk-free rate for every country, therefore assuming that it also reflects the country risk.

3.2.2.1 Barrier database

The eclareon risk database provides information for both the onshore wind investments risks and cost of capital assessment, as well as the impact of support scheme changes on the cost of capital assessment. A description of the database is given in the box below.

RES-frame Risk Database

Barrier research

The RES-frame barrier database comprises all barriers from the three renewable energy sectors (electricity, heating & cooling and transport) which have been reported through an interactive online tool (**re-frame.eu**) from local stakeholders in the EU-28 Member States. Furthermore, these results were verified through back-up research and expert interviews conducted by eclareon.

Severity and Spread

When reporting a barrier, stakeholders have to select which particular RES technologies are affected by this exact barrier and are then asked to rate these barriers on a scale from 1 to 5 according to their **severity** (the effects of the identified barrier on the further development of installations of the particular technology) and their **spread** (the share of installations which are affected by the identified barrier).

Risk categorisation

Only barriers of wind energy were taken into account. Furthermore, only those barriers which have either an uncertain occurrence or an uncertain outcome were considered risks. Subsequently, these risks were grouped into the following eight risk categories: social acceptance risks, administrative risks, financing risks, technical & management risks, grid access risks, policy design risks, market design & regulatory risks and sudden policy change risks.

Development of a risk index

Based on the gathered data, eclareon developed a consistent risk index including the normalised values for severity and spread as well as further objective criteria. With the help of this risk index, detailed statistics can be compiled per Member State, per energy sector, per RES technology and per risk category.

In August 2014, the RES-frame database gathered a total of 772 single national barriers, of which 413 were reported for the electricity sector, 197 for the heating & cooling sector and 159 for the transport sector. From these 413 barriers for the electricity sector, 227 can be considered risks for the wind energy sectors.

Overall, a total of 141 stakeholders (national industry associations, project developers, financial institutions, policy-makers, etc.) were registered in the database and have provided input on the barriers in their countries.

3.3 The evaluation of the model by interviews

The results were then validated by conducting interviews[13] with experts from all Member States. Over 80 equity providers, project developers and bankers were approached. The goals of the interviews were as follows:

- Check whether the identified risk categories were covering all risks;
- Evaluate the risk profiles;
- Evaluate the estimated cost of equity and ranking of investments risks;

[13] An example of the questionnaire and an overview of the interviewed persons can be found in Annex E.

- Evaluate the effectiveness of policy on reducing investments risks and how this could be improved;
- Check model assumptions (e.g. assumptions used to calculate the cost of equity).

Based on the networks of the project team, a database of financial experts across the EU-28 was composed. Member States for which no or too few contacts were available, additional contacts were found through renewable energy associations, banks, project developers, utilities, etc.

After conducting the interviews, a summary was made reflecting the view of the interviewed experts.

3.4 The creation of the country risk profiles

After conducting all interviews, the country profiles were created. The template for the country profiles was largely based on the template of the interviews. The objective of the country profiles is to present an objective representation of the data, without interpretation from the interviewers and/or analysts. The country risk profiles consist of the following sections:

1. Ranking of investment risks in onshore wind.
2. The influence of policy on mitigating risks.
3. Financial parameters.

The country risk profiles can be found in Annex A.

4 Results

This chapter presents the insights we gained for each EU Member State on the renewable energy investment environment. The focus will be on the EU-wide perspective, presenting an overview of the differences between Member States seeking to answer the following questions: What risks affect old and new EU Member States? Are countries in western, eastern and southern Europe affected by different or similar risks?

These and other questions are answered in this chapter. Besides risks, the focus will be on the financial parameters for RES investments.

Based on the data gathered through literature, modelling and interviews, country risk profiles have been prepared. These profiles can be found in Annex A.

4.1 Risk perception

The following graph provides an overview on how market actors in 24 out of 28 EU Member States rank the risks categories identified for onshore wind energy projects:

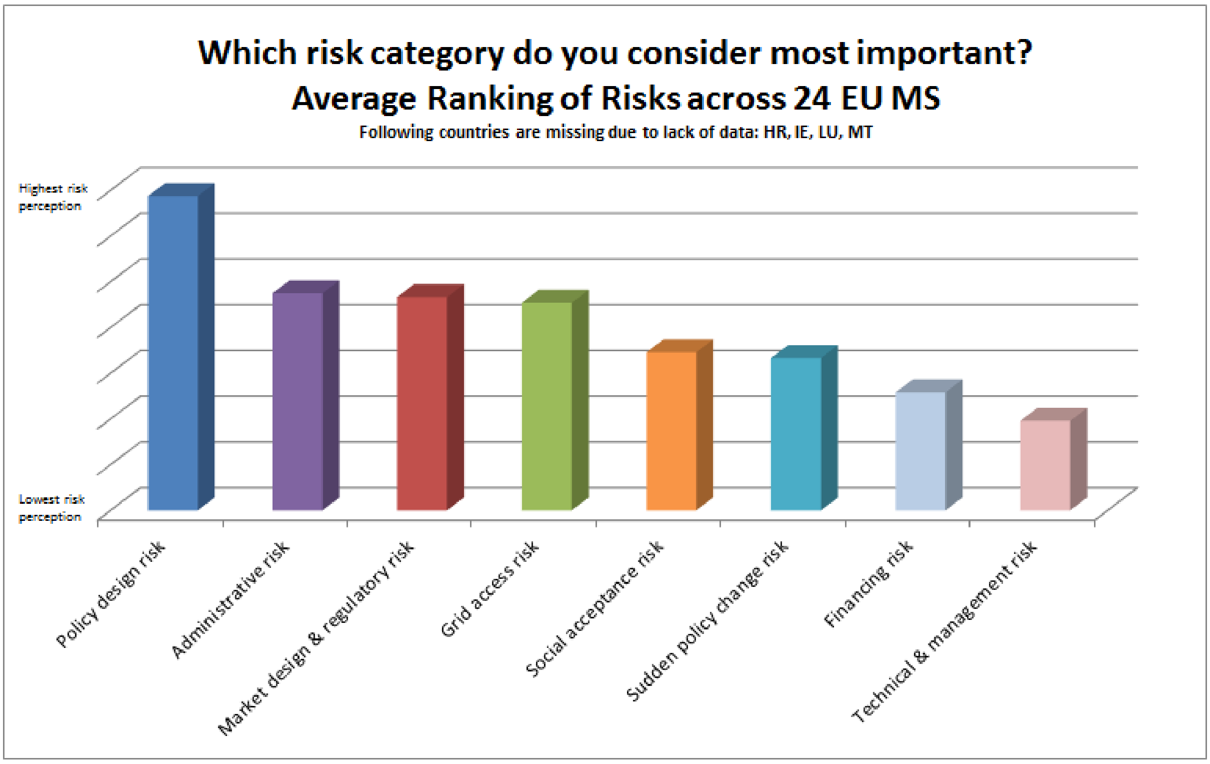


Figure 7: Average ranking of risks across 24 EU MS[14]

[14] The highest ranked risk per Member State was awarded 8 points, while the lowest ranked risk received 1 point. In countries where not all 8 risk categories were reported, the 8 points were evenly distributed between

Figure 7 shows that, on average, policy design risks were perceived as the most pressing risk to onshore wind energy projects across the EU. We can derive from this very high ranking that **the design of the support scheme is still one, if not the key, pre-requisite for stable investment conditions**. Several experts referred to the policy design as being "the rules of the game". For this reason, changes made in the policy design will have a high impact on investors, as it will change these "rules" and therefore bring uncertainty to investors. For instance in the UK, the upcoming policy scheme change leads to some unrest as projects developers are trying to find out what the advantages and disadvantages of the new policy scheme are, how it will affect their projects and, most importantly, if there is a reason to advance or postpone their projects. In addition, policies such as quota & green certificates or caps in premium schemes/FiT impede a prediction of revenue which makes the calculation of the business case more difficult. N.B.: the changes discussed under policy design risk are changes that have been announced upfront. Changes that are being imposed suddenly are categorised under sudden policy changes.

A group of risks concerning **administrative issues, market design and grid access,** follow at a relatively equal level. Interviews revealed that in most countries there are issues with obtaining grid access for renewable energy. With increasing shares of intermittent renewable energy sources and lack of clarity on responsibilities for connecting, enforcing and bearing the costs, it can be expected that this will become a more serious problem in the coming decades.

The third group of risks contains the **social acceptance, sudden policy change and financing risks**. These risks are all considered very critical in some of the Member States while – as we shall see – they are not relevant in others. Technical & management risk is at the end of the ranking, despite the fact that resource risk is considered as a pressing issue. This challenge, however, is regarded in most markets as part of the policy design[15].Figure 7 provides an overview[16] of the risks which were perceived as the most important risks in each Member State. **Policy design is ranked as most important risk in 10 out of the 28 Member States, followed by administrative risks (7 Member States) and market design & regulatory risks (3 Member States)**. The map shows a broad distribution of the top-3 risk categories across Member States; these 3 risks are present in all parts of the EU.

the present risk categories (e.g. in case only 5 risks were reported, the highest risk received 8 points, the second 6.4, the third 4.8, the fourth 3.2 and the lowest risk 1.6 points). Subsequently, we calculated for each of the three regional groups as well as the entire EU-28 the average value per risk category.

[15] The exact ranking of all risks in each Member State can be found in the following chapter.

[16] This overview is based on the aforementioned interviews with market actors in 24 out of 28 EU Member States.

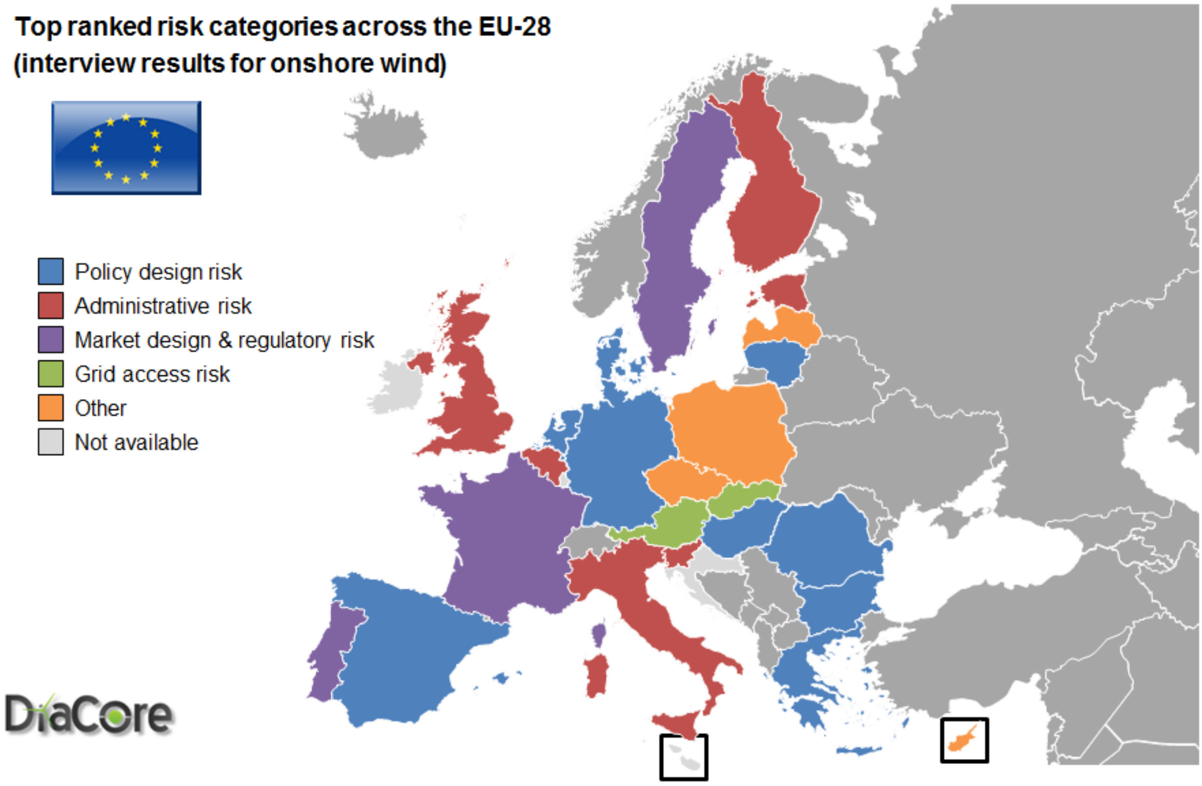


Figure 8: Top ranked risk categories across the EU-28 (interview results for onshore wind)

In Table 2, the top-3 risk categories for onshore wind projects are presented per Member State. This table allows for a more in-depth comparison between Member States. The ranking reveals meaningful details: **The risk category sudden policy change appears in the top-3 for many Eastern European Member States (Czech Republic, Bulgaria, Hungary, Slovenia, Latvia, Slovakia), and the risk category financing appears in the top-3 for several Southern EU Member States (Cyprus, Greece, Portugal, Romania).**

Table 2: Top-3 ranked risk categories per EU Member State

Member State	Rank 1	Rank 2	Rank 3
Austria	Grid access	Market & regulatory	Administrative
Belgium	Administrative	Grid access	Sudden policy change
Bulgaria	Policy design	Sudden policy change	Grid access
Croatia	-	-	-
Cyprus	Financing	Administrative	Policy design
Czech Republic	Sudden policy change	Policy design	Grid access
Denmark	Policy design	Social acceptance	Market & regulatory
Estonia	Administrative	Policy design	Technical & management
Finland	Administrative	Grid access	Policy design
France	Market & regulatory	Policy design	Social acceptance
Germany	Policy design	Technical & management	Administrative
Greece	Policy design	Financing	Social acceptance
Hungary	Policy design	Sudden policy change	Grid access
Ireland	-	-	-
Italy	Administrative	Policy design	Grid access
Latvia	Technical & management	Financing	Sudden policy change
Lithuania	Policy design	Social acceptance	Technical & management
Luxembourg	Policy design*	Administrative*	-
Malta	Administrative*	Policy design*	-
Netherlands	Policy design	Administrative	Social acceptance
Poland	Social acceptance	Policy design	Administrative
Portugal	Market & regulatory	Policy design	Financing
Romania	Policy design	Financing	Grid access
Slovakia	Grid access	Policy design	Sudden policy change
Slovenia	Administrative	Sudden policy change	Market & regulatory
Spain	Policy design	Sudden policy change	Market & regulatory
Sweden	Market & regulatory	Policy design	Social acceptance
UK	Administrative	Policy design	Grid access

* based on model results

Some risk categories, such as financing risk or sudden policy change risk, appear in certain regions of the EU more frequently than in others. In order to test whether this pattern is correct, the choice was made to cluster Member States in three regions and compare which risks were considered most important for onshore wind energy projects. Figure 9 illustrates the perception of risks that can potentially influence RES investments broken down into three regional groups:

- North-West Europe (Austria, Belgium, Germany, Denmark, Finland, France, the Netherlands, Sweden and the United Kingdom);
- Eastern Europe (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia);
- Southern Europe (Cyprus, Spain, Greece, Italy and Portugal).

These average values are depicted in the following spider chart (Figure 9):

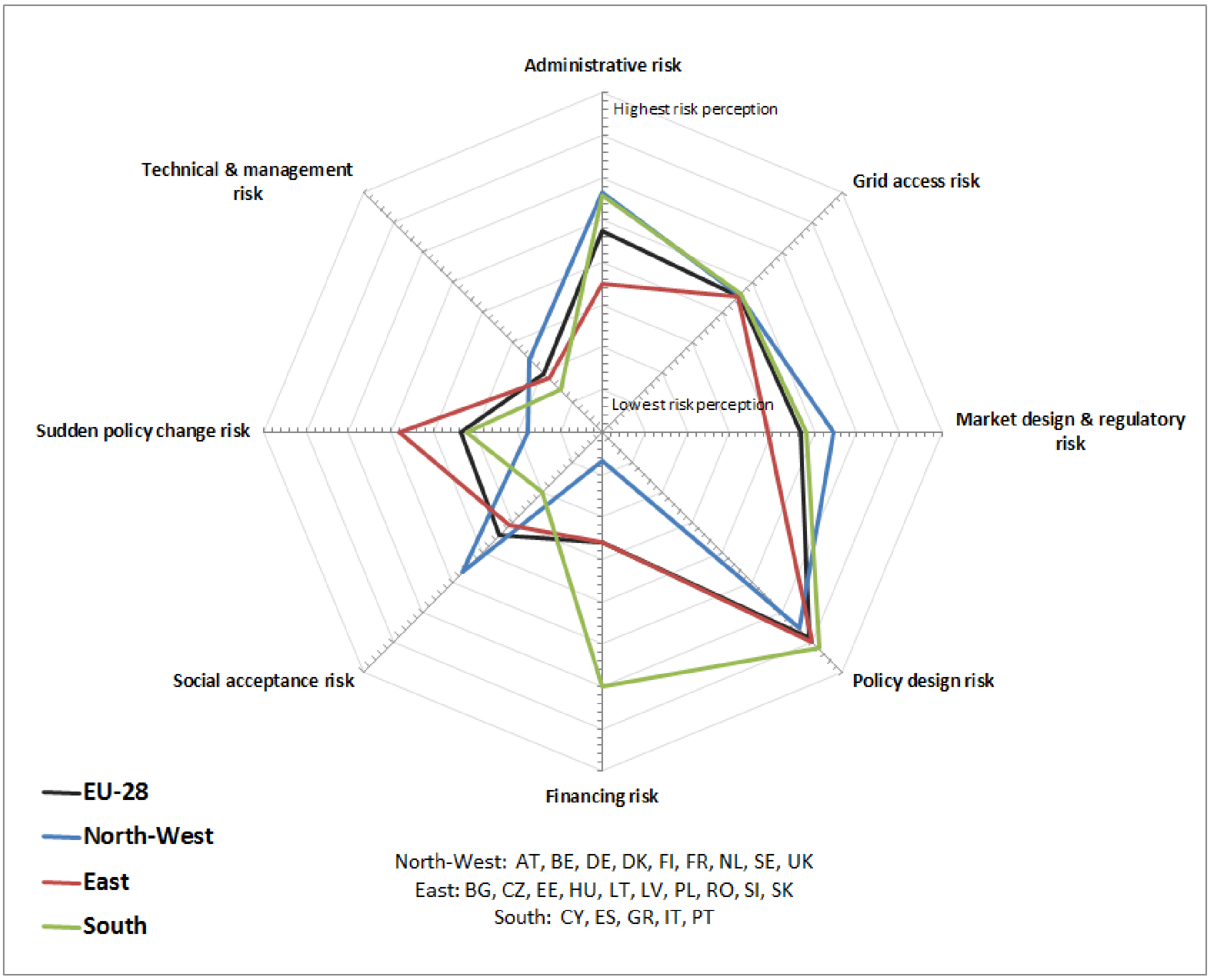


Figure 9: Comparing North-Western, Eastern and Southern Member States

The graph shows the following:

- There is no difference across regions in the perception of grid access risks and a relatively small difference for policy design risks;
- For every region, policy design risks are perceived as most important, with the East and South regions scoring slightly higher than the North-West region.

The graph also shows differences between the regions, the biggest difference being the financing risk category: **financing is not a big issue in the North-West region, but for the Southern countries this is perceived as the most pressing risk after policy design**. The financial crisis in the last years has had a severe effect in particular on Southern European countries. The crisis reduced access to loans and makes wind energy investments more risky in regions that have been hit by the financial crisis. This risk increases the costs of financing, and thus the LCOE of wind energy projects with a high CAPEX, as CAPEX constitutes the main part in the LCOE of onshore wind energy projects.

In order to outbalance the increased LCOE, higher reimbursement for the produced electricity is necessary, which puts additional burdens on Member States going through a financial crisis. As a consequence, the financing of RES wind onshore projects is made more difficult.

Another remarkable result is the different perception of **social acceptance risks** which **ranked the highest in North-Western countries**. **The market design & regulatory risk also seems to be more important in North-Western countries**, which could indicate that current market design and regulations are no longer fulfilling the needs of the RES-developers particularly in that region.

Sudden policy change, on the other hand, was reported as the most pressing risk in the Eastern region. In accordance with that observation, interviewees from this region mentioned that over the years renewable energy has lacked "political will", resulting in policy design changes.

Besides comparing geographical regions, it is also interesting to see if and how risk perceptions change according to RES development.

The following spider chart (Figure 10) illustrates the perception of different risk categories broken down to these three groups of countries:

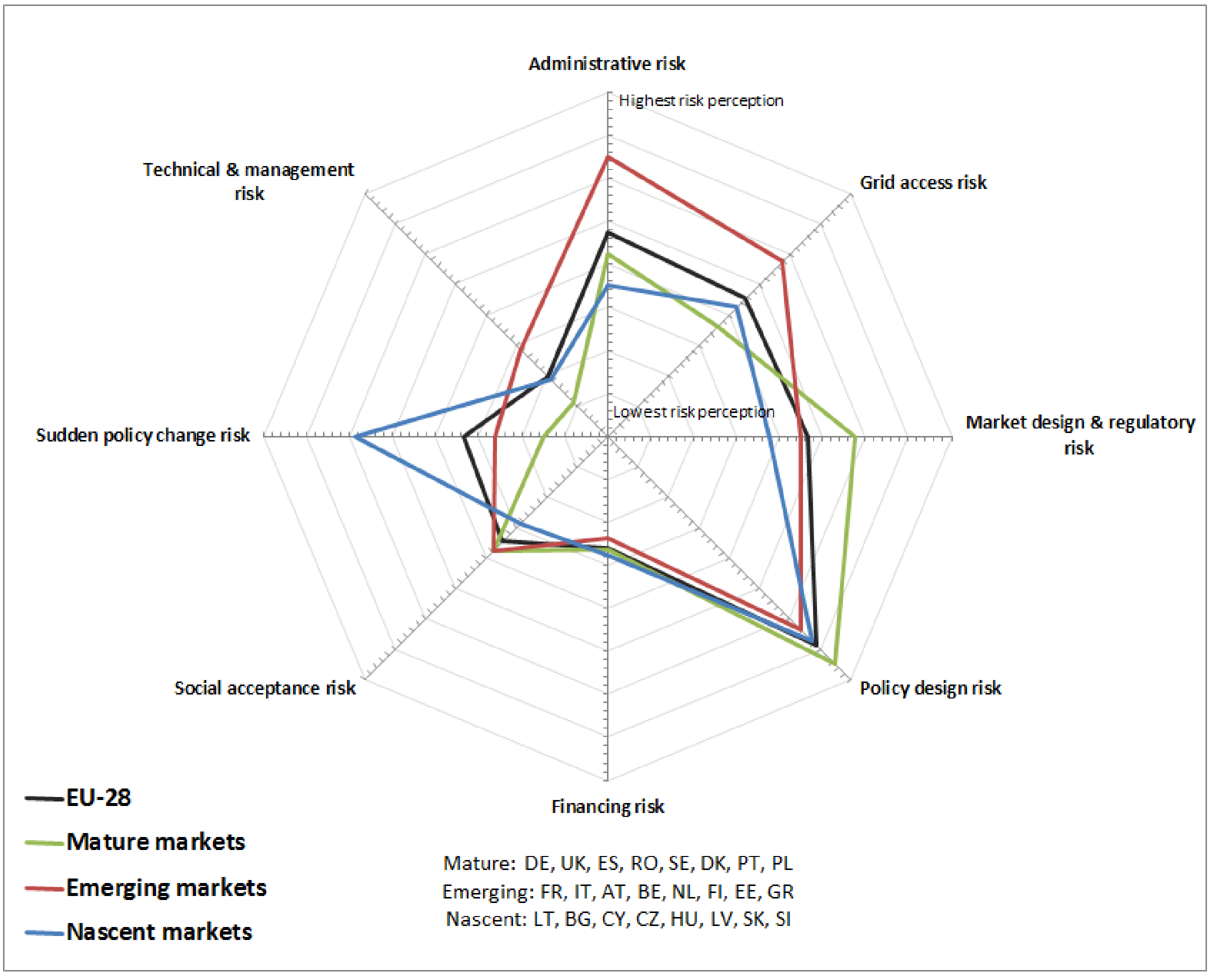


Figure 10: Comparing Member States according to wind sector development[17]

The graph shows that, depending on the market development, different risks occur. Sudden policy change risks, for example, score much higher in nascent markets than in emerging and mature markets. In fact, **the highly perceived risk of sudden policy changes might be an important reason why some nascent markets fail to turn into emerging markets: a high risk of changing policy design might discourage project developers and equity providers to invest in these projects.**

Administrative risks, grid access risk and technical & management risks are perceived most relevant in emerging markets, while policy design risks are ranked relatively low in comparison to nascent and mature markets.

[17] EWEA data on the onshore and offshore wind energy development was used (in absolute capacities, in relation to the overall consumption and in growth over the past three years), resulting in a ranking of Member States according to the maturity of their wind energy sector (see Annex G). Points from 0 to 10 were given for following factors: The share of wind energy in overall electricity consumption, the average annual wind energy capacity increase in the period from 2011 to 2014 as well as the total installed capacity. Based on this ranking, the Member States were divided into three groups: nascent markets (0-3 points), emerging markets (4-5 points) and mature markets (6-10 points).

One reason for this might be that in nascent markets, the issue of a functioning and reliable support scheme has to be resolved first. Once in place, wind energy projects can be actually planned. At this stage, new risks become apparent, such as underdeveloped administrative procedures and lack of experience of wind energy developers, public authorities and/or grid operators. With the development of projects, all actors gain experience and learn how to cooperate. As a consequence the ranking of administrative and grid access risks decreases, while the market shows a more rapid development and grows more mature.

In mature markets, policy design risks and market design & regulatory risks are top-ranked. This may seem surprising, but it reflects what is occurring in many matured markets: they are meeting the boundaries of the systems that have been designed to stimulate the roll-out of wind energy. Now, a new phase begins, that might require different needs, and therefore different policy, market and regulatory designs e.g. to reduce incentives and to integrate wind energy to the market. As a consequence, policy design risks and market design & regulatory risks move into the focus.

Another way of comparing risks is to look at which stage they occur in the development process of a wind energy project. Figure 11 shows a simplified diagram of the development of a wind energy project defined in four phases: inception phase (covering the first technical and formal preparation of the project development), the building phase (covering the construction of the wind energy plant), the operational phase (covering operation and maintenance, and depending on the support scheme selling of the generated power), and finally the post-support phase (eligibility period of the support phase is over. All generated electricity must be sold on the market). The decommissioning phase is not shown here, since for onshore wind energy the risks of this phase are considered to be neglegible.

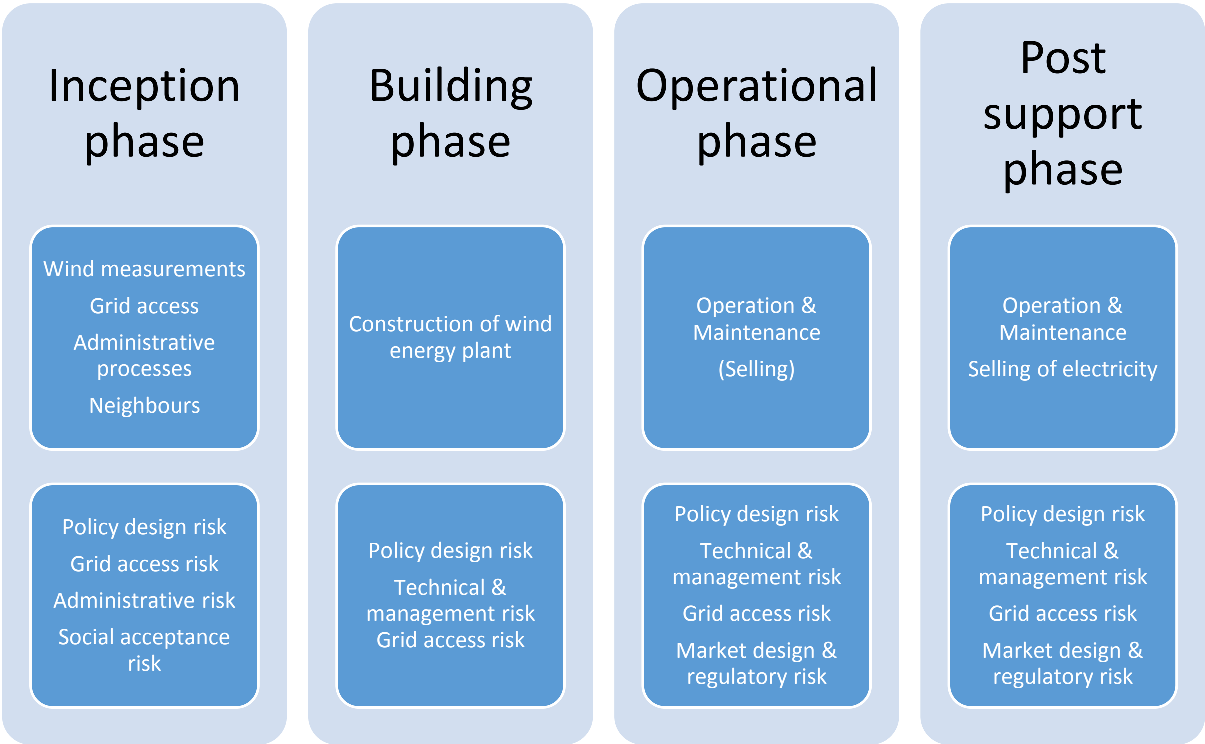


Figure 11: Relevance of investment risks during project development phases

At the beginning of the project, certain risks are dominating, i.e. administrative risks as well as social acceptance risks and policy design risks. At this stage, the majority of projects fail (60-80% according to project developers), thus the probability of a failure is relatively high. On the other hand, the invested capital at this stage is still relatively low (the "value at risk"), thus the financial impact of a failure is relatively low. However, these costs are usually fully borne by the project developers. This means that risks materialising at the very end of the inception phase might force project developers to terminate their project without being able to recover the incurred development costs. The later this happens, the higher the incurred costs.

In order to have a long-term sustainable business model, project developers have to recover costs in projects in order to make a financial close. If, for instance, the tendering takes place at a very late stage of the inception phase, it can lead to high incurred costs that have to be recovered in other projects. As a consequence, the overall prices of tendered projects can go up. More generally, processes during the inception phase (such as permitting or grid connection processes) can lead to increased costs if they:

- Take place at the very end of the inception phase;
- Lead to the ultimate failure of the project;
- Leave the project developer little control over the outcome.

During the **building phase**, the probability of a project failure goes down because challenges during the permission process, the grid connection process and possible conflicts with neighbours are usually resolved. On the other hand, new risks become apparent such as the risk of (retroactive) sudden policy changes or technical & management risks. In addition, the investment costs increase rapidly and therefore the possible effect of the risks. Thus, although the probability of the occurrence of a risk decreases, the effect of the risk increases and with that the impact of the risk. Therefore, investment risks are even more relevant in this phase than during the inception phase.

This pattern also holds during the **operational phase**. Most of the investments have been made at this point which would result in a severe effect of risks that materialise. Additional risks such as technical & management risks, grid access risks (curtailment) and – depending on the support scheme – market design & regulatory risks become more relevant.

The last phase of a wind energy project is the post-support phase. **When the support has been phased out, market design & regulatory risks become very relevant**, as, from that point onwards, a full integration in the market will be necessary. **Over time, the relevance of technical risks also increases.** The blades of wind energy plants are exposed to massive forces. This can cause material fatigue, particularly at the end of the operational phase and the post support phase. Considering the increased size of wind energy plants, it is expected that the exposure, and thus damages through material fatigue, will increase in the future. As a consequence, the relevance of technical & management risks may increase in the future.

4.2 The Weighted Average Cost of Capital in the EU-28 (WACC)

An important parameter indicating the investment climate in a country is the Weighted Average Cost of Capital (WACC). During the interviews, country experts were asked to comment on the modelled outputs of the financial parameters. Their input was used to update the WACC-figures. The result is presented in the map on the next page (Figure 12).

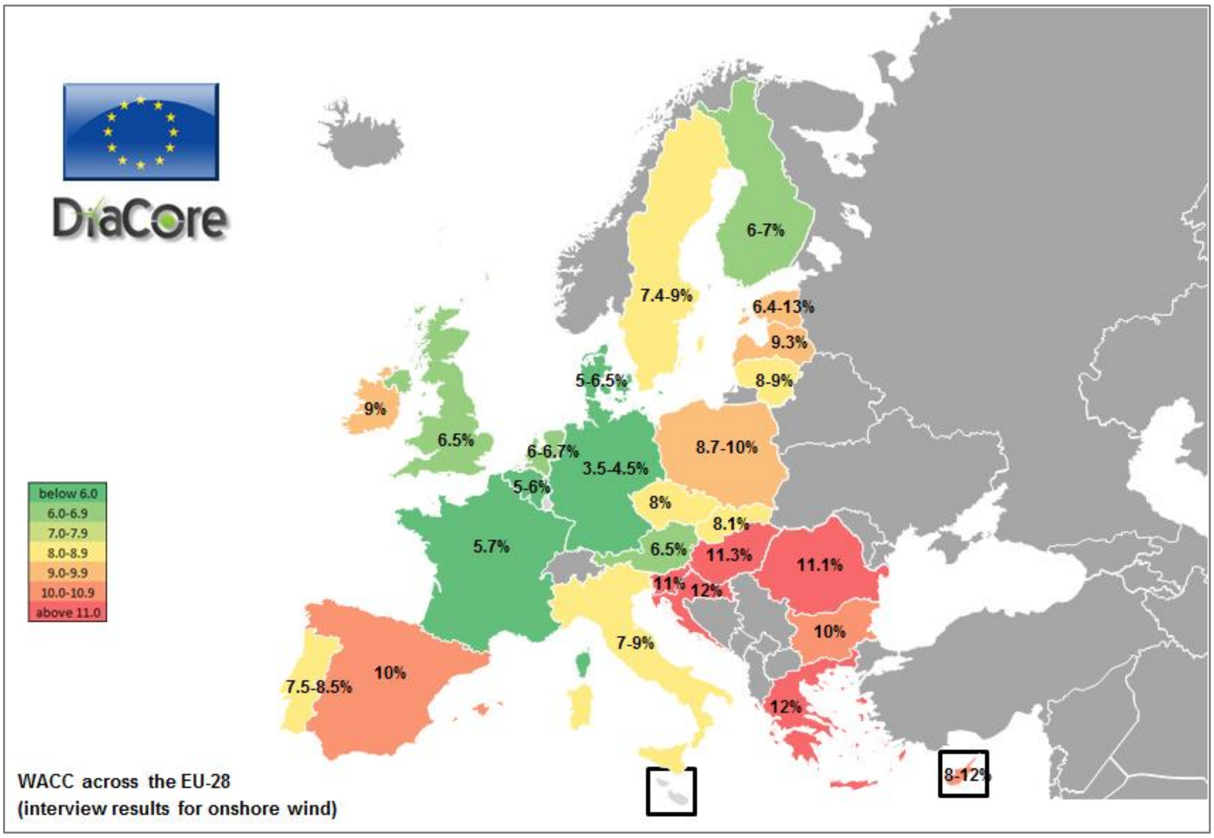


Figure 12: WACC estimations onshore wind – approximation based on interviews

The first result is a **huge gap between EU Member States: Germany has the lowest WACC in the EU-28, with a value of 3.5-4.5% for onshore wind energy projects**. From an investor's perspective Germany thus provides a low risk environment for onshore wind energy investments, which enables investments with relatively low capital costs. **The other extreme in the EU are Croatia and Greece, where circumstances are less favourable,** showing WACC-values that can be more three times as high as in Germany.

In between, there is a large number of Member States with WACC-values twice and three times as high as Germany. This huge difference can be explained by the fact that, in all factors of the WACC calculation, the German case is the most favourable: with a lower risk premium and both costs of debt as well as equity being much lower. Moreover, the relatively low-risk environment in Germany allows for a higher share of (lower) debts in the WACC, thereby further reducing the value. According to interviewees, another important reason is the fierce competition between banks that significantly reduces the cost of debt.

The effects of such high WACC-values are remarkable, especially when taking into account the fact that capital expenditure is the main cost factor for wind energy projects.

High capital costs directly result in higher cost of electricity for wind energy project developers, who require higher tariffs to have a viable business case.

As a consequence, in Member States with higher risks the same installed capacities will lead to higher costs when compared to a market that carries lower risks and thus lower capital costs. The comparison also qualifies the relevance of natural conditions for the economic assessment. Markets with relatively mediocre wind conditions (such as Germany) can be financially much more interesting than markets with very good wind energy conditions (such as Spain or Portugal). This shows that natural resources are only one factor among others in the investment decision. Other factors that have an impact on the WACC – such as the policy design risks or country risk – must also be taken into account. Last but not least, the figures show that the energy transition in many EU Member States was also possible because of very low and favourable costs for capital.

Other interesting observations can be drawn from the examination of the WACC, but also the single factors of the WACC, i.e. the values for cost of debt, cost of equity and the ratio between debt and equity in the single Member States.

4.3 Debt/equity ratio across the EU-28

Figure 13 below shows the ratio of cost and debt for onshore wind projects across the EU-28. The figures are based on our model, and have been modified in accordance with the results of the interviews with project developers and investors (see section 3.3 for details). The comparison confirms the conclusions drawn from the WACC examination: **the conditions for financing onshore wind projects differ significantly from country to country. In 2014, when the market actors were interviewed, the markets in Germany and Denmark allowed for a debt ratio that reached or even surpassed 80%**. This allowed developers in these markets to benefit from lower cost of debts, as they were able to use a very high leverage.

Investors in South-East European Member States had to provide up to 50% of their investment budget through equity financing. This drove up the costs for financing onshore wind energy plants and often made financing of projects impossible. A debt ratio below 70% (ranging from 50%-65%) was found in almost a third of all EU markets, which illustrates the perceived risks for onshore wind investments in many EU Member States.

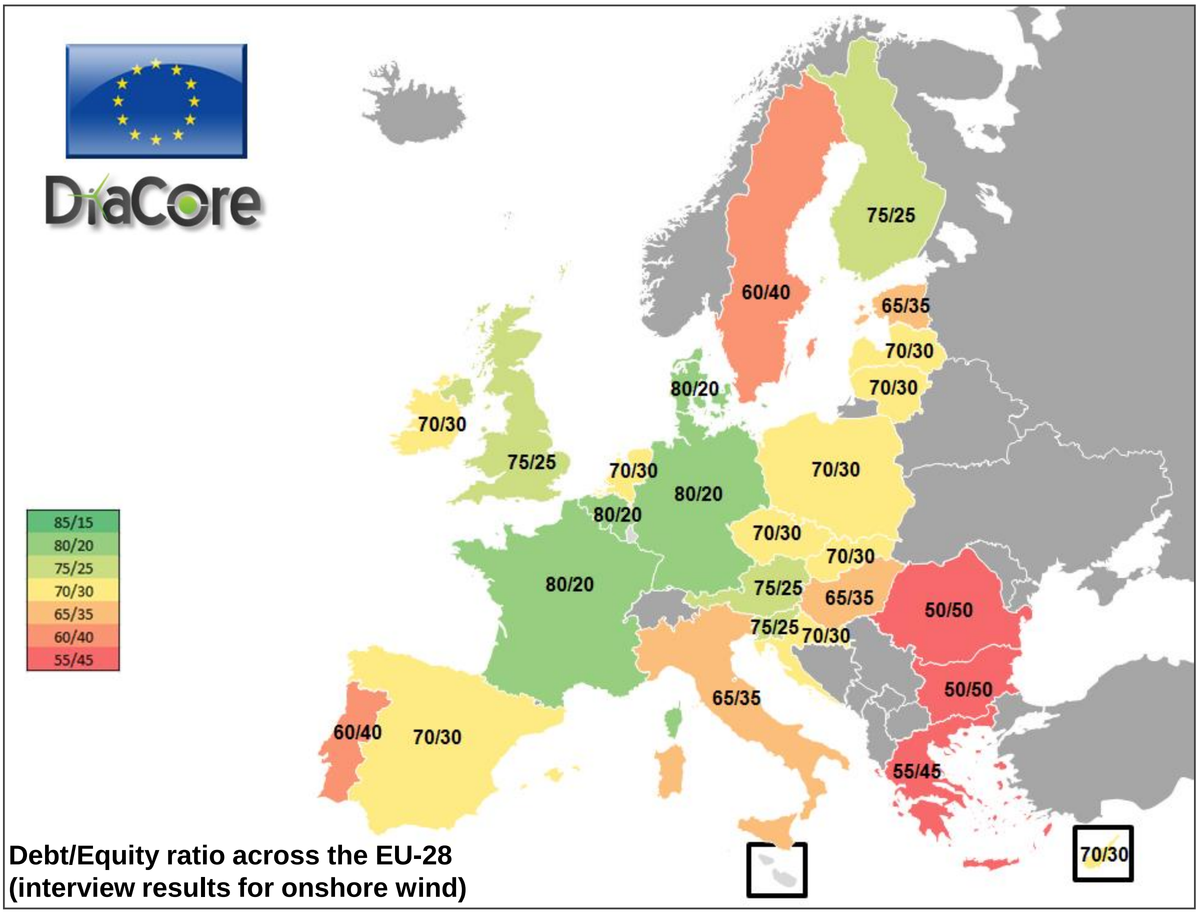


Figure 13: Debt/Equity ratios across the EU-28 (estimation for onshore wind)

4.4 Cost of debt in the EU-28

The following map (Figure 14) presents the results for the cost of debt across the EU-28.

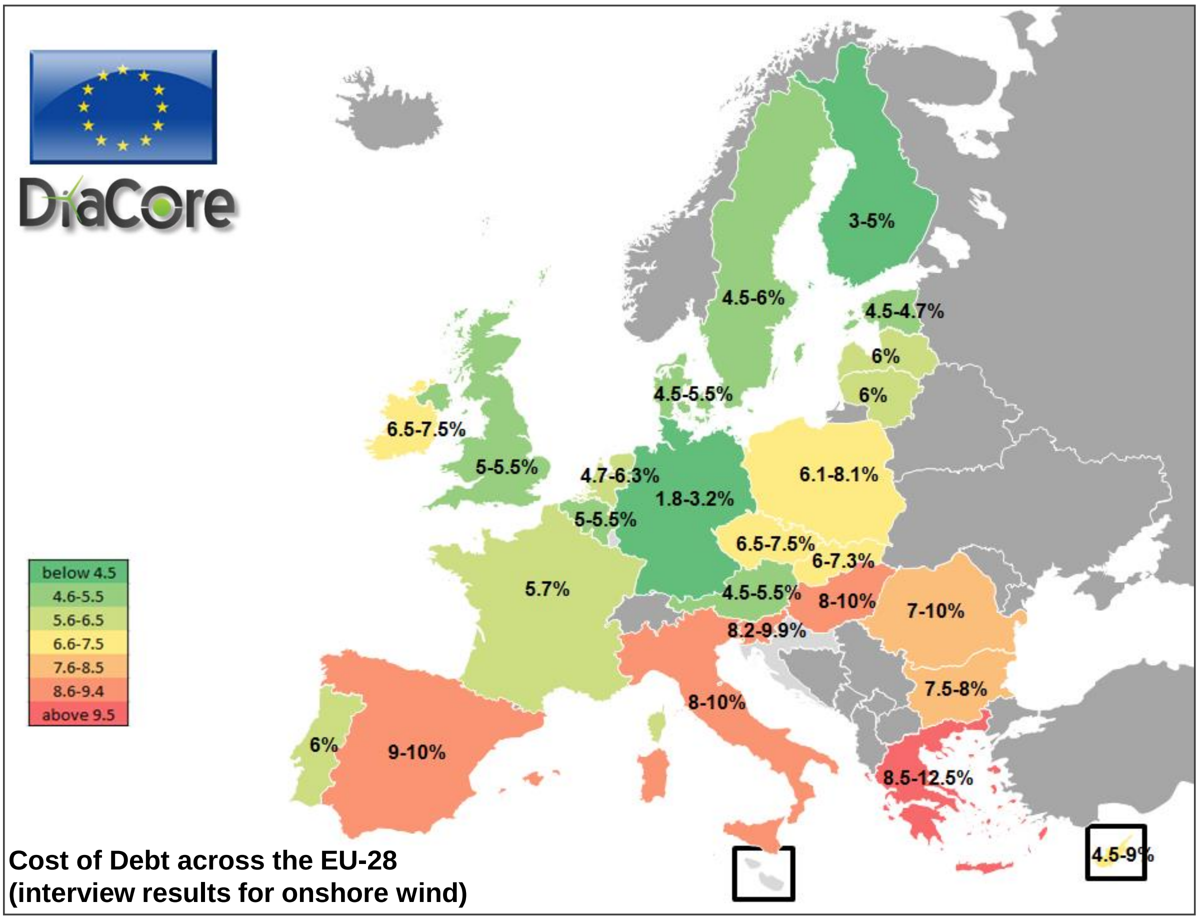


Figure 14: Cost of debt across the EU-28

Again, **Germany shows the lowest results with values for cost of debt ranging between 1.8% and 3.2% with a falling tendency in 2015**. According to German experts, another reason for the very low values is the abovementioned **competition between German banks**: many banks have come to consider wind energy projects as secure investments and underbid each other. As a result, **German project developers face much lower costs of debt than developers in countries with less competition.** The cost of debt is currently featuring a falling tendency caused by post-crisis measures, resulting in declining EIB loans and EURIBOR. What was surprising – and quite alarming – was that, **in some countries, the values for the cost of debt were found to be substantially higher than in the model results. Among these countries are Romania, Bulgaria, Italy and Spain**.

It is difficult to assess whether the increase of rates is due to specific renewable energy policies (e.g. the level of support per kWh), due to the general economic situation or due to a lack of competition between national banks. In any case, it sheds a light on a growing gap within Europe between Northern European countries that benefit from lower costs of debt and Southern European countries that do not.

4.5 Cost of equity in the EU-28

The interview results for the cost of equity are presented in Figure 15. According to interviewees, the values of cost of equity has changed over the last years as a result of the collapsing renewable energy boom. During the boom, the cost of debt was much higher because the interest in business opportunities, as well as the interest in higher profit margins, had initiated speculations in grid capacities. This example illustrates that sustainable support scheme tariffs or quotas do not necessarily require high tariffs. Quite the contrary, in some cases, very attractive tariffs can cause instabilities for the overall policy design. The interplay between profitable and stable business conditions should be kept in mind when assessing or defining the policy design.

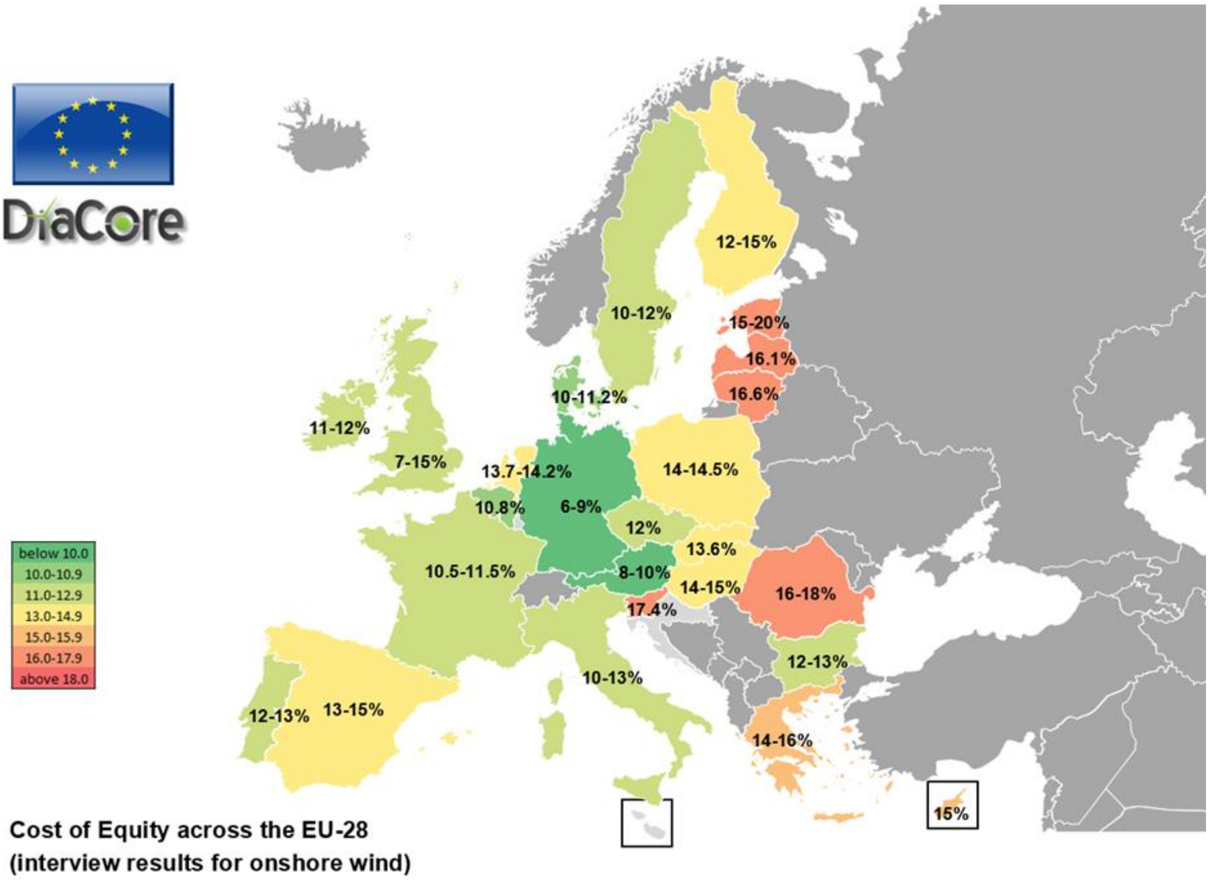


Figure 15: Cost of equity across the EU-28

We also aimed to look at the relation between the WACC and the policy design, represented by the choice for support scheme, as described in the RES LEGAL Europe website. This is presented in Figure 16 below.

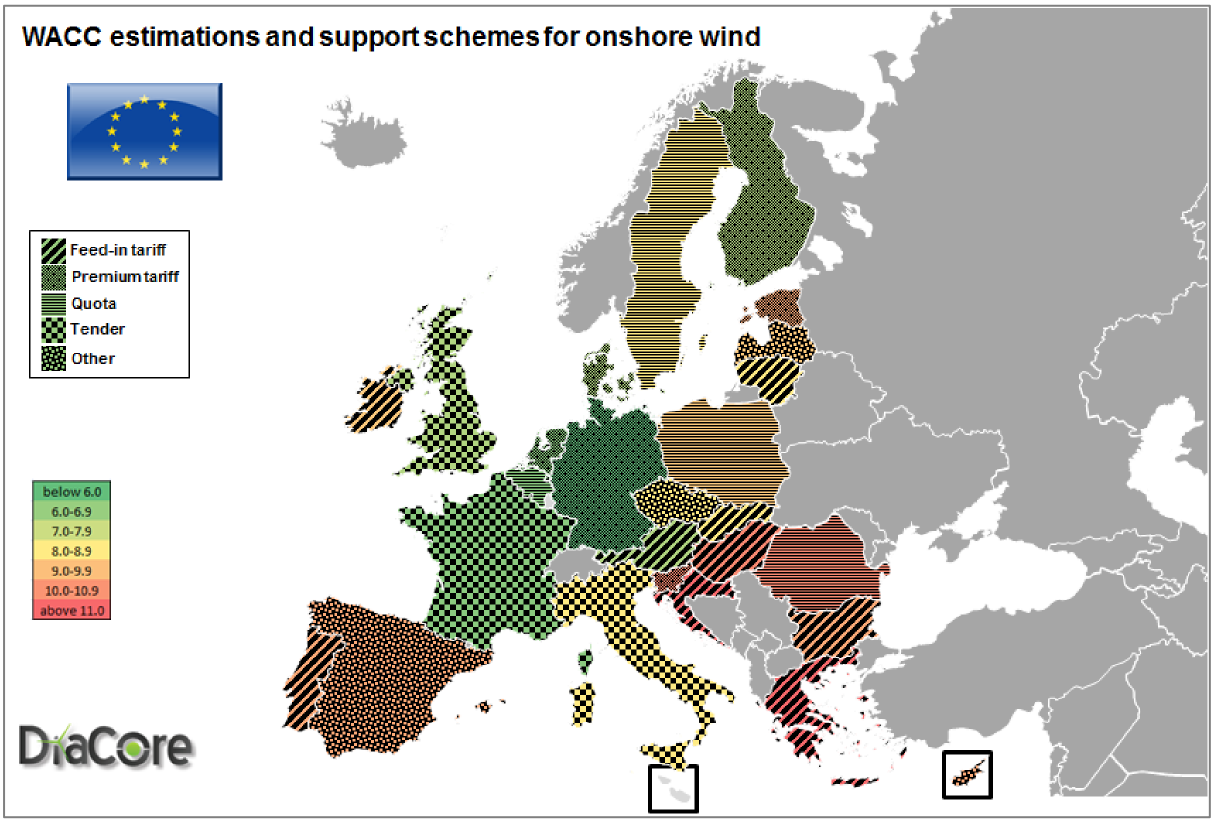


Figure 16: WACC estimations and dominant support schemes for onshore wind

At first glance, this figure does not show an obvious link between the choice of a particular support scheme and a high or low WACC-value: markets with a quota system such as Belgium can still reach a low WACC-value, and in some markets offering a feed-in tariff, the capital costs can be very high. However, it is important to take two factors into account:

- The first is the **specific design of the support scheme**. For example Belgium offers a favourable minimum price for green certificates so that many risks are balanced out;
- The second factor is the **country specific risk**. Many markets still struggle with the aftermath of the financial crises. In such a situation, the country risks seem more decisive than the policy design risks and the national support scheme. As a consequence, comparisons between support schemes are only meaningful if the overall country risk is similar, too. In this regard the comparison between homogenous markets such as **Denmark, Sweden and Finland** is interesting. All three countries **have a very low country risk, but the overall WACC in Sweden is significantly higher than in Denmark and Finland.**

> According to Swedish investors, the higher investment risk is actually mainly due to the shortcomings of the support scheme which does not offset existing price risks.

Apart from such an obvious example, other assessments are more difficult to make. National values for WACC depend to a large extent on the specific design of the support scheme (and not only on the choice of the support scheme) as well as on the overall country risk.

Part 2:
Policy measures to mitigate RES investments risks

5 Methodology on assessing impacts of policy design changes on cost of capital

5.1 Motivation for assessing the impact of changes in support schemes

In Europe, RES investments have been heterogeneous in terms of country coverage and technology coverage, for example, for wind power and PV. To reach the 2020 RES target and continue RES deployment beyond 2020, the EU will need to increase the level of investments by maintaining the investment rate in the current markets (countries and technologies with high investment rates) and tap into undeveloped markets (countries and technologies with potentials, but few investments so far). Past research shows that the level of financial support for RES investments significantly differs among EU Member States. But, high support levels do not always lead to an abundance of investments and strong growth, as there are policy-related risks, but also risks related to the presence of non-economic barriers (e.g. permits and authorization procedures, access to the grid, relationship with system operators). Moreover, general risks, such as country risks (e.g. country creditworthiness rating, country attractiveness index), general political instability (e.g. frequent change of governments), and the risks related to the preparedness/ openness of the electricity market to integrate renewable electricity (e.g. market structure and policy design risks) impact the level of RES investments (Boie, et al., 2015).

This report will not only address and assess policy-related risks, it will also contribute to policy design recommendations, thereby reducing risk-related costs for targeted RES deployment. To reach this goal, information on the linkage between policies, risks and costs are necessary. In literature, different aspects and risks related to RES policy schemes have been discussed, but impacts of policy designs on risks have hardly been quantified, as neither the link between policies and risk is properly established nor the risks are assessed. This report addresses these challenges by conducting a survey linking policies with risks.

5.2 Approach to assess impact of policy designs on risks

5.2.1 Discussion on policies, risks and cost of capital in literature

To attract capital for RES investment, a minimum rate of return is necessary. The minimum rate of return is called financing costs, and can be defined as "the expected rate of return demanded by investors in common stocks or other securities subject to the same risks as the project" (Brealy, et al., 2008). This definition includes three concepts:

1. The opportunity cost concept.
2. The capital market mechanism.

3. The relation between expected return and uncertainty.

The approach of this work package builds on the latter: the higher the uncertainties (risks), the higher the minimum required expected return. Therefore, the cost of capital for RES investments seems to be properly reflected by interest rates, expected return on equity and equity share.

The impact of policies on risks has been discussed by several authors. For example, Wiser & Pickle (1998) show that a carefully designed policy can reduce renewable energy costs dramatically by providing a predictable revenue stream, resulting in reduced financing costs. They reviewed five case studies of RES policies showing that "policies that do not provide long-term stability or that have negative secondary impacts on investment decisions will increase financing costs, sometimes dramatically reducing the effectiveness of the program. […] It is essential that policy-makers […] pay special attention to the impacts of renewables policy design on financing". Their conclusion is that a carefully designed RES policy could decrease LCOE dramatically by reducing uncertainties about revenues which subsequently lowers risks and, hence, financing cost. Based on this statement and the findings of the risk categorization within the project DiaCore (DiaCore D3.1), risks induced through policy designs are considered as the most crucial risks for wind power investments across the EU.

Couture & Gagnon (2010) analysed the design of feed-in schemes, namely the fixed price or market-independent price policy like tariffs and the premium or market-dependent price policy, with respect to RES investments. According to them, fixed price policies can help to lower investment risks due to lower price risks, while premium policies expose RES generators to greater price and, hence, investment risks, but also act as an incentive to generate electricity when it is most needed. According to Dinica (2006), the impact of these policies on risks can be captured through changes in revenues or expenditures. He recognises that several policy elements, which affect price, demand and contract risks, translate into lower profitability and cash flow.

These changes are also reflected in expected returns and equity shares. In Giebel & Breitschopf (2011) a similar approach has been pursued to assess the impact of different policy designs on cost of capital. They translate changes in risk exposures by means of conjoint and cash-flow analysis into changes of cost of capital. Based on these findings, it is assumed that policies' impact on risks can be captured by the expected cash-flow of a project and, hence, by expected returns.

5.2.2 Assessment approach

Our assessment of the impact of policy design on risk and financing costs is based on the logic depicted in Figure 17. Policies affect revenues and expenditures of RES investments through their design of premiums, tariffs, penalties and purchase or marketing obligation. Revenues and expenditures determine the return on investment, i.e. the level of return and the variation of returns over the lifetime of a RES project. Thus, policy designs affect the exposure to price risks through the design of premiums and tariffs, volume risks through forecasting and marketing of generated electricity and cost risks if penalties are due.

The level and variation of return on investment determines its financing structure and parameters, namely the equity share, return on equity and the lending interest rate. These financing parameters determine the weighted average cost of capital (WACC).

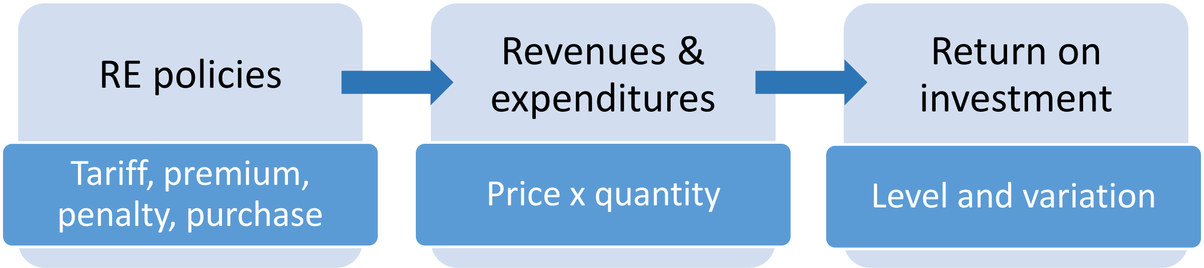


Figure 17: Approach for assessing the impact of policy design on risks

To gain insight into the relationship between policies and risks and cost of capital, a survey among developers, equity providers (i.e. project developers and bankers) was conducted. They were asked to indicate the level of selected financial parameters under different policy designs and indicate changes of these parameters if certain policy designs were changed. An online questionnaire was developed, tested and applied. The results were used to assess the risk exposure measured by means of WACC. The objective is to understand to which extent special policy designs mitigate risks from the perspective of investors/generators, i.e. shift risks from these actors to others.

5.3 Survey

5.3.1 The policy cases

Based on findings in literature, feed-in schemes have been used for the assessment because the impact of design changes can be made very explicit for this support scheme and empirical experiences for different design variant exist in Europe. The latter aspect is very important to allow surveyed persons to give fact-based responses. Changes in the feed-in schemes influence the levels of price or market risks as well as risks of unanticipated expenditures or uncertainty on produced and market volumes. The selected policy designs are briefly described in Box 1. The modifications in the policy design focus on changes regarding level and variations of revenues. Moreover, uncertainties in expenditures are included as well.

Box 1: Description of selected policy design cases

Sliding feed-in premium (FIP_s): In this policy scheme, a feed-in premium is determined upfront and reflects the minimum revenue that RES power producers will receive for their electricity. Part of this revenue is generated through selling electricity on the market (yellow area in Figure 18). The premium is paid on top of the market price. If the market price is lower than the strike price, RES producers will receive a premium to compensate for the difference. In case the market price exceeds the strike price, no premium will be paid. The sliding FIP determines the volume risk exposure as generators have to forecast and market their generated electricity. Depending on the special design of the strike price there might also be a small price risk.

Sliding feed-in premium – No premium for negative prices ($FIP_{s\ neg}$): The design of this policy scheme is identical to the above case (FIP_s), except for the case that negative electricity wholesale market prices occur. In that case, no premium will be paid to the RES power producers. This policy affects the level and variation of returns.

Fixed feed-in premium (FIP_f): In this policy scheme, the premium is independent from the market price. The premium is a constant payment in addition to the market price realised at the wholesale market. Hence, the variation in returns strongly depends on the market price variations.

Sliding feed-in premium – Tender procedures ($FIP_{s\ tender}$): In this case, the premium is obtained via a tender procedure. The feed-in premium is based on the winning bid. The policy scheme used during operation is a sliding feed-in Premium, but it includes penalty payments if the start of the plant operation is delayed (delay 6 or 12 months: penalty = 5% to 10% of investment volume).

Feed-in tariff (FIT): RES producers will receive a fixed, i.e. constant, tariff over the lifetime of the RES project independently from the electricity wholesale market price. They deliver their electricity to distributors and are not obliged to market it.

These policies address three types of risk: the price risk due to varying market prices, the volume risk due to forecasting and marketing of the generated electricity, and cost risks because of the penalties. The expected degree of risk exposure associated with the different policy designs is illustrated in Figure 178. The yellow field of each policy design indicates the electricity market prices (vertical) over time (horizontal) and the blue fields the feed-in tariff or the premium, which is paid on top of the market price. The red field represents unplanned expenditures in case of a delayed project completion (penalties).

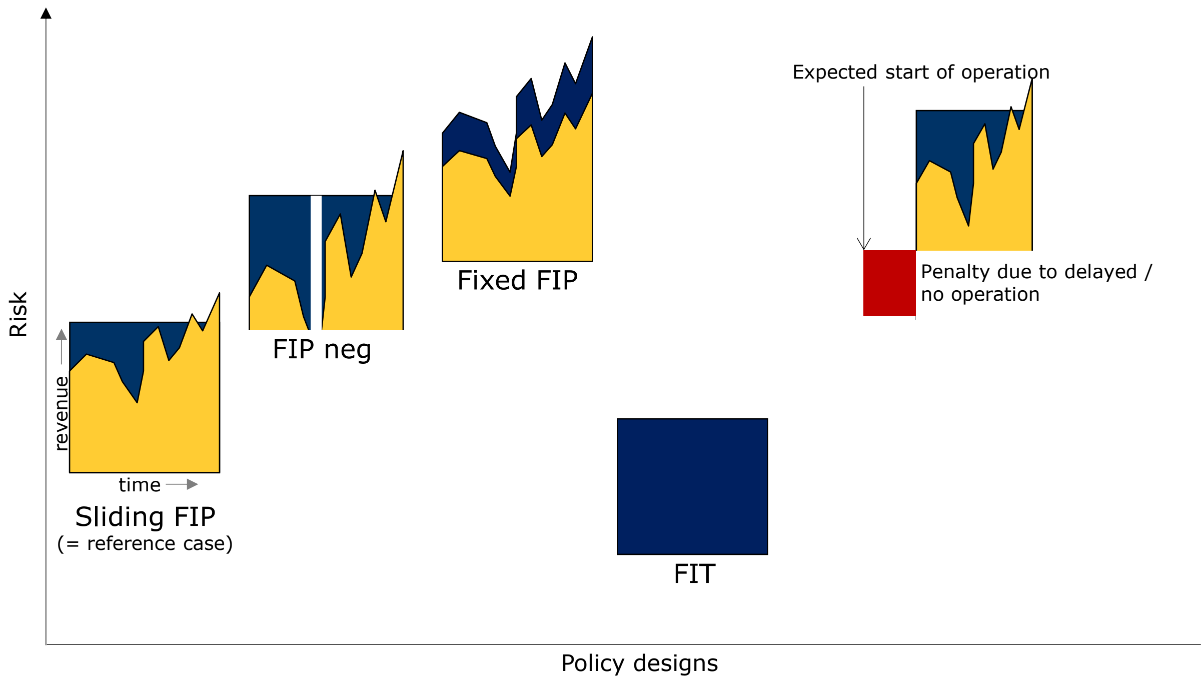


Figure 18: Policy design and risk levels

The **sliding FIP** is used as base rate to which the changes in cost of capital are depicted. The yellow area in Figure 18 shows the fluctuating electricity market price. On top of this market price, a premium will be paid (blue area). The premium is capped to a maximum value (the strike price), meaning that it becomes smaller the more the market price augments. When the market price reaches the strike price, no premium will be paid. Therefore, the price risk exposure in the case of FIP_s is low and linked to the premium setting formula. However, the volume risk is large, since the generators have to forecast and market their produced electricity. In the case of $\mathbf{FIP_{s\ neg}}$ the price risk extends to periods in which the market price for electricity is negative. Therefore, revenues might drop to zero when generation exceeds demand.

Risk exposure is significantly higher under surplus capacities. Regarding the **fixed FIP**, the revenues fluctuate in line with the electricity price fluctuations as the premium paid (blue area) on top of the market price (yellow area) is fixed, i.e. independent from the electricity market price. Therefore, revenues are less certain and stable, as extreme fluctuations of revenues might occur (extremely high (profits) and low (losses) values). In contrast, the **FIT** ensures a stable and constant revenue (=tariff) over the lifetime of the investment. There is no price risk and market risk. Finally, the $\mathbf{FIP_{s\ tender}}$ displays the same price risks as the FIP_s, but it also includes a risk of unforeseen costs, as a penalty (red area) is due if the operating start is delayed. The evaluation of this penalty could be considered as completion or construction risk as it might occur due to technical, management, supply or planning problems.

5.3.2 Financing parameters

To capture the impact of policies on risks, cost of capital is used. It measures the risks by means of a weighted average of cost of equity and debt, i.e. the weighted average cost of capital (WACC), which is a widely used tool in financial analyses. Given the WACC as the most suited indicator for risks, the interest rate of debt, the return on equity (ROE) and the equity share (ES) represent the main financing parameters that determine the WACC and reflect different risk levels for debt as well as equity providers. Although risks might affect other financing parameters, such as upfront fees, guarantees or term structures, the focus of this approach is on these three financing parameters. They capture the uncertainties in revenues or expenditures through the respective magnitude of the minimum required ROE and equity share.

To find out how the financing parameters are impacted by the different policy designs, the participants of the survey had to indicate how strongly the financing parameters – interest rate, ROE and equity share – will change if the policy design are modified. This means they had to specify to what extent the rates would change if there was a switch from the sliding feed-in premium to a slightly riskier policy design. Such a switch could be e.g. to a sliding feed-in premium where no premiums are paid if the electricity market price is below zero, or to a less risky design such as a feed-in tariff.

Furthermore, the respondents were asked to indicate, whether the given financing parameters for the sliding feed-in premium were matching the current rates in their country. They could also suggest new values. The design of the questionnaire can be found in Annex F. Based on the answers, the WACC under each policy design was calculated. The differences represent the additional risk costs when moving from one policy design to another.

5.3.3 Organisation and response

To approach potential participants, the survey and its electronic link have been introduced at several conferences and workshops, sent to different mailing lists and personal contacts. In total, more than 200 people were addressed through the DiaCore email list and even more through the energy-L email list (see Annex 1). Fourteen surveys were returned covering the countries Austria, Belgium, Germany, Greece, Italy, Lithuania and Spain. To verify the results of the survey, bilateral talks were conducted with some of the respondents and the results were presented and discussed at workshops.

6 Results

As the selected policy designs address different levels of uncertainties in revenues and expenditures, investors' risks differ and, hence, the financing parameters do too. The survey results display different changes of interest rate, return on equity and equity shares by type of region and policy design. However, the presented results rely on a small number of cases (n = 14) and are far from being representative for the whole EU. They should be considered as indicative results. The results for the EU will be shown as an average across all respondents, i.e. each respondent gets the same weight (lower bound) and as an average of countries, in which each country has the same weight (upper bound). The latter reduces the influence of the number of respondents per country while single answers per country receive a relatively high weight.

6.1 Interest rates, return on equity and equity share in the EU

Figure 19 shows the lower and upper bounds of the EU average of interest rate (i), return on equity (ROE) and equity share (ES) under a sliding feed-in premium policy (FIP_s) design (see Box 1) for a period between June and September 2015. The lower bound takes the average of the respondents (equal weight for each respondent), the upper bound the average of the countries (equal weight for each country). The countries in the Southern part of the EU display about 1.16 times higher values for wind power projects than the Central EU Member States.

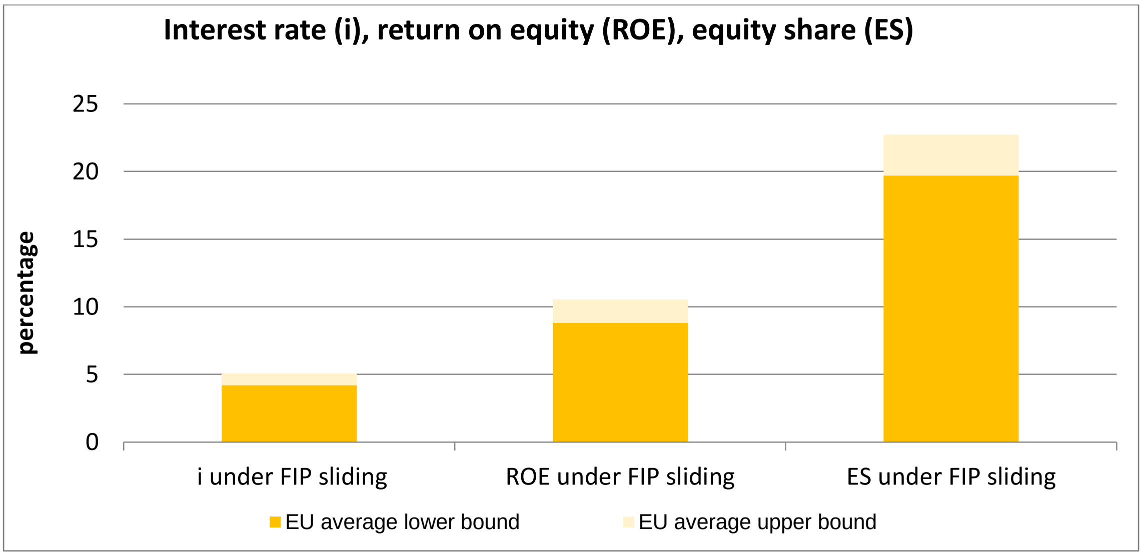


Figure 19: Indicative values of selected financing parameters in the EU under a sliding feed-in premium policy for wind on-shore projects, June - Sept. 2015

6.2 Weighted average costs of capital (WACC) in the EU

Given these financing parameters, the WACC is calculated based on the average financing parameters under a sliding FIP and a FIT. The first ranges roughly between 5%-6% for the EU average, while the WACC under a FIT scheme is between 4.4%-5% (Figure 20). The WACC level between central and Southern EU countries differs strongly under both policy schemes. For sliding FIP, the WACC is about 90 basis points (bp) (1% = 100bp) higher in South EU countries compared to Central EU countries, for FIT the difference is about 140 bp.

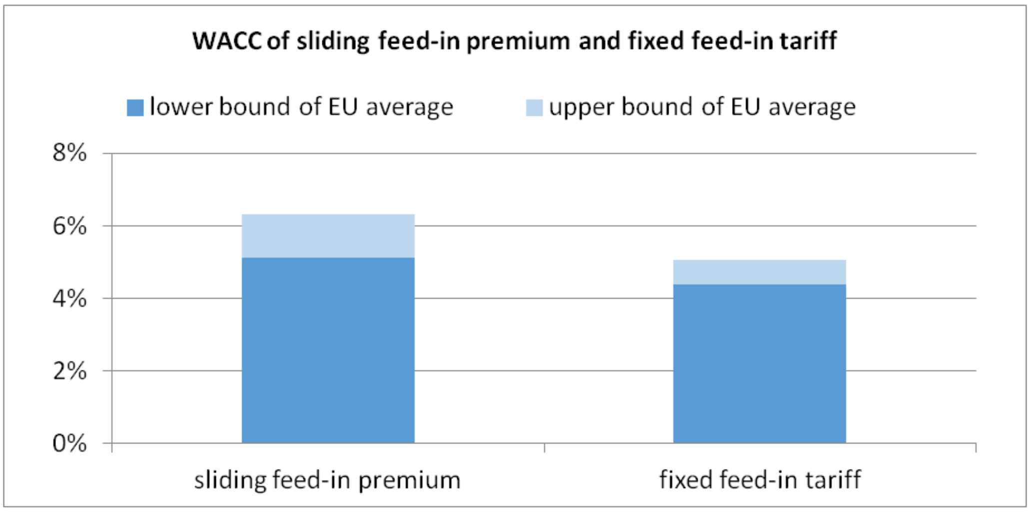


Figure 20: Indicative values of the WACC in the EU (average) under a sliding feed-in premium and feed-in tariff policy for wind on-shore projects, June - Sept. 2015

6.3 Impact of policy designs on WACC

The changes in policy designs could lead to WACCs ranging between 4.5%-5% p.a. for the low risk policy FIT (Figure 20) and between 6%-7% p.a. for larger risk exposure in sliding FIP with tender or fixed FIP. While in Central EU countries the *sliding FIP with tender* is regarded as the policy with the highest risk – measured in terms of WACC –, in Southern EU countries the *fixed FIP* policy is considered as more risky.

The switch from a sliding feed-in premium to a sliding FIP with tender or fixed FIP, significantly increases the EU average of the WACC by about 100 bp (Figure 21). The results of a change to a *sliding FIP without premium payments under negative market prices* shows a relative large range. Differentiating between regions, the increase in cost of capital due to a shift from sliding to fixed FIP is perceived as much higher by central European countries (120-160 bp) than by Southern European countries (90 bp). This might be explained by the difference in knowledge background and experiences with FIT, fixed and sliding FIP in these countries and highlight the relevance of perception.

Furthermore, the probability of negative prices increases with increasing shares of intermittent renewable energy. In regions or markets in which intermittent renewable energy has already a significant share, this policy scheme might not be favoured.

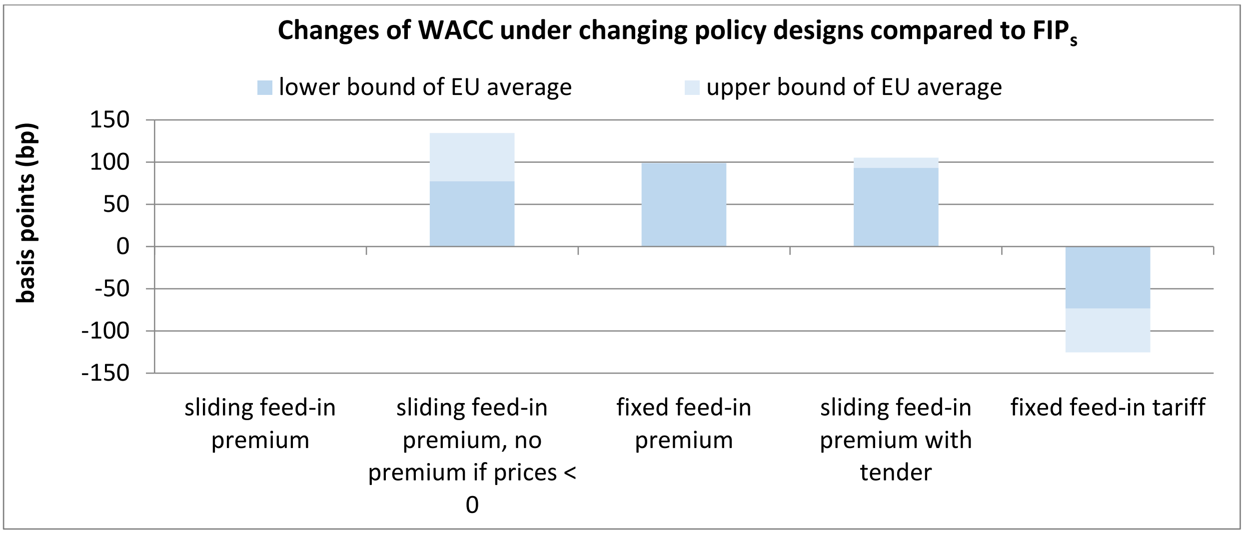


Figure 21: Indicative changes of the average EU WACC under different policy designs for wind on-shore projects, June - Sept. 2015

Comparing these results to other studies, e.g. Giebel & Breitschopf (2011), similar changes in WACC are reported when shifting from a fixed feed-in tariff to a fixed feed-in premium or sliding feed-in premium. Although this impact assessment of policies on cost of capital has a more indicative character, it seems to provide some interesting insights and supports other findings and statements (Wiser & Pickle, 1998; Giebel & Breitschopf, 2011).

7 Policy toolbox

The policy toolbox was created with input from both the onshore wind investments risks and cost of capital assessment as well as the impact of support scheme changes on the cost of capital assessment. In the interviews for the onshore wind investments risks and cost of capital assessment we addressed the effectiveness of current policies in reducing project risks and how this could be improved. This information is used in the policy toolbox. Additionally, the feedback gathered from the online questionnaire (see section 6) and workshops (organised as part of the DiaCore projects) were used. These outcomes are therefore very important to give an indication on the effect of policy measures on the business case.

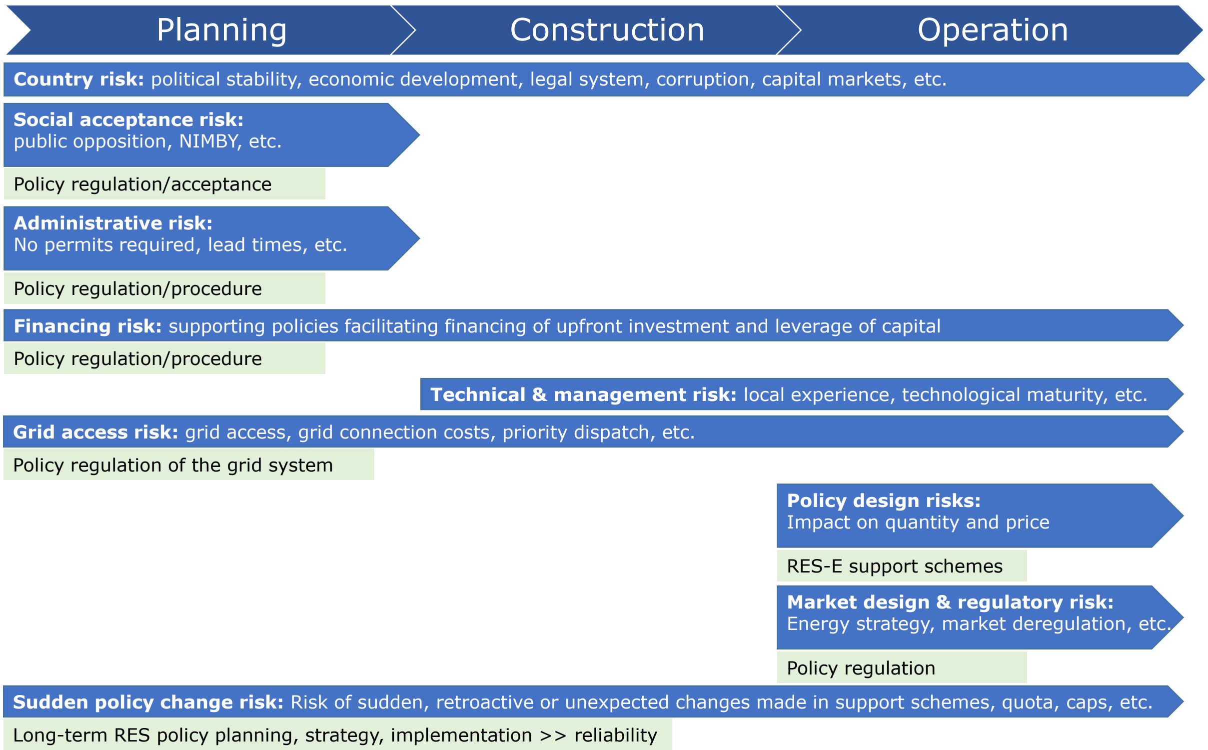


Figure 22: Risks related to RES projects

In this project, the following nine risk categories (see Figure 22) were presented forming the basis of the analysis in this report:

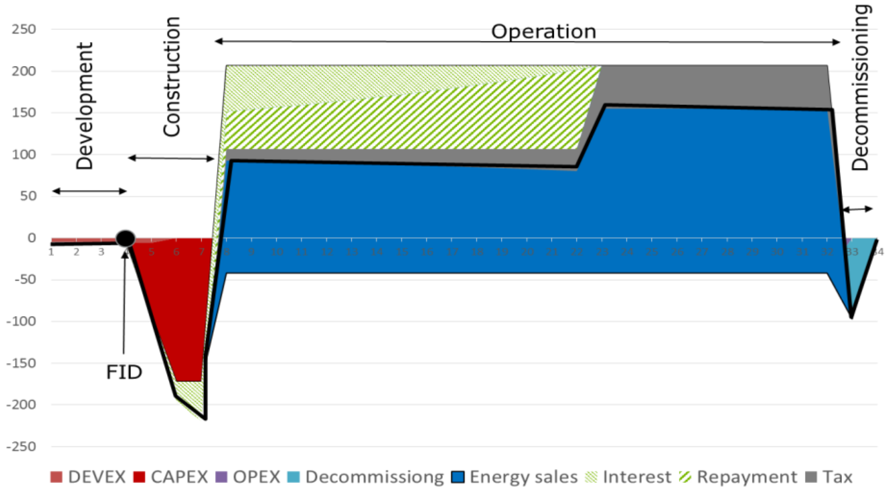
- Country risk
- Social acceptance risks
- Administrative risks
- Financing risks
- Technical & management risks
- Grid access risks
- Policy design risk
- Market design & regulatory risks
- Sudden policy change risks

As stated in section 3.1.1, the focus in this study was specifically on risks that are specifically related to RES investments. For this reason country risk was not included in the interviews with financial experts. However, since country risks are important, it is included in the policy toolbox to offer policy makers input for the formulation mitigating policy measures.

Each risk category has a different relevance and/or weight in the various project lifecycle stages (in this report, we addressed planning, construction operations (and decommissioning), see Figure 3 and Figure 22). Some risk categories indirectly affect the discount rate applied by investors – e.g. through inherent risks in the support scheme - , others directly affect the business case of a project – e.g. the annual variations in the energy yield. For each risk category, different strategies can be applied by the investor: avoid (e.g. no investment, if the energy yield is not known), mitigate (e.g. arranging for high-quality maintenance staff), transfer/share (e.g. insurance, loan guarantees) or accept.

In the context of "*Triple A*" policy, the design of the instrument[18] (notably mitigation and sharing) is important, as it reduces the risk to the investor and/or financier. Avoidance of risk may often result in non-investments in RES, whereas acceptance typically results in higher risk premiums and, hence, higher cost of capital. If government or policy design create inherent risks, risk mitigation through a different enabling environment, policy instrument design or risk sharing could reduce the cost of capital and accelerate the deployment of RES.

[18] '*Triple A'* policies in this report are policies that would increase the project creditworthiness to the highest rating, similar as for countries and companies.



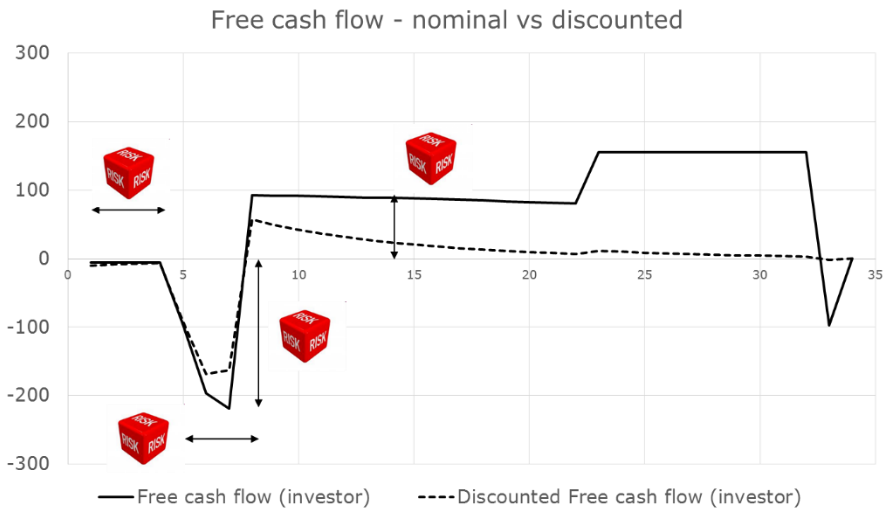


Figure 23: Example of a cash-flow for a 500 MW offshore wind energy project (investor perspective, in M€) (top), and Illustration of the free cash-flow (nominal vs discounted at 15%) of this project with an illustration of the key parameters that are most sensitive in a risk analysis (bottom) FID: Financial Investment Decision

Below, the *Triple A* policies will be presented addressing each risk category. It will not be possible to quantify the impact of these *Triple A* policies on project risks and cost of capital for each risk category and policy instrument, however the onshore wind investments risks and cost of capital assessment presented in this report[19] gives indications of the major risk categories (see country reports, Annex A).

[19] Based on a theoretical financial approach which was validated by stakeholder interviews.

Figure 23 gives an indicative example of the cash-flow of a 500 MW offshore wind energy project with CAPEX of 1.4 billion euro. The shape of the free cash flow determines the overall net present value and internal rate of return and, hence, whether or not the project is attractive to investors.

The bottom of the figure shows the nominal and discounted cash-flow (investor perspective). It illustrates the importance of risks in the early years of the project cycle, due to the time preference of money. The surface under the dotted line (for positive values) should at least equal the surface above the dotted line for negative values. As an example: development costs (DEVEX) contribute to 2% of the levelised cost of electricity (LCOE) for this project. Intuitively one would expect that a reduction of these DEVEX by 10% (e.g. through improved permitting procedures) would result in a 0.2% (10% * 2%) reduction in LCOE. However, due to the time preference of money – which is reflected in the value of the discount rate[20] - this effect is much bigger, almost 1% in this example (15% discount rate).

7.1 Country risks

Description: Country risks refer to a set of factors which can adversely affect the profits of all investments in a country. These factors include political stability, level of corruption, economic development, design and functioning of the legal system and exchange rate fluctuations.

The country risks affect all investments in a particular country, not only those in RES. So, improving the political, regulatory, financial and economic conditions will also benefit RES deployment by reducing the risk premiums applied by investors and lenders. In this section, we will focus on economic risk, which is most relevant to European Member States, and on which renewable energy deployment can have a positive impact. Other country risks (e.g. corruption, a flawed legal system) may be harder to address through RES deployment or in particular through RES policies.

Project lifecycle impacts: Country risks affect the full project lifecycle. Since the risks are not specific to investments in renewable energy, they are typically addressed through generic monetary, economic and fiscal policies, through restructuring of laws, regulations and institutions, etc.

Risk strategy: High country risks typically result in high cost of capital and high required levels of financial support to attract investors. If, from a societal perspective, the benefits of renewable energy still outweigh these higher costs, a policy response is to accept this risk and the financial/budgetary consequences hereof.

[20] The time preference of money reflects the behavior of investors: they prefer to have €1 today over €1 in a given future. If an investor values €1.15 over one year to be equal to €1 today, the discount rate is 15%. Higher discount rates hence result in higher weighted average cost of capital (WACC).

However, if the country risk is mainly related to the economic condition of a country, the government may wish to use the deployment of RES, as a means to strengthen the economy. RES deployment hence becomes part of a (long-term) economic and industrial policy framework. Depending on specific national conditions (e.g. geographic, economic, supply and demand structure, RES resource potential and cost), the government can stimulate particular elements of RES value chains in RES clusters, offering opportunities for economic growth and job creation. This more holistic approach has the opportunity to reduce the country risk in the long-term.

Policies (value creation): IEA-RETD (2014)[21] provides elements of policies that increase the domestic value creation through RES deployment. Such policies "aim at increasing the domestic share from RES value creation such that overall societal welfare is maintained or increased. This can be most efficiently achieved by:

- Improving competitiveness and the regulatory and economic framework for economic sectors and technologies related to RES, based on allocative efficiency;
- Improving the availability, accessibility, and quality of resources (capital, natural resources, human capital) used for RES deployment;
- Stimulating demand for RES(T); and
- Directly addressing support to selected RET producers or service providers." (p.3).

In concreto, these policy interventions and opportunities focussing on economic growth and supporting economic stability could include (IEA-RETD, 2014):

1. Strategic investment promotion: Strategic targeting of specific firms and segments of the value chain based on a long-term vision for the RES sector.
2. Linking investment to employment creation and capacity building:
   - Supplier development programmes, including coordination of promotion measures, matching between potential customers and suppliers, or economic incentives to intensify supplier relations and technology transfer;
   - Local Content Requirements (LCRs), which should be constraint in time and evaluated regularly, technology-neutral and in line with other industrial policies.
3. Developing industrial clusters, including mechanisms to promote a mix of competition and cooperation between firms; that emphasise the linking of firms to the education and R&D institutions; that focus on cooperation within the industrial cluster itself and with government.
4. Improving cooperation between public research organisations and private sector, e.g. through the creation of centres of excellence.

[21] IEA-RETD (2014), Policy Instruments to Support Renewable Energy Industrial Value Chain Development (RES-ValuePolicies), [Lehr, U., B. Breitschopf & G. Vidican; GWS/Fraunhofer ISI/German Development Institute], IEA Implementing Agreement for Renewable Energy Technology Deployment (IEA-RETD), Utrecht, 2014.

5. Enhancing know-how through education & training, e.g. by integrating training programmes in vocational training systems; promoting and coordinating local apprenticeships, etcetera.

Policies (other): Renewable energy projects are equally affected by corruption, political instability and/or a dysfunctional legal system, as any other investment. However, RES policy instrument design should pay particular attention to misuse, *gaming* or fraud, which should be built in into the process and design of the support scheme.

Exchange rate fluctuations are of less importance to the countries in the Eurozone, but can be relevant for imported commodities that are being paid in other currencies (e.g. solar PV modules, biomass).

7.2 Social acceptance risks

Description: Lack of social acceptability of renewable energy investments can cause investment risks, e.g. through delays in or cancellation of projects, with associated cost for legal or regulatory processes. The Not-In-My-Backyard (NIMBY) mentality captures the phenomenon that citizens generally are in favour of renewable energies, yet oppose projects in their direct vicinity.

Project lifecycle impacts: These risks predominantly occur during the planning/project development phase, where permits need to be acquired. In Europe, notably wind- and bio-energy projects are confronted with opposition from directly involved stakeholders. But also a generic opposition against RES (e.g. through perceived high unjustified support costs, or through the higher burden on energy bills for specific groups) can delay or obstruct the realisation of RES projects. With increased deployment of RES, this opposition is likely to grow over time.

Risk strategy: From a policy perspective a mitigation- and/or share strategy may be best followed. Mitigation strategies address the root causes of the opposition, for instance through communication programmes, stakeholder management and participation processes, smoothening of legal and regulatory processes, etc. In a sharing strategy the government takes over part of the project development activities, e.g. the acquisition of permits.

Policies: Building on these risk strategies the following best practice policies could be considered by national or local governments:

- **Stakeholder participation and innovative democratic processes**
  Project developers, (local) authorities and policy-makers aim to avoid lengthy project development processes and frequently try to involve stakeholders in an early stage or offer them financial compensation or participation. The approach is generally rather technocratic and is based on the assumption that good arguments will result in a successful project implementation. But many stakeholders (neighbours, house owners, companies) feel that they have to bear the burden, whereas others reap the benefits. Opponents and proponents are mobilised which seldom results in a solution-oriented discussion. A better, more effective approach can result in a larger uptake of energy solutions, with support from local people.

  Different process tools and approaches can facilitate "true" stakeholder participation, like Future Search, Open Dialogue, Open Space Technology, or World Cafe. Governments could actively share best practices, draft guidelines for successful processes of stakeholder participation and involvement, in cooperation with the RES industry and stakeholder representative groups. Notably, local governments may wish to explore new democratic models that can increase local participation and support.

> **New democratic models**
> In 2015 the city of Utrecht (NL, over 300.000 inhabitants) applied a variant of 'deliberative democracy' and asked 165 randomly selected citizens to draft an energy plan towards 2030 (www.utrecht.nl/energy). The process highly concentrated on finding 'common grounds' for the elements of the city's energy future, within the group of participants and with other stakeholders (e.g. distribution system operator, housing cooperatives, etc.). Whether or not this new approach can actually accelerate the deployment of energy efficiency measures and renewable energy will be demonstrated in the coming years.

- **(Partial or Initiated) Co-development by government**
  Governments may take over part of the planning risk for project developers/investors by arranging the (generic) environmental and spatial planning permits. For offshore wind this is applied in, for instance, France and The Netherlands, followed by a tender procedure. In Denmark, the transmission system operator (TSO) has been made responsible to prepare the environmental impact assessment for six proposed near-shore sites. The project will still have to pass a specific (environmental) impact assessment, but the overall risk is reduced.

  Also, local governments (e.g. cities with RES or climate targets) can take a proactive role by arranging the required permits. Best practices need to be shared, since the different roles of government and project developer require special attention.

- **Streamlining and proper management of administrative procedures**
  A streamlined and properly managed administrative process, with clear moments of stakeholder interaction and clear procedures, can ease the development of RES projects while ensuring (local) stakeholder interests. It reduces administrative risk (see below), but can also help to increase social acceptance.

- **Enabling or prescribing financial participation**
  One way of increasing public acceptance is to offer financial participation (debt or equity) to directly involved stakeholders. In Denmark, it is obligatory for project developers to offer shares for on- and near-shore wind energy (minimum of 20%) to nearby residents and/or enterprises (near-shore). If not obligatory, the project developer will typically take the lead in this. Doing so, the potentially (or perceived) negative impacts can be partially financially compensated. Governments can facilitate this through removing legal and financial barriers, which currently may obstruct financial participation. For example, across Europe different laws and regulations exist with respect to crowdfunding (platforms). These differences across Member States will increase the transaction cost of a European roll-out of this new finance model.

- **Facilitate citizen project ownership**
  Higher levels of direct local project ownership reduce (in general) local resistance. To enable this, project approval has to be standardised and transparent. Remuneration procedures need to be designed in a simple and straightforward way. Such concerns and challenges are particularly important when introducing tenders that otherwise have the potential of disadvantaging small-scale project developers due to complex bidding procedures.

- **Addressing distributional impact of renewable energy support policies**
  In many countries, policy support instruments for renewable electricity are financed through a surcharge or levy on the electricity price for end-users. Small consumers typically pay the highest rates, whereas industry and notably energy-intensive industries are exempted or pay much lower rates. With higher shares of RES, some end-user groups may be confronted with significantly higher energy bills, whereas others benefit from lower electricity market prices. This distributional effect needs to be monitored and addressed appropriately by policy-makers.

- **Communication: facts and figures**
  Misperceptions about the role of renewable energy in current and future energy systems can be persistent. It is important that stakeholders have access to reliable, factual and complete information, which is considered to be credible. Governments can provide such impartial information or support (non-governmental) organisations with a neutral reputation.

7.3 Administrative risks

Description: In order to construct and operate a power plant, developers must obtain several permits. The total time required to obtain these is referred to as administrative lead time. Among the Member States, administrative procedures can vary depending on the complexity and time required to get permits and licences.

Project lifecycle impacts: These risks predominantly occur during the planning/project development phase, where permits need to be acquired.

Risk strategy and Policies: Administrative and social acceptance risks are intertwined. (See above for strategies and policies). However, the structure and quality of the public administrative system is of importance as well. With RES becoming more and more integrated in (and/or affecting) the built environment, national and regional governments are faced with new challenges, for instance where energy and climate policies and spatial planning policies need to interact.

Governments may address this by the following actions:

- Provision of guidelines and sharing of good practices for national and regional civil servants;
- Education, training and informing civil servants (e.g. responsible for energy, built environment, transport, spatial planning, health, safety & environment, communication, etc.); or
- Creation of one-stop-shops for regulatory procedures.

7.4 Financing risks

Description: RES projects that are to be financed or re-financed off-balance, need to be bankable and investable. During the project development phase, the market-, financial-, economic- and/or policy circumstances might change, resulting in banks not willing or able to lend money under acceptable conditions and/or investors requiring (too) high returns. This could jeopardise the (re-)financing of the project, and hence the construction or continuation of operation of the project.

Project lifecycle impacts: Financing risks occur throughout the project lifecycle. However, in most cases, it is relevant for the planning phase, notably for projects with high CAPEX in combination with relatively long development periods before the financial investment decision (FID). Some projects can only lend a restricted period (e.g. five year), or are initially financed on-balance. In both examples, re-financing is required after this period. Again, financing conditions may have unfavourably changed in the meantime.

Risk strategy: For the project developer/investor, several risk mitigation strategies can be applied (e.g. fixing several financial parameters in advance). From a policy perspective, risk sharing is frequently applied (e.g. loan guarantees).

Policies: Governments can reduce the financing risk through their involvement on the financial market, e.g. through government or public/private investment funds and banks (e.g. European Investment Bank, EIB). These financial institutions basically apply the same financial criteria as their commercial counterparts, but through their government connection, they can act both as a catalyst and a "safety-net" for project finance. Other instruments, like loan guarantees or export credit facilities, can act as such. In nascent RES markets, general information on lending to RES projects is also helpful. Education, training and information to bankers is also an effective way of improving finance conditions for RES.

Part of the financing risk can also be reduced through designing policy support instruments aligned with financing practices, hereby providing sufficient security to lenders and equity providers (see below under policy design risk).

7.5 Technical & management risks

Description: Technical & management risks refer to the availability of knowledge and experience to successfully develop, construct, operate and decommission a particular RES project.

Project lifecycle impacts: This risk category occurs throughout the project lifecycle, but is most relevant for the construction, operations and decommissioning phase.

Risk strategy: Technical & management risks are clearly within the realm of the developer/investor and operator of a RES project. From a policy perspective, governments can facilitate the development of the required knowledge base, skills, and experience, in the way addressed under "country risk".

Policies: The generic policies addressed under "country risk" are relevant for this risk category as well: they contribute to a strong RES sector that can deliver viable RES projects according to specifications.

- **Performance and risk databases for new/innovative technologies**
  For new or innovative technologies, technical and/or managerial experience and skills may still be limited. In order to accelerate the learning curve of such technologies, it is important that good and best practices are shared among RES industrial parties. This could be achieved through an obligatory registration of performance, incidents and risks, which is a condition for receiving government support.

7.6 Grid access risks

Description: To become operational, the renewable electricity projects should be connected to the electricity grid. This process includes the procedure to grant grid access, connection, operation and curtailment. Any uncertainties in these procedures will result in higher uncertainties in project returns and, hence, higher cost of capital.

Project lifecycle impacts: Grid access risks will be addressed before financial closure. However, they will only materialise during the operations phase of the project.

Risk strategy: The project developer will strive for avoidance of grid access risk, as this is one of the most crucial parameters to the business case of the project.

Policies: Governments and regulators play an important role in providing clarity on procedures and processes with regard to grid extension (plans), grid access, and on liabilities and compensation in case of delayed or interrupted access or curtailment. These interfaces are of crucial importance to financiers. Compensation schemes, especially, can reduce this risk, but they need to be well-designed and defined. For instance, an objective and realistic method should be available to determine the lost production and lost returns in case of delayed or interrupted grid access.

7.7 Policy design risks

Description: Government interventions are needed to correct market failures and/or support innovative technologies that are not yet mature. Support instrument aim at bridging the finance gap between market prices and renewable energy production costs. The mere fact that renewables depend on government support is a risk factor (see "sudden policy change risks"). On top of that, the design of the policy support has particular implications for the risk profile of a project. Some policy instruments entail a higher exposure to market design & regulatory risks (e.g. quota obligation schemes) than others (e.g. feed-in tariff), resulting – in general – in higher risk premiums. However, specific instrument design may affect the degree of risk exposure.

Project lifecycle impacts: Policy design risk affects the operations stage of a project. Most RES technologies have high capital expenditures (CAPEX) and require relative long periods (e.g. 10-20 year) to recover these CAPEX at an "acceptable" return and repay any debt to lenders with an interest. The risk of any changes in project returns directly affects the risk premium for key financial parameters.

Risk strategy: Most policy support instruments apply a risk transfer strategy. By providing (partial) security of returns, governments can reduce the risk in the operations phase significantly.

Policies: In order to reduce the cost of capital – and, hence, the overall level of required policy support – policies typically may address the level of the expected return and/or the standard deviation in the expected return. Both aspects are crucial for deciding on RES investment.

Policies that bridge the finance gap, or provide even higher support through (e.g. through high feed-in tariffs or premiums), will increase the project return which will lead to more RES investments at lower cost of capital. On the other hand, the net effect may result in higher overall levels of policy support.

Policies that reduce the uncertainty in the expected return (addressing price, cost and volume risks) will reduce the volatility of revenues and can contribute to lower cost of capital.

The following policy elements reflect these principles:

- **Reduced revenue risk by using contracts for difference instead of fixed premium systems**
  In case of the sliding premium or contract for difference (CfD), the premium is a function of the electricity price. This way plant operators of RES-E are not exposed to the overall risk of the electricity market price. At the same time, the benefits in terms of market integration of renewable energies is the same as for fixed premium models. Furthermore, sliding premium systems also reduce the market design & regulatory risk of overcompensating RES generators. Therefore sliding premium systems seem to be the preferred option. Consequently, six Member States, which have intensely discussed the optimal design of feed-in premium systems (Denmark, Finland, Germany, Italy, the Netherland and UK), use this design option.

- **Reduce compliance risk by a careful tender design**
  Tender schemes need to assure compliance by the implementation of financial and non-financial prequalification requirements and penalties. Finding the proper balance between prequalification needs and penalties on the one hand and between financial and non-financial obligations on the other hand, can help reduce investment risks.

- **Flexibility/banking**
  Certain support instruments cap the amount of subsidy per year (e.g. only to a certain number of full-load hours). If energy production stays under this cap (e.g. through a lower wind resource in a particular year), followed by a year with higher yield, this will result in a net loss of income of the project if no banking is allowed. Banking (and similar flexible instruments, like variable investment tax deduction, tax loss carry back/forward) can improve the financial performance of a project and reduce risks.

- **Increased predictability of policy influences on market development**
  Notably for CfD designs with a cap on the total support given per project (in terms of €/MWh), there is a risk that electricity market prices will fall to lower levels, with the level of support not being sufficient to bridge the finance gap. As these low prices would be a consequence of the deployment of more "policy induced" variable renewable energy (VRES) sources, governments may provide more clarity on the amount of (V)RES they intend to support for the coming 10 to 15 years (e.g. as part of tender schemes). This information (plus similar information from countries in the same electricity market/system) allows project developers and financiers to reduce the level of one risk component.

7.8 Market design & regulatory risks

Description: Market design & regulatory risks refer to the uncertainty regarding government energy strategy and power/energy market liberalisation. Fair and independent regulation implies that electricity market regulation safeguards that RES-producers have non-discriminatory access to the market.

Project lifecycle impacts: This risk category affects the operations stage of a project.

Risk strategy and Policies:

- **Create a marketplace for all actors** (i.e. free access of actors, no market entry and exit barriers, controlling body, private non-state companies, etc.).

- **Reduce the revenue risk by continued RES support in times of moderately negative electricity prices**
  The Energy and Environment State Aid Guidelines restrict the possibilities for governments to support renewable energies in times of negative prices. Due to the fact that RES investors only have limited means to mitigate the occurrence of negative prices at the electricity markets, the requirement to stop RES support payments during these times poses an unproductive risk.

- **Provide compensation for RES generators in case of grid-related curtailment of RES generation**
  The main mitigation measure for grid-related curtailment is the investment in grid infrastructure. Since this mitigation measure is typically not the responsibility of RES generators, uncompensated grid-related curtailment of RES generation poses an unproductive risk and should therefore be avoided.

- **Introduce a neutral party to avoid and settle disputes on market functioning**
  The introduction of more and new forms of renewable energy technologies in the energy system may result in conflicts between for instance project operators and grid operators. Instead of filing lawsuits other routes to avoid or settle disputes may be applied, through the involvement of a neutral entity. In Germany the *Clearingstelle EEG* can provide mediation, joint dispute resolution, and/or arbitration. Such an entity can also pro-actively provide general advice on the interpretation of laws and regulations.

7.9 Sudden policy change risks

Description: Sudden policy change risks refers to risks associated with drastic and sudden changes in the RES strategy and the support scheme itself. In the worst case, this could imply a complete change or abandoning of the RES support scheme or even retroactive changes. Sudden policy change risks are defined as the risks of any unexpected, unanticipated, short-term announced or sudden changes of policies or policy design features.

Project lifecycle impacts: This risk category affects the planning and operations stage of a project.

Risk strategy: Policy-makers should avoid sudden policy changes. All literature on policy instrument design calls for stable, predictable and enabling policy environments.

Policies: The best way to avoid sudden policy changes is to avoid a situation where the policy instrument support is perceived to be too high, resulting either in windfall profits or in high government or societal expenditures.

- **Design responsive yet predictable policy instruments**
  With support levels that – in a predictable way – follow and report on developments in deployment and costs/prices, such a situation may be prevented.

- **Integrate RES policies into economic and industrial policy frameworks**
  One important policy approach is to embed the deployment of RES in a more holistic economic and industrial policy framework, as introduced under "country risk". This will increase the co-benefits of RES deployment and can justify expenditures for RES support.

In other words, policies should result in a dynamic, responsive lock-in into renewable energy.

8 The impact of improving financing conditions – a model-based prospective analysis (Green-X)

8.1 Approach

This section is dedicated to provide the quantitative underpinning of previously discussed findings and recommendations on improving financing conditions across the EU. By use of TU Wien's Green-X model, a quantitative analysis is conducted that indicates the impact of changes in WACC conditions.

Green-X is an energy system model that offers a detailed representation of RES potentials and related technologies in Europe and in neighbouring countries. It aims at indicating consequences of RES policy choices in a real-world energy policy context. The model simulates technology-specific RES deployment by country on a yearly basis, in the time span up to 2050, taking into account the impact of dedicated support schemes as well as economic and non-economic framework conditions (e.g. regulatory and societal constraints).

Moreover, the model allows for an appropriate representation of financing conditions and of the related impact on investor's risk. This, in turn, allows conducting in-depth analyses of future RES deployment and corresponding costs, expenditures and benefits arising from the preconditioned policy choices on country, sector and technology level.

The assessment of the impact of improving financing conditions builds on four different scenarios that are defined as follows:

- Two distinct RES policy pathways are used, i.e. a business-as-usual (BAU) scenario that reflects the currently implemented RES policy framework and where non-economic barriers that limit the uptake of RES technologies in various countries are assumed to prevail, and, alternatively, an ideal policy world of strengthened national RES policies (SNP), assuming a strengthening of policy instruments in accordance with binding 2020 and 2030 RES targets together with a rapid mitigation of non-economic barriers.

- Both overall RES policy pathways are combined with the two WACC worlds – i.e. real and ideal WACC conditions as thoroughly assessed and discussed in the remainder of this report. For the calculation of the ideal WACC the assumption was taken that, in all MS, the same cost of equity as for the best in class (i.e. Germany) is applicable. The cost of debt was kept at the country specific level. This approach leads to a significant reduction of the WACC from 8.3% to 5.9% on EU28 average. Concerning the transition period, in the ideal WACC case, the assumption is taken that gradual improvements in financing conditions materialise in forthcoming years up to 2020, forming a "level playing field" for wind onshore investments across the EU in the period post 2020.

8.2 Results

Key results of the model-based assessment of the impacts of improving financing conditions are summarised in the table below. More precisely, this table provides an overview on results concerning deployment and policy costs – i.e. RES-related support expenditures – in the period up to 2020 and beyond (up to 2030). Impacts are shown for wind onshore, being in the spotlight for the risk evaluation performed.

Under BAU conditions, the switch from a real to an ideal WACC case shows a strong impact on wind onshore deployment: the amount of electricity generated from wind onshore increases by slightly less than 2% up to 2020, and by about 3% up to 2030, while the corresponding support costs decrease by up to 3.1%.

The scenarios of strengthened national policies (SNP) draw a different picture. The reduction of yearly support expenditures would be around 4.2% for the period until 2020, and 15.6% for the forthcoming decade.

Table 3: Key results on the impacts of improving financing conditions for wind across the EU

Impacts of improvements in risk performance (WACC) at EU level (EU28)	Scenario:	Business-As-Usual (BAU)				Strengthened National Policies (SNP)			
		WACC real	WACC ideal			WACC real	WACC ideal		
	EU28 (average)	8.3%	5.9%			8.3%	5.9%		
				Change to WACC real				Change to WACC real	
	[Unit]				%*				%*
Impact on wind onshore									
Electricity generation from wind onshore									
2020	TWh	319.0	324.9	5.9	1.9%	353.7	362.6	8.9	2.5%
2030	TWh	560.1	576.6	16.5	2.9%	674.5	680.7	6.2	0.9%
Support expenditures for wind onshore, yearly average									
2016 to 2020	billion €	8.8	8.6	-0.2	-2.1%	8.7	8.4	-0.4	-4.2%
2016 to 2030	billion €	7.8	7.5	-0.2	-3.1%	8.4	7.1	-1.3	-15.6%

Note: * ... deviation to default (WACC real), expressed in percentage terms (compared to default)

Source: Green-X modelling

Calculations based on the Green X Model show that if all countries would have the same renewable energy policy risk profile as the best in class, the EU Member States could reduce the policy costs for wind onshore by more than 15%[22]. A reduced country risk could lead to greater savings.

[22] These results are based on a hypothetical case, as they look at isolated RE risks profile changes. This indicative calculation aims to provide a first estimate of cost savings potential.

9 Conclusions

The objective of this report was to take a closer look at the **role of risk** in renewable energy investments, to identify barriers and provide solutions in the form of **policy measures** to **enhance investments** in the RES sector. Our research led to the following results:

Across all EU Member States, the risk related to the policy design is perceived as one of the most pressing.

RES investments are influenced and impacted by several risks categories. Apart from the country risk, the policy design risk is ranked as one of the most severe risks. An important part of the policy design is the support scheme to increase the cost-price competitiveness between renewable energy and fossil alternatives. In ten Member States, policy design is ranked as the most important risk. Other risks frequently mentioned in the top-3 risk categories are administrative risks (including permit procedures), market design & regulatory risks (including energy strategies and market deregulation), and grid access risks. In Member States where national governments introduced retroactive measures to support schemes (e.g. Czech Republic, Bulgaria, Slovenia, Spain), the risk of sudden policy change was ranked very high, too.

Countries within the same region show a similar risk profile.

Countries from the same region or with similar market development or technology deployment status display a similar risk perception/profile/status. For example, in Southern European markets, financing risks are very pressing, while the sudden policy change risk category appears in the top-3 for many Eastern European Member States (Czech Republic, Bulgaria, Hungary, Slovenia, Latvia and Slovakia).

Social acceptance risks rank the highest in North-Western countries. The market design & regulatory risk also seems to be more important in North-Western countries, which could indicate that current market design and regulations are no longer fulfilling the needs of the RES developers in the region.

Remarkably, in most cases policy design risk remains the most important and does not show strong variations between regional groups.

In developing onshore wind markets, administrative risks are particular relevant. **Administrative risks, grid access risk and technical & management risks are perceived most relevant in emerging markets, while policy design risks are ranked relatively low in comparison to nascent and mature markets.**

During the implementation phases of a RES project, the importance of risks changes. At an **early stage**, the project is dominated by different risks, i.e. administrative risks, social acceptance risks and policy design risks. At this stage, a large part of the projects fails (according to project developers 60-80%). Although the probability of failure is high, the impact is low as the invested capital at this stage is relatively low. On the other hand, these costs are usually fully borne by the project developers, which means that, for this specific type of stakeholder, the risk is reasonably high.

During the **building phase**, the probability of a failure decreases, but the invested costs and, thus, the impact increase rapidly. This means that the resulting risk, depending on the investments, can be significant for the project developer. This is why sudden policy changes can have a disastrous effect on the market.

The last phase of a RES project is the **post-support phase**. When the support has been phased out, market design & regulatory risks become very relevant, as from that point onwards, a full integration to the market will be necessary. Over time, the relevance of technical risks also increases.

There are big differences in capital costs among EU Member States.

The **cost of capital** for onshore wind projects varies between Member States. The WACC **(Weighted average Cost of Capital)** is an important input parameter in project evaluations. As RES technologies such as onshore wind require high upfront investments costs, the WACC significantly influences the business case of such projects. According to the interviewed experts, the 2014 WACC for onshore wind projects varies massively, for example between 3.5% in Germany and 12% in Greece. In most North-Western Member States, WACC figures will be 7% or lower, providing a good financial basis for onshore wind. Eastern and Southern Member States show higher WACC figures. There the WACC ranges between 10-12%, resulting in increased expenses for tax payers and energy consumers.

The parameters of the WACC, cost of equity, and cost of debt show similar results. The **cost of equity** for onshore wind projects in 2014 ranges between 6% (Germany) and 15% or more (Estonia, Greece, Latvia, Lithuania, Romania and Slovenia). Western Member States generally show lower values (typically between 6-15%), while higher figures are observed in Eastern countries (16% and more). An increased level of support can lead to lowering the risk perception of equity providers and subsequently to lower cost of equity and WACC.

The **cost of debt** varies between 1.8% in Germany and 12.6% in Greece. **Germany shows the lowest results with values for cost of debt ranging between 1.8% and 3.2%**. A reason for the very low values could be the competition between banks: many banks have come to consider wind energy projects as secure investments and underbid each other. The cost of debt currently features a falling tendency caused by post-crisis measures, resulting in declining EIB loans and EURIBOR.

In some countries, the values for the cost of debt were found to be substantially higher than in the model results (e.g. Romania, Bulgaria, Italy and Spain). It is difficult to assess, for each individual example, whether the increase of rates is due to specific renewable energy policies or due to the general economic situation or to a lack of competition between national banks. In any case, it sheds a light on a growing gap within Europe between Northern European countries that benefit from lower costs of debt and Southern European countries that do not. Across Europe, the lower cost of debt values are found in Northern Member States (up to 6%), while the Southern countries show values of 7% and up. According to investors, the main factors for the cost of debt value are the general country risk, the specific renewable investment risks and also the competition between debtors.

The debt/equity ratio varies considerably between Member States, caused by both country specific aspects and the financial crisis.

In 2014[23], the markets in Germany and Denmark allowed a debt share reaching, or even surpassing, 80%. This enabled developers in these markets to benefit from lower cost of debts, as they were able to use a very high leverage. Investors in South-Eastern Europe had to provide up to 50% of their investment budget through equity financing. This drove up the costs for financing onshore wind energy plants and often made financing of projects impossible. A debt share below 70% (ranging from 50%-65%) was found in almost a third of all EU markets, which illustrates the perceived risks for onshore wind investments in many EU Member States.

Our analysis based on the overall country survey and comparison does not show an obvious link between the choice of a particular support scheme and a high or low WACC-value: markets with a quota system, such as Belgium, can still reach a low WACC-value and in some markets offering a feed-in tariff, the capital costs can be very high. However, it is important to take two factors into account: The first one is the specific **design of the support scheme**. Belgium, for example, offers a favourable minimum price for green certificates so that many risks are balanced out. The second factor is the **country specific risk**. Many markets still struggle with the aftermath of the financial crises.

Germany has the lowest weighted average cost of capital in the EU-28, with a value of 3.5-4.5% for onshore wind energy plants. **The other extremes in the EU are Croatia and Greece where circumstances are less favourable,** showing WACC-values that are up to three times as high as in Germany. Nevertheless, policy design has an impact on WACC as well.

[23] When the market actors were interviewed.

Certainty in revenues due to guaranteed feed-in or non-fluctuating remunerations decrease cost of capital: To better understand and capture the impact of RE policy design on cost of capital, a survey has been conducted with a limited number of respondents. The survey results are indicative, but clear: a policy design that exposes investors/operators to no or low volume and price risks (such as the FIT), reduces cost of capital by about 100 bp. This is due to the fact that, in cases of lower risk for investors/operators, a lower ROE and equity share is accepted. And lower cost of capital would lead to lower costs of RES projects and potentially to an increased number of projects being realised. Hence, the deployment level of RES is also affected by the choice of policy design.

RE Policies ensuring certain revenues shift risks from generators to society: Lower risks for investors due to increased certainty in revenues implies a shift of risks from investors/operators to those actors paying the premium or tariff, in most cases the final electricity consumers. This is because guaranteed feed in or fixed remuneration sets off the market mechanisms, and forecasting and marketing is shifted from generators to transmission grid operators, which transfer their costs to consumers (in case of burden-sharing through electricity consumers). And, at the system level, the levelised costs of electricity generation decrease due to falling costs of capital.

Risk premiums due to RE policy design changes are mainly reflected in the equity share and return on equity: The degree of change in the three components of the WACC differs. In practice, financing institutions such as banks and insurances have regulatory binding risk provision requirements, e.g. Basel II, which do not allow banks to reduce risk margins unlimited. As shown in a study of Breitschopf & Pudlik (2013), even if the regulatory required risk margins for projects in wind power under a fixed feed-in tariff scheme exceed actual risks, banks can barely reduce them under the given regulation.

However, the level of cost of debt is primarily set by the market and changes in policy design have a comparatively limited impact: about 100 basis points of WACC, when moving from a sliding to a fixed premium compared to more than 1000bp between low risk and high risk country (e.g. Greece): In a competitive market, banks' scope to adjust lending rates is limited as they follow the market price setting principles: is there an excess supply of capital (credits), the costs of debt are low, and vice versa. In contrast, equity providers are free to adjust their expected returns to changing risk levels. This is reflected by the survey results as well: expected returns disclose larger changes than loan interest rates. Moreover, under increasing uncertainties banks tend to demand higher equity shares, leading to higher costs of capital, as well.

Besides these analysed policy designs, other factors highly impact the cost of capital. For example, retroactive policy changes, as implemented in Spain (FIT of PV) or as announced (but not implemented) in Germany, have affected the cost of capital, because the probability of retroactive policy changes has increased uncertainty about future revenues. Subsequently, investors' risks have increased as well. This higher risk translates into a higher minimum threshold for ROE. Similarly, financing institutions reduce their risk exposure by demanding a higher equity share.

As risk perception and aversion differs according to investor types, policies might determine which type of investor will actually invest: high risk RES investment might attract investors with a large portfolio and low risk aversion. Additional instruments, such as grants, guarantees, and subsidised interest rates, could reduce the level of risk exposure (return) and, therefore, might even attract smaller and more risk averse investors under a "riskier" policy scheme. However, these additional support policies might increase policy costs.

Efficiently allocating risks and hence costs between generators and society is a challenge: In summary, an increasing market integration of RES generation implies more responsibility for RES generators. This is equivalent to shifting risks from the public (e.g. consumer) to generators. This increase in risk entails higher return on equity and equity shares, hence higher financing costs. As a consequence, appropriate remuneration levels are required to achieve the RES targets and compensate for higher risks and trigger RES deployment. This leads to increased policy costs, which are offset by decreasing costs for market integration (decreasing cost of balancing). Therefore, careful monitoring of the balance of policy costs – reduction due to risk shifts (balancing) versus increase of policy costs due to high remuneration levels – is needed.

The sliding FIP with a tender is the preferred option: compared to a sliding FIP without a tender, the FIP with a tender seems to ensure a lower but sufficient level of revenues (assuming an efficient and effective[24] tender process) while compared to a fixed FIP, it limits risk exposure by providing a certain remuneration, leading to lower policy costs for the public due to "efficient" premiums.

The policy toolbox provides a starting point for mitigating country risks and lowering the cost of capital for RES investments.

For each of the nine risk categories, measures to mitigate these risks have been formulated, based on the input from interviewees, project developers and policy-makers. The resulting measures provide a starting point and useful guidance. In order to be effectively implemented, the measures should be tailored to the specific needs of Member States' national regulatory framework. For mitigating **country risks**, it is most important to make **RES deployment a part of a (long-term) economic and industrial policy framework** by improving competitiveness of RES options and the availability, accessibility and quality of resources.

For **social acceptance risk** it is most important to **focus on the stakeholder process** and provide the opposition a platform for sharing their concerns. Several approaches and strategies are mentioned, ranging from new democratic models (in which citizens are pro-actively asked for their input) to co-development by government.

[24] Under an effective bidding process price (premium) = marginal costs.

Administrative risks focus mostly on permitting procedures and relate quite strongly to the **structure and quality of the public administrative system**. With a stronger integration of RES in the built environment, interaction of policies and spatial planning requires clear guidelines, one-stop shops and education of civil servants.

Financing risks are mostly related to the perception of the banks and equity providers on the market-, financial-, economic- and/or policy circumstances and how these might change. This might lead to high cost of capital, which can then jeopardise the project. **Risk sharing and/or a strong(er) involvement of governments** can mitigate these risks by functioning as a safety net.

Technical & management risks refer to the availability of knowledge and experience to successfully develop, construct, operate and decommission a particular RES project. Mitigation of these risks relates to the **development of knowledge, skills and experience**.

For **grid access risks**, the focus is on ensuring timely grid connection for new projects. Any uncertainty on this procedure will result in higher uncertainty in project returns, and, hence, higher cost of capital. Mitigating these risks will therefore focus on **creating clarity on grid procedures and processes** with regard to grid extension (plans), grid access, and on liabilities and compensation in case of delayed or interrupted access or curtailment.

Policy design risks relate mostly to support schemes and other government interventions to support the implementation of RES. Depending on the support scheme, risks are transferred between the market and project developers. In order to reduce the cost of capital, mitigating measures typically address the **level of the expected return and/or the standard deviation in the expected return**. Important in this discussion is the balance between support to stimulate RES development, implementation and overspending (windfall profits).

Market design & regulatory risks refer to the uncertainties regarding government energy strategy and power/energy market liberalisation. Implementing **fair and independent regulation** ensures non-discriminatory access for RES-producers to the market.

Sudden policy change risks refer to drastic and sudden changes in a country's RES strategy and/or support scheme. The result of these changes is a significant decrease or even a complete standstill of the development of RES. Causes for sudden policy changes are, for instance, the cost-effectiveness of government budgets spent on the implementation of RES. A good balance needs to be found between stimulating RES with the right policy design while ensuring cost-effectiveness in order to **avoid windfall profits of high government or societal expenditures**.

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Annex A – Country risk profiles

In this Annex the country risk profiles for the EU Member States are presented. These profiles are based on interviews[25] with experts from all Member States. Over 80 equity providers, project developers and bankers were approached. Table 4 presents the implemented interviews per country.

Table 4: Interviews per country

Country	Interviews
Austria	2
Belgium	3
Bulgaria	3
Croatia	1 – no model
Cyprus	4
Czech Republic	2
Denmark	4
Estonia	2
Finland	2
France	1
Germany	6
Greece	9
Hungary	2
Ireland	1 – no model
Italy	4
Latvia	2
Lithuania	2
Luxembourg	0
Malta	0
Netherlands	5
Poland	3
Portugal	3
Romania	2
Slovakia	2
Slovenia	1
Spain	3
Sweden	3
United Kingdom	5

Group 1 grey coloured, Group 2 green coloured, Group 3 blue coloured, Group 4 no colour
Note: The number of interviews conducted per country was not the same. Therefore, the country profiles are separated in four different groups. The first group contains Luxembourg and Malta. In these two countries no interviews were achieved, therefore the profile was based solely on the model output. The second group contains Croatia and Ireland. In contrast to the first category, in these two countries the profile was based only on one interview and no model output due to lack of data availability. Only one interview was achieved also in France and Slovenia, nonetheless it was combined with the model output. Finally the fourth cluster of countries contains those with at least two interviews and model outputs.

The interviews served the following purposes:

- Check whether the identified risk categories were covering all risks;
- Evaluate the risk profiles;

[25] An example of the questionnaire and an overview of the interviewed persons can be found in Annex D.

- Evaluate the estimated cost of equity and ranking of investments risks;
- Evaluate the effectiveness of policy on reducing investments risks and how this could be improved;
- Check model assumptions (e.g. assumptions used to calculate the cost of equity).

After conducting all interviews, the country profiles were created. The template for the country profiles was largely based on the template of the interviews. The objective of the country profiles is to present an objective representation of the data, without interpretation from the interviewers and/or analysts. The structure of the country risk profiles is as follows:

The first section discusses renewable energy investment risks. Here, the model results are compared to the interview results. The table shows the ranking of the risk categories for both. In the ranking of the investment risks both the results of the theoretical model and the interview results are presented. In case the model results and the interview differed, the risk categories were highlighted using the same colour.

The second section concentrates on the policy framework of every Member State based on the feedback received. Interviewees were asked to score the current policies based on their effectiveness and provide comments on the impact of recent policy changes.

The third section compares the estimated financial parameters with the values provided by the interviewees.

The country profiles of the 28 Member States can be found below.

Austria

Short summary
2 interviews (1 consultant, 1 equity investor)

- At the beginning of the project, the grid access risk has a very high impact on RES investors.
- In the post-support phase, market and regulatory risks can become very important.
- According to interviewees CoD, CoE and WACC are slightly lower than estimated.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Grid access	Grid access
	Administrative	Market & regulatory
	Market & regulatory	Administrative
	Policy design	Policy design
	Social acceptance	Social acceptance
	Financing	Financing*
	Technical & management	Technical & management*
Least important risk	Sudden policy changes	Sudden policy changes*

* This risk was not mentioned during the interviews (n=2).
The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The two risks that were mentioned by both interviewees were the grid access risk and the administrative risk. However, with regard to the impact of the grid access risk, opinions were divided: one interviewee mentioned that most grid connection issues were clarified with the grid operator before the beginning of the project, while for the other, the obtaining of the grid connection permit is the highest risk in Austria. The latter depends partly on the municipality – if other RES projects have already been realised in the past, the municipality will be more open to new RES projects. The same interviewee pointed out that the impact of administrative risks also depended on the municipality.

For one interviewee, the highest risk in Austria was the market and regulatory risk, as the framework conditions may change during the project's lifecycle. This was especially due to the fact that feed-in tariffs in Austria are only guaranteed for a period of thirteen years. Since market tariffs are much lower than the provided feed-in tariffs, this constitutes a certain risk for investors. The other interviewee had a different opinion, mentioning that there could be some issues after the guaranteed support expires, but did not perceive this risk as very pressing.

In summary, the impact of the above mentioned risk categories highly depends on the implementation phase of the project. While the grid access risk can be high in the inception phase, the market and regulatory risk can be very important in the post-support phase.

Both interviewees agreed that the social acceptance risk only plays a minor role in Austria. In the past, there have been several local referendums on new wind energy projects. However, if these referendums were in favour of RES, the public opposition accepted this decision, and stopped protesting.

In general, the stakeholders pointed out that PV projects were much riskier than wind energy projects, since it is very hard to find financing. In Austria, there are therefore almost no large ground-mounted systems.

Influence of policy on RES investment risks

The new Green Electricity Act came into force in Austria in 2012. The feed-in tariff system is now working on a first-come, first-served basis. Every year, the regulator allocates a certain grid capacity which plant operators can apply for. Feed-in tariffs are then guaranteed for a period of thirteen years. The interviewees agreed that, after some minor problems in the first year, this system is now working very efficiently. Therefore, the policy design risk plays only a minor role in Austria.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Opinions divided** 70/30 to 80/20	• First interviewee: 70/30 is realistic. • Second interviewee: In the past, the ratio was even 85/15, but nowadays it is rather 80/20.
WACC	6.5%	**Agreement** 6.5%	• According to both stakeholders, the estimation of the WACC for wind onshore is quite accurate. • As there are virtually no larger PV projects in Austria, it was not possible to estimate the WACC for PV.
Cost of equity	10.8%	**Opinions divided** 8-10%	• One interviewee stated the CoE should be around 10%. • According to the other interviewee, CoE in Austria is much lower, around 8%.
Cost of debt	5.3-6.1%	**Opinions divided** 4.5-5.5%	• The interviewees agreed that CoD should be lower: One interviewee rated the CoD at 5-5.5%, the other at 4.5-5%.
Debt term	10 years	**Agreement** Longer	• No feedback was received on the debt term.

Belgium

Short Summary
3 interviews (2 project developers, 1 debt provider)

- In Belgium, administrative and grid access procedures in the development phase are considered to be the most important sources of risk.
- The support system in Belgium is unaltered for the last 10 years and is regarded as fairly effective in promoting wind energy.
- Social acceptance and renewable energy financing are not considered as important risk sources.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Administrative
	Grid access	Grid access
	Sudden policy change	Sudden policy change
	Social acceptance	Technical & management
	Market & regulatory	Market & regulatory
	Financing	Policy design
	Policy design	Financing*
Least important risk	Technical & management	Social acceptance*

* This risk was not mentioned during the interviews (n=3)
The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Interviewees mentioned that the risk categorisation is rather complete. Only one interviewee mentioned the resource risk as missing. Resource risk is being regarded as the risk of not meeting the wind yields estimated upfront, which can result in lower income and lower cash flows. Nonetheless, policies are able to account for these risks, as it could be a feature of their design.

Based on the answers, some conclusions can be drawn. First, the majority of the risk categories as presented in the table above were indicated as being an "important risk". Only social acceptance risks and financing risks were not mentioned. **Administrative risks, grid access risks and sudden policy change risks are indicated as being the most important by both the model and the interviewees.** Administrative risks are considered to be more severe than grid access, as in Belgium grid access in the past has so far been fairly certain without many delays. However, this could change in the future with the increase of renewable energy penetration.

Next in the interviewees' ranking was the sudden policy change risk. Sudden policy changes can have severe impact on investments, as doubts for the stability of existing legislation prevent the long-term commitment of investors. Any adverse changes in the legislation can affect future investment strategies, but not already operating projects.

Remarkably, even though the Belgian policy framework has remained unaltered for almost twelve years, interviewees consider policy changes as a very important risk. It was especially mentioned that retrospective changes in legislation can entirely freeze investments. Nevertheless, such changes have not yet been observed in Belgium. Model results suggest that the impact of technical & management risks is negligible. Some interviewees agreed: the experience gained in onshore wind projects has considerably reduced technical & management risks, even in some cases for offshore wind. Other interviewees disagreed, stating that technical & management risks are important, particularly for offshore wind projects, as they have higher operational and maintenance costs compared to on-shore wind projects.

This cost increase should be taken into account upfront during the evaluation of a project. However, this was not supported by everyone. Social acceptance and financing risks were not mentioned as being important in Belgium, contrary to the results of the model. Finally, policy design risks were mentioned, but considered unimportant as according to the interviewees, the existing policy framework is something predetermined and there is no alternative choice.

Influence of policies on RES investment risks

Interviewees scored the effectiveness[26] of policies in Belgium to decrease investment risks with a score of 3-4 (n=3) suggesting a fairly effective system. In order to make support mechanisms more effective, the interviewed financial experts suggested to introduce a policy like feed-in tariff which would provide more certain future cash flows. Additionally, it was mentioned that for a stable system, lower LCOE is needed. While higher remuneration from support mechanisms is desirable for developers, this will only hold for the short term. In the long term, high prices paid by the consumer, due to the support mechanisms, can cause social opposition preventing further development.

According to the interviewees, the policy framework is not equally stable for all technologies in Belgium. For instance, investments in PV were negatively affected over the last years due to the frequent change of the value of certificates, making investors reluctant to invest in new large-scale PV projects. On the contrary, wind energy has experienced a long-run stability in the policy framework over the last 10-12 years. This lasting stability, started with the change of the PPA regime to CFD regime. The CFD regime effectively reduced market design & regulatory risk for electricity prices and improved the investment environment for wind energy according to the interviewees.

[26] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Divided** 70/30 to 80/20	• 70/30 seems reasonable, although 80/20 is also reasonable.
WACC	6.4%	**Divided** 5-6%	• The WACC should be lower, in the range of 5-6%.
Cost of equity	10.8%	**Agreement** 10.8%	• Interviewees agree that the modelled value is about right.
Cost of debt	5.6-6.1%	**Agreement** 5-5.5%	• Cost of debt should be a bit lower, 5-5.5%.
Debt term	10 years	**Agreement** 10-15 years	• Debt terms vary between providers and projects and are usually in the range of 10-15 years.

For most of the parameters, the interviewees seemed to agree with each other, although their opinion would not necessarily match the values of the model. Below, we have described some of the most important arguments that came up during the interviews:

Debt/Equity ratio - The opinions on the Debt/Equity ratio for an onshore wind farm differ among interviewees between 80%/20% (n=1) and 70%/30% (n=2). However, one of the interviewees (who supported the 70%/30% ratio) mentioned that for large companies the equity share could be less. Despite the disagreement on onshore wind, all interviewees would agree that for offshore wind project the debt/equity share is 70%/30%. Specifically, it was mentioned that banks are more conservative than they used to be and more reluctant to lend money for project financed projects unless higher mark ups are accepted such as liquidity premium.

Cost of equity – Two interviewees provided their input for the CoE agreeing on the estimated value of the model. Both interviewees also agreed that, for offshore wind project, the cost of equity should be about 2%-3% higher. For a PV project, one interviewee commented that the CoE should be 2%-3% lower as the procedures required are more straightforward for PV than for on-shore wind.

Cost of debt – For the cost of debt, interviewees estimated that the model assumption was too high. Specifically, for onshore wind and PV project, the CoD should be 200 basis points above the risk-free rate (or 5%-5.5% in total) and for off shore wind it should be around 300–350 basis points. Overall, the spread depends on the characteristics of the project such as the duration of the support mechanism, the regulatory framework, the system in every country, the investment environment and the location (wind yield, foundation, operation and management).

Bulgaria

Short summary
3 interviews (1 consultant, 2 project developers)

- Policy design and sudden policy change risks have highest impact on RES projects in Bulgaria. Recent energy policy measures only increased these investment risks.
- Due to the high political risk, cost of debt and cost of equity are both very high.
- The biggest problem is the lacking legal security. Most foreign investors have therefore withdrawn from the Bulgarian market.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Grid Access	Sudden policy change
	Sudden policy change	Grid access
	Market & regulatory	Market & regulatory
	Administrative	Administrative
	Social acceptance	Social acceptance
	Financing	Financing
Least important risk	Technical & management	Technical & management

* This risk was not mentioned during the interviews (n=3)
The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The two risks that were mentioned by all interviewees were the policy design risk and the sudden policy change risk. Grid access risks (e.g. refusal of grid connection or curtailment) and market design & regulatory risks (such as the lacking liberalisation of the Bulgarian energy market) were also mentioned. Social acceptance and administrative risks were considered as minor risk categories. According to one interviewee, the "judicial risk" has the highest impact on RES projects in Bulgaria. This refers to the unpredictability and the lack of transparency of the legal system. In general, law suits against the state regulator or the TSO are very lengthy and are mostly unsuccessful. According to the interviewee, courts are biased and decide often in favour of the state regulator.

In general, the biggest problem in Bulgaria is the lacking legal security. The policy design and the sudden policy change risks have the highest impact on the cost of equity in Bulgaria. In the past, the feed-in tariff have been changed suddenly and there have been several retroactive measures which considerably worsened the investment climate. At this moment, there are no more foreign companies investing in renewable energy and over the past 2-3 years no new RES project above 1 MW has been implemented. There are only few smaller projects mostly developed by Bulgarian investors. These developers only receive bank loans due to the fact that they have a successful "main business" (such as construction companies, hotels, etc.) which increases their creditworthiness. Currently, there are no investors which would focus only on renewable energy.

Influence of policy on RES investment risks

All three interviewees agreed that the recent energy policy measures in Bulgaria only increased the investment risks. Especially the retroactive changes (introduction of a "grid access fee" for existing RES plants) and the massive lowering of the feed-in tariffs have deterred most foreign investors. Moreover, the state regulator has announced that there were no free grid capacities for PV and wind energy plants until 2016. This situation is further worsened by the fact that the Bulgarian Government announced it had achieved its renewable energy targets for 2020 and therefore decided to halt granting grid access permits even to already constructed projects. However, the alleged fulfilment of the RES target is strongly doubted by stakeholders from the Bulgarian renewable energy sector.

One interviewee mentioned that the most important political measure of the last five years was the decision of the Bulgarian Government to keep electricity prices for households artificially low. Currently, these prices are far below market prices. According to the interviewee, the entire energy market was therefore manipulated and different retroactive fees have been imposed on RES plant operators in order to save the state-owned TSO from bankruptcy.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** Before: 70/30 Now: 50/50	• During the phase when RES projects where actually being implemented, 70/30 was a realistic ratio. • Nowadays the ratio is more 50/50. However, in the past years, there have hardly been any larger projects.
WACC	9.8%	**Agreement** 10%	• According to majority of interviewees the WACC should be around 10%. • For PV and wind the WACC should be about the same.
Cost of equity	16.7%	**Opinions divided** 12-13%	• Two interviewees said the estimation was realistic and that the CoE was raised in the past years due to policy, market and grid connection risks. • One interviewee stated the opposite: The CoE should be lower, around 12-13%. During the renewable energy boom until 2011, the CoE was around 16-17%, due to speculation with grid capacities.
Cost of debt	7.3-7.6%	**Agreement** 7.5-8%	• All interviewees agreed that the cost of debt for wind onshore and PV should be around 7.5-8% due to the high political risk.
Debt term	10 years	**Agreement** Longer	• No feedback was received on the debt term.

Croatia

Short Summary

1 interview (Croatian Energy Market Operator Ltd)

Croatia has set its RES-E target at 20% renewable energy consumption in 2020. The share of renewable energy in total energy consumption increased over the past years from 14.1% in 2005 to 15.5% in 2013. In the table below, the total installed capacity of RES power plants is presented (November 2014)[27]:

RES	Installed capacity (MW)
Wind PP	297,25
Solar PP	31,68
Small hydro PP	1,48
Biomass PP	7,69
Biogas PP	12,14
Landfill gas PP	2,0
Sewage gas PP	2,5
Total	**352,24**

In Croatia, renewable energy generation is supported mainly through a feed-in tariff for eligible producers ("qualified producers")[28]. Additionally, the Croatian Bank for Development and Reconstruction (HBOR) and the Fund for Environmental Protection and Energy Efficiency operate a loan scheme or non-reimbursement incentives for RES-E projects. These incentives have been in place since 2004 and are renewed every December, building on the experiences and results of the previous year.

Due to accession to the EU some of RES support schemes were amended. In April 2013, the Economic Programme of Croatia was presented, with the Government committing itself to promote investments in energy efficiency and energy renovation of buildings, renewable energy sources, and technologies with low greenhouse gas emissions (in particular for the development of heating systems, heat pumps, biomass generation plants).

[27] Croatian energy market operator (HROTE) //http://www.hrote.hr
[28] The Tariff System for Electricity Production from Renewable Energy Sources and CHP // http://narodne-novine.nn.hr/clanci/sluzbeni/2012_06_63_1508.html

The fee to encourage the production of electricity from renewable energy sources and CHP ("Naknada za poticanje električne energije iz obnovljivih izvora energije i kogeneracije") for final consumers (financing of feed-in tariff) was increased sevenfold in 2013 and currently accounts for 0.46 €ct/kWh[29]. The RES contribution is a fee collected by all electric utilities and passed on to the Croatian Energy Market Operator (HROTE). After that HROTE pays the contribution to "qualified producers" for the RES electricity fed into the network.

In October 2013, the Government adopted the National Action Plan for RES[30], which restrict RES development through a cap on capacities (in particular for wind and solar power). The proposal foresees by 2020 20.1% on the share of renewable sources in final energy consumption. Furthermore, the action plan suggests that between 2015 and 2020 the installed capacities of solar and wind energy shall not further increase and would thus remain at their current levels: 52 MW of solar PV and 400 MW wind. A relatively small amount of growth is planned in hydro power (reaching up to 2158 MW), geothermal (reaching up to 10 MW) and biomass energy (reaching up to 125 MW).

According to the National Acton Plan, a new "Tariff System for Electricity Production from Renewable Energy Sources and CHP" (NN 133/2013)[31] was adopted and come into effect on 1 January 2014. It requires several changes to the system of the calculation and amount of the feed-in tariff, it clarifies a number of legal terms, and it defines requirements for skilled workers in the field of RES installations and maintenance. Moreover, the changes aim to accelerate the administrative procedure and remove barriers for concluding a contract with the Croatian Energy Market Operator (HROTE) in order to become a "qualified producer."

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	70/30	• 70/30 D/E ratio is reasonable. This ratio is used for calculation for the purchase price for RES.
WACC	9.7%	12%	• The average WACC for all the projects that was used for purchase price calculations is 12%.

[29] Electricity from Renewable Energy Sources and Cogeneration // http://narodne-novine.nn.hr/clanci/sluzbeni/2013_10_128_2778.html
[30] Ministry of Economy (2013): National Renewable Energy Action Plan // www.vlada.hr/hr/content/download/275263/4062911/file/120.%20-%202.pdf
[31] The Tariff System for Electricity Production from Renewable Energy Sources and CHP // http://narodne-novine.nn.hr/clanci/sluzbeni/2013_11_133_2888.html

Cyprus

Short Summary
4 interviews (2 consultants, 2 equity providers)

- Administrative procedures and lack of capital liquidity are critical.
- Net-metering and auctions constitute the latest major policy actions.
- No offshore wind energy plant in operation.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Financing
	Policy Design	Administrative
	Financing	Policy Design
	Market & regulatory	Market & regulatory
	Grid access	Grid access
	Technical & management	Technical & management
	Sudden policy change	Sudden policy change
Least important risk	Social acceptance	Social acceptance

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

According to the interviewed stakeholders, financing, administrative and policy design risks are the most important risk components. Financing renewable energy projects in Cyprus is currently difficult because of the country's financial situation and the suspension of grants and subsidies to stimulate renewable energy investments. Also administrative risk is a more structural problem, as permitting procedure has shown significant delays.

Interviewees mentioned examples of permitting procedures for PV plants that have lasted for more than three years. Regarding the influence of policy design risk, the interviewed stakeholders do not fully agree with each other. They do agree that the abolition of the FIT support scheme has had a negative influence, yet the degree of this impact was ranging between high and moderate. The market design and regulatory risks are considered to be comparable with the modelled results, followed by grid access risk. In Cyprus the costs for grid access are paid by project developers.

In addition, the distance between the sitting point of the RES power plant and the grid electricity network has been a critical criterion for the permission of these projects. All interviewees agreed that technical & management and social acceptance risks are the least important risk factors with a minimal impact on the cost of equity.

The majority of the interviewees considered that this risk component analysis is complete and no other risk component currently exists in Cyprus. Nevertheless, one energy expert mentioned several other risks such as environmental risks, extreme weather conditions, period of project implementation, qualified technical labour for installation and drawing/maintain investments in the renewable energy sector.

Influence of policies on RES investment risks

Interviewees did score the effectiveness[32] of Cypriote policies to decrease investment risks with a mean score of 3 (n=3). Two of the interviewees stated that existing policies have high efficiency on the reduction of the total investment risk but the two others mentioned moderate or low effort to this result. According to the interview outcomes, the investment in RES sector, especially solar-PV plants, is considered as the safest investment option in Cyprus.

During the first half of current decade, several policy changes were implemented having both positive and negative effects. The introduction of a net-metering system (for small PV systems) had a positive effect on RES investments while the replacement of the previous FIT support scheme by auctioning had a negative effect. As auctioning system led to lower selling price of renewable electricity produced it became less attractive for private investors in Cyprus and reduced the risk from the government perspective. Also the introduction of new grid fees and connection fees, as well as an increase of the tax rate for companies from 10% to 12.5%, resulted in policy-related changes that negatively affected investments in the renewable energy sector.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 70/30	• There was a total agreement on this ratio. • Variation between different projects – same average level for all technologies.
WACC	12.3%	**Agreement** 8-12%	• For PV, this value is considered to be high. Now, for all RES project a range of 8-12% is more representative.
Cost of equity	19.3%	**Lower** 15%	• One interviewee mentioned that it is really high. An average rate could be 15% based on references and market actors.
Cost of debt	4.6-10.6%	**Opinions Divided** 4.5-9%	• One expert stated that representative range is between 6.5-8.5%. • For PV, the CoD is about 6% - or between 4.5-9%.
Debt term	10 years	**No opinion**	• No feedback was received on the Debt term.

[32] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Opinions of the interviewees were rather divided, mainly, for the cost of debt. A detailed description of the arguments that came up during the interviews is provided below:

Debt/Equity ratio – The 70/30 is considered as a reasonable and realistic value that has been extensively observed before and the current financial crisis. However, after the economic crisis, several variations of this ratio have been observed ranging from 0%-100% up to 100%-0%, caused by the absence of constant capital liquidity from the banks. In addition, it was mentioned that significant variations are not expected among different technologies.

WACC – According to the interviewees, the WACC is influenced by different factors such as the country of implementation, the RES technology and, to a lesser extent, the project size. This specific gradation of the influential parameters has been expressed from all interviewees. In addition, regarding PV power plants, the WACC value is considered, in general, to be identical for small and large scale investments. For the case of different technologies, only one expert stated that the WACC for PV projects is higher than for onshore wind.

Cost of equity – For large scale PV plants the cost of equity is considered to be higher than the modelled one.

Cost of debt – For the case of PV power plants, an expert specialised in this field stated that a range of 4.5-9%, with an average value of 6%, is the most realistic. Another interviewee mentioned that a range of 6.5-8.5% is representative for both technologies. At last, the third participant stated that the referred values are fine. Regarding the debt term, the 10 year-period assumed above is considered as an acceptable option.

Czech Republic

Short summary

2 interviews (1 consultant, 1 equity investor)

- Policy design and sudden policy change risks have highest impact on RES projects in the Czech Republic. Recent energy policy measures only increased these investment risks.
- Due to the high political risk, cost of equity and WACC are higher than estimated.
- Currently, the development of new RES projects is not foreseen by the Czech Government.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Grid access	Sudden policy change
	Social acceptance	Policy design
	Sudden policy change	Grid access
	Technical & management	Social acceptance
	Administrative risk	Administrative risk*
	Financing risk	Financing risk*
	Policy design	Technical & management*
Least important risk	Market & regulatory	Market & regulatory*

* This risk was not mentioned during the interviews (n=2)

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The two risks that were mentioned by all interviewees were the policy design risk, the sudden policy change risk, the grid access risk and the social acceptance risk.

With regard to the policy design and sudden policy change risk, the stakeholders agreed that this issue has the highest impact on RES investors. After the Czech government started to introduce retroactive measures against renewable energy operators, many (especially foreign) investors were scared off and stopped investing in the Czech renewable sector. Moreover, the Czech Government even decided to abolish the entire feed-in tariff system for all RES technologies. Without the support, it is unlikely that any new projects will be implemented in the future.

The grid access risk was also mentioned by both interview partners. Even if a project is actually being implemented, there is still the risk that the grid operator could refuse to connect it to his distribution or transmission system. However, since many projects do not even reach the phase of implementation, this issue is not as important as during the renewable energy boom until 2011, when the Czech RES sector was struggling with the virtual saturation of the grid.

According to the interviewees, the social acceptance risk is closely connected to the policy design and sudden policy change risks. Due to the fact that especially PV has a very negative image in the Czech Republic (the "PV boom" from 2009 to 2011 led to considerably higher electricity prices for consumers), the Government is blaming rising electricity prices on renewable energy operators and has therefore stopped all support for renewable electricity.

Influence of policy on RES investment risks

The interviewees agreed that the current policies are doing everything possible to raise the risk in order to prevent investors from implementing more RES projects. Since the Czech Government is currently not interested in supporting renewable energy, the aim is rather to stop the development of the sector completely.

The stakeholders mentioned several political measures: first there was a connection moratorium which lasted for more than a year. Then, a retroactive fee was introduced for existing RES plants, which had a severe impact on the trust of foreign and Czech investors. And last but not least, the feed-in tariff scheme was abolished completely. All these changes have made investments in RES in the Czech Republic almost impossible.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 70/30	• During the phase when RES projects where actually being implemented, 70/30 was a realistic ratio. The current ratio is hard to estimate, since no larger projects have been realised in the recent past.
WACC	7.2%	**Agreement** 8%	• Due to the high political risk, the WACC should be at least 8%. • However, this is hard to say, since no larger projects have been realised in the past 2-3 years.
Cost of equity	12.1%	**Opinions divided** 12%	• The interviewees agreed that a CoE of around 12% is a realistic estimation.
Cost of debt	5.5-6.2%	**Agreement** 6.5-7.5%	• The cost of debt could be slightly higher, around 7%.
Debt term	10 years	**Agreement** *longer*	• No feedback was received on the debt term.

Denmark

Short summary
4 interviews (1 association, 2 utilities, 1 banker)

- In Denmark WACC, cost of equity and cost of debt depend very much on the ownership model.
- The established policy design has so far provided secure investment conditions for both onshore and offshore wind energy projects. Policy design risks are nevertheless considered the most critical risk. Social acceptance by the neighbours and the municipality is also considered important for the valuation of an onshore wind energy project.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Social acceptance	Social acceptance
	Market & regulatory	Market & regulatory
	Administrative risk	Administrative risk*
	Financing risk	Financing risk*
	Technical & management	Technical & management*
	Grid access	Grid access*
Least important risk	Sudden policy changes	Sudden policy changes*

* This risk was not mentioned during the interviews (n=4)

The interviewees confirmed the assumptions from the model. They agreed that the risk category Policy Design has the highest impact on the cost of equity. The history of the wind energy development in Denmark has shown that the political climate in general and the specific rules on the support of RES have the strongest impact on RES investments. The second risk that was mentioned by all interviewers was the social acceptance risk – ubiquitous wind energy plants seem to increase criticism neighbours also due to alleged effects on health. Another risk that was widely mentioned is the market design & regulatory risk. Other risks have not been mentioned.

Influence of policy on RES investment risks

Interviewees did score the effectiveness[33] of Danish policies to decrease investment risks with an average score of 4 (n=4). In the past five years discussions on changes of the Danish support scheme showed the strongest impact on RES investments. In particular the extension of support schemes has led to a reduction of risks for wind energy investments. In case of PV a very beneficial support scheme had been introduced several years ago. It became so successful, however, that the government decided to adapt it. As a consequence, the complete PV market stalled.

[33] The effectiveness of policy was scored on a scale from 1-5: 1=having no influence at all, 5=reducing the whole risk.

It is worthwhile to point out that this radical policy change did not just result in higher capital costs but in a complete stop of any investments. The capital costs did not increase there were simply no investments at all.

The interviewees agreed that the existing conditions can be considered very positive for onshore wind energy and interestingly also for offshore wind energy. In the case of the latter, Danish politics managed to mitigate the general risks for offshore wind energy projects as well as the risks from the support scheme (a tender regime) by shifting certain tasks such as the development of the grid infrastructure (and therewith risks) to the TSO. The project developer does not need to take these tasks into account when calculating the risks of the project.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Opinions divided** 70/30-100/0	• Many wind energy plants are projected by utilities which have a much higher share of equity (often 100%). • Project financing is not very common. • Due to the co-own model neighbours and municipalities can own up to 20% of the shares of onshore and near-shore wind parks. Their financing ratio has to be taken into account as well.
WACC	6.4%	**Opinions divided** 5-6.5%	• If the investment is done by a large utility with an equity share of 100% the WACC will be much higher (10-12%). • In case of developers, on the other hand, the value is about right or even too high. • The WACC is highly influenced by the owner structure (see first bullet).
Cost of equity	11.2%	**Opinions divided** 10–11.2%	• Majority of interviewees indicated a slightly lower value, also because the most attractive locations are blocked with wind farms already. • The value for offshore wind energy plants is higher but not that high as many risks are covered by the current system, in which the grid operator is responsible for developing the grid.
Cost of debt	5.2-5.9%	**Opinions divided** 4.5-5.5%	• Depending on the ownership structure the interviewees agreed with the numbers or considered them too high. • In case of economically potent investors the cost of debt could be down to 3%.
Debt term	10 years	**Agreement** Shorter	• A debt term of 10 years seems too long. Usually in Denmark flexible rates are more common than fixed rates.

Estonia

Short Summary
2 interviews (bankers)

- The main risk categories are administrative and policy design risks.
- In recent years, ongoing political discussions has increased uncertainty and subsequently political design risk.
- Cost of equity for an onshore wind project is about 16%, cost of debt - not higher than 4.5%.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Administrative
	Policy design	Policy design
	Grid access	Technical & management
	Technical & management	Grid access
	Market & regulatory	Market & regulatory
	Sudden policy change	Sudden policy change
	Financing	Financing
Least important risk	Social acceptance	Social acceptance

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

According to interviewees all the main categories of the risks are included in the chart. Based on the results some conclusions can be drawn. First, all risks included into the model were mentioned at least once as being "important risks". Second, interviewees agree that the main risk categories are administrative and policy design risks. Administrative procedures are very time consuming as many different institutions are involved in order to obtain all necessary permit for construction and grid connection. For some wind energy project administrative procedure took even 7-8 years. In recent years, ongoing political discussions has increased uncertainty and subsequently political design risk.

After administrative risk and policy design risk, interviewees consider technical & management risks and grid access risk most important. Financing risk, sudden policy change risk and social acceptance risk are expected to have the least influence on the cost of equity. In general the Estonian society is accepting renewable energy, therefore the risk is low. Finally, interviewees assume that the cost of equity is about 15-20% depending on various aspects of the project and in general agree that the cost of equity is about 16%.

Influence of policies on RES investment risks

Although renewable energy policy measures have remained unchanged so far, over the past three years possible changes have been discussed and preparation of legal memorandums have been performed. This have already changed the risk profile. Currently, a lot of discussions on this issue is ongoing. This creates uncertainty in the market, making banks reluctant to make investments with a long term perspective, such as renewable energy projects.

Interviewees did not score the effectiveness[34] of the Estonian policies.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**About right** 65/35	• Suggested by the study D/E ratio is reasonable, although currently the actual debt/equity ratio is 65/35.
WACC	6.4%	**Opinions divided** 6.4-13%	• Interviewees' opinion regarding WACC significantly diverged from assuming too high to too low.
Cost of equity	15.7%	**About right** 15-20%	• Interviewees had rather unified opinion regarding cost of equity, i.e. they assume that cost of equity could be as it is modelled.
Cost of debt	5.6-6.1%	**Too high** 4.5-4.7%	• Interviewees assume that modelled cost of debt is too high.
Debt term	10 years	N/A	N/A

As, for most of the parameters, the opinions were slightly divided, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio - Ideal debt/equity ratio is 70/30. Currently actual debt/equity ratio is 65/35. The interest during construction time rises the part of equity. During next 3-4 years equity will go up to 40-50%. The interest during construction exerts the highest influence on the Debt/Equity ratio of a project.

WACC – The opinions of the interviewees differed on the WACC. One interviewee has estimated that the WACC should be lower than the estimated 6.4% because the estimated cost of debt is estimated too high. The other interviewee stated that the WACC should be higher, as the cost of debt has decreased significantly during the last years while the cost of equity increased. Therefore, the WACC should be about 12-13%. The interviewees did agree that the WACC is not changing depending on project size.

[34] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Cost of equity – The interviewees did more or less agree with the modelled value of the cost of equity, although they estimated it a bit higher. One interviewee stated that the cost of equity for an onshore wind project is about 16%, the other interviewee suggested a range of cost at about 15-20%.

Cost of debt - Interviewees have a unified opinion regarding modelled cost of debt. They assume that estimated cost of debt is too high. However, opinions of interviewees diverged when they provided suggested cost of debt. One interviewee estimated the cost of debt at about 4.5%, the second interviewee estimated a range of 3.5-4.5%. However, even subject to the differences in opinions a unified opinion is that cost of debt should not be higher than 4.5%.

Finland

Short summary
2 interviews (GreenStream Network, Finnvera)

- Interviewees state that market and regulatory risks, technical & management risks, administrative risks and policy design risks are the most important categories of risks.
- Wind energy development was stimulated by the implementation of feed-in tariff system in Finland. Due to existing feed-in tariff system the wind energy plants projects are not considered risky.
- Modelled WACC is considered as a reasonable ratio (6-7%).

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Administrative
	Grid access	Grid access
	Market & regulatory	Policy design
	Technical & management	Market & regulatory
	Social acceptance	Social acceptance
	Financing	Financing
	Policy design	Technical & management
Least important risk	Sudden policy change	Sudden policy change

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Investment risks wind onshore

Based on the results some conclusions can be drawn. Firstly, almost all risk categories are mentioned at least once as being an "important risk". Interviewees state that market and regulatory risks, technical & management risks, administrative risks and policy design risks are the most important categories of risks. When comparing the importance of risks interviewees suppose that in general the impact of market and regulatory risk would be as high as access to grid. There should be also some policy design risk. Administrative risk seems to be too high for Finland and technical & management risk seems to be quite low comparing to other risks. Grid access risk to some extent also should have impact on the cost of equity. According to the interviewees the influence of these risks on the cost of equity are depending on the development stage of the project.

In the beginning of a project, both administrative risks and social acceptance are very important, while in later stages these risks are negligible. Administrative risk (to obtain permits) is very high for wind project in Finland at the project development stage. Policy design risk are expected to be higher at the development stage as the total installed capacity for wind energy is capped at 2500 MW, while currently a lot of projects are under development. Therefore policy design risk should be higher and market design/regulatory risk lower. At the project construction stage this changes: grid access risk and technical & management risk will become lower and social acceptance risk and policy design risk are not regarded a risk factor anymore.

Influence of policies on RES investment risks.

Wind energy development was stimulated by the implementation of feed-in tariff system in Finland. The feed-in tariff system was introduced in 2011 and during the last three years wind energy activities has increased a lot. Due to existing feed-in tariff system the wind energy plants projects are not considered risky.

Interviewees did not score the effectiveness[35] of Finnish policies.

Financial parameters

In the following overview the results of the interviewees were compared to the model values. The values in the table below are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 70/30 to 80/20	• 70/30 seems as a good ratio in general. • In locations with very good climate condition, and in case of projects sponsors with high creditworthiness, investors can get even a higher share of debt. It could reach 80/20 ratio.
WACC	6.7%	**Agreement** 6–7%	• Modelled WACC is considered as a reasonable ratio, but will change over project development stages.
Cost of equity	11.0%	**Divided** 12–15%	• Depending on the phase (pre-financial close or operation).
Cost of debt	5.1-6.0%	**Agreement** 3-5%	• Cost of debt could be 3-5%.
Debt term	10 years	**Agreement** 10-12 years	• The debt term should be more.

As for most of the parameters the opinions were divided, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio - For the beginning of the project the assumption of 70/30 could be right, although for onshore wind 80/20 is also observed. Profitability of the project has impact on the Debt/Equity ratio. Creditability of the project developer (or rather the project sponsor/owner, which may or may not be the same as the developer) is very important. The municipal energy companies can get the highest amount and cheapest

[35] The effectiveness of policy was scored on a scale from 1-5: 1=having no influence at all, 5=reducing the whole risk.

debt, especially when they operate through so called “mankala structure” involving efficient distribution of risks between several energy/industrial companies as project sponsors.

This is a bit complicated but typical structure in Finland. More information is available at: http://www.ben.ee/public/Tuumakonverentsi%20ettekanded%202009/Peter%20S.%20Treialt%20-%20Mankala%20principles.pdf

WACC - At the development stage risks are higher therefore the WACC should be higher than the estimated 6.7%. At the project construction stage (already permitted projects) the WACC should be less than 6%. At an advanced project development stage the WACC for onshore wind could be about 6-7%, and for earlier stage projects much higher.

Cost of equity – Interviewees assume that the cost of equity will depend on the phase of project implementation. At the project construction stage this year the cost of equity is below 10% for wind energy projects. For another renewable energy sources the cost of equity is higher than 10%. At the project development stage it is much higher. 11-15% would refer to a project in a rather advanced stage of development.

Cost of debt. - Banks usually provide debts for the 10-12 years as feed-in tariff for wind energy is ensured for twelve years. Risk-free rate: 1% (based on ten year Finnish bond rate). Margin - 3%. Cost of debt - 4% (pre-tax). This should apply also to project finance debt on non-recourse basis. Municipal energy companies, especially when using so called "mankala structure" can get even lower risk premium and in such case the cost of debt could be about 3% (pre-tax). For ten years debt: 5-6% is too high should be about 3-5%.

France

Short Summary
1 interview (consultant)

- Interview focus on wind energy technology.
- Unstable regulatory framework - Numerous changes during current decade.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Market & regulatory
	Policy design	Policy design
	Grid access	Social acceptance
	Market & regulatory	Grid access
	Social acceptance	Sudden policy change
	Financing	Administrative
	Technical & management	Technical & management
Least important risk	Sudden policy change	Financing

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The interviewee mentioned that the importance of these risk components is differentiated between the planning and operation phase of an onshore wind energy project. According to this distinction, the interview participant provided a general ranking of these categories for both these stages. For the case of projects under operation, the grid access, market design and regulatory and policy design risks are mentioned as the most important ones. In addition, the social acceptance impact is lower and the administrative risk is greater than the projects under the planning procedure (this specific ranking is provided above).

The market design & regulatory and the policy design risks are indicated to be the most influential risk parameters directly affecting the investment risk profile of a RES project under planning. In addition, the interviewee mentioned that sudden policy change risk is quite an important risk in France as the policy framework shows changes almost every two years. At last, technical & management and financing risks are stated as least important in both cases.

Regarding the riskiness of investments in the renewable energy sector, it was mentioned that if wind potential is well assessed, wind energy investments are pretty safe and less risky than other kind of investments. In this context, a new risk category, the wind potential risk, was recorded during this interview. In particular, as sites with great wind potential are already covered, the new power plants may not have the return that was initially expected.

Influence of policies on RES investment risks

As the interviewee mentioned that the impact of existing renewable energy policies is negative on the national investment risk profile, the effectiveness[36] of France policies to decrease investment risks was not scored according to this scale (negative value was received).

Numerous changes of the national renewable energy policy have been implemented during the last five years leading, in general, to an increase of the total risk of renewable energy investments. More specifically, in the past five years considerable and frequent changes of the legislative framework were made, mainly regarding regulatory issues. In 2009, the taxation applied to the operators significantly increased, at a rate of 50%, leading to a decline of their revenues. In 2010, the legislative framework has been altered and a new permit was introduced regarding the construction and operation of a wind farm. This permit made the procedure more complex and caused permitting procedures to change constantly.

Also in 2010, a rise in taxation of about 10% for developers has been made as well as a series of alterations in the electricity grid connection. In 2011, two new support schemes for planning wind farms and network planning were established. In 2013, another change of permitting procedures was implemented, however, not to every region in the country. Specifically, wind farms of less than five wind turbines are currently not permitted and, in 2015, new permits are specified for all regions of France. Finally, a change of costs for connection to the grid has been occurred.

Financial parameters

The table below reflects the interviewee's feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

[36] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	80/20	• For most of the project cases, a ratio of 80:20 is representative.
WACC	6.1%	**About right** 5.7%	• For onshore wind, the WACC is equal to 5.7%. • For offshore wind, this indicator is higher. • No reference for solar-PV projects.
Cost of equity	10.5%	**Too high** 10.5-11.5%	• It is higher than this value (a specific value or range was not given).
Cost of debt	5.9-6.3%	**Too high** 5.7%	• Risk-free rate: 2.25% for 15 years maturity. • Values for cost of debt: 5.70% (2012) and 5.42% (2013). • For offshore wind, renewable energy project spread is higher than 4% and the cost of debt is little higher than the range of 6.4-6.8%.
Debt term	10 years	**Longer** 15 years	• The debt term is 15 years.

Germany

Short summary
6 interviews (1 project developers, 2 utilities, 3 bankers)

- In Germany WACC, cost of equity and cost of debt are considerably lower than expected.
- The established feed-in tariff has provided secure investment conditions. The introduction of a premium scheme has reduced that security.
- Apart from policy design risks resource risks are the most critical risk category for onshore wind energy.

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Grid access	Technical & management
	Administrative	Administrative
	Technical & management	Grid access
	Financing	Market & regulatory
	Social acceptance	Social acceptance
	Sudden policy change	Sudden policy change
Least important risk	Market & regulatory	Financing

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Investment risks wind onshore

The two risks that were mentioned by all interviewers were the technical risks (mainly as resource risks) and the policy design risks. Administrative risks (such as regional rules on distance regulations and general development risks) were also mentioned. Grid access risks were not considered as pressing as expected in case of onshore-wind energy.

The majority of interviewees pointed at resource (or elementary risks) as one of the main risks for onshore wind energy projects in Germany to be missing. Although interviewees suggest to integrate this under the category of technical & management risks, we have included this under policy design risk. The reason for this is that wind yield is a risk that cannot be influenced by the project developer. Yet, to make sure that this does not affect their willingness to invest in wind energy, this risk should be addressed somewhere. The only place where this can be addressed is the policy design.

Furthermore, some interviewees brought up the importance of timing in the risk assessment: at what phase in the project are risks assessed? At the start of a project, risks like grid access, social acceptance and administrative risks are very relevant, but in terms of invested budget the risks is insignificant when compared to the construction and operation phase. During that phase other risks such as technical/management will become more important. The focus again changes when the support scheme expires and the plant has to sell its electricity on the free market. At that moment market design and regulatory risks become very important. In the model, risks were estimated at the beginning of the project, before financial close.

Influence of policy on RES investment risks

Interviewees did score the effectiveness[37] of German policies to decrease investment risks with a score 4 (n=3). In the past five years, discussions on sudden (retro-active) changes of the German Act on Developing Renewable Energy Sources (EEG) showed critical impact on RES investments. Such discussions lead to hasty investments in wind energy and PV and to a complete freeze of investments in nascent markets such as offshore wind energy. The replacement of the existing feed-in tariff regime has also increased risks for project investors. The effect of the tender regimes is not clear yet but most investors expect that it will lead to a further increase of risks.

The EEG 2012 provided a very secure investment framework. The changes of the EEG 2014 will increase the risks (though most investors expressed understanding for the latest reforms).

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Opinions divided** >80/20	• The majority of interviewees indicated 80/20. • Under very good wind condition the ratio can increase to up 94/6. • Utilities have a much lower ratio 0/100 – 50/50.
WACC	5.6%	**Opinions divided** 3.5-4.5%	• According to majority of interviewees the WACC is lower. • Indications ranged between 3.5% and 4.5%.
Cost of equity	9.3%	**Opinions divided** 6–9%	• Majority of interviewees indicated 6-8 %. • Actual value depends on class of investors (utilities usually demand higher cost of equity than private energy cooperatives).
Cost of debt	5.3-5.7%	**Too high** 1.8–3.2%	• All interviewees agreed that the cost of debt were much too high. • Main reasons for the low tariffs are the credit programme by German KfW and the general decreasing credit rates. • Decrease of credit rates is still ongoing but the current numbers are only a snapshot.
Debt term	10 years	**Agreement** Longer	• No feedback was received on the debt term.

[37] The effectiveness of policy was scored on a scale from 1-5: 1=having no influence at all, 5=reducing the whole risk.

Greece

Short Summary
9 interviews (6 consultants/academics, 3 equity providers)

- Risks related to policy and finance are critical.
- Social acceptance is significant for large scale (especially onshore wind) investments.
- No offshore wind in operation.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Financing	Financing
	Social acceptance	Social acceptance
	Administrative	Grid access
	Grid access	Administrative
	Sudden policy change	Sudden policy change
	Market & regulatory	Market & regulatory
Least important risk	Technical & management	Technical & management

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Based on the responses of the interviewees, the three most important risk components are policy design, Financing and social acceptance risk. The extracted interview results align with the model estimations. Regarding the social acceptance risk, the majority of the energy experts indicated that it constitutes a critical risk component and has lower values for PV investments than onshore wind energy plants (e.g. visual disturbance of landscape perception).

Moreover, some of the interviewees assumed that its value is even higher than suggested in the model. Another critical risk component in RES investments is grid access. For large-scale RES projects (i.e. onshore wind), grid access risk might increase compared to small-scale installations, as high penetration of RES power plants into the national electricity grid might require additional actions and improvements of the existing grid infrastructure (e.g. high voltage overhead lines, high and medium voltage substations, submarine interconnections). Other risk categories (administrative, sudden policy change and market design & regulatory risks) exert some influence on RES investments. Finally, technical & management risk is characterised as the least important risk component and is not taken into consideration in RES investment decisions.

Some interviewees also stated that policy design, market design and regulatory and sudden policy change risks are considered as one single risk category in their investment decisions. In addition, based on the feedback of one expert, the values of cost of equity and WACC may be different between different project stages (planning, construction, operation) as different risk components occur and play a more crucial role. For example, social acceptance and financing risks occur at the planning phase but during the construction and operation stages, these may be very limited. For the case of offshore wind projects, experience and knowledge are missing in Greece, as no project of this technology is currently operating.

According to one interviewee, the level of the "System Marginal Price" (SMP) could be another risk component, especially for RES producers trading their energy into the market. This could act as a future long term risk element as renewable energy power plants are currently non-dispatchable and have priority access to the grid in Greece. Another interview participant mentioned that a possible additional risk category could be the ambitiousness of EU policy related to RES energy targets set for the extended deployment of clean energy technologies.

Influence of policies on RES investment risks

Interviewees did score the effectiveness[38] of Greece policies to decrease investment risks with a score of 2 (n=2). The extraordinary tax contribution, the delay in reduction of feed-in tariff and the current financial situation of Greece are some of the negative factors that mainly affect the investment risk in the renewable energy sector.

In more detail, during the past five years, the main critical measure influencing the national energy system was the adoption of the Law N.4254 ("New Deal"). This specific law has imposed both positive and negative effects. On the one hand, a retroactive reduction of the FIT level for PV power plants has initially led to an increase of the risk in RES investments. Nevertheless, it was also mentioned that the new tariff scheme has reduced the investment risk, for new projects, along with the expected return on investments (ROI) and contributed to remain safe the investment environment in the national RES sector, where, in parallel, the electricity deficit account has showed a considerable decrease.

Some other policy actions that resulted in an increase of the investment risk are the imposed taxes to RES producers and the absence of efficient liberalisation of the energy market, which constitute a market's regulation malfunction. Nevertheless, one interviewee expressed his opposition to the level of impact of taxation on the investment risk as he mentioned that the tax regime has even become more attractive during the last two years.

Finally, the transition to premium and auctioning schemes, at an EU wide level, might result in a more risky environment for RES producers due to the transition to "unfamiliar" support mechanisms and as the remuneration level may not be guaranteed, mainly for the case of a fixed premium scheme. Regarding the development of PV plants, constraints of further development have been also imposed. Specifically, an upper annual limit of 200MW and 0.5MW per power plant has been set for this specific technology. Additionally, net metering system is implemented only for PV systems and mainly for small units.

[38] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 60/40 or even 50/50	• Before 2013, a representative value for D/E ratio was 70:30. • Nowadays, this ratio is 60/40, or even lower and equal to 50/50. • For the period 2015-2017, the debt share is equal to 30%, 32% and 35% each year, respectively, for the case of the Greek electricity transmission (ADMIE) and distribution (DEDDIE) businesses.
WACC	13.5%	**Opinions divided** 12%	• More experts stated that it is lower – around 12%for onshore wind. • Few interviewees mentioned that it is fine. • Few others mentioned that it is slightly higher.
Cost of equity	20.7%	**Agreement** 14-16%	• Mostly all interviewees mentioned that the extracted value of 20.7% was too high for 2014. Cost of equity should be in the range of 14-16%.
Cost of debt	9.5-14.2%	**Agreement** 8.5-12.5%	• Most of the interviewees mentioned that this indicator is lower than the model result.
Debt term	10 years	**Opinions Divided** 10-15 years	• An interviewee stated that it is 10 years (max 12 years) on a project finance basis with some resources based on client's profile. • Another expert mentioned that the debt term is 15 years or more.

As the opinions were rather divided on most of the parameters, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio – Due to updated bank investment policies (resulting from the financial crisis) this parameter has changed. Some experts mentioned that its value is influenced by the project and company size, in general, as larger enterprises benefit more from access to soft loans. In addition, the banks currently require guarantees in assets for providing the appropriate liquidity to private investors.

WACC – Opposite views have been received regarding this indicator. It was mentioned that the compared to the model results the WACC is lower or identical, for large scale onshore wind and PV power plants. Some interviewees stated that the WACC might be little higher for small-scale projects and for projects connected to the High Voltage (HV) electricity network. Controversial feedback has been received for large-scale PV power plants, where interviewees indicated both higher and lower values. For offshore wind, there is no specific value due to lack of experience about this specific technology.

Cost of equity – The majority of experts stated that this index is much lower than 20.7%, with average estimates to be between 14-16%, regardless of the specific renewable energy technology.

Cost of debt – Interviewees agreed that the cost of debt is lower for onshore wind and PV power plants than modelled above. Interviewees proposed ranges between 8.5-12.5% (or even 6%) with limited difference between these specific mature RES technologies. In addition, its value is highly influenced by the company's level of credibility.

Hungary

Short summary
2 interviews (1 consultant, 1 bank)

- Policy design and sudden policy change risks have highest impact on RES projects.
- Especially for wind, grid access risks are also imminent, as capacity limit of tender procedure has been reached.
- The estimated cost of equity is too high, 14-15% is realistic.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Grid Access	Sudden policy change
	Administrative risk	Grid access
	Market & regulatory	Market & regulatory
	Technical & management	Technical & management
	Sudden policy change	Administrative risk*
	Social acceptance	Social acceptance*
Least important risk	Financing	Financing*

* This risk was not mentioned during the interviews (n=2)

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The two risks that were mentioned by all interviewees were the policy design risk and the sudden policy change risk. Grid access risks (e.g. refusal of grid connection or curtailment) and market design & regulatory risks were also mentioned.

According to stakeholders, the policy design risk is mainly caused by the fact that he Hungarian RES sector has been waiting for years for a new feed-in tariff scheme with more favourable tariffs and different conditions to replace the current feed-in tariff scheme. However, the legal amendments have been repeatedly delayed and it is still unclear if or when the support system could be amended.

With regard to grid access risks, new wind energy projects have been put on hold. According to the current procedure, the maximum grid capacity for wind energy has been limited at 310 MW. As this limit has already been reached, only wind project for own consumption can be realised. With regard to PV installations, this grid access risk is less relevant, since PV projects do not have to undergo the tendering procedure to receive the feed-in tariff.

Influence of policy on RES investment risks

The interviewees agreed that the Hungarian government has not been able to reduce investment risks for RES developers due to the fact that the RES sector is still waiting for the implementation of the new feed-in tariff scheme (METAR) to replace the old feed-in tariff scheme (KAT). The high political risk (also concerning possible retroactive changes) constitutes a severe barrier for the further development of the Hungarian RES sector.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 65/35	• On average 35% equity and 65% debt, in some cases even 40% equity and 60% debt. • Before the economic crisis, 80/20 was common.
WACC	11.3%	**Agreement** 11.3%	• 11.3% is realistic. The WACC varies according to the technology and project size.
Cost of equity	18.6%	**Too high** 14-15%	• Cost of equity is too high: 14-15% is realistic.
Cost of debt	8.1-10%	**Agreement** 8-10%	• This is realistic, with no big difference between wind and PV.
Debt term	10 years	**Agreement** Longer	• No feedback was received on the debt term.

Ireland

Short summary
1 interview (energy advisor)

Ireland had set a goal that in 2020 at least 16% of their energy consumption would come from renewable energy sources. In order to achieve these targets the Irish government has set as a target to generate 40% of electricity, 12% of heating and 10% of transport from renewable sources. Due to beneficial weather conditions, wind energy both on shore and off shore could contribute significantly to the achievements of these targets.

Investment risks wind onshore

Despite the great wind potential in Ireland, investments in wind energy inherit significant risks according to our interviewee. It was mentioned that the chance of success of a wind project from the very start is only 10%. In order to assess the risks, it is essential to separate the lifetime of a wind project into two periods: the pre-consent and the post-consent period.

In the pre-consent stage, the most important risks are grid access risks, planning risks and social acceptance risks. Due to these risks, many projects eventually fail and do not proceed further. In Ireland, according to our interviewee, grid access is by far the most important source of risk at this stage, as this can seriously delay a project. In the interview examples were mentioned of procedures that can last up to 10-15 years. For this reason, developers are forced to apply for grid access even before they start planning the project. Apart from grid access, related planning rules, legal challenges and bureaucracy increase administrative risks, causing many projects to fail.

In the post-consent stage, policy design risks, market design and regulatory risks, technical & management risks and financing risks are important. Of these, policy design risks are by far the most important. Despite having a Feed-in Tariff scheme in place, revisions of policies and the lack of clear rules increases the uncertainty and the costs. Another important risk category is market design and regulatory risks, where uncertainty on the compensation for curtailment is increasing the cost of equity for investments. Lack of commissioning engineers and large professional costs such as legal, technical and insurance service can increase the technical & management risks.

Finally, it was mentioned that sudden policy change risk is not important as retrospective changes in policies do not occur very often.

Current policy framework

According to our interviewee the policies in Ireland are not effective in promoting renewable energy and realising Ireland's extensive potential. In fact it was mentioned that the chosen policies introduce risks instead of removing them.

The uncertainty arises due the inability of the feed-in tariff system to account and compensate for any losses due to curtailments. Due to this inability of the system, loss of revenue can occur, introducing volatility and risk.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	*About right*	• It used to be higher close to 80/20 but now it tends to be lower. • The debt ratio depends on the banks required Debt Cover ratio.
WACC	9%	*About right*	• No further comments.
Cost of equity	13.8%	*11% – 12%*	• No lower than 11%.
Cost of debt	6.8-7.9%	*Slightly too high*	• Lower rates may arise due to the funds provided by EIB and KfW.

Italy

Short Summary
4 interviews (2 consultants, 2 equity provider)

- PV projects are considered to be a more safe investment in Italy.
- Reduction of incentives led to increase of related investment risks.
- No offshore wind energy plant in operation.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Administrative
	Policy design	Policy design
	Grid access	Grid access
	Financing	Financing
	Sudden policy change	Sudden policy change
	Market & regulatory	Market & regulatory
	Social acceptance	Social acceptance
Least important risk	Technical & management	Technical & management

In general, the feedback obtained from the interviews has been differentiated regarding a total ranking of the respective risk components. Most of the experts mentioned that the ranking of risks (almost) identical to our modelled result. According to the interviewees' responses, the financing risk should be a little higher, while the policy design risk should be a bit lower compared to the model. In contrast, one interviewee highlighted as most important risk components the sudden policy change, the market design and regulatory and the policy design risks. Nevertheless, all participated stakeholders agreed on the fact that social acceptance and technical & management risks constitute the least important risk elements due to increased acceptance, knowledge and experience on these specific technologies (excluding offshore wind).

Based on interviews' feedback, it was suggested to add a risk component covering the risk of company would go bankrupt or collapse during the whole investment procedure and putting the operation of the respective RES projects into danger.

Influence of policies on RES investment risks

Interviewees did score the effectiveness[39] of Italian policies to decrease investment risks with a score of 2 (n=2), with all interviewees' responses to this question to be identical. This score was grounded on the fact that several policy measures implemented during the previous five years have increased the uncertainty of investments and considerably reduced the returned profit.

In more detail, after 2012, new solar-PV installations have been extensively decreased due to a significant abolition of incentives provided. Moreover, the retroactive reduction of FIT, for wind and PV technologies, also increased the level of risk.

[39] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

The introduction of auctions in the renewable energy market (excluding PV), in July 2012, has led to an increase of risk up to approximately 1.5%. In addition, the unstable policy framework has not been supportive for further development of RES investments. Lastly, the regulatory risk has been affected by the cap limit that was put to be paid on RES investments.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Opinions divided** from 70/30 to 60/40	• Two interviewees mentioned this as the most representative one. • Another expert indicated a 65/35 ratio as more realistic. • Another interviewee set this index, in general, to be 60/40 (from 70/30 of previous years).
WACC	7.7%	**Opinions divided** 7-9%	• Three of the representatives mentioned that it is reasonable. • The other expert stated that for onshore wind it is 8.5-9%, for PV projects is close to 7%. No offshore wind energy plant in operation.
Cost of equity	12.2%	**Opinions divided** 10–13%	• A reference of 13% for the cost of equity was recorded. • One interviewee stated a range 10-12%. • The other experts agreed with the model result.
Cost of debt	7.9-8.4%	**Opinions divided** 8–10%	• For onshore wind and PV, an average value of 9%. • PV technology has slightly lower value.
Debt term	10 years	**No Specific Response**	• No feedback was received on the Debt term.

As, for most of the parameters, the opinions were slightly divided, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio – A debt/equity ratio of around 70/30 is generally considered as realistic one, although a ratio of 65/35 might be closer to the current situation. For the case of wind energy plants, this ratio is generally lower than for PV power plants. The factors that exert the highest influence on the D/E ratio are the existing economic crisis, the availability of funds from banks, the ease of accessing public funds, the stability of incentives and, for large scale investments, the degree of acceptance from the social perspective. Specifically, the liquidity of the bank system, their appetite and policies of banks are considered as the most intense and highly influential factors on the debt/equity ratio.

WACC – In Italy, the WACC of wind assets is typically higher than PV due to higher uncertainty of production and to a lower debt to equity ratio. This indicator depends, at a descending order, on the country of implementation, the specific renewable technology and the project size (small or large scale). Moreover, the degree of saturation of these technologies is considered from the interviewees as an important factor too. In addition, the global economic crisis is critical as this factor also impacts the level of implementation of RES investments at a certain degree. Regarding a large-scale PV plant, this investment has lower risk as onshore wind farms are more risky due to lower social acceptance.

Cost of equity – Regarding the level of this indicator, the feedback obtained was rather divided. Specifically, the majority of the experts stated that a range of 12-13% (close to the modelled value) is realistic. On the other hand, a range of 10-12% or even 9%, has been assumed from another interviewee. Moreover, all participants mentioned that large scale PV plants have identical or slightly lower cost of equity than those of the onshore wind energy plants. This difference is grounded on the higher uncertainty of production and the greater risk occurred during the development and construction phases of a wind energy project.

Cost of debt – Based on the feedback of two interviewees, the cost of debt is lower for the case of a PV project. Another expert stated that the extracted range of values (7.9-8.4%) represents a technically optimal project. Thus, a range of 8-10% is more representative and an average value of 9% can be assumed. About the renewable project spread, at the moment, it is equal to 4% for PV power plants and slightly higher for wind because of the greater uncertainty of production and operation.

Latvia

Short Summary
2 interviews (bankers)

- Interviewees mentioned that financing, sudden policy change and policy design risks are very important and agreed that they should be treated equally important as technical & management risk.
- Interviewees assume that existing policy regime does not greatly reduce investment risks.
- Interviewees indicated that computed cost of equity is reasonable, cost of debt - max 6%.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Financing	Technical & management
	Sudden policy change	Financing
	Policy design	Sudden policy change
	Technical & management	Policy design
	Market & regulatory	Market & regulatory
	Social acceptance	Social acceptance
	Grid access	Grid access
Least important risk	Administrative	Administrative

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Based on the results some conclusions can be drawn. First, all risks included into the model were mentioned as "important risks" by the interviewees. Second, technical & management risk was identified by interviewees to be the most important risk, whereas in the model technical & management risk was estimated to have no impact. Interviewees mentioned that financing, sudden policy change and policy design risks are very important and agreed that they should be treated equally important as technical & management risk.

The model results are here actually pretty much in line with the interviewees' opinion, as the model shows that these three risk categories (financing, policy design and sudden policy changes risks) are estimated to have the highest impact on cost of equity.

Furthermore, some interviewees consider that in case of Latvia, baseline rate should have a higher impact on cost than it is modelled as macroeconomic risk is related to the political issues, which influence on country's economic development and country's relations with other countries. Since opinions on baseline rate diverged by reviewers, we assume that model results is in line with an aggregated opinion of the interviewees. Interviewees agree that market & regulatory, social acceptance, grid access and administrative risks have only a small influence on the cost of equity.

Influence of policies on RES investment risks

Since 2007, renewable energy policy regime changed several times in Latvia with acceptance of new regulations regarding support to renewable energy. For example, changes were made to the methodology for calculation of feed-in tariff resulting in lower support levels and also the share RES-E in the total final electricity consumption was changed. This has increased uncertainty among investors and thus investment risks. Furthermore, there are differences between the support level of RES-E technologies. Biomass and biogas electricity production receive more support and are therefore growing, while other technologies (including wind) receive less support and are therefore attracting less investments and remain smaller.

Interviewees did score the effectiveness[40] of Latvia policies to decrease investment risks with a score of 2 (n=2). Interviewees assume that existing policy regime does not greatly reduce investment risks. Although support to renewable energy is recognised as an important factor in reducing investment risk, other barriers remain and need to be solved. According to interviewees it is necessary to improve knowledge about the best available technologies in the country. Furthermore, the feedback between research institutions, the Government and business entities should be improved so as to inform more effectively businesses and households about the newest technologies and their benefits.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Divided** 90/10 - 60/40	• The 70/30 ratio is reasonable, but the share of equity could be 10-40%.
WACC	9.3%	**About right** 8-9%	• There is little experience with different technologies, therefore it is difficult to say, but computed WACC is assumed as reasonable.
Cost of equity	16.1%	**About right** 16.6%	• Banks have little experience with onshore wind technology implementation, but consider that cost of equity is around the computed figure.
Cost of debt	6.5-7.5%	**Too high** 6%	• Cost of debt are too high.

[40] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Debt term	10 years	N/A	

As, for most of the parameters, the opinions were slightly diverged, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio - The 70/30 ratio is reasonable, however, the Banks experience says that equity could be 10-40%. Banks are tended to accept lower risk projects. The exact D/E ratio depends upon the size of the project; as well on liquidity of the assets purchased and guarantees from the Government, pledge of real estate and other conditions. The exact percentage depends upon the financial "health" and sustainability of the company, as well perspectives of the project. Guarantees, financial status of the company, cash flows are factors that exert the highest influence on the Debt/equity ratio of a project.

WACC - Banks have little experience with different RES technologies, therefore it is difficult to say, but computed WACC is assumed as reasonable.

Cost of equity – It is around this figure, but for chips and biogas it would be higher, since due to support the return on equity (ROE) is rather high.

Cost of debt - Under current market set up the cost of debt is considered as too high. Interviewees indicated that cost of debt is max 6%.

Lithuania

Short Summary
2 interviews (equity providers, banker)

- Interviewees mentioned that policy design risk and social acceptance risks are very important. For the other risks, interviewees agree that they are less relevant the aforementioned risks, but they are not totally irrelevant.
- The wind energy plants projects in Lithuania are not regarded risky due to the existing policy measures.
- The cost of equity could be assumed as of 16.6%, cost of debt should be about 6%.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Social acceptance	Social acceptance
	Administrative	Technical & management
	Market & regulatory	Market & regulatory
	Sudden policy change	Sudden policy change
	Technical & management	Administrative
	Financing	Financing
Least important risk	Grid access	Grid access

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

In the table next to the graph the model results are compared to the interview results, showing the ranking order of the risk categories. For the ranking we used two different indicators: for the model results we used the estimated risk premium and for the interview results we used the frequency that risk categories were indicated as "most important"[41]. The interviewees agreed that all potential categories of risks influencing on cost of equity of renewable energy projects in Lithuania are covered by the study.

Based on the results some conclusions can be drawn. First, all risks included in the model were mentioned as "important risks" by the interviewees. Second, estimations of risks are the highest for the risk categories policy design risk and social acceptance risk. For the other risks, interviewees agree that they are less relevant the aforementioned risks, but they are not totally irrelevant.

Sudden policy change risk, technical & management risk, market design & regulatory risk are still important and influence the cost of equity considerably. These risks are then followed by administrative risk and grid access risk, for which is assumed that their influence is only small. Financing and grid access risks are assumed to be least important and influence the cost of equity not significantly.

[41] In many cases more than one risk categories were indicated as "most important". In those cases, we have included the top-3 risks in the ranking.

Influence of policies on RES investment risks

During the last years there was no changes in renewable energy policy measures therefore there was no impact on risk rates. Currently the wind energy plants projects in Lithuania are not regarded risky due to the existing policy measures. Support measures ensure safe incomes for investors and guarantee repay of loan. In general, if feed-in tariff significantly differed from the market price business would not invest in such projects due to the existing sudden policy change risk.

Interviewees did not score the effectiveness[42] of Lithuanian policies to decrease investment risks. However, they mentioned that the existing feed-in tariffs system is reducing the investment risks.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**About right** 70/30	• 70/30 D/E ratio is reasonable, but also 60/40 is experienced as common practice.
WACC	9.7%	**Too high** 9.3%	• The WACC estimation should be lower taking into account that the estimated the cost of debt is too high. • The WACC changes in projects.
Cost of equity	16.6%	**About right** 16.1%	• Theoretically cost of equity could be assumed as of 16.1%.
Cost of debt	6.6-7.9%	**Too high** 6%	• The cost of debt should be about 6% taking into account EURIBOR and margin (3.5%).
Debt term	10 years	N/A	N/A

As, for most of the parameters, the opinions were slightly divided, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio - Debt/Equity ratio of 70/30 is reasonable for wind energy plants projects. The Banks usually finances with 60% of debt. Debt/Equity ratio depends on investor, on debt term, on clarity of business model, on ability to forecast incomes.

[42] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

It is easy to forecast income for wind energy plants as electricity produced at wind PP is sold based on long-term guaranteed contracts and supported by feed-in tariff.

WACC - The WACC estimation should be lower taking into account that the estimated the cost of debt is too high.

Cost of equity – Interviewees agreed on the estimation of the cost of equity for an onshore wind project in Lithuania. In general the cost of equity is in the range from 10% to 20% with an average value of 15%.

Cost of debt - The cost of debt should be lower, about 5-6% taking into account EURIBOR (for ten years 1.5%) and risk premium (3-4%). Zero swap curve is about 1.5%.

Luxembourg

Short Summary

- No interview implemented.
- No wind energy in operation, few PV power plants in the country (end of 2013).
- Low RES targets for 2020.

Investment risks wind onshore

For the case of Luxembourg, no interview has been implemented. Below you may find the distribution of the nine risk categories and the related ranking of these, at a

Model results (ranking based on risk premium estimation)
Policy design
Administrative
Social acceptance
Financing
Technical & management
Grid Access
Market & regulatory
Sudden policy change

descending order, on the ground of risk premium estimation.

In the table next to the graph the model results are presented, showing the ranking order of the risk categories. Based on the model results, the most important risk source in Luxembourg is policy design followed by administrative risks. Unfortunately, no interview has been implemented to back test these results.

According to the 2014 EWEA annual report the total installed capacity of wind energy in Luxembourg was 58MW by the end of 2012. During 2013 no new installations took place, evidence of very few investments in the wind sector[43].·Per inhabitant, the installed wind capacity is 133W[44], which is significantly lower than the EU average of 233W/inhabitant. The picture is slightly different for the photovoltaic energy. As of 2013 the total cumulative PV capacity was 100MW, which is 186.2W/inhabitant. This is slightly above the EU average of 155.8W/inhabitant[45]. Together wind energy and photovoltaic energy account for almost 50% of Luxembourg's electricity production (23% and 20% respectively).

However, the presence of renewable energy in the total energy consumption of Luxembourg is only 3.1%, which is significantly lower than the targeted 11% in 2020. Based on the National Renewable Energy Plan, established in June 2010, the national objectives for installed capacity are 113 MW of photovoltaic and 131MW of onshore

[43] Wind in power: 2013 European Statistics, EWEA (2014).
[44] Wind energy barometer –Eurobserver (2014).
[45] Photovoltaic barometer – Eurobserver (2014).

wind[46] by 2020. Based on this, it is expected that in the coming period, investments in renewable sources should increase.

Malta

Short Summary

- No interview implemented.
- No wind energy in operation, few PV power plants in the country (end of 2013).
- Low RES targets for 2020.

Investment risks wind onshore

For the case of Malta, no interview has been implemented. Below you may find the distribution of the nine risk categories and the related ranking of these, at a descending order, on the ground of risk premium estimation.

Model results (ranking based on risk premium estimation)
Administrative
Policy design
Social acceptance
Financing
Technical & management
Grid Access
Market & regulatory
Sudden policy change

In the table next to the graph the model results are presented, showing the ranking order of the risk categories. Based on the model results, we used the estimated risk premium for the ranking of the model results. Unfortunately, no interview has been implemented for Malta.

According to the 2014 EWEA annual report, there is no wind energy plant installed in the region of Malta, up until 2013[47]. On solar-PV, Malta has 23 MW of installed capacity, which is translated to 54W of solar-PV installed per habitant[48]. The European country average is equal to 88W/habitant, meaning that Malta is lagging behind on both solar-PV and wind energy. Based on the aforementioned data, Malta is ranked 15th in the list of countries with the highest cumulative PV installed capacity per habitant and 20th regarding the total PV installed capacity. In addition, it is shown that the presence of RES technologies in the current national energy mix of Malta is currently the lowest in all Member States of the EU and the share of RES in gross final energy consumption is equal to 2.7%, for the year 2012[49]. For 2020, Malta has agreed on a 10% target of renewable energy in gross final energy consumption. This means that in the coming period, investments in renewable energy are expected. Based on the National Renewable Energy Plan, established in June 2010, Malta has set its 2020 national objectives on

[46] http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans
[47] Wind in power – 2013 European Statistics, EWEA (2014).
[48] Global market outlook - For photovoltaics 2014-2018, EPIA (2014).
[49] Share of renewable energy in gross final energy consumption %”. Code: t2020_31, Eurostat (2015).

28MW of photovoltaic, 14MW of onshore wind and 95MW of offshore[50] (European Commission, 2010).

Netherlands

Short summary
5 interviews (2 project developer, 3 investment analysts/managers)

- Administrative procedures and policy design are considered to be the most important sources of risk for renewable energy development in the Netherlands.
- Social acceptance for wind energy varies between regions.
- "Energieakkoord" is considered as a step forward, providing long term commitment from government, utilities and other important parties.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Administrative	Administrative
	Social acceptance	Social acceptance
	Financing	Technical & management
	Grid access	Market & regulatory
	Technical & management	Grid access
	Market & regulatory	Financing
Least important risk	Sudden policy change	Sudden policy change*

* This risk was not mentioned during the interviews (n=5)
The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The interviewees indicated two risk categories to be missing: resource risk and construction risk. Resource risk is being regarded as the risk of not meeting the wind yields estimated upfront, which can result in lower income and lower cash flows. Policies are able to account for these risks as it could be a feature of their design. For instance, if wind yields in the first years are more than 25% lower than expected, this could influence the cash flows and business case negatively. However, under the current Dutch subsidy scheme certain measures are taken to cover for this (i.e. wind factor, banking). Construction risk is associated with any uncertainties during construction phase and are included in the technical & management risks.

Based on the results some conclusions can be drawn. Firstly, almost all risk categories are mentioned at least once as being an "important risk". Policy design and administrative risks were indicated as being most important in both model and the interviews. Different is that in the model policy design risks were estimated to have a higher impact than administrative risks. On the contrary, during one of the interviews it was mentioned that Policy design is in fact not considered a risk, as Policy design only defines the rules of the game. The investor can either agree with this or not. We

[50] Malta's National Renewable Energy Action Plan as required by Article 4(2) of Directive 2009/28/EC" 6 July 2010, European Commission (2010).

therefore concluded that the influence of policy design on the cost of equity should indeed be lowered.

Next in rank, interviewees identify social acceptance risks. On the impact of this risk opinions differed, merely caused by the type of projects that the interviewees had experience with. Offshore wind creates very little public opposition as compared to onshore wind. The impact of the opposition against onshore wind though, varies between regions.

For instance in large parts of the province of Flevoland, onshore wind is completely accepted, whereas in North-Holland the development of the Wieringermeer project generates fierce opposition. Here civilians are now litigating to prevent this project. Based on the current discussion, the province of North-Holland has decided to no longer grant permits for onshore wind projects.

For technical & management risks was mentioned that they are not 0% (as suggested in the model), although for onshore wind these risks are still fairly low. They were mentioned two times as being important, but this was then related to offshore wind. Grid access, market design & regulatory and financing are risks that could not be neglected, still they are not experienced by the interviewees as being the most important risks. Finally, sudden policy changes are not considered as risk factor at all as the government is considered to be fairly stable in the Netherlands. The adjustments in the model are indicated by the arrows in the graph.

Current policy framework

Over the last five years, some small changes occurred in the policy regime. This included changes in tariffs and/or changes in other support schemes. According to the interviewees these changes did not directly impact RES investments, although it increased uncertainty among investors. In this light the "Energieakkoord" was mentioned as a step forward, providing long term commitment from government, utilities and other important parties.

Interviewees did score the effectiveness[51] of Dutch policies to decrease investment risks with a score 3 (n=3). To improve this score, interviewees mentioned guarantees for more secure cash flows in the operational phase and reimbursement for capital overruns in the development phase.

Furthermore, increasing government commitment, by guaranteeing that decisions and policies will last for longer periods and will not be changed by a new governments. As renewable projects hugely depend on policies, a long term stable policy framework will reduce the risk for renewables. In this case the role of the UK government in the

[51] The effectiveness of policy was scored on a scale from 1-5: 1=having no influence at all, 5=reducing the whole risk.

development of offshore wind was mentioned as an example of being highly committed as a government, resulting in many investments.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Divided** 70/30	• 70/30 seems reasonable, although for onshore wind it can be also 80/20. • Leverage is not stable over the entire life of the project. Gearing levels change over time and will affect the capital structure.
WACC	6.4%	**Divided** 6-6.7%	• Opinions were divided: one interviewee thought it should be higher, another thought it should be lower for onshore wind. • A range of 6-6.7% was accepted.
Cost of equity	10.8%	**Divided** 13.7-14.2%	• Depending on the phase (pre-financial close or operation). • For PV and wind onshore COE comparable, for wind offshore is higher.
Cost of debt	5.6-6.1%	**Divided** 4.7-6.3%%	• Based on the interviews, cost of debt should be lower. No clear message from interviews, resulting in a large range.
Debt term	10 years	**Agreement** 12-15 years	• The debt term should be more than the projected exit period for the equity investor which is usually after 5 or 7 years.

As for most of the parameters the opinions were rather divided, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio - For the beginning of the project the assumption of 70/30 could be right, although for onshore wind 80/20 is also observed. However, over the lifetime of the project, the leverage can change affecting the capital structure.

WACC - The opinions on the WACC differed between about right (n=2) and far too high (n=1). The interviewee that did not agree with the modelled WACC argued that we use a static model assuming a fixed capital structure (Debt/Equity ratio), whereas in practice the gearing level for a project changes over time, including the WACC.

Cost of equity – There is a rather large spread in the cost of equity among our interviewees. The cost of equity will depend on the phase: during operation it will be significantly lower than before financial close. Before permitting the cost of equity can be as high as 15%, after permitting and before financial close it could be between 9-11% and during operation it could be as low as 8-10%.

Cost of debt – For the cost of debt the opinions differ between too low (n=1), about right (n=1) and too high (n=1). For the latter case, the interviewee points towards the current situation where bond and risk-free rates are at record lows. The mark-up has been pretty stable the last five years while it used to be lower before the crisis. Based on this, the interviewee estimates the cost of debt for wind onshore and PV to be around 3-3.5% and for wind offshore 4.5 – 5.5%.

Poland

Short summary
3 interviews (1 consultant, 2 project developers)

- The risk categories with the highest impact are social acceptance and policy design risks.
- The current support scheme is ineffective and – since several years – the Polish Government has failed to introduce a new RES Act.
- Opinions on cost of equity and WACC were divided. According to one interviewee, these parameters should be much higher.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Grid access	Social acceptance
	Financing	Policy design
	Social acceptance	Administrative
	Administrative	Market & regulatory
	Policy design	Grid access
	Market & regulatory	Financing
	Technical & management	Technical & management
Least important risk	Sudden policy changes	Sudden policy changes*

* This risk was not mentioned during the interviews (n=3)

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The three risks that were highlighted by all interviewees were the social acceptance risk, the policy design risk and the administrative risk.

Social acceptance risk plays a major role in Poland, especially for the construction of larger wind farms. The policy design was also mentioned as an important risk for RES investors. According to the interviewees, the existing support system is not effective. The value of the so-called "green certificate" is currently much lower because of an oversupply of certificates, making a profitable implementation of new projects impossible. This holds especially for PV. Furthermore, there is a lack of political will for a rapid development of renewable energy. On administrative risks, interviewees stated that the Polish Government failed to introduce new legal and administrative measures to support the renewable energy sector. For several years now, Polish renewable energy sector has been waiting for a new support scheme which is still unknown.

Influence of policy on RES investment risks

The interviewees agreed that the Polish Government has not been able to reduce investment risks for RES developers due to the fact that the country is still lacking an act on the support of renewable energy sources. The Polish RES sector has been waiting for years for Poland's Government to propose and approve a RES Act that would enable a stable long-term development of the sector and which would introduce a basic legal order, in particular with reference to a long-term support strategy for the existing and planned installations using RES.

Moreover, Directive 2009/28/CE should have been transposed into national law along with all codes, regulations, standards latest by 5 December 2010, as specified in the Directive. Unfortunately, until today the bill had not been forwarded to the Parliament. This means that the process has been delayed by almost four years and it may take at least one more year before the Act and the relevant regulations are approved.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 70/30	• A ratio of 70/30 is reasonable.
WACC	8.7%	**Opinions divided** 8.7-10%	• Two interviewees agreed with the estimation for the WACC. • One interviewee stated that due to the high risks the WACC should be much higher (around 10%) for RES projects in Poland.
Cost of equity	13.7%	**Opinions divided** 14-14.5%	• Two interviewees said the estimation was realistic, but just too low. • One interviewee stated the CoE should be much higher (around 20%).
Cost of debt	6.1-8.1%	**Agreement** 6.1-8.1%	• All interviewees agreed that the cost of debt for wind onshore is about right.
Debt term	10 years	**Agreement** Longer	• No feedback was received on the debt term.

Portugal

Short Summary
3 interviews (1 consultant, 2 equity providers)
- Secure investment environment and effective energy policy.
- Differentiation of risk profiles between different scale companies.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Market & regulatory
	Financing	Policy design
	Policy design	Financing
	Grid access	Grid access
	Market & regulatory	Administrative
	Technical & management	Technical & management
	Social acceptance	Social acceptance
Least important risk	Sudden policy change	Sudden policy change

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

According to the interviewees, all risks categories are influencing the investments to some extent, although the influence of some is very small (e.g. social acceptance and sudden policy change). It was also mentioned that there is a clear distinction of the risk level between projects that are receiving fixed tariff (FIT) and those which are directly trading their energy into the market. The latter are accompanied by greater investment risk, as guaranteed remuneration result in less risky investment profile. For investments supported by the FIT scheme, market design and regulatory risk is the most important risk component, while for market remunerated RES power plants policy design risk is the most crucial risk factor.

In addition, the financing risk constitutes an important risk component. Administrative risk was also highlighted because of complicated and time consuming procedures for power plants' licensing procedures. Moreover, the grid access risk is considered as important from all interviewees. No specific comment has been recorded for technical & management and sudden policy change risks. Finally, all experts agreed that social acceptance risk is the least influential risk component having a really low impact on the total RES investment profile.

Influence of policies on RES investment risks

Interviewees did score the effectiveness[52] of Portugal policies to decrease investment risks with a score of 5 (n=5). This is grounded on the fact that there is a clear overall framework regarding investments in the renewable energy sector.

[52] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

In addition, no retroactive changes have taken place until now and, thus, a safer investment environment has been ensured for investors in the RES sector.

Specifically, the FIT scheme is considered as a very stable support mechanism and a critical factor that guarantees a lower investment risk. Regarding wind and PV power plants, the reduction of the respective guaranteed tariff has led to a short-term decrease of the remuneration level. Nevertheless, the extension of the time horizon of fixed remuneration, from 15 to 20 years, has resulted into the reduction of the whole investment risk. In total, investors gained, finally, benefits from these two adverse actions. At last, the promotion of self-consumption by net-metering PV installations has been another policy measure that decreased total investment risk.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Divided** 70/30 – 50/50	• One interviewee stated that a typical ratio range between 70/30 and 60/40. • Another expert mentioned that although it is 70/30 in the beginning of the project, a 50/50 average capital structure during the project lifetime is assumed.
WACC	10.2%	**Estimated** 7.5-8.5%	• No feedback received from interviewees. • Based on the input on cost of equity and cost of debt, the WACC was estimated to be lower, around 7.5-8.5%.
Cost of equity	15.4%	**Agreement** 12-13%	• Modelled value is too high. • Lower cost of equity for wind than for PV plants.
Cost of debt	9.9-10.4%	**One opinion** 6%	• Average value of 6% or slightly less.
Debt term	10 years	**One opinion**	• Different values for FIT or market remunerated projects. • 10-12 years for FIT and 8-10 years for market based projects.

In addition, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio – One interviewee set a clear distinction between projects that are remunerated based on a FIT system and those that are trading energy into the market. For the latter, a proportion of less than 50% share levered by debt capital is considered.

Cost of equity – Based on the feedback of one interviewee, they use the Capital Asset Model (CAPM) and a more aggregated approach compared to the theoretical model conducted. Specifically, they mainly take into consideration - in an aggregate way - the risk profile of the asset according to the (i) technology, (ii) regulation & market and (iii) country risk. Therefore, they do not individualise premiums per specific risks as presented above. Specifically, for the case of the market premium, a range between 5-6% is assumed. In total, an average cost of equity of 11% is considered. Another expert stated that this value shows fluctuations from company to company (e.g. companies with great and diverse portfolio, small scale companies).

Cost of debt - The highest impact on the cost of debt is exerted by the liquidity of the market, the previous experience of the project developer and, in general, the company's market position.

Romania

Short summary
2 interviews (1 consultant, 1 project developers)

- Policy design and Financing risk have highest impact. Especially for wind, the grid access risk is also quite high.
- Recent energy policy measures have increased the risk for investors. Until 2013 the market was working well, now the interest of investors has massively decreased.
- Therefore, the cost of equity has risen to around 18%.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Grid Access	Financing
	Administrative	Grid access
	Financing	Market & regulatory
	Market & regulatory	Administrative*
	Social acceptance	Social acceptance*
	Technical & management	Technical & management*
Least important risk	Sudden policy risk	Sudden policy risk*

* This risk was not mentioned during the interviews (n=2)
The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

In general, renewable energy projects in Romania were rated as extremely risky. The two risks that were mentioned by all interviewees were the policy design risk and the financing risk.

With regard to the policy design risk, interviewees stated that the sudden policy design changes and the current RES policy in Romania have the highest impact on the costs of equity. According to stakeholders, these legal amendments made it almost impossible to sell renewable energy projects in Romania. For wind energy this risk is even higher, because the construction phase is longer. Therefore, the policy design and sudden policy change risk (possible legal changes during the construction) is significant.

The interviewed stakeholders agreed that the financing risk has also a great impact on RES investors. It was mentioned that in 2014 banks do not finance RES projects or require a very high equity share. Furthermore, the grid access risk is also quite high. In the past, grid access permits had been issued too quickly, leading to the situation that in several regions the grid capacity is now blocked. One interviewee also mentioned a market and regulatory risk, since in case of curtailment, there are no compensations for RES plant operators.

Influence of policy on RES investment risks

The interviewees agreed that the recent energy policy measures by the Romanian Government have increased the risk for investors. It was reported that until 2013, the renewable energy market in Romania was working well. At the end of 2013 however, the quotas for PV and wind were lowered from six to four green certificates. Therefore, the interest of (especially foreign) investors has massively decreased.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Opinions divided** 60/40 to 25/75	• One interviewee stated that the ratio was rather 60/40. • Another interviewee pointed out that banks do hardly finance RES projects; even if they do so, banks require an equity share of 75% or even more.
WACC	11.1%	**Agreement** 11.1%	• The WACC is realistic. In case of PV, it should be slightly lower.
Cost of equity	18.2%	**Agreement** 16-18%	• Until 2013, the CoE was considerably lower. For 2014, 18% is realistic.
Cost of debt	7.2-9.5%	**Agreement** 7-10%	• 7-10% is realistic. However, PV should be lower than wind.
Debt term	10 years	**Agreement** Longer	• No feedback was received on the debt term.

Slovakia

Short summary
2 interviews (1 consultant, 1 equity investor)

- The grid access risk is by far the most pressing risk for RES investors in Slovakia. Currently, no wind or PV projects above 10 kW receive grid connection permits.
- Stakeholders linked this situation also to policy design and sudden policy change risks. The legal conditions were unstable and the decisions of the state regulator unpredictable.
- Due to the fact that practically no larger projects are being implemented in Slovakia, the interviewees were not able to provide concrete financial parameters.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Grid Access	Grid access
	Administrative	Policy design
	Sudden policy change	Sudden policy change
	Policy design	Administrative
	Social acceptance	Social acceptance*
	Financing	Financing*
	Technical & management	Technical & management
Least important risk	Market & regulatory	Market & regulatory

* This risk was not mentioned during the interviews (n=2)
The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

The two risks that were mentioned by all interviewees were the grid access risk and the policy design risk. The stakeholders agreed that the grid access risk had the highest impact on RES projects in Slovakia. Currently, no new PV or wind energy projects receive a grid connection permit. One interviewee pointed out that the regulator refuses to connect new RES projects to the grid, even though it would be technically feasible. According to the interviewed stakeholders, this connection moratorium was a purely political decision.

Due to the unstable legal conditions in Slovakia as well as the unpredictability of the state regulator's decisions they both also mentioned the policy design risk and the sudden policy change risk. Administrative risks were considered as minor risk category. This however, is mainly due to the fact that RES projects do not even reach the stage of implementation where administrative issues could present a risk for developers.

Influence of policy on RES investment risks

Both interviewees agreed that the recent energy policy measures in Slovakia only increased the risks for renewable energy investors. Especially the connection moratorium for PV and wind energy power plants, which will presumably also be in place for most of 2015, has stopped the development of the entire Slovak RES market and has deterred most foreign investors. The state regulator had announced that there were no free grid capacities for PV and wind energy plants with capacities above 10 kW.

However, representatives from the Slovak renewable energy sector strongly doubt this alleged saturation of the grid and have called the grid connection moratorium a "purely political decision".

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement** 70/30	• Before the connection moratorium, 70/30 was a realistic ratio for wind energy plants.
WACC	8.1%	**Opinions divided** 8.1%	• According to one interviewee, the estimation of the WACC is quite realistic. • Another stakeholder argued that due to the fact that practically no larger projects have been realised so far in Slovakia, it is hard to tell concrete numbers for cost of equity, cost of debt and WACC.
Cost of equity	13.6%	**Opinions divided** 13.6%	• According to one interviewee, the estimation of cost of equity was about right, maybe slightly lower. • Another stakeholder argued that due to the fact that practically no larger projects have been realised so far in Slovakia, it is hard to tell concrete numbers for cost of equity, cost of debt and WACC.
Cost of debt	6-7.3%	**Opinions divided** 6-7.3%	• According to one interviewee, the estimation of the cost of debt is quite realistic. • Another stakeholder argued that due to the fact that practically no larger projects have been realised so far in Slovakia, it is hard to tell concrete numbers for cost of equity, cost of debt and WACC.
Debt term	10 years	**Agreement** *Longer*	• No feedback was received on the debt term.

Slovenia

Short Summary
1 interview (consultant)

- Current RES mix in Slovenia: 2MW of wind energy, few PVs and some small hydro.
- Not extended knowledge and experience regarding wind technology.
- No offshore wind in operation.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Administrative
	Social acceptance	Sudden policy change
	Policy design	Market & regulatory
	Market & regulatory	Policy design
	Sudden policy change	Social acceptance
	Financing	Financing
	Technical & management	Technical & management
Least important risk	Grid access	Grid access

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Based on the expert's response, the modelled results are pretty much in line with his experiences. According to the interviewees, administrative and sudden policy change risks are the most important followed by market design and regulatory and policy design risks. As least influential risk category, the social acceptance risk has been mentioned specifically. The remaining categories were indicated as having minimal influence on the cost of equity, which is in line with the model results. In general, the risk analysis is considered complete and no risk component is missing from this study.

According to the current economic situation, investments in the RES sector are less risky than investments in other infrastructure because of the existing FIT scheme.

Influence of policies on RES investment risks

The interviewee did score the effectiveness[53] of Slovenia policies to decrease investment risks with a score of 4 (n=4). The current policy scheme is considered to be effective leading to a reduction of the total investment risk. In particular, the existing FIT scheme secures guaranteed remuneration and provides security to investors. Moreover, the price system has been clearly set and the state-aid regulations have been established.

Financial parameters

The table below incorporates the received feedback on the financial parameters that extracted from the proposed theoretical model. The financial parameters are, for the case of wind onshore, as follows:

[53] The effectiveness of current policy scheme was scored on a scale 1-5 (1=having no influence at all, 5=reducing the whole risk).

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Slightly higher** 75/25	• This ratio is slightly higher and equal to 75/25. • The factors that exert the highest impact on the D/E ratio are the existing Feed-in tariff scheme and the liquidity from the bank side.
WACC	11%	**Agreement** 11%	• For PV, the model value is fine. Although, for large scale PV power plants should be lower. • Difficult to extract value for wind technology.
Cost of equity	17.4%	**No feedback** 17.4%	• No feedback was received on the total value of the cost of equity.
Cost of debt	8.2-9.9%	**No feedback** 8.2-9.9%	• No feedback was received on the cost of debt.
Debt term	10 years	**Too short** Longer	• 15 years for the debt term.

Based on the 2014 EWEA annual report and the interviewee's response, the total onshore wind installed capacity is currently equal to 2MW and there is limited experience about this technology[54]. In addition, there is no offshore wind energy plant under operation. Moreover, the cumulative PV installed capacity is 212MW, with a ratio of 103W/habitant[55].

Based on the aforementioned data, Slovenia is ranked 8th in the list of countries with the highest cumulative PV installed capacity per habitant and 16th regarding the total PV installed capacity. Regarding the renewable energy targets set for 2020, Slovenia has agreed to install 106MW of onshore wind capacity and 139MW of PV capacity[56]. Based on the figures mentioned above, the PV target has already been achieved. There are no plans for the development of offshore wind energy in Slovenia.

[54] Wind in power – 2013 European Statistics, EWEA (2014).
[55] Global market outlook - For photovoltaics 2014-2018, EPIA (2014).
[56] National Renewable Energy Action Plan 2010-2020 (NREAP) Slovenia, Ljubljana, July 2010, European Commission (2010).

Spain

Short Summary
4 interviews (3 consultants, 1 equity provider)

- Energy policy actions increased significantly the investment risk.
- No new investments are being implemented now.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	Interview results (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Policy design
	Administrative	Sudden policy change
	Sudden policy change	Market & regulatory
	Grid access	Administrative
	Market & regulatory	Financing
	Financing	Grid access
	Technical & management	Technical & management
Least important risk	Social acceptance	Social acceptance

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

All interviewees have mentioned that there is no risk component missing from the analysis. The interview participants agreed that policy design risk is considered to be the most important risk component, affecting the entire risk profile of the country. Sudden policy change and market design & regulatory risks were identified as considerable risk components and interacting with each other. Also administrative risk, related to bureaucracy of permitting procedures, is considered to be a considerable risk. According to most interviewees financing risk has minimal influence on the cost of equity, while another interviewee indicate this as being one of the most important risks. Grid access risk is estimated to have a low impact. Finally, technical & management and social acceptance risks are referred as the least important factors influencing the national investment risk profile. Specifically, the latter is present only for onshore wind energy plants.

Influence of policies on RES investment risks

As interviewees mentioned that policy changes occurred over the past five years have led to a total increase of investment risks in the RES sector. As a result, the effectiveness of current energy policy is considered negative and no ranking on the mentioned scale 1-5 has been recorded (value out of scale).

In 2007, the FIT/FIP schemes and remuneration levels were updated. As these support mechanisms provided very good conditions, they have led to an extensive development of RES projects and, in some cases, overcompensation of RES producers. In 2010, the Spanish government retroactively changed the remuneration level provided which negatively affected RES investors. Since 2012, FIT/FIP remuneration has no longer provided to new RES projects and, during the last two years, no new RES projects have been implemented until now.

Financial parameters

The table below reflects the interviewees' feedback on the financial parameters that resulted from the model. The financial parameters are for wind onshore:

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Agreement**	• 70/30 constitutes a representative value.
WACC	8.1%	**Divided** 10%	• Reasonable value. • Average WACC of approximately 10% - higher for non-FIT supported projects was also mentioned.
Cost of equity	13%	**Divided** 13-15%	• Probably correct value. • Higher for an onshore wind and even higher for offshore.
Cost of debt	7.9-8.7%	**Divided** 9-10%	• One expert mentioned that it is fine. • Another stated an increase of about 20-30%, larger for offshore.
Debt term	10 years	**No opinion**	• No feedback received on the debt term.

As, for most of the parameters, the opinions were rather divided, we have described some of the arguments that came up during the interviews:

Debt/Equity ratio – A ratio of 70/30 is considered reasonable from all interviewed experts. Nevertheless, no RES project is currently implemented due to the policy changes. Main parameters affecting this ratio are currently implemented policies and observed uncertainties in the market and existing sudden policy alterations.

WACC – This indicator varies significantly between countries depending on country specific characteristics. Interviewees mentioned that WACC is higher for large scale PV projects than for onshore wind projects. An average typical value of 10% has been mentioned for Spain, higher than in several other EU countries.

Cost of equity – PV projects have generally lower values than the onshore wind projects.

Sweden

Short summary
3 interviews (1 Energy Company, 1 Bank, 1 Consultant)

- The Swedish RES policy design punishes early movers and thereby fails to address the risks of innovative wind energy investments.
- Market design & regulatory risks and policy design risks are the main risks and can impede future wind energy investments.
- Capital costs are higher than in neighbouring markets.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Administrative	Market & regulatory
	Policy design	Policy design
	Social acceptance	Social acceptance
	Technical & management	Administrative
	Market & regulatory	Technical & management*
	Financing	Financing*
	Grid access	Grid access*
Least important risk	Sudden policy change	Sudden policy change*

* This risk was not mentioned during the interviews (n=3)

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

According to all interviewees the main risk for wind energy plants is their dependency on high electricity prices and that the existing support schemes do not provide sufficient support. This risk can be understood as a market design & regulatory risk or as a policy design risk. In any case it overshadows all other risks by far (90% of all risks). Right now, the electricity prices are too low and the quota system is not able to compensate for these low prices. As a consequence market experts expect reduced growth of wind energy and depreciation of existing projects.

Furthermore, some interviewees brought up the importance of timing in the risk assessment: at what phase in the project are risks assessed? At the start of a project, risks like grid access, social acceptance and administrative risks might be relevant, but in terms of invested budget these risks are insignificant when compared to the construction and operation phase. During this phase (in which more than 90% of the overall budget has been invested) other risks such as the market design & regulatory risk become much more important. The interviewees showed in particular doubts with regard to the high amount for administrative risks. They pointed out that there are only few minor problems with corruption, and the bureaucracy is very business oriented in particular in comparison with countries and markets.

One interviewee also mentioned resource risk as another potential risk. However, that risk is also quite insignificant in comparison to the mentioned market design & regulatory risks.

Influence of policy on RES investment risks

Interviewees did score the effectiveness[57] of Swedish policies to decrease investment risks with a score 3 (n=3). The current system is very positive for consumers as they can benefit from reduction of prices for technology. However, it is negative for the owners of existing old wind energy plants that were built when the technology was still relatively costly. After the reduction of prices for wind energy technology, early movers have to compete with wind energy plants that have been built later for a lower price. Since both the old expensive and the new cheap wind energy plants compete on the same electricity market and receive the same amount of green certificate the first movers have a disadvantage compared with later investors. In conclusion, the current policy design offers no incentive to invest early in innovative but risky technologies, which are necessary for the modernisation of the energy sector. Another risk is that Sweden is about to reach its 2020 goals and it is not clear yet how the political development will be then. In the past five years there were a lot of discussions about how to amend the current support scheme but the conditions have not been improved, yet. According to latest news, the Swedish government intends to increase the target for renewable energy production.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Opinions divided** 70/30 to 50/50	• The majority of interviewees indicated a higher share of equity due to the risks for the industry (price risk and commodity risk). • In the past the share was 70/30 in the current situation it is rather 60/40 or even 50/50.
WACC	6.7%	**Opinions divided** 7.4-9%	• According to majority of interviewees the WACC is higher. • Indications ranged between 7.4% and around 9%.
Cost of equity	11.1%	**Opinions divided** 10% – 12%	• Majority of interviewees indicated about 11% is correct. • After the permission phase is concluded the rating is lower (8.1-9.1%) but before, it is considerably higher (about 20%) therefore 11% seems reasonable. • Actual value depends on class of investors (utilities usually demand higher cost of equity than private energy cooperatives).
Cost of debt	5.1-6.2%	**Agreement** 4.5 - 6%	• Due to the current very low interest rates the values from the model appear too high. • Right now they should be a bit lower (4.5-5%). However, this can change with higher credit rates.

[57] The effectiveness of policy was scored on a scale from 1-5: 1=having no influence at all, 5=reducing the whole risk.

Debt term	10 years	**Agreement** N/A	• No feedback was received on the debt term.

United Kingdom

Short summary
5 interviews (1 equity provider, 1 debt provider, 4 consultants, 1 investment advisor)

- In United Kingdom, planning risk is considered to be as the most important. Planning risk is associated with long administrative procedures.
- It is expected that the new CFD regime will decrease risk in the operational phase of a project, nonetheless there are concerns that it will increase risk in the development phase.
- The opinions differ significantly for the cost of debt and equity indicating higher and lower values from what was expected.

Investment risks wind onshore

	Model results (ranking based on risk premium estimation)	**Interview results** (ranking based on frequency of risk being indicated as most important)
Most important risk	Policy design	Administrative
	Administrative	Policy design
	Grid access	Grid access
	Technical & management	Social acceptance
	Social acceptance	Market & regulatory
	Financing	Sudden policy change
	Market & regulatory	Financing*
Least important risk	Sudden policy change	Technical & management*

The colours indicate risk categories that have a different ranking in the model results and the interview results. Each risk has its own colour code.

Based on the results some conclusions can be drawn. First, almost all risk categories are mentioned at least once as being an "important risk". Interviewees indicate administrative risks as the most important risk category, in contrast with the model. This risk category is mentioned as planning risk which is associated with long lead time of permitting during the development phase of the project. Administrative risks are particularly important because, as interviewees remark, they are very hard to manage.

The second most important risk according to the interviewees is policy design. While it is mentioned as a risk that should be taken into account in the assessment of the project, it is also expected not to be so important in the future under the CFD regime, as the contract is not going to be affected by policies. Combining the results obtained from both approaches we conclude that policy and administrative risks are the most important in the evaluation of a project. Grid access risk is also fairly important in UK, however this can be very site specific: in some areas it is fairly easy to obtain access to the grid while elsewhere it can lead to severe delays.

For social acceptance risks it was mentioned that they are not negligible as indicated by the model. Particularly, social acceptance risks were indicated to be fairly important as this could cause delays in obtaining permits, and increase planning risk. Market design & regulatory risks were also mentioned to impact investment risk, however to a lesser extent than aforementioned risks.

Finally, the opinion on sudden policy changes differs among the interviewees. For instance it is suggested that policy changes can influence the risk of a project. One interviewee mentioned that even the announcement of a change could create unrest between investors, despite whether it would improve or not the investment environment. As an example, the change of the regime from Renewable obligation to Contracts for difference regime has triggered a turbulence in the market and most investors try to obtain permits as soon as possible with the old regime. On the other hand, a different opinion mentions that under the CFD regime policy changes will not matter much.

The interviewees indicated some risk categories that are missing from the assessment. These risks are revenue risk which is the variability in the production of electricity and the ability to sell it. Off taker risk which is the uncertainty caused by the low creditworthiness of the off-taker. The low creditworthiness could result in a default, which means that the off-taker will not be able to purchase the agreed amount of electricity, exposing the producer to uncertainty. Finally planning risk is missing which is regarded as uncertainty caused by the long time lines of permitting. This delay can increase the costs of the project during operational phase. In our model planning risks are represented by administrative and social acceptance risks.

As far as off-shore wind projects are concerned, interviewees remarked that the technical & management risks but also the construction site influences their risk profile.

Influence of policy on RES investment risks

Over the last five years the biggest change made in the policy regime is the transition from Renewable Obligation scheme to Contract for Difference scheme. This transition was commented by all interviewees. Overall, the interviewees acknowledge that with the CFD regime there is an effort to make investments in renewable energy safer. In terms of risks, the operating phase will become "safer" for the investors under the CFD regime, due to three reasons. Firstly, cash flows in the operating phase will be much more certain. Secondly, as the UK government will become the counterparty under the CFD, counterparty risk will be reduced. It is expected that the reduction of the counterparty risk will make it easier to acquire senior debt. Finally, it is expected that there will be a reduction of the pressure on support mechanisms, as CFD regimes will allow competitive prices.

On the other hand, CFD regime introduces more risk in the development phase. This is due to the uncertainty regarding the unclear design of the mechanism and the procedures required to obtain a contract. Hence the concern of the developers is not only the concession of the project but also the uncertainty of getting an approval for a CFD contract.

There is a common agreement among the interviewees that the new regime is going to have a significant impact on the investment landscape. However, they still cannot forecast the direction of this change.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio	70/30	**Divided** 70/30 – 80/20	• 70/30 seems reasonable, although for onshore wind it can be also 80/20. • Leverage is not the same in the entire life of the project. The gearing level changes over time and will affect the capital structure. • With CFD regime gearing could go up as cash flows more certain in the operating phase.
WACC	6.5%	**Divided** 6.5%	• For a highly regulated asset it is around 4%-5%. But for wind onshore it is bit higher which is close to 6.5%. Regulation in UK provides clear guidance.
Cost of equity	10.4%	**Divided** 7% – 15%	• Depending on the phase (project ready to be built or operational). • Difference between on-shore and off-shore around 2%.
Cost of debt	5.6-6.1%	**Divided** 5-5.5%	• Wind onshore similar to PV: 250-300 basis points. Also risk-free rate rather high. CoD should be 0.5%-1% lower.
Debt term	10 years	**Agreement** 12 years	• Could be longer for example 12 years.

As for most of the parameters the opinions were rather divided, we have described some of the most important arguments that came up during the interviews:

Debt/Equity ratio - For on-shore wind the assumption of 70/30 debt to equity ratio is correct although for UK a ratio of 80/20 is also realistic. However, over the lifetime of the project, the leverage will change affecting the capital structure. Finally, with the CFD regime it is expected that the debt share could increase as the cash flows in the operating phase will become more stable, effectively reducing risk and favouring leverage.

WACC - Two interviewees commented on the WACC values. One mentioned that the WACC should be higher for onshore wind another that it is about right. The rationale behind the WACC value is that for a regulated asset it should be around 4-5%. As wind onshore is not regulated and hence bit more risky than a regulated asset, a WACC of 6.5% is about right

Cost of equity – There is a rather large spread in the cost of equity among our interviewees. Firstly, the cost of equity will depend on the phase: during operation it will be significantly lower than before connecting to the grid, without permits or during construction phase. For example if a project has not granted permits yet, then the CoE could be around 15%. For a project ready to be built the CoE will be in the range of 10%-9% depending on its characteristics. Finally an operational project would have a

CoE between 9% and 7%. Offshore wind will have a CoE around 2% higher than on-shore wind.

Cost of debt - Also for cost of debt the opinions differ between too low (n=1), and too high (n=1). For the latter case, the interviewee points towards the current situation where the risk-free rate is fairly low compared to previous years. Hence, with a mark-up of 250-300 basis points, the CoD should be around 4%. On the other hand, another interview points out that a CoD of 5%-6% is fairly competitive nowadays.

Annex B – Cost of equity

In this Annex a more detailed description is provided on the estimation of the CoE of RES projects for each Member State.

The two main models to estimate the cost of equity is the dividend growth model and the capital asset pricing model (CAPM).

- Dividend growth model assumes that the cost of equity is determined by the dividends a company pays and its growth rate, without making any assumption on the risk.
- In the capital asset pricing model (Sharpe, 1964; Lintner, 1965), the expected return or cost of equity is a linear function of a risk-free rate and of the market risk premium scaled by the Beta factor specific to every company.

Both models have some limitations: the dividend growth model is not applicable for companies that do not pay dividends. Additionally, it assumes a constant growth rate for the future, and fails to deal with risk directly. Despite its broader applications, CAPM has also been criticised, mainly due to restrictive assumptions. CAPM has a static nature while the market is dynamic. Additionally, there is an empirical difficulty to assign values for some of the parameters used, such as the Beta coefficient and the return of a market portfolio.

Despite the critic received by many academics, the single factor CAPM is the most widely used method to obtain the cost of equity (Graham & Harvey, 2001; Bruner, et al., 1998). Specifically, according to Graham and Campbell, almost three out four practitioners use the single factor CAPM to estimate the expected return of equity.

This model assumes a linear relationship between required return, risk-free rate and market risk premium is given by the following function:

Equation 1: Cost of equity

$$R_e = R_f + \beta(MRP)$$

R_E Cost of equity
R_f Risk-free rate
β Beta
MRP Market risk premium

The required return should be equal to the risk-free rate plus a market premium scaled by the Beta factor. This works as follows: if a company or project is more risky than the market as a whole, the Beta will reflect that risk, increasing the cost of equity. Beta reflects the market or the un-diversifiable risk of the company. The expected return does not incorporate compensation for diversifiable - unsystematic risk which is company specific and not due to the market as a whole.

Capital Asset Pricing Model (CAPM) shows the expected return required by investors in order to purchase the stock. From the formula, we can see two macroeconomic variables namely the MRP and the Risk-free rate and a company specific which is the Beta. All of the inputs are elaborated in the next sections, as well as the estimation method.

Based on this formula, the CoE for RES projects in the different Member States are calculated. This requires data from various sources. For this study, we used the

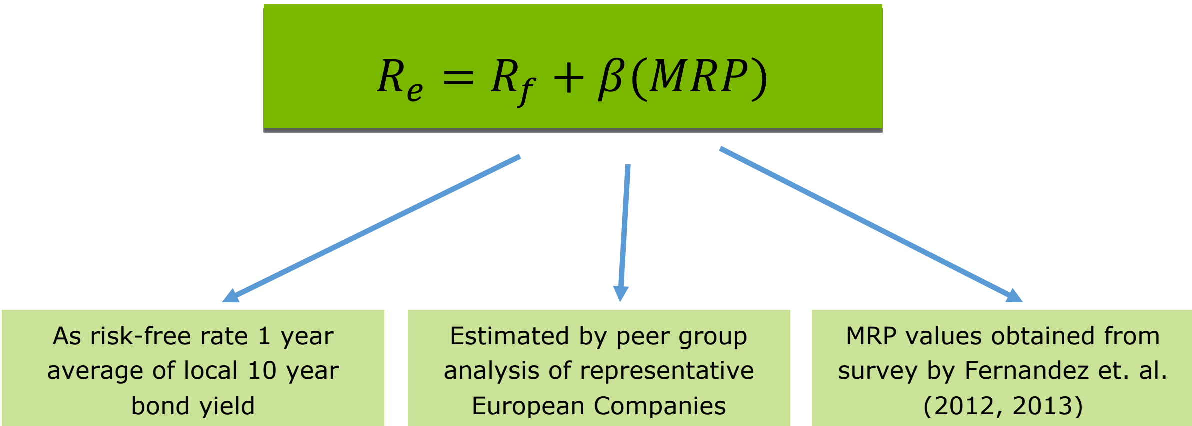


Figure 24: Formula for calculation of cost of equity

following:

- As risk-free rate, the ten year government bond yields were used. Specifically the yield used is the average over the last one year.
- After adjusting for debt to equity ratio and corporate tax rate, Beta falls into the range of 1.4 – 1.6.
- Market Risk Premiums (MRPs) range from country to country. The lowest premium is in Germany where investors require 5.5% of equity premium and the highest in Lithuania, Bulgaria, Greece and Cyprus where investors require close to 8% or higher (Fernandez, et al., 2012).

Market Risk Premium

Market risk premium is the excess return of the market portfolio against the risk-free interest rate. It is considered to be the most important input in the CAPM. Although a vast amount of literature exists, there is not a consensus for the exact amount of equity risk premium. The two most used methodologies is survey based approach Fernandez (2010) and estimation from historical data. The drawback of the survey approach is that it introduces biases mainly because the premiums are overly responsive and optimistic to recent market data (Ilmanen, 2003).

On the other hand, surveys reflect practitioners' opinion apart from solely relying on academic estimates. According to Fernandez (2010), practitioners tend to estimate better the premiums realised while academics in contrast are very inconsistent in their opinions. Estimations of the equity risk premium from historical data rely on the assumption that the past is representative of the future which is not necessarily true in practice.

In order to derive the historical equity risk premium, the returns of the market portfolio are compared to the returns of the risk-free rate. The most cited sources, include Aswath Damodaran, Ibbotson Associates and (Dimson, et al., 2006), report a big spread in equity risk premium estimates. This is due to variation in estimation inputs such as the market portfolio, risk-free rate, estimation period and frequency of estimation.

For the purpose of this study we use the values obtained from surveys by (Fernandez, et al., 2012; Fernandez, et al., 2013), as depicted in Table 5 below. First the MRP values of 2013 were used and for the countries that this was not available the values of 2012 were used.

Table 5: MRP used in 2012 and 2013 across EU-28 Member States (Fernandez, et al., 2013)

Market risk premium used in 82 countries in 2012 and 51 countries in 2013		
EU Countries	**MRP (2012)**	**MRP (2013)**
Austria	5.70%	6.00%
Belgium	6.00%	6.10%
Bulgaria	8.30%	8.00%
Croatia	7.80%	
Cyprus	7.90%	
Czech Republic	6.80%	6.50%
Denmark	5.50%	6.40%
Estonia	-	-
Finland	6.00%	
France	5.90%	6.10%
Germany	5.50%	5.50%
Greece	9.60%	7.30%
Hungary	7.40%	8.20%
Ireland	6.60%	6.20%
Italy	5.60%	5.70%
Latvia	-	
Lithuania	7.90%	8.00%
Luxembourg	6.00%	
Malta	6.60%	
Netherlands	5.40%	6.00%
Poland	6.40%	6.30%
Portugal	7.20%	6.10%
Romania	7.70%	8.10%
Slovakia	6.90%	
Slovenia	6.50%	7.40%
Spain	6.00%	

Sweden	5.90%	6.00%
United Kingdom	5.50%	5.50%

Risk-free rate

Different proxies can be used to represent the risk-free rate. Some examples are the US treasury zero coupon bonds, German Bunds as well as the LIBOR (London interbank offered rate), the zero Swap (Libor) curve or the OIS (overnight indexed swap). Practitioners typically use US or German government bonds as they are considered not to bear any credit risk and liquidity risk. Furthermore, it is common among practitioners to choose long-term bonds when financing a project so as to match the projected period of cash flows, providing a reliable approximation of a risk-free rate.

Based on a study by Deloitte (2013), there are two different approaches to estimate the cost of equity:

(i) The conditional where the country risk is incorporated in the Market Risk Premium and the risk-free rate is the "real" risk-free rate (e.g. German government bonds);
(ii) The unconditional where the country risk is included in the risk-free rate (equal to the rate of return of a long-term government bond yields).

In this study we choose to apply the unconditional approach. By using yields of the local long term bonds an approximation of the country risk is included. Furthermore, the choice of the risk-free rate is consistent with the MRP used. (Fernandez, et al., 2013) In his survey provides values for the risk-free rate, which vary from country to country.

Concluding, as a proxy for the risk-free rate, we use the yearly average yield of the 10-year government bond of every country. In Table 6 an overview of these rates are provided for all EU MS.

Table 6: Average return on 10-year government bonds interest rates for the year 2013

EU Countries	10-year Government Bond Interest Rate (%)
Austria	2.01%
Belgium	2.41%
Bulgaria	3.47%
Croatia	4.68%
Cyprus	6.50%
Czech Republic	2.11%
Denmark	1.75%
Estonia	3.59%
Finland	1.86%
France	2.20%
Germany	1.57%
Greece	10.05%
Hungary	5.92%

EU Countries	10-year Government Bond Interest Rate (%)
Ireland	3.79%
Italy	4.32%
Latvia	3.34%
Lithuania	3.83%
Luxembourg	1.74%
Malta	3.36%
Netherlands	1.96%
Poland	4.03%
Portugal	6.29%
Romania	5.41%
Slovakia	3.19%
Slovenia	5.81%
Spain	4.56%
Sweden	2.12%
United Kingdom	2.03%

Source: ECB (2015)

Beta

Beta is a measure of the co-movement of share returns with the market portfolio returns. It expresses the sensitivity of the stock movement to the entire market.

Beta shows how much a stock amplifies the swings of the market portfolio. Beta values higher than 1 indicate that the stock is more volatile than the market while for Beta values less than 1 the opposite holds. Higher volatility and hence larger Beta result (theoretically at least) in higher compensation in the form of excess returns as it is risk that shareholders have to bear unable to eliminate it by diversification. Many utility companies have Beta lower than 1 whereas high-tech technology companies have Beta larger than 1.

The most widely used way to estimate the CAPM Beta of a share is through statistical regression. The returns of a company are regressed on the returns of the market portfolio. It has to be noted that regression Betas are sensitive to estimation choices such as the frequency of data, the time period, and the assumption for the market portfolio. Nonetheless, there are no accepted standards dictating the use of specific inputs. As an example, large service providers use different sample periods and data frequency. Bloomberg uses two-year weekly returns while Thomson Reuters, Standard & Poor and Morning star use five-year monthly returns.

Renewable energy projects do not have any stocks listed, therefore we cannot estimate the Beta directly through a regression. However, a representative Beta is derived by using the returns of comparable listed companies, a method called peer review analysis. First the Beta of every company is estimated, and afterwards the obtained values are averaged out. Lastly, the Beta factor is adjusted for the financial leverage of the project[58].

[58] In appendix more detailed description of the steps followed is provided.

The sample used consists of 52 RES European companies that are either pure play (companies that have or very close to single business focus) or that achieve 50 percent of their revenues in the renewable energy industry. An empirical investigation by (KPMG, 2013) showed that 68 percent of the surveyed companies (from Germany, Austria and Switzerland) applied a peer group Beta for the value in use, and 88 percent of the companies derived the Beta for their fair value determination from peer groups.

By using a large amount of representative companies in peer group analysis the estimation error is minimised providing more reliable results. Additionally, it allows determining a representative value for the Beta factor, accounting for the debt to equity ratio and tax rates. This is done by using Hamada's equation (Hamada, 1972):

$$\beta_L = \beta_U * (1 + (1 - Tax) * \left(\frac{D}{E}\right))$$

Legend	
β_L	Levered Beta
β_U	Unlevered Beta
D	Debt
E	Equity

The levered or the regression Beta is first unlevered taking into account the capital structure of the sample companies. Afterwards, it is re-levered, to represent the capital structure and the tax rate specific to every country.

In order to estimate the Beta for every peer company, choices for the frequency, the sample period and the market portfolio are made. Specifically, monthly returns are used for the estimation. Monthly returns circumvent the illiquidity problem that can arise by using weekly or daily returns. The sample period is four and five years of data providing a sample big enough for statistically significant results.

This choice is in line with the common practise of companies as according to a report survey by (KPMG, 2013), 50% of companies listed in the DAX-30 index used a multi-year Beta for a period of four years. Finally, the market portfolio is represented by the MSCI ACWI All[59] cap equity index which covers 23 developed and 23 emerging markets and constitutes of nearly 14 thousand stocks. This broad index is considered an adequate representation of the behaviour of the market as whole.

[59] http://www.msci.com/products/indexes/country_and_regional/all_country/

Table 7: Steps used to calculate Beta

1. First a representative sample of listed firms was collected. In total there are 52 companies listed in European stock markets and also in renewable energy indices. These indices are RENIXX World, ALTEX Global, Ardour Global Alternative Energy IndexSM, DAXglobal Alternative Energy Index, Italian Renewable Energy Index, and ISE Global Wind Energy. Altex Global index includes only pure play companies (companies that have or very close to single business focus). The rest of the indices include companies that achieve 50 percent of their revenues in the renewable energy industry. Most of the companies operate in the wind and solar energy segment. See ANNEX A for the entire list of companies.
2. For every firm regression Betas were obtained using daily and monthly return observations for different time periods (5- 3- 1 year and 6 – 3 months for daily observations and 5-4-3-2 years for monthly observations). The values of Betas were statistically evaluated to test their explanatory value (R^2) and statistical significance (t-statistic and p-value). As mentioned above the index used for market proxy was the MSCI ALL CAP. Daily and monthly prices of the stocks and the index as well as debt to equity ratio and market capitalization of every company were collected from Thomson Reuters Database.
3. All Betas that were statistically significant were averaged and unlevered using Hamada's equation. The debt to equity ratio used was the average ratio of the companies used as suggested by (Damodaran, 1999).
4. In total nine different Betas were obtained. Our evaluation of which to use was based on the literature and also on statistical evaluation. Monthly returns were preferred over daily returns to avoid the illiquidity problem that would underestimate our Beta. Also the R^2 of daily returns was lower than monthly indicating lower explanatory power. From the monthly we chose five and four years results as they had the lowest standard error compared to three and two years. Also, the longer periods had more results statistically significant increasing our sample and subsequently decreasing substantially the standard error.
5. The two unlevered Betas were finally re-levered again to the target debt to equity ratio which is 70/30. For every country we obtained a different Beta as the corporate tax rate changes.
6. As a final step to cross-check our results we estimated again the Beta using a sub-sample of the original. Companies that operate only into the wind and solar sector were included. The new Beta had no significant difference from the one obtained using the full sample.

Annex C - Cost of debt

Cost of debt is the total amount of interest paid by an entity so as to borrow money. The lenders, who provide funds, will require higher returns for financing more risky investments. Hence, the higher the probability of the borrower to default on his payments, the higher will be his cost of debt. This indicator can be modelled by adding a risk premium to the risk-free rate so as to account for the perceived risk.

Equation 1: Cost of debt

$$Cost\ of\ Debt = risk\ free\ rate + risk\ premium$$

As interest payments are usually tax deductible expenses, the cost of debt is used on an after tax basis for the calculation of WACC.

Debt providers demand an interest in order to lend their money which depends on the perceived riskiness of the respective company or project. The cost of debt is the effective interest rate that a company pays for its total debt. As credit providers require higher compensation for facing more risk, the cost of debt rises with the perceived risk of the project.

This chapter aims to identify the cost of debt for renewable energy projects among EU Member States. The concentration is on three RES technologies, onshore wind, offshore wind and PV. For the purposes of this study, we have implemented two different approaches to calculate cost of debt. The first one is based on a report published by Eurelectric (2012) and the second one on a study of Bloomberg (2011). These two approaches are elaborated in the following chapters accompanied by a comparison of the two methods and an investigation of the existing literature.

Approach based on Eurelectric report

The 1st mathematical formula is provided by Eurelectric (2012) and is the following:

$$R_d = European\ RFR + CDS + PS$$

Where:

- R_d: cost of debt
- European RFR: Risk-free Rate at EU-level
- CDS: ten-year Credit Default Spread of the Examined Country
- PS: Renewable Energy Project Spread

As it is stated above, the debt risk premium is estimated on the ground of the average annual ten-year Credit Default Swap quotations of the respective companies.

In the context of our calculations, based on the Eurelectric model, we have the following input parameters:

- Risk-free rate: Average ten-year German bond, for the year 2013, which is equal to 1.57%;
- Debt premium_1 (Credit Spread): Average annual ten-year Credit Default Swap (CDS) for each EU Member State;
- Debt premium_2 (Project Spread): 3% onshore wind, 3.5% PV, 4% offshore wind.

Approach based on Bloomberg study

The 2nd calculation model is introduced by Bloomberg and it is calculated by using the following mathematical equation:

$$R_d = TS + CR + PS$$

Where:

- R_d: cost of debt
- TS: Term Swap Interest Rate
- CR: country risk
- PS: Renewable Energy Project Spread

The "Term Swap" is defined as a fixed payment exchange for a floating payment that is linked to an interest rate (mostly LIBOR). In addition, the "country risk" is equal to the difference between the average ten-year national government bond interest rate and the respective interest rate of Germany. It is necessary to mention that tax savings are included into the cost of debt while it is calculated on an after-tax cost basis in the WACC formula. Finally, the "Project Spread" is the risk component related to the risk of a RES project that is incorporated into the calculation of the total cost of debt. This indicator constitutes the risk premium charged on loans by bank borrowers (UKERC, 2014) and, based on Mazars (2012), exceeds 3% for wind energy technology.

For the case of offshore wind technology, this risk premium generally shows 0.4-1% higher margins than that of onshore wind projects (Bloomberg, 2011).

About the project spread of PV, this range between the respective values of the two other renewable technologies, as Mintz Levin (2012) considers higher margins than these of the onshore wind energy. In the context of our analysis, we assume the following project spreads: 3% onshore wind, 3.5% PV, 4% offshore wind.

As an example, a 138 MW wind energy project in Italy, in 2010, had a debt ratio equal to 78% and margins on the loans ranging between 2.6-2.9% (WEF, 2011).

The report of Clean Energy Pipeline states that onshore wind and solar PV power plants are financed at an average of 3.2% above LIBOR, in Europe. For the case of offshore wind farms, this margin is slightly higher than 3.5%.

For the case of the 2nd mathematical formula, the values of the input variables are as follows:

- Risk-free rate: Term Swap equal to 2.68%;
- Debt premium_1 (country risk): (Average ten-year national government bond interest rate) – (Average ten-year German government bond interest rate);
- Debt premium_2 (Project Spread): 3% onshore wind, 3.5% PV, 4% offshore wind.

Existing relative reports

According to the study of Ecofys (2011), the utilised mathematical formula for the quantification of the post-tax cost of debt is highly correlated with the 1st model and is the following:

$$R_d = RFR + RP$$

Where:

- R_d: cost of debt
- RFR: (real Risk-free rate) = (Nominal Risk-free rate) – (Inflation rate)
- RP: (Risk premium) = (Expected Market rate of return) - (RFR)

This study provided an illustrative case study for the calculation of the pre-tax WACC indicator. In this example, the debt to equity ratio was equal to 70:30, the nominal risk-free and inflation rate were 4% and 2%, respectively, and the expected market rate of return was 4.3%.

Based on the report of (Deloitte, 2013), the cost of debt is equal to the aggregation of a risk-free rate plus a spread that reflects the risk premium. For the case of the spread term, the Interest Coverage Ratio (ICR) is used where the risk profile was calculated by incorporating the ratio of EBIT to interest expenses. According to the unconditional method, as risk-free rate is considered the average rate of return on government bonds for the previous year.

Based on the study of (KPMG, 2013), the average cost of debt, before corporate taxes, used for the Eurozone and Switzerland was 5.7% and 4.6%, respectively, for the year 2011/2012. In this report, it is also stated that the average cost of debt, utilised in German companies that were surveyed, was equal to 5.7%.

Moreover, a distribution of the average cost of debt is also provided for all categories of industry. Based on this report, the average cost of debt, before corporate taxes, is equal to 4.7%, for the case of "Energy & Natural Resources", compared to the total average of 5.6% of all examined sectors of activity.

Based on the study of IPART (2013), the cost of debt is equal to the nominal risk-free rate plus a debt margin. For the calculation of the debt margin, there are available two different approaches, using current market data and long-term averages, respectively. For the case of the risk-free rate, the 1st approach uses the 40-day average of ten-year Common wealth government bond yield and the 2nd uses the ten-year average of the ten-year Common wealth government bond yield. About the debt margin, the seven-year Bloomberg fair value curve and the ten-year average of seven-year Bloomberg fair value curve, for the two different approaches, respectively. At last, an allowance of 12.5 basis points for debt raising costs is added to the cost of debt.

Different studies use a range of different values for the case of the debt margin/cost of debt. Grant Thornton (2012) utilised a nominal cost of debt around 8.5% to 9.0%. This range was grounded on the weighted average interest rates on credit outstanding for large and small businesses over the last twelve months as published by RBA and current cost of debt of the company being valued. Grant Thornton (2012) used a nominal cost of debt of 12% according to discussions with the management sector of the company being valued. Ernst & Young (2012) assumed a nominal pre-tax cost of debt of 6.1%. They considered the margin implicit in corporate bond yields over government bond yields and the debt ratings of comparable companies.

Putting it together

Summarising the two approaches presented above, the cost of debt is dependent on three elements, the risk-free rate, the project spread and the country risk component. While the underlying assumption is the same in both approaches, although, the inputs change. The risk-free rate is estimated by using the German bond as a proxy in the first and by the swap curve in the second. Also, two different approximations for the country premium were taken into account.

In the first case, the country premium is considered to be equal to the respective credit default swap while in the second equal it is to the difference of the ten-year government bond yields. These two approaches result in a range of the cost of debt rather than in a point estimate. The following graph depicts the cost of debt for all EU Member States using both approaches for onshore wind projects.

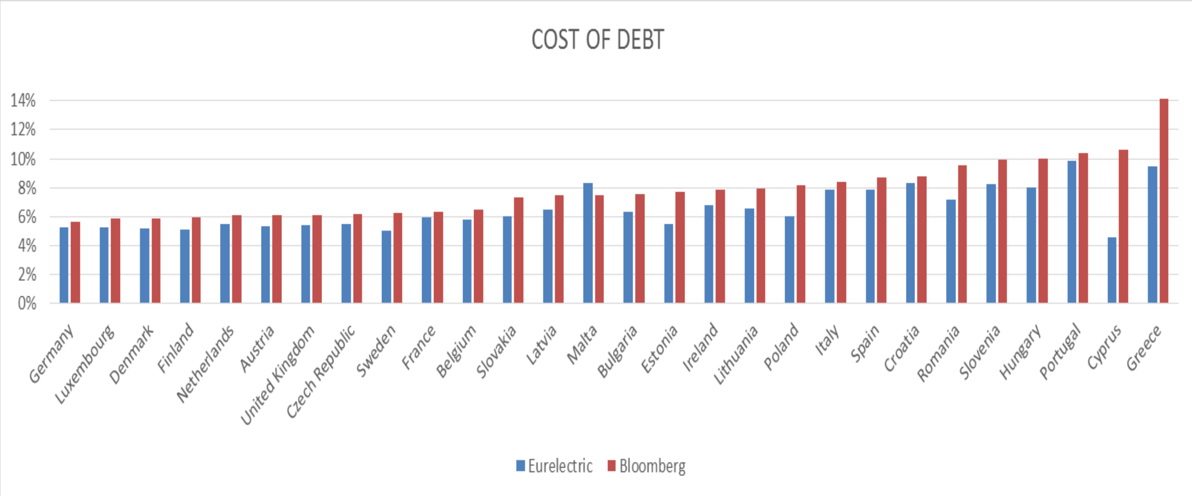


Figure 25: Cost of debt of onshore wind in EU-28 MS

Source: Own calculation based on (Bloomberg, 2011; Eurelectric, 2012), project spread 3%

The cost of debt is regarded as more straightforward and simpler to estimate compared to the cost of equity. However, this is the case when the calculation is for a firm, especially when listed. The fair level of the cost of debt can be approximated by the credit rating of the company. Unfortunately this is not the case for this assessment. The main objective of these calculations is to determine the cost of debt for a renewable energy project. Projects do not have credit rating and if they do they are scarce. Therefore, an aggregate approach was implemented.

As input for the model, the results of both Bloomberg and Eurelectric approaches were discussed with financial experts. Based on this discussion the results of the Eurelectric approach was chosen as input for the WACC estimations, as this gave a more realistic result, especially for Greece and Cyrus.

Capital structure

Capital structure refers to the amount of equity and the amount of debt that a company or a project is using for its funding. The proportion of debt and equity may depend on the strategy that a company wants to follow but also on the industry sector that it operates. A large proportion of debt is considered as a more aggressive strategy as it could provide the potential to generate higher earnings but also increase the risk of bankruptcy. Industries that are capital intensive usually accumulate larger amounts of debt to fund their activities.

Debt is considered to be cheaper than equity as it takes lower risk position and thus project owners generally aim to increase the inclusion of higher debt into a RES project. The rest of this chapter examines the existing literature regarding the Debt to Equity ratio.

Based on studies before current financial crisis, the proportions of debt and equity in the whole capital expensed on a RES project were 80% and 20%, respectively. Nevertheless, it is considered that, during the financial crisis, the debt level has been reduced, reaching 70% in the post financial crisis era. According to MAZARS (2012), the debt share in onshore wind energy projects in United Kingdom, used to be greater than 80% and showed a slight decrease in 2009 and 2012, at approximately 75%. Klessmann, et al. (2013) also stated that the gearing level has changed after the induction of financial crisis, as the 80:20 debt to equity ratio has altered to 70:30.

Based on the study of NREL (2011), the capital structure for onshore wind energy investments for several countries of Europe and for the year 2008 is presented in Table 8.

Table 8: Onshore financial parameters by country in 2008

Country	Debt to Equity Ratio
Denmark	80:20
Germany	70:30
Netherlands	80:20
Spain	80:20
Sweden	87:13
Switzerland	70:30

Source: NREL, 2011

In Table 9, the shares of debt and equity are presented for the main RES technologies in Germany, for the 3rd quarter of 2013.

Table 9: Financial parameters for main RES technologies in Germany (Q3, 2013)

Technology	Debt to Equity Ratio
Onshore Wind	70:30
Offshore Wind	60:40
PV	80:20

Source: Fraunhofer (2013)

Relevant studies include Knápek & Vašícek (2009) who assume debt to equity ratio equal to 60:40 for a representative case of wind energy project in Czech Republic. Similar was the proportion of debt in onshore wind projects in Greece. According to YPEKA (2012) debt accounted for 60% into the total funding of onshore wind and PV projects. For the case of offshore wind energy plants, and according to (EWEA, 2013), the current debt share for the majority of offshore wind farms ranges between 60% and 70%. Based on this study, the cost of finance through debt is highly correlated with the current macroeconomic factors’ trend and existing liquidity limitations in the banking market.

In addition, the report of KPMG (2013) also pinpoints that the financial crisis in Europe has led to limited banking activities. According to the calculation model proposed by this study, the debt share was equal to 60% to 65% for offshore wind projects in Germany. The past gearing level of offshore wind projects had been sometimes higher than 80%.

Data Insight Report published by Clean Energy Pipeline in 2013 provides debt financing details for offshore wind energy projects implemented in Europe, displayed in Table 10 below.

Table 10: European offshore wind project debt finance (Clean Energy Pipeline, 2013)

Offshore Wind Project	Country	Financing Date	Debt to Equity Ratio
Butendiek – 288MW	Germany	1/2/2013	65:35
Lincs – 270MW	UK	1/6/2012	43:57
Northwind – 216MW	Belgium	1/6/2012	70:30
Baltic 1 – 48.3 MW	Germany	1/12/2011	69:31
Meerwind – 288MW	Germany	11/8/2011	69:31
Global Tech 1 – 400MW	Germany	11/7/2011	60:40
Thornton Bank (C-Power) Phases 2 & 3 – 295.2MW	Belgium	1/12/2010	67:33
Borkum West II – 200MW	Germany	1/12/2010	64:36
Bligh Bank Phase I (Belwind) – 165MW	Belgium	1/7/2009	89:11
Thornton Bank (C-Power) Phase 1 – 30MW	Belgium	1/5/2007	80:20

Based on the report of Freshfields Bruckhaus Deringer (2013), current financial recession affects offshore wind industry in a direct way, as it decreases risk appetite among banks and overall liquidity. According to the analysis of Clean Energy Pipeline, a leverage ratio of 60% is assumed and stated that only the 2:3 of the new installed capacity will be partly funded by debt.

In this assessment the assumption for the gearing level is 70% debt and 30% equity.

Annex D – Weighted Average Costs of Capital

In order to fund investments, companies need to raise capital. This capital be their own capital or is attracted from external parties such as investors and/or banks. These external parties will require then a fee for the money that they have made available for these projects. This is referred to as cost of capital and is basically the cost that a company has to bear in order to raise all needed funds. From an investors' point of view, cost of capital is the required return that is demanded in order to invest. Hence, the cost of capital sets a threshold in the evaluation of a project for the minimum return required.

The weighted average cost of capital (WACC) is used to measure the cost of capital. The total capital of a company consists of debt and equity. The weighted cost of capital of a firm is the summation of the cost of every capital component multiplied by its proportional weight. The equation above illustrates that:

Equation 2: Weighted Average Cost of Capital (nominal, post-tax)

$$WACC = \frac{E}{D+E} * R_E + \frac{D}{D+E} * R_D(1 - Tax)$$

Legend	
WACC	Weighted Average Cost of Capital
E	Equity share
D	Debt share
R_E	Cost of equity
R_D	Cost of debt

The WACC represents the minimum rate that a company must bear given the existing assets in order to satisfy its creditors. Creditors will demand higher return to fund riskier activities. Hence, the WACC when calculated will produce a rate representative of the level of risk present in a company's activities.

When choosing the appropriate discount rate to evaluate a project, companies can either choose a corporate WACC or a WACC specific to a project. The cost of capital of the entire firm is not necessarily the same as the cost of capital of a project within the firm. This is because the risk of a project can be different from the risk of the overall company and/or because it has different proportion of debt and equity (debt/equity share). Therefore in order to estimate the WACC for a project we can view the project as undertaken by a company specifically set up for this project, having the same capital structure with it. Hence, the estimated WACC will reflect the risk of the project.

To calculate the WACC, the required return by both debt and equity providers is needed as well as the ratio between the debt and equity share.

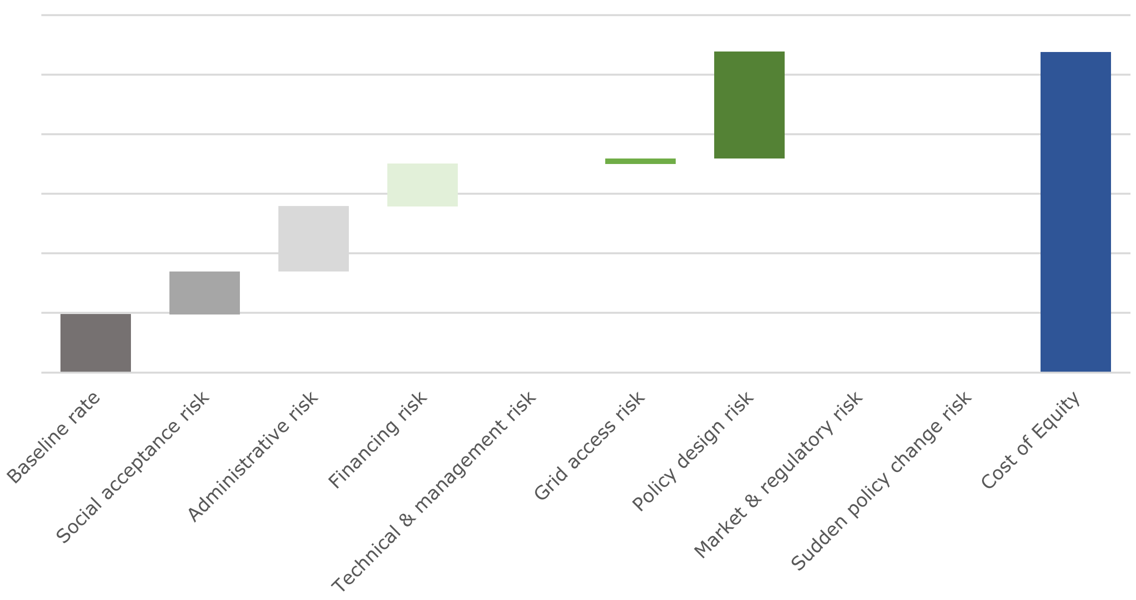
Annex E – Template used for interviews for wind onshore investments risks and cost of capital (example The Netherlands)

Part 1: Investment activities (approximately 5-10 minutes)

a. What kind of projects are you usually involved in? (Infrastructure, buildings, technology, RES etc.)?
b. What kind of project do you regard as the safest investment option in the Netherlands? (Roads, bridges, other infrastructure etc.). What characteristics of such a project make it a "safe" investment?
c. Do you consider an investment in renewable energy projects more risky than the aforementioned project? If so, which characteristics are causing differences in the risk profile?

Part 2: Renewable energy investment risks (approximately 10 minutes)

In our project we assume that cost of equity is the sum of a baseline rate plus risk premiums for project risks. In our project we tried to model this. We identified nine risk categories that we assume would be influencing the cost of equity. The figure below shows a possible decomposition for a RES project in the Netherlands. At the far left we depicted the baseline rate and at the far right the cost of equity before de-risking. The differences between the rates are caused by nine risk categories.



In your opinion:

a. Are there any risks missing?
b. What category has the highest and the lowest impact on the cost of equity?
c. Could you give basis points to the individual risks?
d. If not, can you rank one over the other?

Part 3: Policy-related risks (approximately 5-10 minutes)

a. Which renewable energy policy measures or changes of the last five years have changed the risk rates? Can you quantify the impact in basis points?
b. How effective are the current renewable energy policies in reducing the renewable energy investment risks? Could you rate this on a scale from 1-5 (1=having no influence at all, 5=reducing the whole risk) or quantify them in basis points?

Part 4: Model results (approximately 10 minutes)

In the last part of this interview, we would like to share some of our assumptions and results with you, to test how these compare to your estimations.

1. Debt/Equity ratio

a. In order to calculate the WACC (Weighted Average Cost of Capital) we assumed that the project is financed with 70% Debt and 30% Equity. Do you find this ratio reasonable? Have you observed something else?
b. Which factors exert the highest influence on the Debt/Equity ratio of a project?

2. Total WACC

Term	Description
WACC	Onshore wind: 6.4%

a. Do you agree with our estimation of the WACC? Should it be lower/higher?
b. Does this WACC change in your projects (depending on the country, technology, project size, etc.)?
c. Do you expect higher or lower WACC for a large scale PV power plant (>1MW) and/or off-shore wind projects? How would the WACC change?

3. Cost of equity:

To estimate the cost of equity, we used the following assumptions and data:

Cost of equity = Risk-free rate + beta(Market risk premium)*

In which:

Term	Description
Risk-free rate:	10 year government bond
Market risk premium:	6%
Cost of equity:	10.8% (wind onshore)

a. Do you agree with our estimation of the cost of equity for an onshore wind project in the Netherlands? Would you say that the cost of equity for the Netherlands is higher or lower? Can you indicate how much higher or lower?
b. Do you expect higher or lower cost of equity for a large scale PV power plant (>1MW) and/or off-shore wind projects? How would the cost of equity change?

<u>4. Cost of debt:</u>

To estimate the cost of debt, we used the following assumptions and data:

Cost of debt= Risk-free rate + Country risk spread + Renewable energy project spread

In which:

Term	Description
Risk-free rate:	2.7% zero swap curve (10 years maturity)
Country risk spread:	0.4%
Renewable energy project spread:	3% onshore wind, 3.5% PV, 4% offshore wind
Debt term	10 years
Cost of debt:	onshore wind: 5.5-6.1% offshore wind: 6.5-7.1% PV: 6-6.6%

a. Do you agree with our estimation of the cost of debt? Should it be lower/higher?
b. How many basis points do you add for the respective technologies?

Closure

Finally we would like to ask you the following questions:

a. Do you have any other remarks?
b. Is there anyone you would recommend us to contact?
c. Are you interested in the further developments of the DiaCore project? If yes, in which area in particular? Would you be willing to be invited to future workshops?
d. Can we add your name and the company name to the interview list?

Thank you very much for your kind cooperation!

Annex F – Impact of support scheme changes on the cost of capital questionnaire

Survey contacts

Associations:

- EDORA, the Walloon wind energy association
- EWEA, the European Wind energy association (financing working group)
- German wind power association;

Conferences, workshops:

- Key participants from the Windenergietag in Germany.
- DiaCore Workshop at Brussels;
- Meeting with RES experts in Finland;
- Presentation of results at EUSEW

Mailing lists:

- Project’s Tweeter account (156 followers now)
- Energy-L email list
- Google Strommarktgruppe

Personal contacts (DiaCore email list):

- Partners of Ecofys wind energy unit
- About 50 people in NL, BE, UK, DE, FR, IE and LU
- More than 50 people from LT, LV, EE, FI and HR
- Interviews and direct mailing of DiaCore Interview partners (appr. 80 people in);
- Large wind power installers

Questionnaire

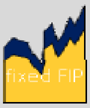
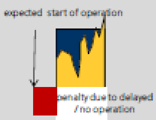
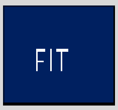
Influence of policy design – comparing investment cases

Technical & financial parameters
- 20 MW wind onshore plant
- 1.5 M€/MW investment
- Average full load hours: 1900 p.a.
- Lifetime of plant: 20 years,
- Term structure: fixed interest over 10 years
- Project reached financial closure

The base case – Sliding Feed in Premium

	In this case, we have a **Sliding Feed in Premium (FIP)** for 20 years paid by final consumers. There is, no adjustments or changes of to the tariff for existing generation plants. There is an, annual digression of FIP for new installations released 12 month in advance, guaranteed grid connection, no shut downs due to grid bottlenecks.		
	Interest rate (per annum)	**Minimum Return on Equity in %**	**Minimum equity share**
Our estimation	**5%**	**10%**	**20%**
If different, please indicate change	+/-…%	+/-…%	+/-…%

Please indicate how these parameters will change compared to the base case if the policy design changes. ***You can indicate ranges or numbers.***

	**Sliding Feed in Premium – no premium if power prices are negative** In this case the policy scheme is still a sliding feed-in premium, but there will be no premium payments when the power price is negative. *All other design elements remain unchanged*		
	Interest rate (per annum)	**Minimum Return on Equity in %**	**Minimum equity share**
Indicate change	+/-…%	+/-…%	+/-…%
	**Fixed Feed in Premium** In this case, we move from a sliding feed-in premium to a fixed feed-in premium. *All other design elements remain unchanged*		
	Interest rate (per annum)	**Minimum Return on Equity in %**	**Minimum equity share**
Indicate change	+/-…%	+/-…%	+/-…%
	**Sliding Feed in Premium – tender procedure and penalty for project delays** In this case, the project is obtained via a **tender procedure**. The feed in premium is based on the winning bid. The policy scheme used during operation is a **sliding Feed in Premium,** but including **penalty payments** if operation is delayed (delay 6 or 12 months: penalty = 5% to 10% of investment volume).		
	Interest rate (per annum)	**Minimum Return on Equity in %**	**Minimum equity share**
Indicate change	+/-…%	+/-…%	+/-…%
	**Feed-in tariff** In this case, we move from a sliding premium to a fixed feed-in tariff. *All other design elements remain unchanged*		
	Interest rate (per annum)	**Minimum Return on Equity in %**	**Minimum equity share**
Indicate change	+/-…%	+/-…%	+/-…%

Annex G – Wind sector development in Member States

Member State	Share 2012	Points	Capacity 2011	Inst. 2012	Increase (%)	Capacity 2012	Inst. 2013	Increase (%)	Capacity 2013	Inst. 2014	Increase (%)	Av. Increase	Points	Capacity 2014	Points	Total
Germany	17,66%	8	29071	2297	7,90%	30989	3238	10,45%	34250	5279	15,41%	11,25%	4	39165	10	**8**
UK	9,41%	6	6556	2064	31,48%	8649	2075	23,99%	10711	1736	16,21%	23,89%	7	12440	8	**7**
Spain	21,66%	9	21674	1110	5,12%	22784	175	0,77%	22959	28	0,12%	2,00%	1	22987	9	**7**
Romania	8,37%	5	982	923	93,99%	1905	695	36,48%	2600	354	13,62%	48,03%	10	2954	5	**6**
Sweden	9,53%	6	2899	846	29,18%	3582	689	19,24%	4382	1050	23,96%	24,13%	7	5425	6	**6**
Denmark	29,58%	10	3956	220	5,56%	4162	694	16,67%	4807	67	1,39%	7,88%	3	4845	6	**6**
Portugal	22,34%	9	4379	155	3,54%	4529	200	4,42%	4730	184	3,89%	3,95%	2	4914	6	**6**
Poland	7,27%	4	1616	880	54,46%	2496	894	35,82%	3390	444	13,10%	34,46%	8	3834	5	**6**
France	5,73%	3	6807	814	11,96%	7623	630	8,26%	8243	1042	12,64%	10,95%	4	9285	7	**5**
Italy	6,52%	4	6878	1239	18,01%	8118	438	5,40%	8556	108	1,26%	8,22%	3	8663	7	**5**
Austria	5,74%	3	1084	296	27,31%	1377	308	22,37%	1684	411	24,41%	24,69%	7	2095	4	**5**
Belgium	6,57%	4	1078	297	27,55%	1375	276	20,07%	1666	294	17,65%	21,76%	6	1959	4	**5**
Netherlands	8,13%	5	2272	119	5,24%	2391	295	12,34%	2671	141	5,28%	7,62%	3	2805	5	**5**
Finland	1,52%	1	199	89	44,72%	288	163	56,60%	449	184	40,98%	47,43%	9	627	3	**4**
Estonia	9,10%	6	184	86	46,74%	269	11	4,09%	280	23	8,21%	19,68%	6	303	2	**4**
Greece	7,86%	4	1634	117	7,16%	1749	116	6,63%	1866	114	6,11%	6,63%	3	1980	4	**4**
Lithuania	6,49%	4	179	60	33,52%	263	16	6,08%	279	1	0,36%	13,32%	5	279	2	**3**
Bulgaria	5,82%	3	516	158	30,62%	674	7	1,04%	681	9	1,32%	10,99%	4	691	3	**3**
Cyprus	8,47%	5	134	13	9,70%	147	0	0,00%	147	0	0,00%	3,23%	2	347	3	**3**
Czech Rep.	1,26%	1	217	44	20,28%	260	8	3,08%	268	14	5,22%	9,53%	4	282	2	**2**
Hungary	3,80%	2	329	0	0,00%	329	0	0,00%	329	0	0,00%	0,00%	1	329	3	**2**
Latvia	2,22%	2	48	12	25,00%	60	2	3,33%	62	0	0,00%	9,44%	4	62	1	**2**
Slovenia	0,00%	0	0	0	0,00%	0	2	0,00%	2	1	50,00%	16,67%	5	3	0	**1**
Slovakia	0,04%	0	3	0	0,00%	3	0	0,00%	3	0	0,00%	0,00%	0	3	0	**0**