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Mapping the cost of capital for wind and solar energy in South Eastern European Member States

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Pricetag

Mapping the cost of capital for wind and solar energy in South Eastern European Member States

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Executive Summary

- Before investing in a renewable energy project, investors perform a risk analysis. If they see an investment as risky, they will demand a higher fee for making capital available. A similar reasoning holds for lenders: they will ask for more securities, will lend less money and/or charge higher fees. 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.

- Renewable energy projects are highly capital intensive compared to investments into other types of generating resources (gas or coal). Once an investment has been realised, owners of renewable energy installations have only limited means to change their cost calculation in reaction to changing economic circumstances. This also means the cost of capital is a crucial element in every renewable energy investment decision, as emphasised in the DiaCore project.

- The cost of capital varies with the perceived risk of an investment. To address these risks and, thus, lower the cost of capital, renewable energy (RE) policies are generally designed to create more certainty in revenues and expenditures of RE projects. In case policies fail to address uncertainties, the increased cost of capital might cause a decrease in the number of RE projects actually realised.

- The Pricetag report elaborates on the relationship between the weighted average cost of capital (WACC) and RE deployment with a focus on South East European Member States: Bulgaria, Croatia, Greece, Hungary, Romania, Slovakia and on two technologies wind onshore and ground-based PV.

- The cost of capital can be influenced by different factors e.g. the country risk and/or the risks specifically linked to the RE regulatory framework of the country. The country risk refers to factors such as for instance the political stability of a country, its corruption, economic development and exchange rate fluctuations. The country risks affect all investments in a particular country, not only those in RE. We made in this project a distinction between the overall country risk of a country, which affects the RE projects, and the specific risk linked to the RE Policies of that country. For that purpose, we have identified the country-specific WACC component (sovereign risk) and the RES framework specific WACC component.

- The International Monetary Fund interest rates[1] have continuously decreased over the past years. Over 2014-2016, the cost of borrowing for corporations fell by approximately 30%. Hence, the WACCs have decreased for all investments since 2014, but for the most part, not as much for renewable investments. This can be attributed primarily to the cost of debt, and in turn, to the policies of the European Central Bank and the national central banks.

- For most markets, investing in wind onshore and PV adds risks to the investments, compared to the sole country risk. Investing in renewable energy is generally perceived as being a riskier investment compared to equivalent investments e.g. in infrastructure projects. In Bulgaria and Romania, this means an additional 7% points, 5% point in the Slovak Republic and 6% point in Hungary, to the cost of equity. However, in Greece, renewable energy investments are regarded as safer compared to average investments and decreases the risk by 2% points in the case of wind onshore, and 3% in the case of PV. An important element is the monthly payments of the support scheme and its long term support term of 20 years.

- Most selected markets did not benefit from the reduced WACC for the deployment of their wind onshore projects, as much as they could have had, which may be due – in certain cases – to high political uncertainty.

- The WACC for wind onshore ranges in autumn 2016 between 5-6% in Slovak Republic up to 10.5-13.7% in Greece. Except for these two countries, there is a strong consistency between the markets explored in this report: The WACC figures for Bulgaria, Croatia, Hungary and Romania vary between 7% and 9.5%. These are lower than in 2014, because of the policies of the European Central Bank and the national central banks mentioned above.

- There was no wind onshore development in many countries with relatively lower WACC such as the Slovak Republic, Hungary and Bulgaria and only tiny development in Romania (which can be attributed to projects initialised before the market busted in 2015). These results can be explained by the fact that these markets lack an effective support scheme allowing for a robust business case, whereas the generation costs for wind and solar are higher than wholesale electricity market prices.

- Of all markets, the largest wind onshore capacity additions were realised in Greece, despite its staggering WACC: Despite the financial turmoil of the country, Greece did provide an effective support scheme and therewith a business model.

[1] MFI interest rates are all interest rates that monetary financial institutions (MFIs) resident in the euro area – except central banks and money market funds – apply to euro-denominated deposits from and loans to households and non-financial corporations resident in the euro area countries.

- The WACC figures for PV are generally lower than the WACC for wind onshore, because of the lower development, technical and yield risks of PV projects. The WACC for PV investments in Bulgaria, Croatia, Hungary and Romania are relatively similar (between 6.8 and 9.5%), the Slovak Republic has again much lower values (4.5 to 6%), whereas Greece has much higher WACC than the other markets (7.3 to 12.4%). The trend of low WACC for PV investments has been observed also in other European markets (such as Germany or France).

- **From our findings, we draw the following main conclusions:**

  • Technology costs for the main renewable electricity technologies (wind and PV) continue to decrease. As a consequence, the cost of capital for financing renewable energy projects has become more relevant when determining the required return on investment to make projects economically viable and determine if there is a business case compared to other types of investments into energy infrastructures.

  • Our findings, which updates the findings from the DiaCore project, suggest that the cost of capital for renewable energy investments should continue to be an issue of concern when seeking to reach the EU renewable energy targets for 2020 and for 2030 in a cost-effective way:
    - First, in all Member States researched, except in Greece, the cost of capital for RE investments is comparatively higher than for equivalent investments, e.g. into infrastructure. This means it remains politically more challenging to continue the expansion of renewable energy in those Member States.
    - Second, in all researched Member States, the *actual* cost of capital are well above the cost of capital found in the best performing Member States in the EU. This means that taxpayers and consumers pay more than necessary to achieve targets for increasing renewable energy.

  • High costs of capital are not a given. National and European decision-makers can change this situation. However, it seems important to take a "package approach" to reducing the cost of capital for renewable energy investments:

    • Countries can benefit from a low WACC *only if* adequate policies are in place.

    • 'WACC-aware' policies and policy instrument designs can have a significant influence on the cost of capital and hence on the costs of the support schemes.

    • If a stable renewable energy framework is in place, further reductions in the cost of capital can be achieved by applying "de-risking" policies and measures.

    • Policy schemes have to be designed at national and European level to allow for adequate RE business cases and trigger private investments.

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1 Introduction

In January 2014, the European Commission presented its proposal for a 2030 policy framework for climate and energy, and proposed to increase the share of renewable energy to at least 27% of the EU's energy consumption by 2030. In October 2014, EU Heads of State endorsed the binding EU target of 27%, and "*Member States contributions guided by the need to deliver collectively the EU target*". Thus, in contrast to the 2020 renewable energy target, the 2030 renewables target is only binding at EU-level and is not be translated into national binding targets.

On 30th of November 2016, the European Commission presented a legislative proposal for a revised Renewable Energy Directive (RED2). Within this proposal, the European Commission proposed to set up a de-risking mechanism in Article 3.4: "*The Commission shall support the high ambition of Member States through an enabling framework comprising the enhanced use of Union funds, in particular financial instruments, especially in view of reducing the cost of capital for renewable energy projects*".

In 2016, the Diacore report "The impact of risks in renewable energy investments and the role of smart policies" provided an overview of how the cost of capital for wind onshore differed between the EU-28 Member States. It has been instrumental in influencing this interest towards the costs of capital of renewable energy in general and wind onshore in particular. It provided for the first time a mapping of cost of capital of onshore wind projects, based on interviews performed in 2014 across the EU.

Other recent studies have shown a strong correlation between the cost of capital of renewable energy (RE) projects and successful RE deployment policies: a study on emerging markets assessed the impact of the weighted average cost of capital (WACC) on RE deployment. It showed that while a WACC of 3% would lead to a staggering share of 40% of RE in such markets, a WACC of 15% would lead to practically no RE development at all[2]. Another study conducted a sensitivity analysis to examine the impact of WACC on PV deployment costs. It showed that the LCOE of PV could increase by 100% up to 200% if the WACC for the projects increased only from 5% to 10%[3].

The current absence of national renewable energy targets may lead to an increased risk of developing a double-speed Europe. As emphasised by the European Commission in its presentation made on renewable energy on the 30th of November 2016: "*Investments are increasingly concentrated in a*

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[2] Hirth, Steckel, The role of capital costs in decarbonizing the electricity sector, Environmental Research Letters, 2016 http://iopscience.iop.org/article/10.1088/1748-9326/11/11/114010/meta;jsessionid=9033A324CC98E1D1562E81B3DC73D7EE.ip-10-40-1-114

[3] Mayer, Current and Future Cost of Photovoltaics – Long-term Scenarios for Market Development, System Prices and LCOE of Utility-Scale PV Systems, 2015 https://www.agora-energiewende.de/fileadmin/Projekte/2014/Kosten-Photovoltaik-2050/AgoraEnergiewende_Current_and_Future_Cost_of_PV_Feb2015_web.pdf

few Member States with low cost of capital and policy frameworks perceived as more stable. UK and Germany alone represented over 2/3 of all investments over 2013-2015". In most South-East European Member States, renewable energy markets have yet to be further developed, while relying on good RES potential.

The objective of the Pricetag project funded by the European Climate Foundation is to update the 2014 wind onshore cost of capital data from Diacore and to provide cost of capital data for PV projects for 2016 in 6 South Eastern European (SEE) Member States: Bulgaria, Croatia, Greece, Hungary, Romania, the Slovak Republic. Our ultimate objective is to provide short term support to the EU debate on a de-risking mechanism.

Hence, we will provide in this report maps of the SEE region featuring the cost of capital for wind and PV, as well as the cost of debt; the cost of equity; the debt/equity ratio and the 2015 installed capacity.

We will also identify the cost of the country risk and of the policy risk: for each Member State, we will indicatively show which part of the cost of capital is due to the country-specific risk, as opposed to the policy-induced risks due to renewable energy policies under the given market situation.

Furthermore, we will provide a calculation of the policy risk premium in the levelised cost of electricity (LCOE) of wind and PV for each Member State.

Last but not least, we will provide country factsheets for each of the selected countries summarizing our interview results.

2 Methodology

This study estimates the cost of capital for investments in onshore wind and PV projects in Bulgaria, Croatia, Greece, Hungary, Romania and the Slovak Republic. The **cost of capital**, expressed as the weighted average cost of capital (WACC), provides insights on how project financing for similar projects can differ between countries and technologies. Differences in the WACC will also be reflected in the levelised cost of electricity (LCOE) and thus influence the cost-price for which renewable energy is being sold on the market and/or the (minimum) levels of policy support to attract investors.

The Diacore report presented the situation based on 2014 figures. In the Pricetag study, an update is provided for the abovementioned six SEE countries. The assessment focuses on financial parameters such as cost of equity, cost of debt, debt/equity ratio and weighted average cost of capital, for both wind onshore and ground-based PV projects. Furthermore, the impact of the WACC on the LCOE will be estimated. The methodology consists of four steps:

1. Estimating financial parameters (cost of equity, cost of debt, debt/equity ratio and the resulting weighted average cost of capital) for the selected countries based on a theoretical model.
2. Verifying the results of the theoretical model in interviews for financial experts in the selected countries.
3. Estimate the LCOE for wind onshore and PV in the selected countries.
4. Aggregate the results of the theoretical model and the interviews.

In the rest of this chapter, these steps are elaborated in more detail.

2.1 Theoretical model

As part of the Diacore work, a theoretical model has been developed to estimate financial parameters based on financial and economic data. For the current assessment, the same model has been used, updated with current data and expanded with PV. As mentioned above, the following financial parameters have been estimated:

- Cost of equity;
- Cost of debt;
- Debt/equity ratio;
- Weighted average cost of capital (WACC).

In this section, each of the parameters is shortly described. More detailed information can be found in the Diacore report[4].

Renewable energy projects are typically financed by two types of funding: **debt** and **equity**. Debt is typically provided by financial institutions (e.g. banks) while equity is provided by private investors (e.g. pension funds and investment companies). Typically, the cost of equity is higher than the cost of debt. The underlying reason is that equity providers have a higher risk in the return on their investment than debt providers on their loans, as debt providers are first in line to receive any project income and/or in case a project fails. To compensate for this risk, equity providers will demand a higher return on their investment. The **debt/equity ratio**, varies between projects and countries, as lenders will restrict their debt share if the project returns are not sufficiently guaranteed to pay back the loan plus interest. The higher the country or policy risk, the higher the safety margin that lenders will apply, and hence the lower the debt share.

By combining the debt/equity ratio and the cost of debt (i.e. the interest rate for debt) and cost of equity (i.e. the required return on equity for the investment), the **weighted average cost of capital (WACC)** can be calculated. In this project, the WACC has been estimated nominal post-tax, at financial close.

Regarding equity, we used the CAPM model to determine the cost of equity as a starting point for the discussion with interviewees. In addition, we asked them how this cost of equity compared – for instance – to equivalent 'policy risk-free' investments in e.g. infrastructure.

For debt, we used country specific figures (rate, term), to be validated during the interviews. We used as basis for the country risks the country's 10-year government bond and interest rate, and/or of the European Central Bank. This enabled us to define the country risk, anything in excess will be considered a mix of project/technology risk and policy risk which can be disaggregated.

For the debt/equity ratio, we used the highest leverage found in Europe as a benchmark from the Diacore results for wind. For PV, we made a separate enquiry. With the above parameters, and the country specific corporate tax rate, the weighted average cost of capital can be calculated – with and without incorporation of policy risk premiums - as well as the consequence hereof on the levelised cost of electricity.

Reference projects have been defined for both onshore wind and ground-based PV. These formed the basis for the interviews and for the comparative analysis of the cost of capital and the consequences on levelised cost of electricity. The reference projects were chosen to reflect typical project

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[4] http://diacore.eu/images/files2/WP3-Final%20Report/diacore-2016-impact-of-risk-in-res-investments.pdf, annex B (cost of equity), annex C (cost of debt) and annex D (weighted average cost of capital).

configurations to be found in the countries like typical project size, energy yield, and particular technologies applied. For onshore wind a 10 MW project (3 to 5 turbines) was taken as a reference, for solar PV a ground-based system of 1 MWp.

The results, which should be regarded as a starting point for discussion, were verified in interviews with financial experts.

2.2 Interviews

The results of the financial model were verified in structured interviews with project developers, utilities, financial experts in each of the selected countries. The purpose of the interviews was threefold:

1. To verify and discuss the results of the financial model with financial experts.
2. To gather detailed insights in financing renewable energy projects in the six SEE countries.
3. To gather input on the discussion what de-risking mechanism are needed to lower risks and the cost of capital for renewable energy investments.

In each country, financial experts were interviewed. Each interview took about half an hour.

The model estimates were included in the interview template to feed the discussion with the experts on the financial parameters. A summary has been drafted for each interview which has been sent to the interviewee for a final check. Interviewees were explicitly asked for permission to use the data provided in the interview and to include their names in the overview of interviewed experts. In the results, no direct reference will be made to the interviewees and their responses.

The interview template and the list of financial experts can be found in the Annex.

We collected the data via interviews with project developers and banks in each Member State regarding PV and wind onshore projects. Where possible, we combined the interviews for wind and solar. We requested input regarding the development phase of a project (e.g. before or after financial close).

During the interview process, we learnt that some in some of the target countries, the deployment of wind onshore projects has come to a halt due to changes of the policy framework. The low market performance made the collection of certain market data more difficult and in some cases (such as Romania) almost impossible. Nevertheless, based on comparisons with neighbouring markets, other technologies and historic data, it was still possible to come up with meaningful and relevant results.

2.3 Levelised cost of electricity (LCOE)

The WACC influences the cost structure of the renewable energy investment and will therefore impact the LCOE. By using a simplified LCOE-model, the impact can be estimated and the LCOE of similar wind onshore and PV projects can be determined. Part of this assessment is to calculate the policy risk premium as a share of the LCOE. This can be made visible as a share of the LCOE, by highlighting the risk premium added for renewable energy projects for both debt and equity. Input for this estimation will be derived from the interviews.

It should be noted that there are many ways of calculating the LCOE, which means that the outcome of this assessment will only provide an indication for the LCOEs. Comparing the LCOE between countries can provide useful insights, but are not always a very accurate indicator for the effectiveness of renewable energy policies. The LCOE is also influenced by more country specific circumstances (such as taxes and debt-terms), which make comparing more difficult. In the report, careful attention will be paid to addressing the results and the extent to which conclusions can be drawn.

In order to calculate the LCOE, we took into account capital expenditures (CAPEX), operational expenditures (OPEX), project (economic) lifetime, taxes and tax structure etc. This allowed us to make a proper estimate of the LCOE and the impact of policy risk premiums for each country.

2.4 Analysis and results

The input gathered in these interviews formed valuable input for the report. The expert interviews on the financial parameters were used to check model outcomes and underlying assumptions. The input of the experts is generally leading, as they have the day-to-day experience with renewable energy investments. The assessment of the model results were also used to update the financial model.

The results are presented in maps of the EU-28, using colours to indicate the differences between the six selected countries. For each financial parameter and the LCOE, two maps will be provided (see next chapter) presenting the results of wind onshore and PV. For wind onshore, a third map will be added, indicating how the WACC had changed for onshore wind investments between 2014 and 2016.

Besides the data on financial parameters, the experts were also asked to share experiences on investing in renewable energy, mostly in relation to the investment risks. Also opportunities for de-risking mechanisms were asked for, and the effect hereof on reducing the cost of equity and WACC. This part of the interviews forms important input to the EU debate on de-risking mechanisms for renewable energy investments in SEE countries.

3 Mapping the cost of capital in the South Eastern European Region

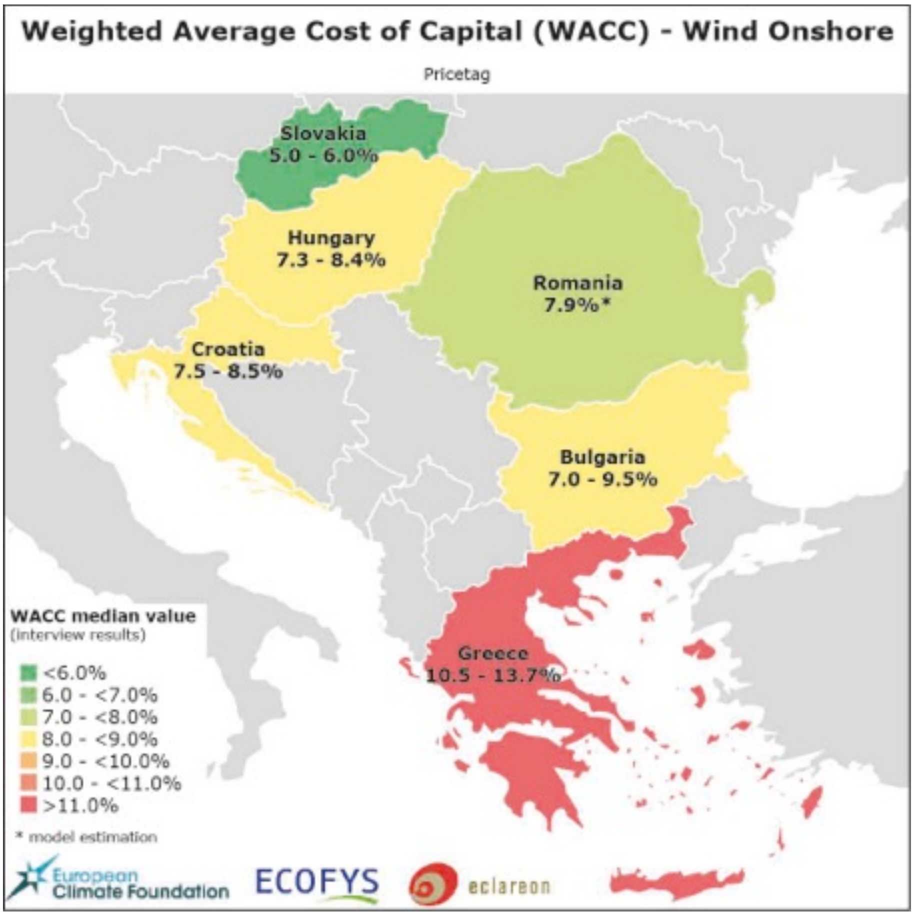
Based on the interview results, we drew maps of the SEE region showing, for the selected countries:

1. The cost of capital for wind onshore and PV.
2. The cost of debt for wind onshore and PV.
3. The cost of equity for wind onshore and PV.
4. The debt/equity ratio for wind onshore and PV.
5. Comparison 2014 and 2016 WACC for wind onshore.
6. Installed capacity for wind onshore and PV.

Please note that the colouring in the maps have been based **on the median value of the interview results and not the average results, in order to avoid run away figures** (except for the debt/equity ratio maps, which use average values to improve their readability). Since there has been no wind power development in Bulgaria, Hungary and the Slovak Republic for several years, the estimates below, which are based on detailed interviews with experts, have to be considered as hypothetical. Furthermore, please note that the figures related to wind onshore in Romania are model estimations. Due to the current situation of the Romanian wind onshore market, it was not possible to acquire solid market-based figures in the interviews. The model estimations for wind onshore in Romania were further validated through a comparison with the wind onshore figures of neighbouring markets, a comparison for PV in Romania and historic Romanian wind onshore figures. More information can be found in the country profile of Romania.

3.1 Cost of capital

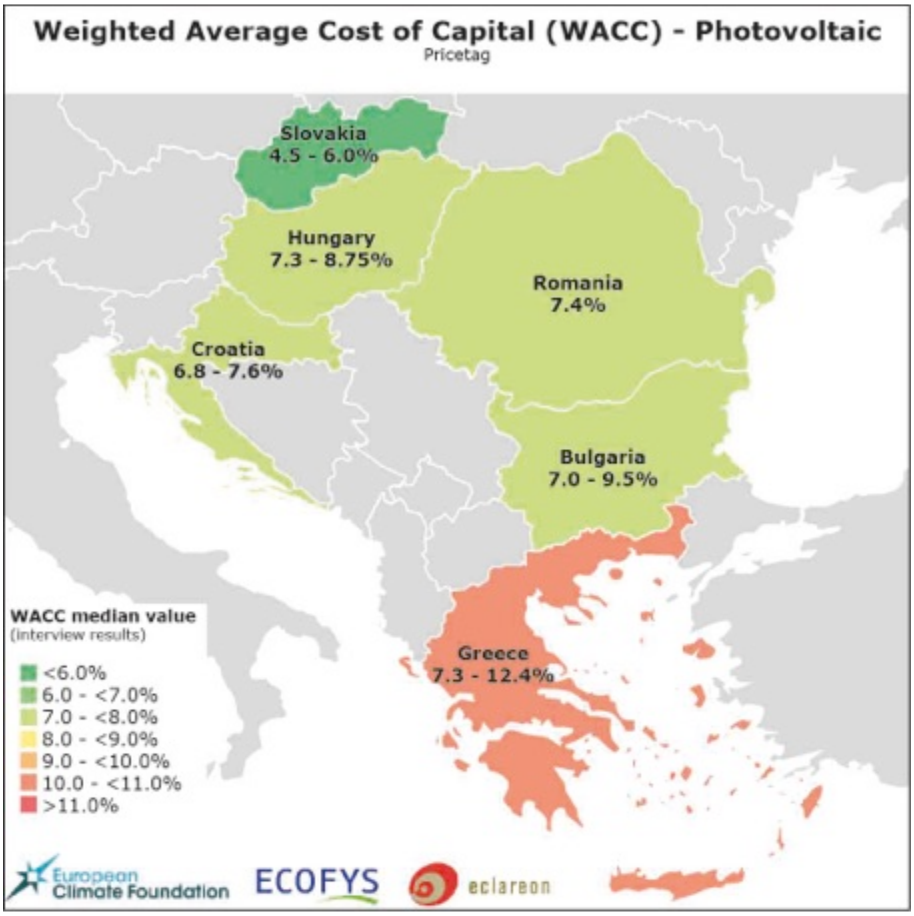
The map below provides an overview on the weighted average cost of capital for wind onshore projects in Bulgaria, Croatia, Greece, Hungary, Romania and the Slovak Republic.



The results show a large margin that ranges from 5-6% in the Slovak Republic up to 10.5-13.7% in Greece. Within this region, there is a difference of up to seven percentage points in WACC. Except for Greece and the Slovak Republic, there is a strong consistency between most markets of the SEE region: The WACC figures for Bulgaria, Croatia, Hungary and Romania vary between 7% and 9.5%. The WACC level for Greece does not show a great difference with the 2014 DiaCore value of 12%, as the national economic environment and the investment level in the wind energy sector remained generally the same.

As explained in the country profile in greater detail, the strong decrease of the WACC in The Slovak Republic can be attributed to the profound economic growth of the Slovak economy in general, and not to the specific RES policy.

However, these results have to be taken with some caution, as in most countries, there is no wind onshore development at the moment.



The WACC figures for PV are generally lower than the figures for wind onshore. These findings resonate with experiences from earlier studies, such as DiaCore, where interviewees pointed out that the WACC of PV projects is usually lower than the WACC of wind onshore projects, because of the lower technical and resource risks of PV projects.

The WACC figures of PV projects follow a similar pattern as those for wind onshore: The WACC for PV investments in Bulgaria, Croatia, Hungary and Romania are relatively similar (between 6.8 and 9.5%), the Slovak Republic has again much lower values due to its strong macro-economic situation (4.5 to 6%)[5], whereas Greece has much higher WACC than the other markets (7.3 to 12.4%). In Greece, the wide range of WACC value responses highlights the absence of considerable investments in the PV sector from 2014, due to the establishment of the Greek law 4254/2014, which imposed significant retroactive cuts of the FIT for solar PV projects.

[5] Due to the weak position of the Slovak PV sector it was possible to collect numbers from only two interviews on the situation of the PV market.

3.2 Cost of debt

The results for the Cost of Debt (CoD) of wind onshore projects show a range of six percentage points. In the Slovak Republic, Hungary, Croatia and Romania, the figures vary between 5% and 7%, whereas in Bulgaria and Greece, the range is significantly higher, between 7% up to 11%. The colouring of Bulgaria (7%-10%) is even darker than in Greece (7%-11%) because we looked at the median values and not the average values, and the results for Bulgaria were more uniform than those in Greece. The main reason for the high value in Bulgaria is the severe scepticism of local banks due to the uncertain investment climate.

In comparison to the values collected in the Diacore project in 2014, the CoD has strongly decreased. This is likely explained by the policies of the European Central Bank and the national central banks. The International Monetary Fund interest rates[6] have continuously decreased over the past years

[6] MFI interest rates are all interest rates that monetary financial institutions (MFIs) resident in the euro area – except central banks and money market funds – apply to euro-denominated deposits from and loans to households and non-financial corporations resident in the euro area countries.

(ECB 2016a)[7], only in the time period 2014-2016, the cost of borrowing for corporations fell by approximately 30% (ECB 2016b)[8].

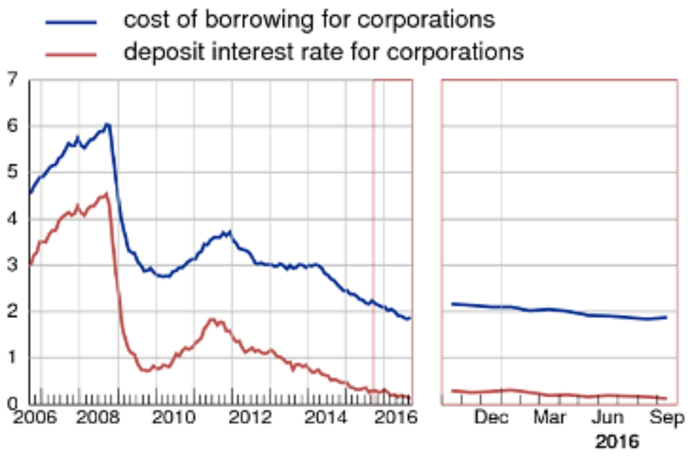


Table xx: European Central Bank press release of November 2016: https://www.ecb.europa.eu/press/pdf/mfi/mir1611.pdf

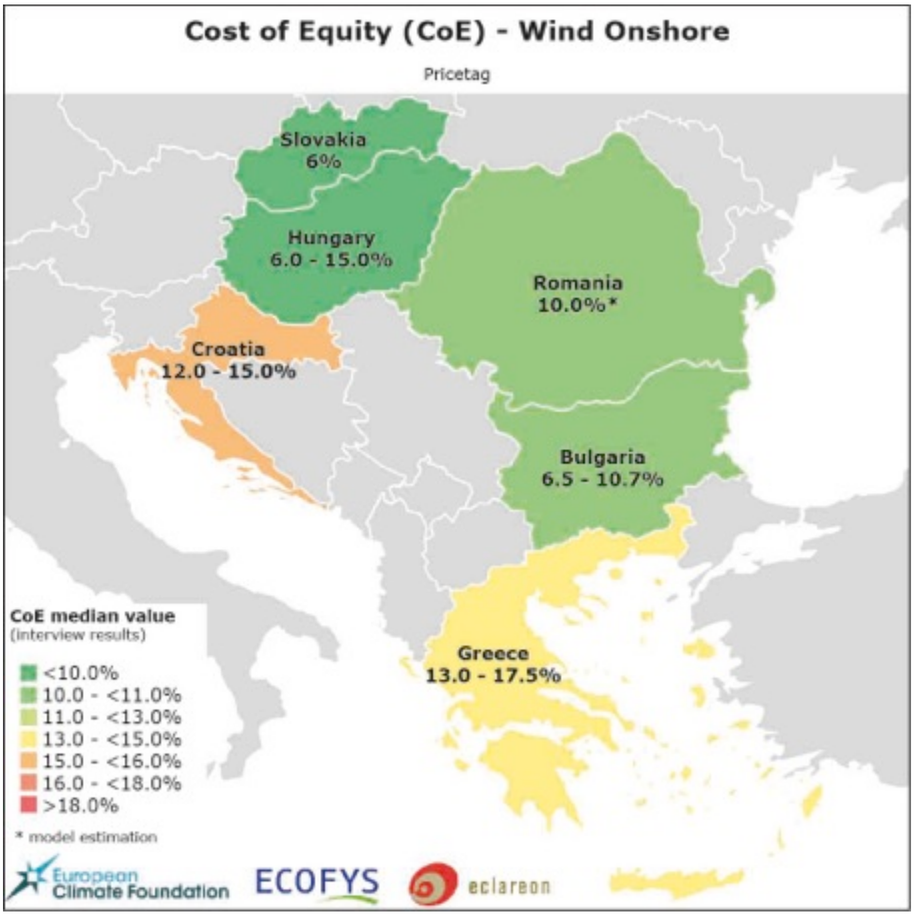
This resonates with interview results where bank representatives pointed out that capital is abundant for projects with a solid business case.

[7] https://www.ecb.europa.eu/stats/money/interest/interest/html/index.en.html

[8] https://www.ecb.europa.eu/press/pdf/mfi/mir1611.pdf

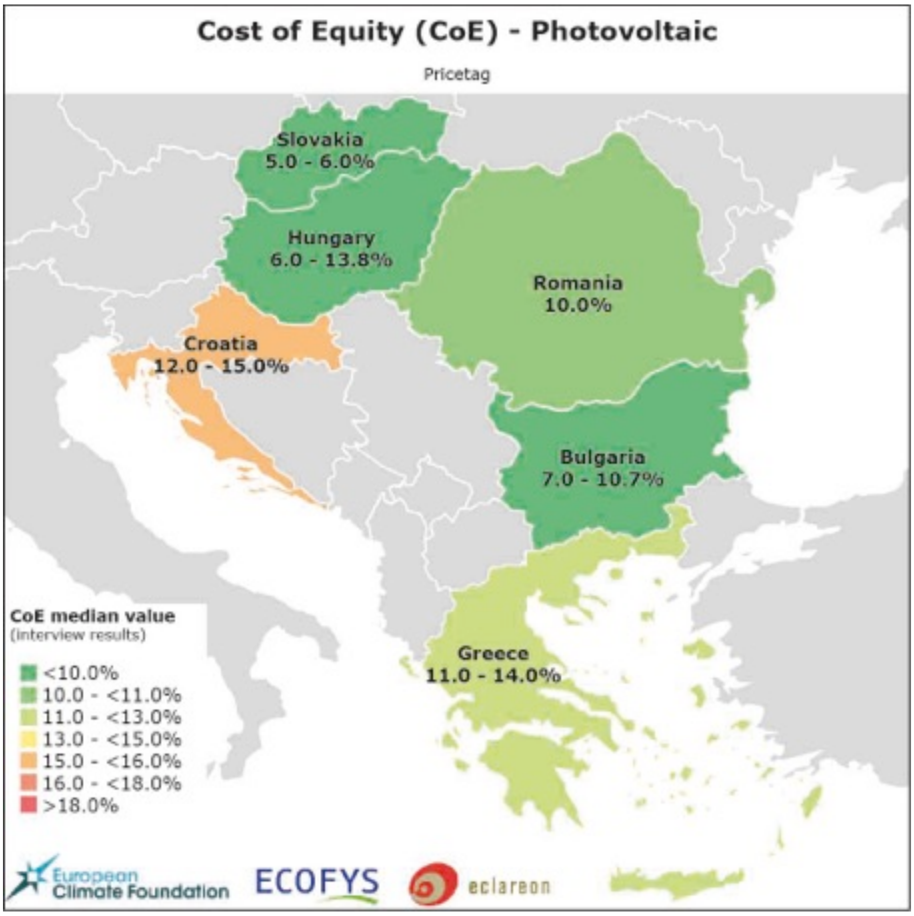
The results for Cost of Debt of PV projects resemble those for wind onshore. Most of the figures are similar or a little lower which can be explained with the lower risk associated with PV projects. The largest difference can be seen in Hungary that has exceptionally low numbers which is also due to a grant from the Hungarian National Bank or an interest-free loan distributed, through tendering procedures applying only in special cases. Further details of this programme are described in the country profile of Hungary.

3.3 Cost of equity



Note: the colours of this map do not reflect the ranges featured on it, but the median values.

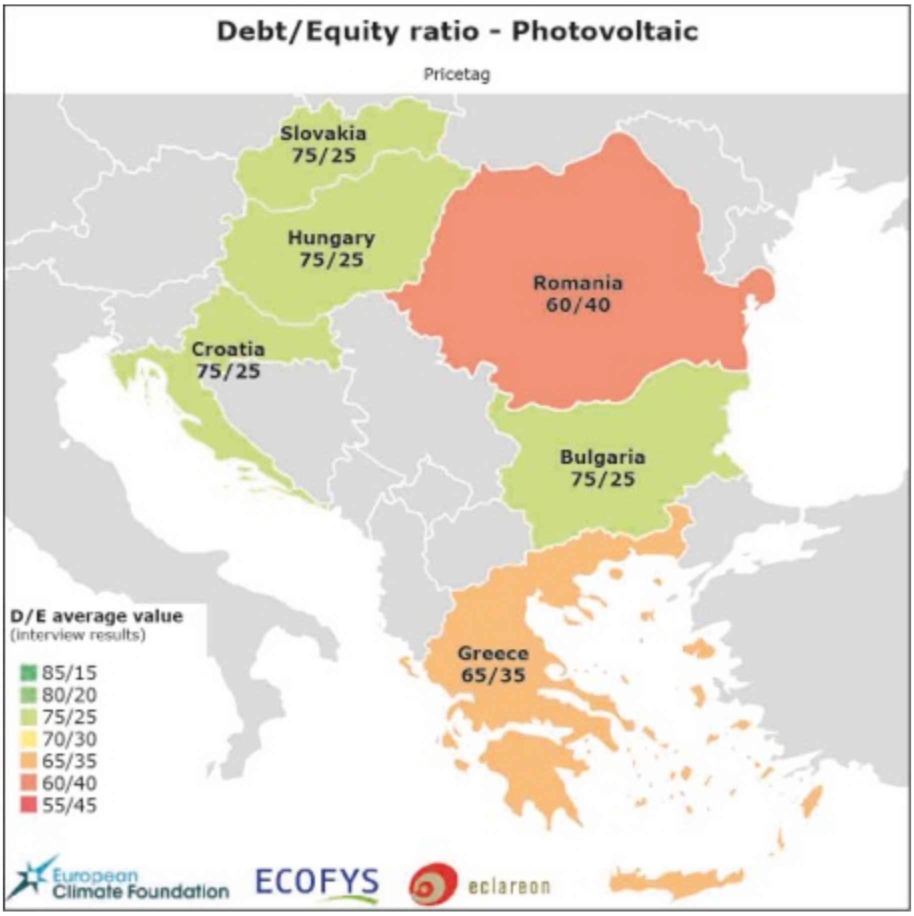
The results for Cost of Equity show a large diversity of figures starting at the lower end with 6% in the Slovak Republic, Hungary and Bulgaria and numbers at the higher end with 12%-15% in Croatia and 13-17.5% in Greece. As the following figures show, Croatia and Greece are also the markets where wind onshore projects are still being developed. One possible explanation for the low figures in the other markets could be that in those markets investors were keen to have any kind of project development even if lower Internal Rate of Return had to be expected. In Croatia, it could also be the effect of the increase of the wind target from 400 MW to about 740 MW. This may have opened a new market for developers who were already in the pipeline of projects, and were at relatively high stages of projects developments. Hence, when the quota increased, they just started building. For the case of Greece, a wide range of the observed Cost of Equity values is displayed with a median average level of 15%, identical to the one provided by the Diacore study. This outcome is grounded on the fact that no considerable changes were observed during the last couple of years in terms of support scheme applied and wind onshore projects deployment.



The results for Cost of Equity of PV projects resemble those of onshore wind power projects. The numbers in Greece, Hungary are bit lower which can be attributed to the lower risk of such projects compared to wind power.

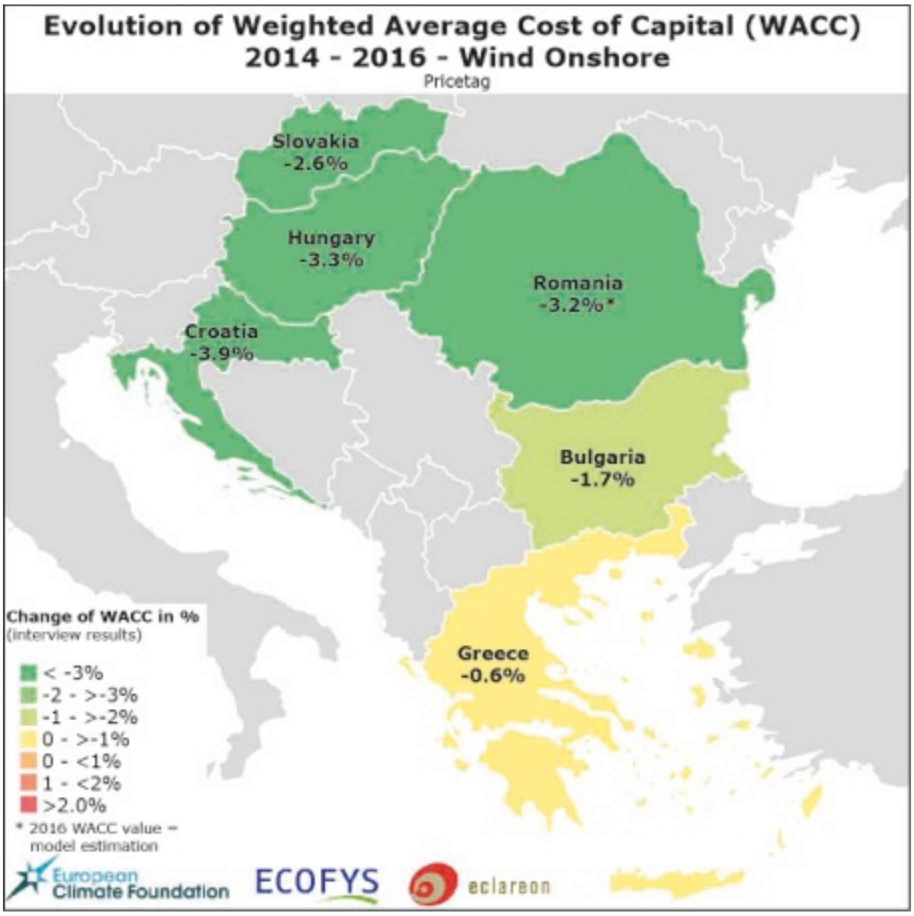
3.4 The debt and equity ratio

The collected data on Debt/Equity Ratio of wind onshore projects shows results ranging from 65/35 in Greece and 70/30 in the other markets.



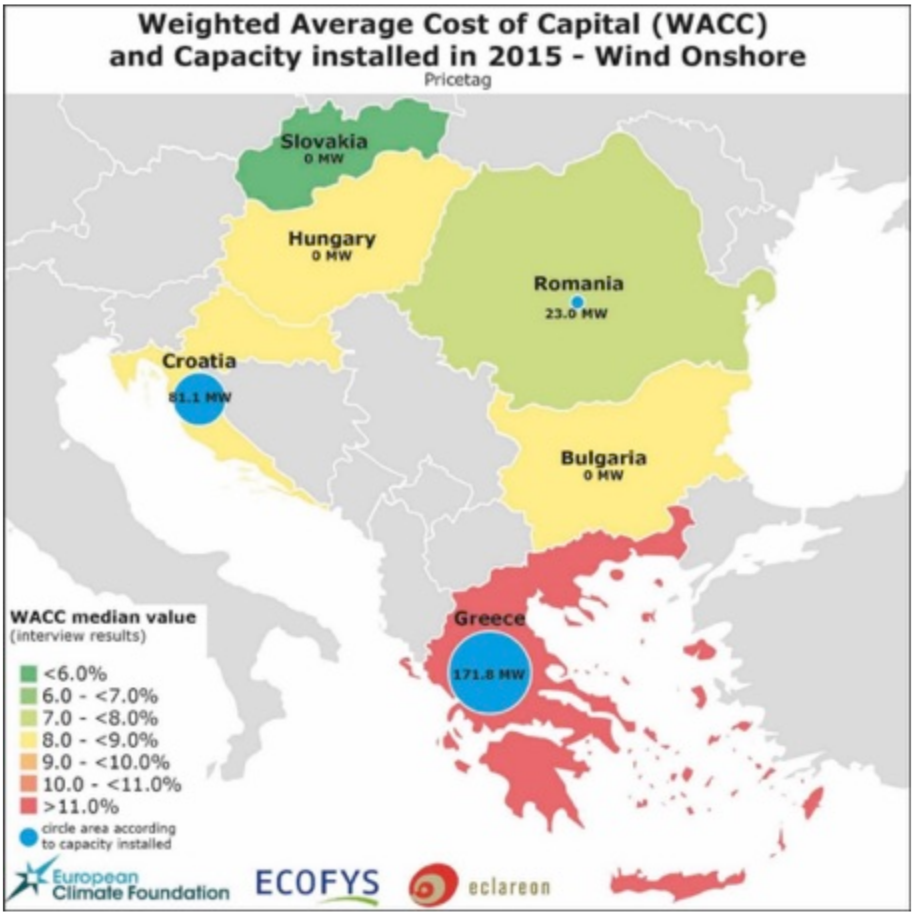
The collected data on Debt/Equity Ratio for PV shows a higher share of debt in comparison to wind onshore projects in most markets. The only exception is Romania that shows low figures of 60% for the debt share. This might be also due to the difficult market situation for RES projects which makes the assessment of Romanian market less clear. In general, the debt share is also substantially higher than in 2014.

3.5 Comparison 2014 and 2016 WACC for wind onshore



The results of the Diacore study (which interviews were performed in 2014) allows for a comparative analysis of the evolution of WACC figures for wind onshore projects until 2016. All markets have experienced a decrease with a strong decrease in Croatia, Hungary, Romania and the Slovak Republic, but only a slight decrease in Greece. The slight decrease in Greece can be explained with the ongoing financial crises from which Greece has recovered the least of all countries. The decrease in the Slovak Republic is substantial taking into account that the Slovak Republic already had much lower WACC numbers in 2014 than the other countries. However, since the overall installed capacities of wind onshore in the Slovak Republic amount only to 5 MW in total, this number has to be considered as very theoretical. We would also like to stress for Hungary and Bulgaria that there has been no development in the past years and that the numbers are rather hypothetical. Still, the decreasing WACC figures in the SEE countries resemble the general trend that can be observed at European level, as the RE-frame preliminary results show (to be published mid-2017).

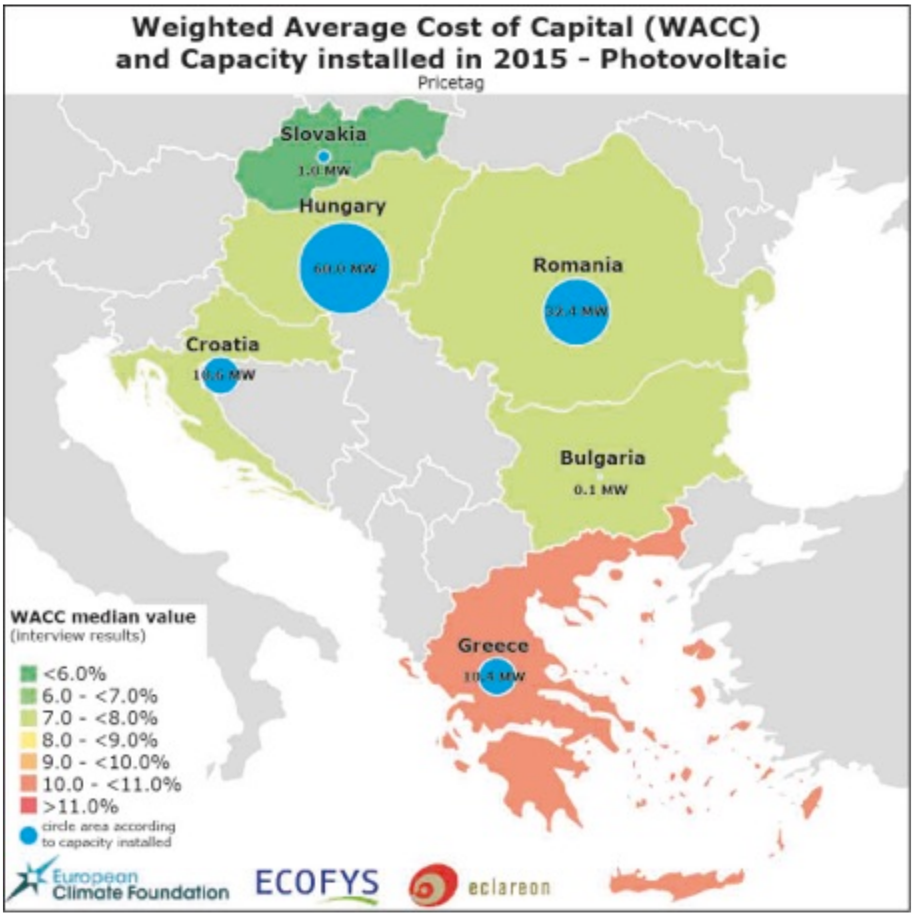
3.6 Installed capacity for wind onshore and PV in 2015



The map above links the WACC of wind onshore projects to the installed wind onshore capacities in 2015, as reported by the EurObserv'ER wind barometer[9]. The results seem somewhat surprising because there was virtually no development in many countries with lower WACC such as the Slovak Republic, Hungary and Bulgaria and only tiny development in Romania which can be attributed to projects that were initialised before the market busted in 2015. Of all markets, the largest wind onshore installations were achieved in Greece, despite the staggering WACC on this market. These striking results can be explained by the fact that most other markets lack an effective support scheme that allows for robust business cases, as described in the following chapters. (Note however that only two of the interviewees for the Slovak Republic were able to give rather hypothetical numbers on the WACC since the national wind power market is almost not existing). In Croatia, this result could also be due to the increase of the quota (from 400 to about 740 MW), the political will to

[9] http://www.eurobserv-er.org/pdf/wind-energy-barometer-2016-en/

achieve the RES target, and also to the fact that the Croatian FIT system is a considered a relatively low-risk investment (due to stable payments). In general, Croatia did not experience significant retroactive measures, besides the new introduction of balancing costs of circa 3.5 EUR/MWh. Despite the financial turmoil of the country, Greece has still provided an effective support scheme and therewith a business case for investors. The comparison of the figures show, however, how much the Greek economy had to spend for RE deployment just because of the increased cost of capital. On the other side of the spectrum, the figures also show that most other markets did not benefit from the reduced WACC for the deployment of their wind onshore projects.



The map above links the WACC of PV projects to installed PV capacities in 2015 (all, hence including both building integrated and ground-based systems), as reported by the EurObserv'ER PV barometer[10]. Also in this case, it is striking that the Slovak Republic with the lowest WACC of all selected markets has one of the lowest growth of installations. This can be explained by the

[10] http://www.eurobserv-er.org/pdf/photovoltaic-barometer-2016-en/

restrictive support scheme which allows only the development of small roof-top installations. In general, all markets show only a very limited deployment because of unfavourable support schemes and other policy conditions. In Croatia, this may be due to the fact that the solar PV target has been achieved.

4 Identification of the cost of the country risk and of the policy risk

The previous chapter explored several financial parameters, creating insights in the differences in cost of capital between the selected countries. Although these parameters give an indication for the risk of investing in renewable energy, it does not give information about the part of these risks *solely related to renewable energy*. The figures for cost of equity for instance include, besides the risks related to renewable energy, also the risks related to doing business in the country and the risks of investing in general. To create insights into the risks related to renewable energy investments specifically, a breakdown of the cost of equity is made for each technology and country. Basically, two figures are presented:

1. The country risk premium for the selected countries; and
2. The additional risk premium for investing in renewable energy.

4.1 Approach

For this assessment, the cost of equity is used as the main indicator for risk. Also the cost of debt (especially in immature markets) and the debt/equity ratio reflect the risk profile of a renewable energy project, so the calculated risk premium in the WACC should be considered as minimum value. The interview results on cost of equity for wind onshore and solar-PV are used as the estimation for renewable energy investments (see section 3.3 for results). To estimate the risk premium of renewable energy investments for the selected countries, these figures should be compared to the country risk premium of each country. This country risk premium reflects the average cost of equity for investments in that specific country.

For estimating the country risk premium, we used the country risk premiums from Damodaran (Damodaran, 2016). Based on the most recent figures, the country risk premiums for the selected countries were estimated as follows:

Table 1: Country risk premiums (Damodaran, 2016)

Country	Country risk premium
Bulgaria	3.0%
Croatia	4.7%
Greece	15.7%
Hungary	3.9%
Romania	3.5%
Slovakia	1.3%

A description of how the country risk premium is estimated is provided in the textbox below (Textbox 1). The reason for using the estimations from Damodaran is that all premiums could be derived from a single source, using one transparent method.

Based on the country risk premiums and the cost of equity estimations, the additional renewable energy risk premium can be calculated.

Textbox 1: Approach for estimating the country risk premium (Damodaran, 2016)

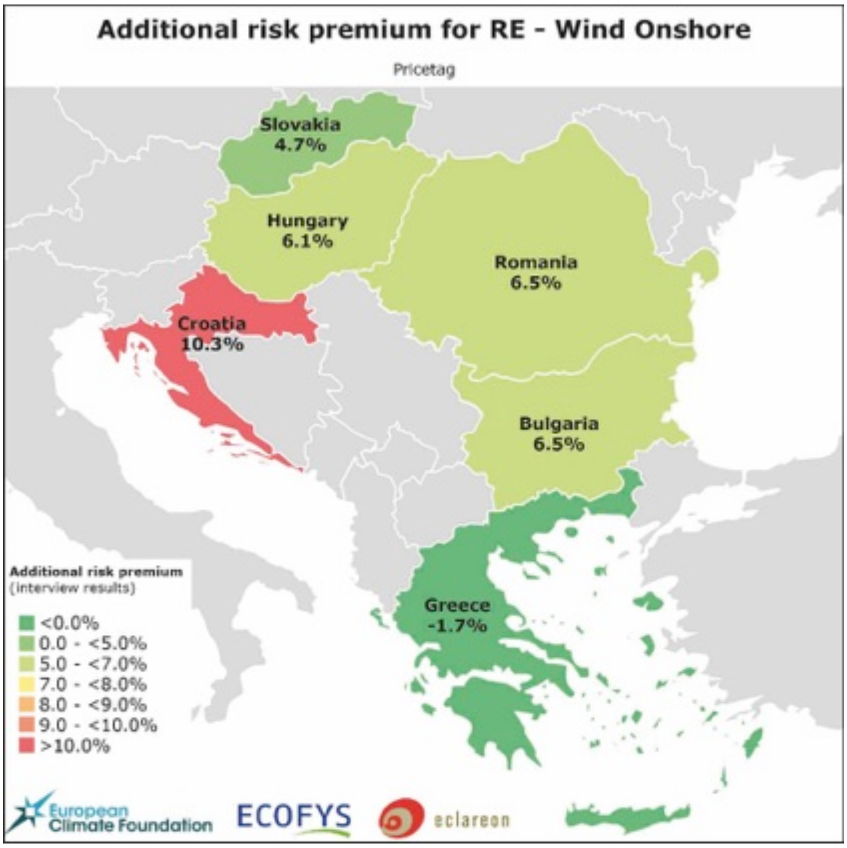
Approach for estimating the country risk premium

The country risk premium (CRP) is a parameter used to create insights in the additional risk of investing in projects in a specific country. The CRP values macroeconomic factors such as political instability, volatile exchange rates and economic turmoil. In general, the CRP is higher for developing markets than for developed countries (Investopedia, 2016; Damodaran, 2016)

The country risk premiums for the selected countries were retrieved from Damodaran (Damodaran, 2016). He calculates the CRP by multiplying the default spread by the relative equity market volatility for that market. For emerging markets, an average default spread of 1.34 (estimated by comparing an emerging market equity index to an emerging market government/public bond index). This is added to the 6.0% risk premium for mature markets (e.g. Germany, United States – based on the S&P 500 country ratings).

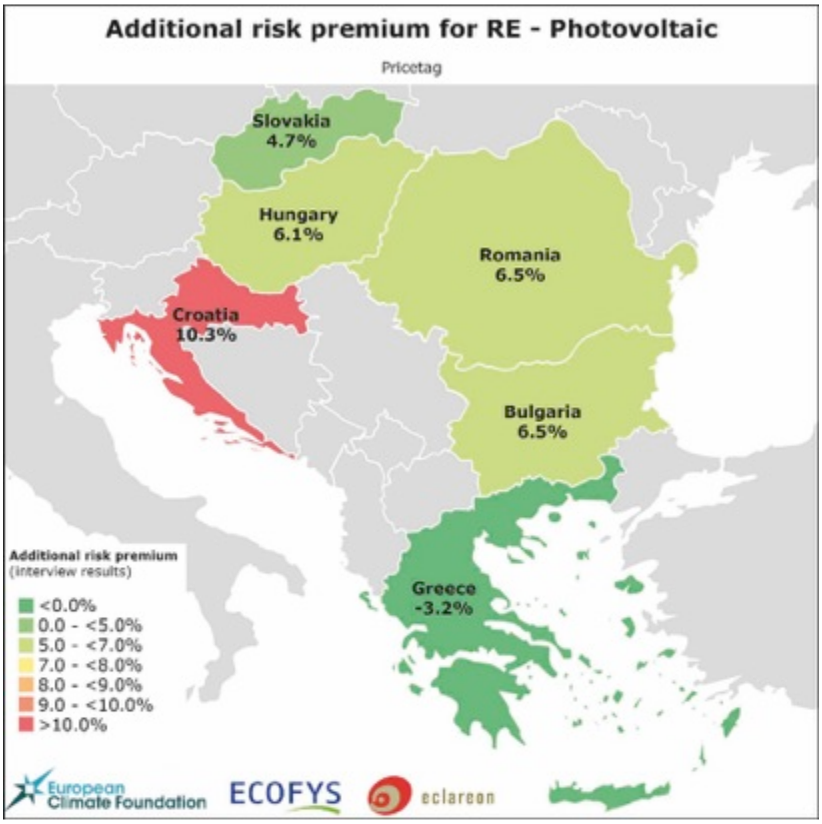
4.2 Results

The maps below show the additional renewable energy risk premium in the cost of equity for wind onshore and solar-PV for the selected countries:



For most markets, investing in wind onshore adds risks to the investments, compared to the sole country risk. In Croatia, investing in wind onshore means an additional risk premium of 10.3% points, in Bulgaria and Romania, this means an additional 6.5% points, and 4.7% point in the Slovak Republic and 6.1%points in Hungary. The figure for Croatia, 10% (or 7-10% when bearing in mind that the cost of equity has a range of 12-15%), is however believed to give a distorted picture and may be too high.

However, it is interesting to see that in Greece, investments in wind onshore are perceived as safer investments compared to other public investments (e.g. construction of roads), as it decreased the risk by 1.7% points. Our interviewees mention as main reasons for making these investments a safer option the guaranteed monthly payments (FIT remuneration) of the existing wind support mechanism and the great technical expertise gained during the last 10 years, securing the timely and successful implementation of these projects.



For solar photovoltaic, we can see exactly same pattern, except that investments in PV in Greece are considered even safer compared to the country risk: In Croatia, it means an additional risk premium of 10.3% points (see comment above, supported by anecdotal evidence that PV may be even more secure than conventional investments), in Bulgaria and Romania, this means an additional 6.5% points, and 4.7% point in the Slovak Republic and 6.1%points in Hungary. However, in Greece, investments in PV are perceived as a safer investment compared to wind onshore, as it decreased the risk by 3.2% points (instead of 1.7%). This pattern is reported for more SEE countries: where similar ranges are given for the cost of equity, onshore wind is believed to be on the higher end, and solar PV on the lower end of this range. Again, our interviewees mention as key reasons the monthly payments of the support provided to PV investments, the considerable technical expertise gained so far and also the more stable and predictable energy production from the sun.

In the table below, the results of the additional renewable energy risk premium calculations are presented underlining the cost of equity for wind and PV.

Table 2: Additional renewable energy risk premium (cost of equity)

Country	Country risk	Cost of equity Wind onshore	Cost of equity Solar-PV	Additional RE risk premium	Additional RE risk premium

	premium	(median value and range)	(median value and range)	Wind onshore	Solar-PV
Bulgaria	3.0%	10% (6.5-10.7%)	10% (6.5-10.7%)	6.5%	6.5%
Croatia	4.7%	15% (12-15%)	15% (12-15%)	10.3%	10.3%
Greece	15.7%	14% (11.5-17.5%)	12.5% (11-14%)	-1.7%	-3.2%
Hungary	3.9%	10% (6-15%)	10% (6-13.8%)	6.1%	6.1%
Romania	3.5%	10%	10%	6.5%	6.5%
Slovakia	1.3%	6%	6%	4.7%	4.7%

The table shows that for most countries the cost of equity for investing in renewable energy is larger than the country risk premium. This means that **investing in renewable energy is perceived as being a riskier investment compared to average investments in those countries**. For Bulgaria and Romania, the risk premium is about 6.5%, while for Croatia the premium is 10% (see the discussion under onshore wind). The Slovak Republic shows a slightly lower premium (4.7%), but Greece shows a negative result: -1.7% for wind onshore and -3.2% for solar-PV. This means that in Greece renewable energy investments are regarded safer than the average investments. This was also mentioned during the interviews, where interviewees indicated that renewable energy was actually seen as one of the safest investments. The main reason is that the subsidy system is beneficial for investors, as payments are typically paid on a monthly basis.

5 Calculation of the policy risk premium in the levelised cost of electricity of wind and PV

Based on the overall data on cost of capital, we calculate in this chapter the levelised cost of electricity (in €/MWh) for onshore wind and PV. We used assumptions on CAPEX, OPEX, project (economic) lifetime, taxes and tax structure, policy instruments to make a proper estimate for each country, in so far as information was available. In a next step, we derive the effect of the estimated RE-specific risk premium in the cost of equity, on these levelised costs (in €/MWh) for onshore wind and PV due to the renewable energy policy risk. As indicated above, the assumptions for the input of these calculations are derived in a semi-quantitative manner, so the outcome is indicative as well.

5.1 Approach

During the interviews with the financial experts, investment parameters, such as CAPEX[11], OPEX[12] and debt term, were checked with interviewees. Other parameters needed to calculate the LCOE such as the duration of the policy schemes, full load hours and corporate tax were derived from literature and experts.

For the LCOE calculations, a simple cash flow model was used, calculating the LCOE according to some basic rules. A short description of the model and its rules are described in Annex. Here also an overview of the input figures is presented.

Before calculating the LCOE, all input figures were checked by wind and solar-PV experts. Based on this check, it was decided to change the OPEX-figures from the interviews as they were considered too high. For wind onshore, the OPEX was estimated in some cases to lie on average around 9%, where 3-4% is more common. Also for solar-PV the OPEX estimations were believed to be too high: on average 8% was reported where 2-3% is more common. In both cases the OPEX figures were adjusted.

For each country, the LCOE is calculated in two different ways:

1. **Based on the figures derived from the interviews.** These LCOE figures reflect the current costs of electricity from wind onshore and PV in the selected countries.
2. **Based on the assumption that renewable energy policies would be as efficient as the best-in-class in Europe** on renewable energy (i.e. Germany). This means that the cost

[11] CAPEX only refers to the actual investments in the technology (so turbines, panels, etc.). DEVEX is excluded from this.
[12] OPEX was expressed in % of CAPEX

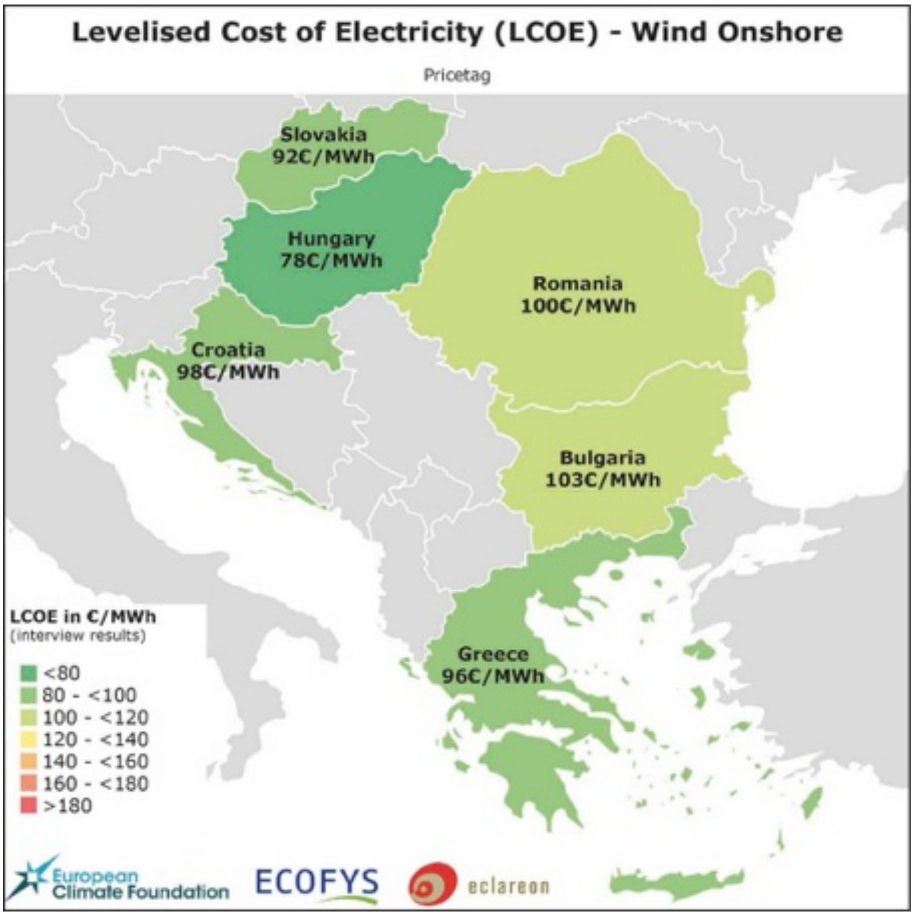
of debt, cost of equity and debt/equity ratio of the selected countries were replaced with German figures.

The results of both LCOE calculations have then been compared to the current remuneration levels, creating insights as to whether the current remuneration levels could cover the generation costs, and help renewable energy projects become viable.

5.2 Results

5.2.1 LCOE derived from interviews

The results of the LCOE calculations based on interviews for wind onshore are presented in the figures below.

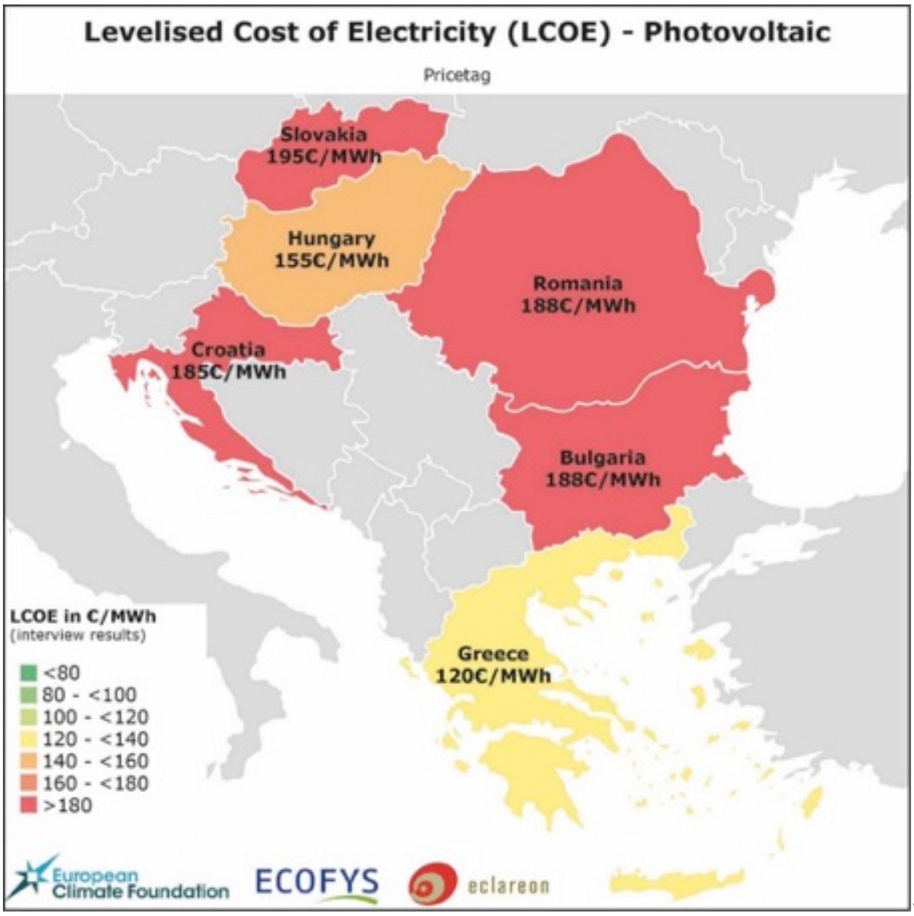


Most countries show LCOE values around 100 €/MWh, despite significant differences in the term of the support scheme, and the WACC. Only Hungary has a relatively low LCOE of 78 €/MWh due to the lower reported CAPEX, and lower cost of capital: the cost of debt and cost of equity for Hungary are among the lowest of the six countries. In principle, a low LCOE in Hungary would support RES projects. However, if we look at wind installed capacity in 2015, we see that no wind onshore MW has been installed in 2015 in Hungary. This can be explained by the current remuneration levels explored in the next chapter. The high cost of capital for Greece are compensated by a relatively long term support scheme (20 year), which has a LCOE-reducing effect.

Note that for all countries we have used the same number of 2500 for the full-load hours for new projects. In some countries, the range in this value can be significant, up to for instance 3700 for coastal projects (e.g. in Croatia).

The figure below presents the LCOE for PV derived from interviews.

Most LCOE values for the 1 MW ground-based PV reference project lie in the range of 185-195 €/MWh, with Greece (120 €/MWh) and Hungary (155 €/MWh) as outliers on the lower end. For Greece, this is a combination of the high solar irradiation (with 1500 full-load hours assumed in the model) and long term for the support. For Hungary, (1050 FLH) the low cost of capital play an important role.



5.2.2 Comparing LCOE derived from interviews with current support levels

In Table 3, we compare the LCOE with the current remuneration levels: If the LCOE is lower than remuneration levels, then the support scheme is effective in making the project viable. The colour codes indicate whether the current remuneration level is sufficient for investing in wind onshore and/or solar-PV (green) or not (red). Gray colours represents that potentially viable projects may occur.

Table 3: Results LCOE calculations based on interview data

Country	Wind onshore		Solar-PV	
	LCOE derived from interviews [€/MWh]	**Remuneration level** [€/MWh]	**LCOE derived from interviews** [€/MWh]	**Remuneration level** [€/MWh]
Bulgaria	103	[48 terminated in 2015]	188	[69 terminated in 2015]
Croatia	98	37* [about 95**]	185	37* [70**]
Greece	96	98 (82-105)	120	94-104
Hungary	78	tender	155	ca. 100 (<20 MW)
Romania	100	32*+certificates (29.4-59.9) *1.5	188	32*+certificates (29.4-59.9) *3
Slovakia	92	62.5	195	28-34*** (only rooftops <30 kW are eligible)

* For these countries the average electricity wholesale price for 2016 was used (ENTSOE, 2016)

** Croatian electricity price is based on day-ahead prices between 24 Nov 2016 – 28 Nov 2016 (CROPEX, 2016). Values between brackets show support levels at the beginning of 2015. The scheme was halted in the fall of 2015. Since 2016 Croatia has a tender scheme.

*** For the Slovak Republic the remuneration level is estimated based on electricity prices for industrial consumers (Eurostat, 2016) and the wholesale market prices (ENTSOE, 2016)

We see from the table that **the low LCOE in Hungary has not been sufficient to deploy new wind and PV projects, as support for wind onshore projects and large PV plants is virtually non-existing in Hungary. And this is the case for several countries in this region. The maps and** Table 4 below provide a more detailed overview of active RES support in the selected countries.

[redacted]

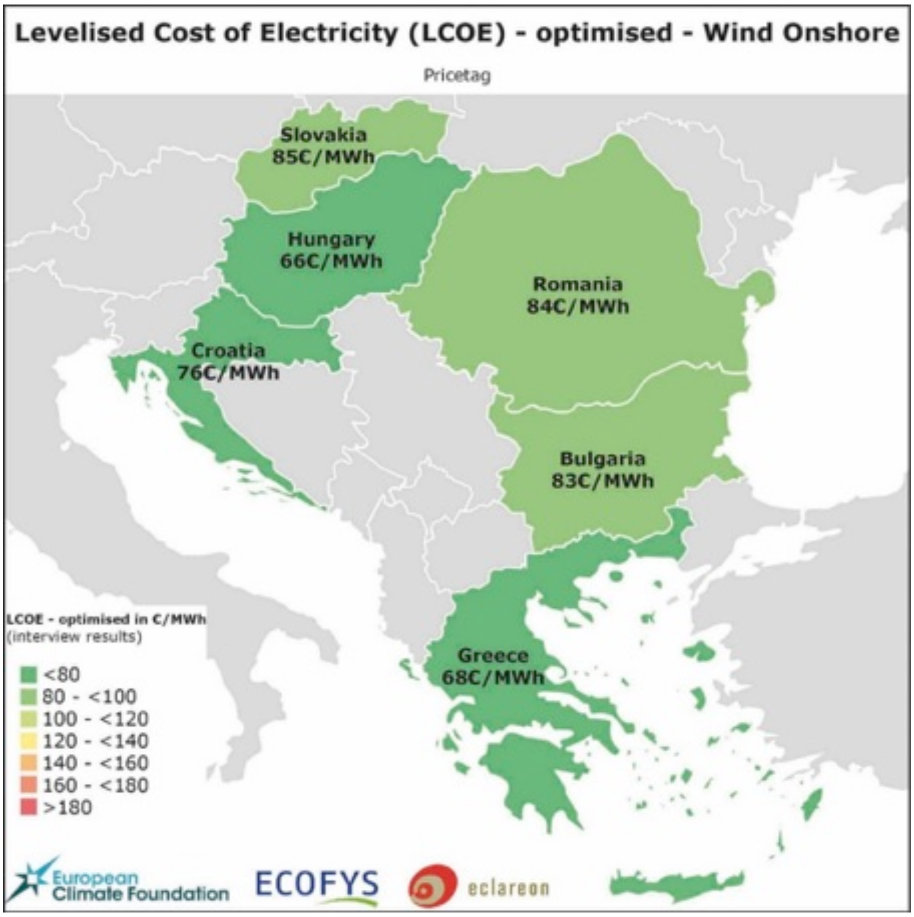

Active RE support schemes - Photovoltaic
Pricetag
Slovakia
Hungary
Romania
Croatia
Bulgaria
Greece
Existence of support schemes for Photo-voltaic installations
Active support scheme
Active support scheme (in theory)
No active support scheme
European Climate Foundation
ECOFYS
eclareon

Table 4: Overview of the activity of RES Policy schemes in the selected countries

Country	Active RE policy scheme?	Description of situation
Bulgaria	No, terminated in 2015	Prior to the termination there was support for large-scale wind and PV.
Croatia	No, terminated/halted in 2015	There is no FIP in Croatia since the fall 2015, as a FIP system has been voted on in fall 2015, but there are no bylaws due to political reasons, including a vote of no confidence to the former Prime Minister and new elections, the government did not yet adopt by-laws to regulate the design of the Feed in Premium system. Hence, in practice the system does not exist. There are some talks for first auction for FIP to be implemented in Fall 2017 but nothing confirmed yet.
Greece	Yes	Financial situation of the country/government is withholding investors from making large investments, for instance in wind onshore or large-scale solar (>= 1 MW)
Hungary	Yes (in theory)	For wind power plants >50 kW the eligibility for the feed-in tariff is supposed to be allocated within tenders. In 2010, the only tender for 410 MW additional capacity was withdrawn. There has been no tender since. Concerning PV, there is an active support scheme but the administrative process becomes more complicated and costly for plants with a capacity >500 kW. Moreover, a tax on solar panels has been imposed. As a consequence, the deployment is limited to three larger PV plants.
Romania	Yes (in theory)	Due to a lower green quota than expected and several political changes, RES investors suffer from a surplus of millions of green certificates. Most projects do not benefit from long-term green certificates purchase agreements with electricity traders and have small to no chance of selling green certificates at the market. This surplus is expected to grow even further, when suspended GCs will be issued beginning with 2017.
Slovakia	No for wind power and PV >30 kW	Wind power systems cannot be built because of a freeze status for systems larger than 10 kW that cannot be connected to the grid and cannot receive support. In addition, the support of PV production is applicable just up to 30 kW of the total installed capacity.

5.2.3 LCOE derived from best in class in Europe on wind and PV

To create insights into the impact of smart policies on the LCOE, we have replaced the national figures for cost of debt, cost of equity and debt/equity ratio by the German figures, hereby creating "optimised" renewable energy policy scenario. The input figures for this calculation can be found in Annex B. The results are presented in the figures and table below:



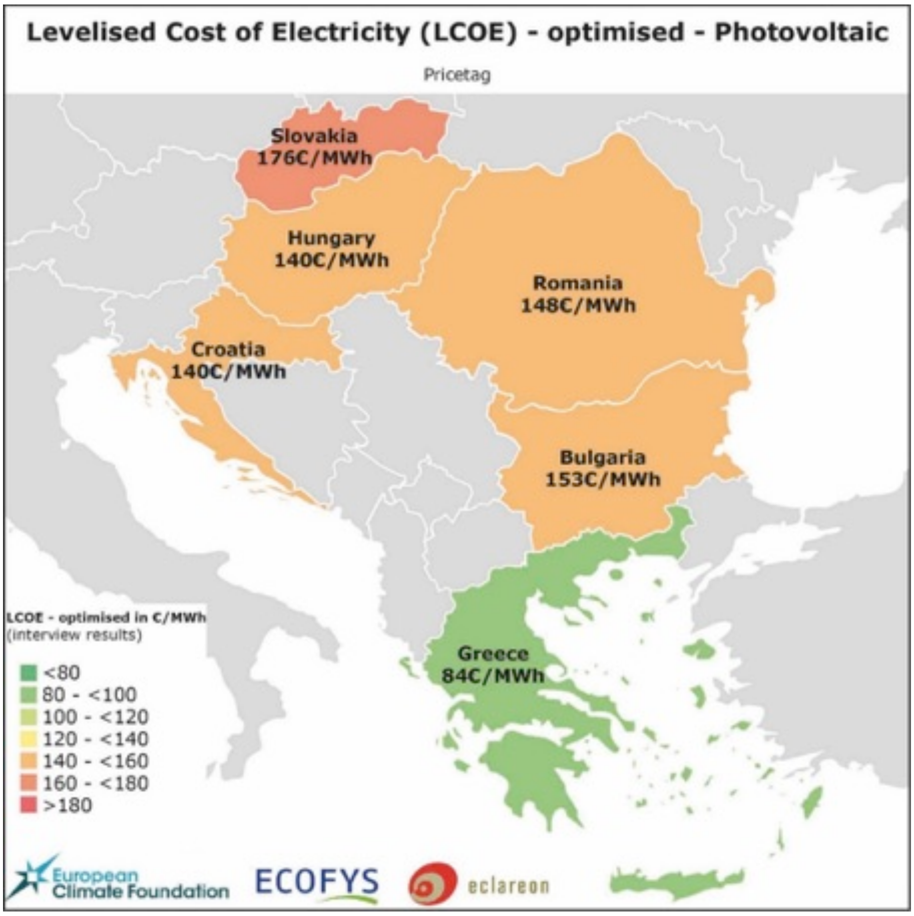


Table 5: Results LCOE calculations based on optimised conditions for cost of capital compared to 2016 remuneration levels

Country	Wind onshore		Solar-PV	
	LCOE optimised [€/MWh]	**2016 Remuneration level** [€/MWh]	**LCOE optimised** [€/MWh]	**2016 Remuneration level** [€/MWh]
Bulgaria	83	[48 terminated in 2015]	153	[69 terminated in 2015]
Croatia	76	37* [about 95**]	140	37* [70**]
Greece	68	98 (82-105)	84	94-104
Hungary	66	tender	140	100 (<50 MW)
Romania	84	32*+certificates (29.4-59.9)*1.5	148	32*+certificates (29.4-59.9)*3
Slovakia	85	62.5	176	28-34*** (only rooftops <30 kW are eligible)

Footnotes: see Table 3

For each country, the LCOE would decrease significantly: on average the LCOE decreases by 15-20%. For Greece, this means that remuneration levels for both wind onshore and solar-PV are sufficient. For the other countries where the policy schemes are inactive, the business case is not financially interesting, although it has improved significantly. Exception is the Slovak Republic, where the optimised LCOE is only slightly lower than the initial LCOE. The reason is that the Slovak Republic's current cost of debt, cost of equity and debt/equity ratio are already comparable to that of Germany.

The results of the LCOE calculation show that business cases for renewable energy can improve in the selected countries and that further improvement in renewable energy policy can further decrease the LCOE for wind onshore and PV. To create better insights in the results, we have compared the LCOE for wind onshore and solar-PV to the support schemes of 2014 (DiaCore, 2014). At that time, the support schemes were still actively used in all selected countries. The results are presented in Table 6.

Table 6: Results LCOE calculations based on optimised conditions for cost of capital compared to 2014 remuneration levels

Country	Wind onshore			Solar-PV		
	LCOE [€/MWh]	**LCOE - optimised** [€/MWh]	**Remuneration. Level (2014)** [€/MWh]	**LCOE** [€/MWh]	**LCOE - optimised** [€/MWh]	**Remuneration. Level (2014)** [€/MWh]
Bulgaria	103	83	63-64	188	153	93-100
Croatia	98	76	85-86	185	140	157-203
Greece	96	68	82-105	120	84	94-104
Hungary	78	66	104-130	155	140	about 100
Romania	100	84	122-144	188	148	310-354
Slovakia	92	85	74-75	195	168	103-104

The results show with the current LCOE of wind onshore projects in Greece, Hungary and Romania would have been financially interesting under the 2014 support scheme. For the optimised LCOE, projects in Croatia would also be viable. The remuneration levels for Bulgaria and the Slovak Republic were in 2014 significantly lower than those of the other countries.

For solar-PV, projects in Romania would have been interesting under the 2014 support scheme, while for the optimised LCOE also projects in Greece and Croatia are interesting. Still, this means that projects in Bulgaria and the Slovak Republic are not financially interesting, even not in optimised circumstances.

6 Conclusions, discussion and key messages

6.1 Onshore wind energy

The WACC for wind onshore ranges in autumn 2016 between 5-6% in Slovak Republic up to 10.5-13.7% in Greece. Except for these two countries, there is a strong consistency between the markets explored in this report: The WACC figures for Bulgaria, Croatia, Hungary and Romania vary between 7% and 9.5%.

There was no wind onshore development in many countries with relatively lower WACC such as Slovak Republic, Hungary and Bulgaria and only tiny development in Romania (which can be attributed to projects initialised before the market busted in 2015). Of all markets, the largest wind onshore installations were achieved in Greece, despite its staggering WACC. These puzzling results can be explained by the fact that most other markets lack an effective support scheme allowing for a robust business cases. Despite the financial turmoil of the country, Greece did provide an effective support scheme and therewith a business model.

The observed WACC decrease for wind onshore between 2014 and 2016 is not due to the implementation of safer renewable energy policies for investors. It is attributed to the policies of the European Central Bank and the national central banks. The International Monetary Fund interest rates[13] have continuously decreased over the past years. Over 2014-2016, the cost of borrowing for corporations fell by approximately 30%.

6.2 Ground-based solar photovoltaic energy

The WACC figures for PV are generally lower than the WACC for wind onshore, because of the lower technical risk and yield risks of PV projects. The WACC for PV investments in Bulgaria, Croatia, Hungary and Romania are relatively similar (between 6.8 and 9.5%), the Slovak Republic has again much lower values (4.5 to 6%), whereas Greece has much higher WACC than the other markets (7.3 to 12.4%). The trend of low WACC for PV investments has been observed also in other European markets (such as Germany or France).

[13] MFI interest rates are all interest rates that monetary financial institutions (MFIs) resident in the euro area – except central banks and money market funds – apply to euro-denominated deposits from and loans to households and non-financial corporations resident in the euro area countries.

6.3 Discussion

The cost of capital can be influenced by different factors e.g. the country risk and/or the risks specifically linked to the RE regulatory framework of the country. The country risk refers to factors which can adversely affect the profits of all investments in a country. These factors include for instance the political stability, corruption, economic development and exchange rate fluctuations. The country risks affect all investments in a particular country, not only those in RE. We aimed in this project to make a distinction between the overall country risk of a country, which affects the RE projects, and the specific risk linked to the RE Policies of that countries. For that purpose, we have identified the country-specific WACC component (sovereign risk) and the RES framework specific WACC component. The conclusions we reached were the following:

- For most markets, investing in wind onshore and PV adds risks to the investments, compared to the sole country risk. Investing in renewable energy is perceived as being a riskier investment compared to average investments. In Bulgaria and Romania, this means an additional 7% points, 5% point in the Slovak Republic and 6% point in Hungary, to the cost of equity. However, in Greece, renewable energy investments are regarded as safer compared to average investments and decreases the risk by 2% points in the case of wind onshore, and 3% in the case of PV. An important element is the monthly payments of the support scheme and its long term support term of 20 years.
- Most other markets did not benefit from the reduced WACC for the deployment of their wind onshore projects, as much as they could have had, which may be due – in certain cases- to high political uncertainty.

Our research has shown that the WACC, particularly for wind onshore, varies a lot between the respective markets. The reasons for the spread of the numbers can be manifold. One of the findings of the Diacore study was that the main factors for the difference in WACC were the macro-economic situation in the MS as well as the country specific RE profiles (Diacore 2014).

The overall macro-economic situation cannot be finally assessed at this point due to the multitude of factors. From a monetary viewpoint, the currency as such (EURO or non-EURO market) does not seem to have a profound impact on the level of the WACC if we consider that with Greece and the Slovak Republic the two EURO MS show the largest discrepancy. This might indicate that the currency per se has no strong impact on the cost of capital in one way or the other. Instead, the current policy of the European Central Bank and the national Central Banks might have an impact on cost of capital in the sense that the decrease of WACC (compared to 2014) correlates with increased activities such as quantitative easing politics by the central banks.

A much larger indicator might be the overall economic well-being of the examined markets. The figure below portrays the economic development of the Pricetag MS over the past 10 years.

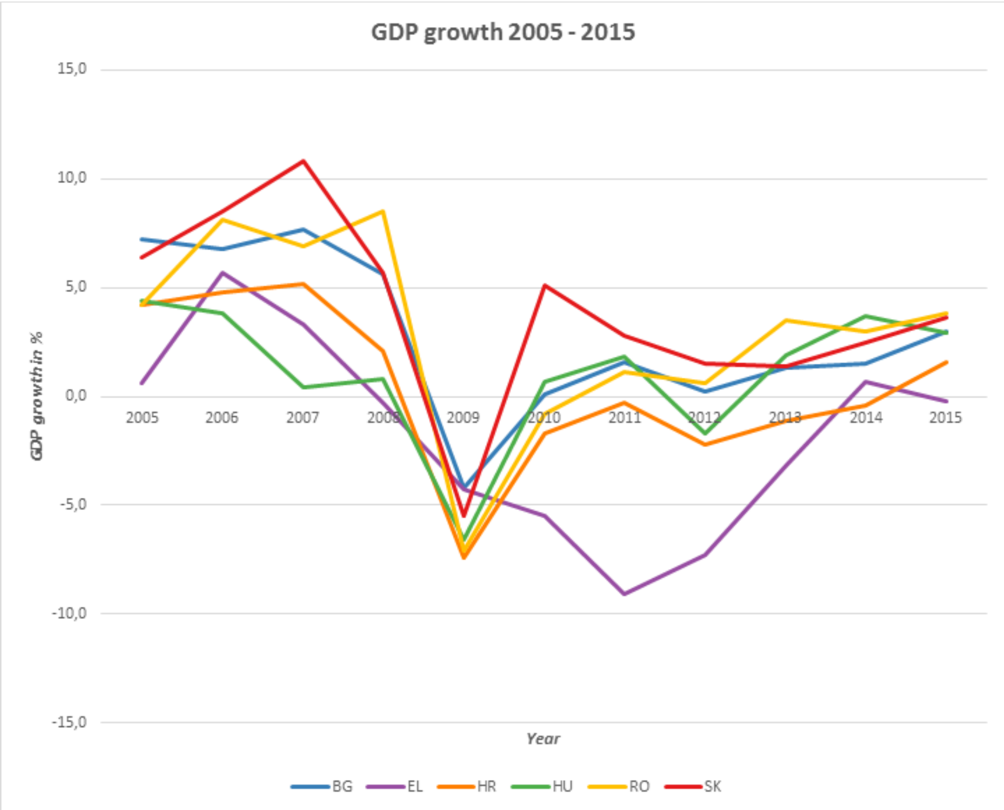


Figure 1: Real GDP growth, 2005–2015 (% change compared with the previous year; % per annum) Eurostat (2014)[14]

The comparison of the real GDP growth and the WACC in the countries reveals that the Slovak Republic, the country with the lowest WACC, experienced the highest GDP growth in the past years (3.2% p/a), whereas Greece, the country with the highest WACC, endured the lowest growth of GDP (-2.1% p/a). Also in terms of absolute GDP, the Slovak Republic is leading (although Greece is still coming second). The correlation of the economic development and the WACC indicates the impact of the economic situation on the investment conditions for RES, as expressed through the WACC.

The correlation between the country specific RES profiles and the level of WACC is more difficult to establish. Markets with ostensibly low WACC such as the Slovak Republic, Bulgaria, or Hungary currently provide risky and unstable investment conditions for wind onshore projects which is reflected in zero-growth of wind onshore projects during the past years, whereas Greece still

[14] http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Real_GDP_growth,_2005%E2%80%932015_(%C2%B9)_(%25_change_compared_with_the_previous_year;_%25_per_annum)_YB16.png

experiences a moderate growth of wind onshore capacities. Despite the lower WACC values in the other markets, project developers seem to lack a promising business case, which indicates that low WACC figures are necessary to bring down the deployment costs and allow for a sustainable growth of the market. However, they are not sufficient for allowing business cases as such.

6.4 Key messages

- Policy schemes have to be designed at national and European level to allow for adequate RE business cases and trigger private investments.
- Countries can benefit from a low WACC only if adequate policies are in place.
- In addition, 'WACC-aware' policies and policy instrument designs can have a significant influence on the cost of capital and hence on the costs of the support schemes.

Annex A – Country profiles

We aim within this chapter to provide an overview per country of the key results from the interviews within Pricetag.

Bulgaria

Key Ideas

6 interviews in total, out of which inputs for ground based PV and wind onshore were provided by two utilities in particular 2 managers working in Bulgarian DSOs and 3 RE market experts and the CEO of the Bulgarian Association of Producers of Renewable Energies.

- Over the last two years, due to the retroactive measures applied in 2014 and 2015, no significant ground-based PV and onshore wind projects were developed.
- The debt/equity ratio of wind projects amounts to 70/30, taken into account the fact that the production of electricity from renewable energy sources in the Bulgaria requires significant investment and use of loan capital. However, the capital structure of PV projects slightly differs from the debt/equity ratio of wind projects: The debt ratio of wind onshore projects equals to approximately 80%.
- The WACC for onshore wind and PV is in the range of 7–9.5%. This range seems to be feasible due to the costs caused by the high risk of retroactive measures which increase the CAPEX of some projects and hence affect the WACC. However, the average WACC for wind and the WACC for PV projects differ only by 0.5% from one another according to the agreement among the interviewees: 8.3% for wind and 7.9% for PV.
- The Cost of Equity for PV has been estimates in the range of 6.5–10.7%, while for onshore wind, it is slightly higher, in the range of 7–10.7%, assuming that wind projects are more specific and the investment risk is higher.
- The Cost of Debt for onshore wind and PV is in the range of 7–10%. This relative wide range could be explained by the fact that the interviewees referred to old projects of different sizes, since there are almost no big new projects in the last two years.
- The interviewees identified many different risks. However, all agreed that the most significant ones are the absence of a stable support scheme and the abrupt and retroactive measures such as cutting off of feed-in-tariffs that have been already adopted or the adoption of grid access fee only for wind and PV producers by the Energy Regulator (KEVR).
- Last but not at least, the research has shown a significant difference between the official results of Energy and Water Regulatory Commission (KEVR) and the input by representatives of the Bulgarian PV and wind power sector. According to representatives of the RES sector, the KEVR is using intransparent decision making methods and even in cases, when a public decision is made, no statements, opinions or

notes of suggestions are taken into account.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio PV	60/40	Opinions quite in line 70-80%/20-30%	Almost all interviewees indicated a debt/equity ratio of 70/30. However, according to business consultants in the sector, 80/20 is more realistic ratio.
Debt/Equity ratio wind onshore	50/50	Opinions in agreement 70/30	Almost all interviewees indicated a debt/equity ratio of 70/30. See the comment above (Debt/Equity ratio PV).
WACC PV	7.4%	Opinions divided 7–9.5%	Indications ranged between 7 % and 9.5% The range seems to be reasonable due to the costs caused by the high risk of retroactive measures, which affect the WACC.
WACC wind onshore	7,9%	Opinions quite in line 7–9.5%	Almost all interviewees indicated an WACC of approximately 8,3–9%. However, there is a significant difference between the results of the Energy and Water Regulatory Commission (KEVR) and the input made by stakeholders of the Bulgarian PV and wind power sector.
Cost of Equity PV	10%	Opinions divided 7–10.7 %	The majority of interviewees indicated a ratio of 9–10% accept the Energy Regulatory Commission, which takes an CoE ratio of 7%, when calculating the Feed in tariffs. Actual value depends on class of investors (utilities usually demand higher cost of equity than private energy cooperatives)
Cost of equity wind onshore	10%	Opinions divided 6.5–10.7 %	See the comment above (Cost of Equity PV).
Cost of debt PV	6%	Too low 7–10%	All interviewees indicated a ratio would be around 7–10%
Cost of Debt wind onshore	6%	Too low 7–10%	See the comment above (Cost of debt PV).

Debt term PV	10 years	10–20 years	No feedback was received on the debt term, the results are from desktop research.
Debt term wind onshore	10 years	10–20 years	No feedback was received on the debt term, the results are from desktop research.

Typical wind onshore and PV project used for estimations for Bulgaria:

For our estimations, we used typical wind onshore and PV-projects:

Wind onshore	Model estimations	Interviewees
Size	10 MW (3-5 wind turbines)	< 30KWp – 1MWp
CAPEX	1,375 €/kW	778.3–1,017 €/kWp
OPEX	10%	17.46–19.18 %
Economic lifetime	10-20 years	15 years

The interviewees referred to old projects (2014), because of the fact that there are no new ones on the last years. The following parameters refer to wind onshore installations with a capacity of between 30KWp and 1MWp.

The CAPEX was estimated to

- 1,017 €/kWp for installations with a capacity of up to 30 KWp,
- 947.5 €/kWp for installations with a capacity of up to 200 KWp,
- 847.6 €/kWp for installations with a capacity of up to 1 MWp,
- 778.3 €/kWp for installations with a capacity of more than 30 KWp.

The OPEX was estimated to

- 13.50 €/kWp (19.18 %) for installations with a capacity of up to 30 KWp,
- 12.57 €/kWp (19.18 %) for installations with a capacity of up to 200 KWp,
- 11.02 €/kWp (18.45 %) for installations with a capacity of up to 1 MWp,
- 8.25 €/kWp (17.46 %) for installations with a capacity of more than 30 KWp,

taking into account that the inflation rate of the OPEX is 2 %.

The economic lifetime of those type of installations amounts to 15 years.

PV	Model estimations	Interviewees
Size	1 MWp, ground-based	<5–30 KWp, roof-based
CAPEX	1,600 €/kW	1,247–1,466 €/kWp

OPEX	12%	2–15%
Economic lifetime	10-20 years	15–25 years

The following estimations are based on PV roof-based projects, since there were not any new ground-based projects during the last years. The following parameters refer to roof-based projects with capacity of 5–30 KWp.

The CAPEX was estimated to

- 1,247 €/kWp for installations with a capacity of up to 5 KWp,
- 1,466 €/kWp for installations with a capacity of 5–30 KWp

The OPEX was ranges between 2–15% or

- approx. 35 €/kWp for installations with a capacity of up to 5 KWp,
- approx. 27 €/kWp for installations with a capacity of 5–30 KWp,

taking into account that the inflation rate of the OPEX is 2 %.

The average economic lifetime of those type of installations amounts to 20 years.

The safest market for investment is still the one for agricultural land, although the market is converging after the period of rapid growth, which was followed by the accession of Bulgaria to the EU.

In the last three years, the growth rate of the rent and the price of land had always a double-digit number, but now the growth rate is below 10%. It could be said, that there is an element of inertia, caused by one-off effects such as shocks outside of the sector (e. g. crisis in the banking system after the collapse of the Corporate Commerce Bank (CCB)), which led to an influx of fresh capital. One seems certain – the market of agricultural land is around its peak and times of speculative interest concluded.

The undeniable reason for the growth of the agricultural land market are the subsidies in the sector. The direct support payment per unit area in 2014 was BGN 1.2 billion (approx. EUR 600.000). On the other hand, those subsidies boost the demand, but also change the profile of the buyer, reason for which is when applying for EU funding with project an ownership of land or long-term lease is a must.

Renewable energy investment risks

To stimulate the construction of new plants, the Regulator should set a preferential price, which could cover not only the economic risks, but also the **technological risk**. The development of energy projects using new and not fully developed technologies based on renewable energy is generally more expensive, even in cases where the primary energy source is free (in this case solar energy) compared to conventional energy projects. Normally, the banks are sceptical and do not want to bare such technology risks.

The **uncertain investment climate** is further risk for future investors. The local banks deny financing of renewable energy projects. What is more, even the European Bank for Reconstruction and Development made a recent statement: "We do not contemplate any investments in renewables in Bulgaria, not this year, not next year, not until the framework is more clear."

The risks with the largest impact are **absence of a stable support scheme** and **abrupt and retroactive measures:**

- In 2014, the Energy Regulator (KEVR) approved a grid access fee only for wind and PV producers. The price for it amounts to 2.45 BGN/MWh (approx. 1.75 EUR/MWh) and it will be paid to the Transmission System Operator. The fee is applied retroactively as of September 18th 2012.

  Cutting off of feed-in-tariffs that have been already adopted (with as much as 40% for some technologies). What is more, even permits, issued officially by ministries (e.g. Ministry of Environment and Waters) are being declared null and void for investors/energy producers who have already commissioned their power plant (e.g. in 2012, the feed-in-tariffs were reduced with 5-40%). These measures are most widely observed since the adoption of the Renewable Energy Act of 2011.

The **lack of public discussion while decision making** has also an negative impact on the investment climate. For example, every year, at the end of June, KEVR holds a closed meeting, where it sets the Feed-in Tariffs for electricity that is produced from renewable sources. The KEVR is using intransparent decision making methods and even in cases, when a public decision is made, no statements, opinions or notes of suggestions are taken into account.

Impact of policy changes

None of my interview partners could answer this question. Reason for this is the fact that all of finalized projects were mainly supported (financed) by the FiT. Since 2014, there is no FiT for new big projects. Since the liberalisation of the electricity market, there are not any realized projects, so the interviewees found it hard to provide any kind of information on this question.

In the last 5 years, changes in the energy laws were made, such as changes of the duration of preferential rates and PPAs and actualisations of the preferential prices (FiTs) based on new analyses made by the regulator (KEVR). All of those changes had a negative impact on the projects, implemented by my interview partners.

- In 2016, legislative changes in the energy sector are expected, based on the upcoming analysis of the World Bank commissioned by the Bulgarian government.
- Introduction of free "intra day" energy market.
- Introduction of the "polluter pays" principle,

- Excise duty increase for plants using conventional sources.

The day "X" for the cabinet of Prime Minister Borisov came and the Parliament voted on 16th December 2017 for his resignation, so the future of the sector is still unclear. It must be ensured that the sector is building on what has been achieved over the past two years such as the introduction on the stock exchange and the liberalization of the electricity the gas market and is not influenced populistic interests by the time of the next elections in spring 2017.

De-risking mechanisms

Currently, there are not any sufficient support mechanisms for reducing the investment risk in the sector. The current legal framework and the retroactive measures of the Regulator in the last four years have weaken the investment climate. All stakeholders were united on the opinion that the current policies are not only ineffective, but they also hinder further development in the sector. One could not talk about de-risking mechanisms in a country, whose Energy Regulatory Commission is using intransparent decision making methods and does not make any statements or take an expert opinion into account.

It is hard to be estimated, if the following de-risking mechanisms will have an impact in the WACC and how high it would be. According to one of the DSOs, the WACC will decrease slightly (less than 1 %) in the next three years. Reason for this could be the still unclear changes in the legislative framework, based on the upcoming analysis of the World Bank commissioned by the Bulgarian government.

Investment risks	De-risking mechanism
Ecological and agricultural restraints	Amendments to Ordinance 14 on technical rules and standards for design, construction and use of facilities and equipment for production, transformation, transmission and distribution of electricity are needed can be removed the ban on the installation of wind turbines at 500m of settlements. Also, we need to remove the restriction for installing wind turbines in locations as long as they meet the noise ordinance. The stakeholders are agreed with the limitation of photovoltaic installation on arable land of 1-5 category.
Uncertain regulations and	If there are problems with fees and administrative arbitrariness caused by municipalities' administration, the investors should turn to the governor

different interpretations of law	or to the court.
Misleading results of the NREAP	The last NREAP should be inspected and reviewed._The NREAP sets a target of 16% energy from RES in the final energy consumption by 2020, but it remains unclear according to which criteria this target shall be fulfilled. Moreover, Bulgarian experts are sceptical about how this objective shall be reached, considering the following arguments: • The energy from PV power plants is not being properly measured. A monitoring against illegal measuring of the working hours is needed. • Completed installations, which are not connected to the grid because of grid capacity lack in some regions, are also included in those 16%. • Many old and non-constantly working hydro-power plants are counted among the RES production. • The percentage mix of renewables referred by the NREAP is in fact not met. For example, the proportion of biogas and biomass has not been reached, because the bankrupt biomass plants in Ihtiman and Bansko have not been considered as non-working. The misleading results and the provision of false information in the NREAP from 2013, completely stopped the construction of new biogas plants, and indeed of all other RES because according to the Report, Bulgaria has met its target for the share of green energy eight years earlier.
The Sustainable Energy Development Agency has limited competences	Currently, there is no national authority responsible for the implementation of an integrated national plan to promote the development of renewable energy and energy efficiency in all sectors. There is an Agency responsible for sustainable energy development, called the Sustainable Energy Development Agency (AUER). However, this agency is subordinated to the Ministry of Energy, which limits its competences. Therefore, the status of this Sustainable Energy Development Agency (AUER) should be changed in order to become an institution working independently from the Ministry. This step could contribute to a better support to the renewable energy sector.
Not easily accessible public information about the site selection process –although there are relief/lay, topographic, rough potential wind and	To accelerate the introduction of cadastral maps.

solar, etc. maps which are publicly accessible, the finding of the documents is rather a lengthy and difficult process related with personal connections, trial-and-fail attempts at communication, pulling strings, etc. Despite the requirements of a EC directive, still there are no publicly available cadastral maps.	

Croatia

Key Ideas

8 interviews (4 PV and wind project developers, 1 energy market regulator with recent experience in banking, 3 commercial banks)

- The quota for solar PV in Croatia is limited to 50MW. Consequently, the market stopped in 2013/2014 when this level was reached. The quota for wind energy increased from 400 MW in 2015 to 740 MW in 2016 and has also been reached, but projects are still in construction. Consequently the data on wind energy is more up to date than for solar PV.
- A new renewable energy law was enacted in September 2015. The law introduced a change from Feed in Tariffs to Feed in Premiums and competitive bidding. However until today, this has not been implemented, because of internal political instability that led to new elections in September 2016. Consequently the effectiveness of current policies could not be estimated, as they are still not known in detail.
- The debt/equity ratio for wind onshore is estimated at 70/30, although projects financed by the Croatian Bank for Reconstruction and Development receive 75/25. The debt/equity ratio for solar PV is estimated at 75/25 on average. This final ratio however largely depends on the investor/project developer experience and profile.
- The WACC estimations for onshore wind range from 7,75% to 8,5% while the estimations for solar PV range from 6,85% to 7,6%. There is a slight fall in WACC as compared to initial model estimates and this is mainly contributed to a fall in bank margins by 1%. Banks in Croatia compete for the best projects, which are very rare and consequently this led to a decrease in margins. The fall in EURIBOR interest rates could also be ascribed to this trend but its effect is smaller.
- The risk-free investments in Croatia, including airports and highways achieve a WACC of about 6%, indicating that renewable energy policies lead to a risk premium of about 1 to 2% in WACC costs.
- The Cost of Equity has been estimated as 15% for both onshore wind and solar PV, however some wind project developers have indicated that there is a downwards trend and that high quality investments can receive cost of equity of 12%. This too could also be one reason why the overall WACC is decreasing.
- The Cost of Debt for both onshore wind and solar PV has been estimated in the range from 4,5% to 7%. This is lower compared to the model estimates, and largely due to a fall in bank margins, which is mainly the result of decreasing cost of debt in Europe overall.
- The most significant risks as indicated by the interviewees are policy design and country risk. The renewable energy policies in Croatia lack long-term stability. Furthermore the fear of retroactive changes is high, partly due to experiences in neighbouring EU countries like Bulgaria and Romania and partly due to a recently planned retroactive change in Croatia. Namely the new renewable energy law plans to

introduce a surcharge for balancing costs (in order of 3,5 EUR/MWh) that would apply to all existing and future producers.

- Long term stability and strategic planning on a national level was indicated as the main de-risking mechanism. Furthermore the interviewees anticipate that the upcoming Feed in Premium system will not increase risk significantly. However this is provided that long-term regulatory stability is ensued.

Financial Parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio wind onshore	70/30	**Opinions divided** <70/30 and 75/25>	• The typical value is 70/30. However, the conditions depend on the source of financing. For instance, a banker told us that the Croatian Bank for Reconstruction and Development achieves 75/25.
Debt/Equity ratio PV	80/20	**Opinions divided** <70/30 and 80/20>	• The majority of interviewees indicated 75/25 • Only two project developers stated 80/20 while one solar PV developer (who constructed 30% of the existing plants) indicated 70/30 • Considering this, the average is 75/25. However, some bankers that were interviewed did not have recent solar PV experience due to the fact the market stopped in 2013/2014
WACC wind	8.5%	**Opinions divided** <7.75 and 8.5>	• There is a downward trend for WACC mainly due to a decrease in bank margins that have fallen by 1%. Bankable projects are very rare in Croatia and so banks compete for the best ones by lowering their rates. • Most interviewees indicated that the cost of equity is 15%. but that there is a decreasing tendency. Project developers in particular indicated that 12% can be obtained but only for experienced investors, with a good profile and track record. It is fair to say that the overall WACC should be about 0.5% lower

WACC PV	7.6%	**Opinions divided** <6.85 and 7.6>	• The reasons for a slight drop in WACC (about 0.5%) are the same as for wind energy
Cost of equity wind onshore	15%	**Opinions divided** <12% to 15%>	• Same comments as above. There is no apparent difference between the technologies
Cost of equity PV[15]	15%	**Opinions divided** <12% to 15%>	• The majority of interviewees indicated 15% (5 out of 8) • Two project developers commented that the cost of equity is 12 to 13% (due to the fact that Croatia is a stable EU country, with a history of successful projects)
Cost of equity wind onshore	15%	**Opinions divided** <12% to 15%>	• Same comments as above. There is no apparent difference between the technologies
Cost of debt PV	7%	**Opinions divided** <4.5% to 7%>	• One interviewee stated the cost of debt is between 4.5% and 5.75%, and another one between 5% and 6%. According to them, the banks have decreased margins by 1%. This is mainly due to a lack of bankable projects in Croatia, which leads the banks to compete and decrease their costs.
Cost of Debt wind onshore	7%	**Opinions divided** <4.5% to 7%>	• See above. There is no apparent difference between the technologies
Debt term PV	10 years	**Agreement** 10 to 12 years	• The debt term is 10 to 12 years – typically this is the FIT length minus two years. For instance, the FIT used to be 14 years, so the typical debt term was 12 years
Debt term wind onshore	10 years	**Agreement** 10 to 12 years	• See above. There is no apparent difference between PV and wind technologies on this point

[15] Please note that the costs of equity obtained from project developers were probably more relevant than the ones obtained from bankers. Bankers have not financed a solar PV project for a long time (due to the quota) while some project developers are still active in smaller projects. It is also important to note that these numbers concern mainly PV project of smaller size (typical for Croatia is 30 kW)

Typical wind and PV estimations:

For our estimations, we used typical wind onshore and PV-projects. In the tables below, these estimations are compared to the estimations of the interviewees:

Wind onshore	Model estimations	Interviewees estimations
Size	10 MW (3-5 wind turbines)	35 MW (12 to 20 turbines)
CAPEX	1,375 €/kW	1200 - 1500 €/kW
OPEX	10%	3,5 - 10%
Economic lifetime	10-20 years	15 - 30 years

PV	Model estimations	Interviewees estimations
Size	1 MWp, ground-based	0,03 MWp roof based
CAPEX	1,600 €/kW	900 - 1600 €/kW
OPEX	12%	6-12%
Economic lifetime	10-20 years	10 - 25 years

The PV-results show quite a large range in the CAPEX-figures, ranging between 900-1600 €/kW. The upper limit of the range was provided by interviewees that had their last PV experiences two to three years ago. The most recent data (900 for bigger than 30kW and 1100 for smaller) came from interviewees that are still active in the Croatian solar PV market.

Renewable energy investment risks

The safest investments in Croatia are considered to be highways, airports and modernization of existing production processes (like food processing). Such investments achieve a WACC of between 6-8%. **This means that renewable energy investments are typically adding a risk premium equal to 1-2% in WACC.** Airports and highways are the safest investments because they usually involve a government guarantee, and expansions of existing production facilities because their business model is already proven. Wind and solar PV depend on politics (as is the current case due to repeated elections etc.) and policies. Due to the instable regulatory framework, wind and solar PV have higher WACC.

The risks with the largest impact are **policy design risk and sudden policy change risk**. These were followed with **grid access risk and administrative risks**. The interviewees fear the most changes in policies because they impact their long term planning and can potentially impact existing projects cash flows. A retroactive measure that is currently expected includes charging all existing and future project for balancing costs. Although these costs are estimated to be relatively small (about 3.5 €/MWh), their introduction is still perceived as very negative. This is mainly due to the fear potential of future changes that could have a greater impact. For instance, some project developers challenged the government's ability to finance the renewables support scheme, due to a relatively small renewables surcharge. Grid access risk is perceived as important as it is dependent on approvals and cost estimates from Hrvatski Operater Prijenosnog Sustava (HOPS) the branch Hrvatska elektoprivreda (HEP), which is the main government electricity company. Namely the final cost estimate for the grid connection is obtained at approximately 60% of project development stage and after the location permit is granted. Besides this HOPS determines the amount of solar and wind energy the grids can take and without their approval no project can be developed. This is determined based on their internal studies.

There were no differences between solar PV and wind.

Impact of policy changes

In the last five years only minor changes have occurred, such as decreasing the FIT of solar PV and wind energy and the removal of a necessary bank guarantee. Furthermore, the quotas for these technologies have changed as well. The solar-PV quota was limited to 50 MW and no new plants were signed for a couple of years. For wind energy the quota was increased from about 400 MW to about 740 MW in at the end of 2015. However, the change with the largest impact was the recent proposal for introduction of the Eco Balancing Group, where RES producers are obliged to pay balancing costs of about 3.5 €/MWh. This measure will be applied retroactively to all projects. The measure was first introduced end of 2015 together with the new RES law and the introduction of the Feed in Premium. However the new government was formed in October 2016, and after one year of political instability. During this time the prime minister received a vote of no confidence and re-elections were held. Consequently the exact format of the FIP system has still not been defined and this causes additional uncertainty. It is difficult to estimate how these most recent changes will impact future investment decisions. However, the announced retroactive introduction of balancing costs had a negative effect on the overall investment climate for RES already prior its implementation, since now investors are uncertain if the government will introduce some new additional changes.

De-risking mechanisms

Interviewees rated the effectiveness of current renewable energy policies to reduce RES invesments risks with a range between 1 and 5. Five scores. The scores are variable because the interviewees do not know how the future policy design will look like. At this stage, the future design of the FIP system is not known and the previous Feed in Tariff system is officially not in effect.

Quotes ranged from : "If the new premium system works predictably and stable, this should be rated between 3-4. However the previous FIT system could be rated at 5". "Currently it is very low – the current policies cannot reduce the investment risk – they are unknown". "The previous FIT system could be rated at 3-4. The new FIP system cannot be commented upon until there are some projects being financed". "If a new and improved energy strategy is written and applied, and all regulation and deregulation is in place, then the renewable energy policies could achieve a score between 4 and

5. Because of the current uncertainties, the policies are increasing the investment risk". "The answer is 1. For instance, last year the company has acquired for its clients 20 million HRK (about 2,5 million EUR) worth of projects through EU funds and in cooperation with the Environmental Protection and Energy Efficiency Fund. However when they started developing the projects, the Fund notified the company that they couldn't pay him the "awarded" funds. They explained that this was because of changes in the government and the rebalancing of the budget. Therefore in the current system, there is no legal security, as the country does not respect its contracts in general. However the PPAs have been respected well without any exception and in that sense he knows that the support price will be paid out"

According to interviewees, the biggest de-risking mechanism is **long-term regulatory stability** and functioning of the legal system. Cost of equity, WACC, cost of debt and debt would all decrease but no quantified impact has been made.

Measures as mentioned below should be taken to make the cost of capital for renewable energy projects in SEE countries comparable to Western European countries:

- Have long-term regulatory stability.

- Improve the overall macroeconomic conditions of the countries in order to reduce the country risk.

The country risk is the primary source of high WACC in the countries. For instance Croatia is currently rated Ba2.

Greece

Short summary – Key Ideas

7 interviews in total, out of which

Inputs for ground based PV were provided by (1 developer , 1 utility, 1 bankers, 1 policy maker, 3 RE market experts) Inputs for ground based PV were provided by (1 developer , 1 utility, 1 policy maker, 2 RE market experts)

- Over the last 2 years and due to the retroactive decrease of the feed-in tariffs applied in 2014, no PV projects and only a few onshore wind projects were developed.
- The debt/equity ratio depends on who is financing the project and on the investor's profile. Onshore wind projects have higher debt/equity ratio, since such projects are usually developed by larger companies. Banks cap their part to 70% for onshore projects. PV projects featured a debt/equity ratio of 60/40%.
- The WACC for onshore wind is in the range of 10-12%. This range seems to be due to the infrastructure costs which increase the CAPEX of some wind projects and hence affect the WACC. There was no agreement among the interviewees about the WACC for PV where the resulted range is 7-12%.This result could be due to the fact that no PV projects were implemented or developed in the last 3 years and therefore the interviewees referred to old projects and also of different sizes.
- The CoE for PV is around 12%, while for onshore wind, it is higher. According to the interviewees, the CoE for wind can be project-specific, as for some projects the risks due to lack of infrastructure may be higher.
- The CoD for onshore wind is in the range of 6-8% while for CoD for PV, the range is much wider (6-12%) which seems to be due to the different size of the projects (residential, small, large) and the different investor profiles.
- The interviewees identified many different risks. However all agreed that country risk and the retroactive effect of a policy are significant investment risks.
- A new policy was introduced in August in 2016. The main changes are the new policy scheme (feed-in-premium) and the obligation to participate in the intraday electricity market. The interviewees expected that the new policy will result in a more competitive market but at the same time will promote new investments in RE projects.

Financial parameters

Financial parameter	Model value	Interviews	Technology	Comments

Debt/Equity ratio	65%/35%	**Opinions in agreement** 60/40	• PV	• Almost all interviewees indicated a debt/equity ratio of 60/40. • Small project (up to 100 kW) can be even financed by 100% own equity. • A bank's associate indicated that the ratio is in the range of 60-65%/35-40% and strongly depends on the investors profile.
Debt/Equity ratio	55%/45%	**Opinions quite in line 60-70%/30-40%**	• wind onshore	• Because of the size of the projects, which are quite big usually larger companies develop wind projects and therefore the debt/equity ratio is higher. • The maximum share of the bank is 70%. 2 projects developer and a policy maker indicated that the ratio is 70%/30%. Other experts mentioned that the value is 65%/35% or even 60%/40% being the same with PV. • Regarding the factors that exert highest influence on the debt/equity ratio, the answers were diverse: banks capability to finance, investors profile, political and economic stability and project specific factors. The 2 most popular answers were: 1. the investors profile and 2. the bank's ability to finance the project.
WACC PV	12.4%	**Opinions divided** 7-12%	•	• The collected answered were very different. This could be due to the fact that over the last 3 years there were barely any investments in PV. • 3 experts indicated 10-12%, one indicated 8% (but the value changes for different projects), one 7-7.5% and one agreed with

				the proposed value of 12.4%. The interviewed policy maker didn't not provide any value, since investments in PV have not been made in the last years. • Almost all interviewees agreed that the most important factors that affect the WACC in PV are the political and the economic stability and the safe investment environment.
WACC wind onshore	13.7%	**Opinions divided** 10-12%	•	• Most of the interviewees provide a range instead of a fixed value. The value of 11% was included in the ranges of 3 interviewees, one agreed with the proposed value of 13.7% and the policy maker indicated that a typical wind farm would have a WACC of 12%. • According to the interviewees the economic stability and the country's risk affect the WACC. • The given range of WACC seems to be related to the different projects; Some projects have much higher CAPEX because of the necessary infrastructure works which increase the cost of capital and hence affect the WACC.
Cost of Equity PV	21%	**Opinions divided, too high** 10–15%	•	• 5 interviewees answered the question • The majority of the interviewees provided a range around 12%.
Cost of equity wind onshore	21%	**Opinions divided, too high** 11–18%	•	• 5 interviewees answered the question • The range can be wide since it depends on the project itself; some projects have increased risks (e.g. depending on location

				infrastructure, works might be required) and in these cases the CoE increases.
Cost of debt PV	11%	**Opinions divided** 6–12%	•	• Most interviewees agreed that the modelled cost of debt was too high. • 2 interviewees provided answers close to the modeled value. • Depending on the size of the project, the cost of Debt changes; larger projects have lower cost of debt.
Cost of Debt wind onshore	11%	**Opinions quite in line** 6–8%	•	• Most interviewees agreed that the Cost of Debt was too high. • With the exception of one interviewee who agreed with the modelled value, the rest agreed that the cost of debt for onshore projects is within the range 6-8%.
Debt term PV			•	•
Debt term wind onshore	10 years		•	•

Typical wind onshore and PV project used for estimations for Greece:

For our estimations, we used typical wind onshore and PV-projects:

Wind onshore	Model estimations	Interviewees
Size	10 MW (3-5 wind turbines)	20-30 MW (A-B wind turbines)
CAPEX	1,250 €/kW	1200 - 1375 €/kW
OPEX	4%	6-18%
Economic lifetime	10-20 years	20-25 years

Additional feedback and comments from the interviewees:

Wind farm size: All interviewees agreed that the model estimation (10 MW) was very low.

Regarding the CAPEX, one of the interviewees provided a value around 1200-1300€/kW for a typical project. However the CAPEX can be increased due to the fact that infrastructure costs (roads, grid) increase the CAPEX.

On the OPEX, the opinions are very different and vary between 6-18%, as presented in the table above. An interviewee estimated the OPEX for onshore wind to be 30-35 € per installed kW.

Lifetime: the majority agreed that the lifetime of the project is 20 years.

According to the majority of the interviewees, renewable energy projects are considered to a safe investment in Greece at the moment, mostly due to the secured income[16]. The answers regarding the other type of investments that are currently safe in Greece were diverse and included mostly infrastructure projects, such as road and harbours as well as tourism.

In the touristic sector for instance, WACC is around 10 %. The investments in tourism, despite the fact that they do not have a secured income like RE projects, are still considered to be safer than investments in RE projects.

PV	Model estimations	Interviewees estimations
Size	1 MWp, ground-based	1 MWp
CAPEX	1,050 €/kW	<1000-1200 €/kW
OPEX	2%	4-12%
Economic lifetime	10-20 years	20 years

Half of the interviewees agreed that a typical size of a PV projects is 1 MW while the rest are of the opinion that this is a median size.

The majority of the interviewees agreed that the CAPEX is in the range of 1000-1100 €/kW.

The majority estimated that the OPEX is in the range of 10-12%. An interviewee indicated that the OPEX is around 15 €/kW.

Renewable energy investment risks

A very important risk, is the country risk which seems to impact all investment activities. Additionally, according to the interviewees, the retroactive policy is a risk that has a very negative

[16] Investors considered the income from renewable energy projects to be secure since the power purchase agreements were based on a predefined energy price (feed-in tariff) at least under the policy scheme applicable until August 2016.

impact on the investment environment. Other risks are the lack of the long-term renewable energy strategy, the heavy taxation of the companies and the state of the Greek banks which could be considered as bankrupt.

With regards to the risks related to the new policy which was issued in Greece in August 2016, the related risks are the uncertainty of the policy scheme since there are many unclarities, as well as the change of the scheme from feed-in tariffs to feed-in premium and the obligation for energy market participation for which there is no experience in Greece.

Impact of policy changes

Back in 2014 a law was introduced which resulted in a significant decrease of the feed-in tariffs. that law was applied retroactively. As a result no PV projects were develop ever since. With regards to the wind projects, only a few were developed.

It is estimated that the 2014 law resulted in an increase of 1-2% in terms of WACC and CoE in onshore wind.

With regards to the new law, which was introduced in August 2016, it is expected that the market will become more competitive.

No changes in the policies are expected in the next years considering that the new policy was introduced only a couple of months ago. Nonetheless, clarification with regards to the market rules and the policy scheme are expected to be published in the next period.

De-risking mechanisms

Interviewees (6) gave an average score of 2.6 on the effectiveness of currently implemented renewable energy policies to reduce renewable energy investment risks

The majority of the interviewees (4) gave a score which is >= of the average score (2.5). These interviewees believe that the new policy will have a positive effect in the investments in RE projects, considering that in the last years there only a few onshore wind projects developed. However, these interviewees were still a bit sceptical since the policy scheme and the details with regards to the market rules and the support scheme are not yet clear.

According to many interviewees one significant risk which should decrease is the Country's risk. Additionally, the banks should be able to provide finance to RE projects and the economic environment should be steady. The payments of the power producer's should be in time and not with 6 months delay which is the current situation. A couple of interviewees also indicated that a clear strategy for RE is necessary.

If these de-risking measures would be implemented:

- the CoE is would decrease and it could even drop to <10%
- the WACC would decrease and it would be in the range of 7 – 9%
- the cost of debt would decrease to ~5%

- the debt/equity ratio would increase and from 60%/40% which is in some case it would reach 70/30

The cost of Capital in Greece is higher due to the financial crisis, the lack of trust and the capital controls[17]. For this purpose the lift of capital controls and the support from EIB could help the situation of the banks and hence the RE investments.

Additionally, another measure would be to improve existing grid infrastructure and permitting procedures which have a significant share in the Cost of Equity of the larger projects (wind farms, large scale PV plants). Last but not least, a decrease of the cost of debt seems to be necessary by a few of the interviewees.

[17] Capital controls were imposed in Greece in June 2015 by the Greek Government in order to avoid a potential collapse of the banking system. The direct results of the capital controls have been the restricted withdrawals and money transfer to foreign banks. The capital controls remain enforced but with relaxed restrictions.

Hungary

Key Ideas

9 interviews in total, out of which input for ground based PV were provided by (3 project developers, 1 utility, 1 financial institute, 1 authority). Inputs for wind onshore were provided by (1 utility and 2 project developers/plant operators)

- **In general, Hungary has a still barely evolved PV-market with rising tendency (approx. 110 MW in 2015 and approx. 170 MW in 2016 overall installed capacity).** Due to the risks resulting from the policy design and the respective legal framework**, the installed capacity** for wind power **stagnates at 329 MW since 2011.**
- The debt/equity ratio for PV-projects depends on the conditions of the loan granted: If a favourable loan is offered by the state (in the framework of a funding programme), only 10% of equity are required. On average, a debt/equity ratio of 70%/30% for projects up to 500 kW is considered realistic. A**ccess to bank loans** for projects with a high capacity (>500 kW) **is considered exclusive and banks demand for guarantees which a medium-scale entrepreneur cannot afford**.
- In case of wind power, the political and legal framework has entirely impeded the development of new projects since 2011. Therefore, the financial parameters for wind can only be hypothetically re-evaluated. However, if projects were realised, a debt/equity ratio of 70%/30% is considered appropriate.
- The WACC for ground based PV plants is around 7.32%-7.4%. However, the majority of the interviewees experienced difficulties in determining this financial parameter: On the one hand, many PV-projects are realised through EU-funds. On the other hand, interviewees stated that – under given conditions – it is barely possible to evaluate the representative figures for equity-based external financing. As an alternative, the industrial standards of Damodaran's model are used. The WACC for onshore wind is hypothetically around 8%-8.5% in Hungary.
- Concerning the CoE for PV in Hungary, the opinions of the experts were divided: One expert stated 6%, another 8.75%. However, this parameter has only been assessed by three interviewees owing to the above-mentioned difficulties. The equity-IRR is approx. 15% for wind onshore and varies between 6-12% for PV**.**
- **The CoD for PV-projects depend on the financing scheme, the plant**'s capacity as well as the investor profile. If the project developer is eligible for EU-funds within tendering procedures, the CoD is 0%-2.5%. However, a usual bank loan is around 3.5% while the total range was 0-5.06%. Concerning wind onshore, only one project developer could refer to a value, namely 6%. However, the entire wind power market has been stagnating for years.

  In general, the **remuneration scheme for RES-E is considered unreliable which affects the creditworthiness especially of SME. Severe** risks **might impede the realisation of projects and lead to an additional financial burden (e.g. grid**

issues and high taxation). In the wind energy sector, the policy measures have led to a complete standstill. With regard to the amendments introduced in 2016, no change is expected in the upcoming years. Moreover, the administrative costs rise significantly for plants with >500 kW due to the strict scheduling system of electricity production with the result that there are only two PV-plants with a higher capacity complicating the assessment of the financial parameters.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio PV	75/25	**Opinions quite in line** >70/30	• The majority of interviewees indicated a ratio of 65-75/25-35. • These figures are broadly convergent with the debt/equity ratio which has been evaluated by the Hungarian Energy and Public Utility Authority (HEA): This was 70/30 on average. • Under exceptional conditions the ratio can increase up to 90/10 with a credit from the National Development Bank. However, the requirements in order to receive this type of loan can hardly be met according to the interviewed experts. • Utilities have a different ratio with regard to the two existing high-capacity ground-mounted plants: The one was self-financed by 50% and by 50% through a development tax credit. The other 10 MW PV-plant which is state-owned, was self-financed by 20% and by 80% from EU-funds.
Debt/Equity ratio wind onshore	70/30	**(Agreement)** >65/35	• This value has been commented on by two project developers. Two project developers indicated 70/30, the other 35/65. The value has to be considered as very hypothetical, since no plant has been constructed since 2011.
WACC PV	7.4%	**Opinions divided** 7.32-8.75%	• According to the three information sources, the value for the WACC is realistic. • See below. • Indications ranged between 7.32% and 8.75%. However, 8.75% were indicated by the company

			whose PV project was by 50% equity financed and where 50% were granted through tax exemption on the company result. (Therefore, the 8.75% can be seen as equity costs and not as the WACC.) • 7.32% were indicated by the Hungarian Energy Authority (HEA) for the WACC, taking an average RES-investment project into consideration (not PV in particular).
WACC wind onshore	7.9%	**Higher** 8.0-8.5%	• This value has only been commented on by two project developers. One developer indicated a range of 8.0-8.5%, another indicated 8.5%. The value has to be considered as very hypothetical.
Cost of Equity PV	9.3%	**Opinions divided** 0–13.78%	• One investor indicated 6% (which they calculate with for every RES project). • According to the Hungarian Energy Authority (HEA), the cost of equity amounts up to 13.78% for an average RES project. • Actual value depends on class of investors (utilities usually demand higher cost of equity than private energy cooperatives). • The equity-IRR for PV-projects was indicated with 6-12%. • The cost of equity is 0% when a project is completely financed through EU-funding.
Cost of equity wind onshore	14%	6-15%	• One investor indicated 6% (which they calculate with for every RES project) • According to the Hungarian Energy Authority (HEA), the cost of equity amounts up to 13.78% for an average RES project. • With regard to the current situation in Hungary, this value is also hypothetical. • The company of another project developer stated that with reservations regarding the grid connection costs as well as the wind climate, the IRR of wind projects in Hungary is around 15%.
Cost of debt PV	6%	**Opinions divided** 0–5.06%	• 0-2.5% with a grant from the Hungarian National Bank or an interest-free loan through tendering procedures. However, this type of a loan is associated with conditions which cannot be fulfilled. • Another investor said 3-5% and another 3-4%

			• According to the Hungarian Energy Authority (HEA), the average cost of debt amounts up to 5.06%
Cost of Debt wind onshore	6%	**(Agreement)** 6%	• The cost of debt was commented on by one project developer. However, his company does no project financing, only corporate financing. Considering this and the fact that no plants are built, this value is hypothetical.
Debt term PV		15-20 years	• The financial institute contacted stated a maximum debt term of 15 years. • The debt term of 20 years is related to household-size PV installations.
Debt term wind onshore	10 years	**N/A**	• No feedback was received on the debt term.

Additional Detailed information collected on:

Debt/ Equity ratio – PV

Considering the debt/equity-ratio, the proportional distribution has been assessed realistic as well as the WACC for ground-mounted systems by one investor. The head of strategy of a well-known company has rated the debt/equity-ratio 65%/35% and the WACC 8.75% which is the cost of equity in their case.

Nevertheless, another system installer stated that there are also financing models which grant loans at a debt/equity-ratio of 90%/10% and a bank loan with up to HUF 150 million (approx. EUR 485,46 tsd.) with an interest rate of 0-2.5%. In this case, the interviewed experts were divided: At least two of them stated that it is almost impossible to access that kind of a loan which is tied to conditions which cannot be adhered (in most cases).

Debt/ Equity ratio – Wind

One of the interviewed investors – whose company is somehow or other involved in the construction of 126 MW (out of 329 MW) installed capacity in Hungary – has stated that the debt/equity ratio of 65%/35% is hypothetically realistic.

Total WACC – PV

The results for PV in Hungary should be viewed against the background that – due to the comparatively low overall capacity – no real market has been established yet and therefore representative results cannot be ensured for the queried financial indicators.

In general, the evaluation of the WACC is difficult since national banks do not grant loans for SME's resp. middle-sized plants. Those (= middle sized ground-mounted plants) are usually realised through EU-funds (e.g. Environmental and Energy Efficiency Operational Programme) whereby usually the Hungarian state is the main beneficiary. However, the tendering procedures have been unanimously considered being not transparent and very exclusive.

Cost of Equity – PV

In addition, the cost of equity was named being approx. 6% on condition that Hungarian government bonds and the market risk premium are not right values for Hungary to calculate with.

Interviewees stated that – under given conditions – it is barely possible to evaluate the representative figures for equity-based external financing. As an alternative, the industrial standards of Damodaran's model are used.

Cost of Debt – PV

All in all, national banks usually do not grant loans for PV projects with a high capacity (>500 kW) due to the fact that the legal background for the construction process and the financing (namely the support scheme) for PV plants with a high capacity is not considered reliable. This is also caused by the fact that the remuneration scheme (namely the feed-in tariff) might be changed arbitrarily. Small-scale installations are generally spreading more dynamically in Hungary due to the financing opportunities as well as due to the net-metering system which applies for installations with a lower capacity than 50 kW. However, the net-metering is not considered sustainable for DSOs who press the government to change the system in the near future.

Typical wind onshore and PV project used for estimations for Hungary:

For our estimations, we used typical wind onshore and PV-projects:

Wind onshore	Model estimations	Interviewees
Size	10 MW (3-5 wind turbines)	1-4 MW (1-6 wind turbines) or 50 MW (15-20 wind turbines)[181]

[18] Within the model, a typical size of wind parks with 3-5 wind turbines and a capacity of 10 MW was suggested. However, the typical size of wind turbines which have been erected in Hungary was between 0.6-2 MW until 2011. The typical overall capacity of the wind park depends on the type of connection. If the wind park is connected to the medium voltage grid, typically an overall capacity of 1-4 MW has been

CAPEX[192]	1,375 €/kW	1,000-1,375 €/kW
OPEX[20]	10%	5-10%
Economic lifetime	10-20 years	10-15 years

Additional feedback and comments from the interviewees:

- Real estate projects usually pay off in about 5-6 years in Hungary.

PV	Model estimations	Interviewees
Size	1 MWp, ground-based	Ground-based: <0.5 MWp, exceptional projects: 10 MW/16 MW. New planned: 2x20 MW
CAPEX	1,600 €/kW	1,000-1,300 €/kW (depending on the economies of scale)
OPEX	12%	3-5%
Economic lifetime	10-20 years	20-25 years[211]

installed. If the wind park is connected to the high voltage grid, the overall capacity is around 50 MW, since it guaranteed the best economical feasibility and the connection costs could be shared. If new plants were built now, the optimal capacity with regards to the domestic wind climate would be 2-3.5 MW per turbine. Considering the current grid structure in Hungary, 1-2 plants could be connected to the medium voltage grid, wherefore the wind park would consist of 1-6 wind turbines. If the wind park was connected to the high voltage grid, a wind park with up to 15-20 wind turbines (max. capacity of 30-50 MW) could be built. However, 50 MW are still (hypothetically) considered as a threshold due to the regulatory environment.

[19] According to the project developers, it is difficult to understand the term of CAPEX, since companies might calculate this figure in a different manner. For example, the grid connection/extension/reinforcement costs might be included or not.

[20] [3]According to the project developers, it is difficult to understand the term of OPEX, since companies might calculate this figure in a different manner. For example, the grid maintenance costs, additional construction costs might be included or not.

[21] According to a system installer with long-term experience, PV-systems have a lifetime of 30-40 years. Therefore, the economic lifetime is at least 20 years. However, experience has shown that in case of technical problems which often occur, the warranty cannot be ensured due to the fact that a large number of panel manufacturers has stopped production. This might affect the economic lifetime.

Renewable energy investment risks

PV: The administrative burden is too high/ administrative processes are long and bear risks which might impede the realisation of a project *(policy design/administrative risk)*:

All in all, the administrative tasks which have to be performed are considered too high and seem to vary depending on the investor involved. Furthermore, it occurs that money is spent for the authorization procedure but it might turn out that the feed-in tariff will not be granted in the end of the authorization process (for unjustifiable reasons).

In addition, for plants with a higher capacity than 0.5 MW (third category) the operators have to hand in a schedule for electricity production on a daily basis. If the production is estimated erroneously by more than 50%, the plant operator is obliged to pay financial penalties for every incorrectly given kWh beyond the 50%. The strict scheduling system is associated with a high administrative burden and is one of the main reasons for investors to decide against the construction of a plant with a higher capacity than 0.5 MW.

PV/all RES projects: Site selection might be a problem to an investment decision *(grid issues)*:
The DSO might refuse the connection to the grid from a certain site for unknown or unjustifiable reasons. The law only prescribes that the DSO has to connect the RES-E plant to the grid, however, it is up to the DSO whether he accepts the chosen site by the system installer or not. Furthermore, there are no incentives for the DSO to extend the grid. As a result, he often passes on the costs to the project developer which threatens the financing and therefore the realisation of projects.

PV: Tendering procedures for EU-funds are not transparent and might distort the market *(Financial risk)*

On the one hand, EU-funds for PV investment projects through tendering procedures are certainly accessible for public buildings which means that the government is the greatest beneficiary of the tendering system in the renewables sector. It has been observed that applications are often submitted by the same market players, given the fact that inter alia too much experience with the administrative procedures is necessary to win a tender. Consequently, it is barely possible for new market players to participate. In addition, experts of the Hungarian PV market stated that it makes no sense to participate in tenders, because 'the winner is known in advance'. Moreover, the conditions in order to be eligible for the funds which are tendered are not clarified until the end of the procedure and therefore mean a financial risk to the investor until the tender is closed. Furthermore, it has been analysed that the projects which are realised through tenders are not considered cost efficient and competitive on the free market. Those projects operate on approx. 30-40% higher costs than not tendered projects.

Impact of policy changes

Massive changes concerning the political line since 2010 with regards to the 'right to exist' of wind power plants *(risks caused by policy design)*

In 2010, the Hungarian government has withdrawn the invitation to tender for a capacity of 410 MW to be additionally installed in the country but has announced that a new invitation to tender will be released in 2011. However, no invitations to tender have been announced since. Furthermore, interviewed experts have stated that the dialogue between the wind power sector and the Hungarian government has ceased completely.

Administrative barriers entirely impede the realisation of investment projects in the wind energy sector *(policy design/regulatory risks)*:

As of September 2016, special restrictions for wind power plants have been introduced. To sum up the new regulations, the technical requirements comply with the standards for wind power plants which were built approx. 10 years ago. However, the most important and significant barriers to the construction of new wind power plants are the modifications of the regulations on national site planning and building requirements. On the one hand, this Government Decree determines that wind turbines are not allowed to be constructed in areas for building purposes and its borders within a range of 12 kilometres. According to a respective study[22], there are no available sites in Hungary which fulfil the requirements (Those do not apply for household-size wind turbines up to 50 kW). On the other hand, a flexible paragraph has been included, namely that the construction of wind power plants has to be in line with the superior interests of the Hungarian defence necessities. According to experts, this paragraph can be argued with in any case the Hungarian government wants to inhibit the construction of a new wind power plant. In concrete terms, the Decree has stopped the development of the wind energy sector in Hungary for an indefinite period.

National taxation policy influences payback time *(Financial risk)*:

According to the interviewed experts the Hungarian government has rather contributed to increased risks for investment in the PV sector than to their abolition. On the one hand, this has financial aspects: The high value added tax of 27% in Hungary (which is the highest in the European Union) is considered a high impediment for investment projects in general. In addition, the government has levied an environmental tax on solar panels as of 2015 which is HUF 114/kg (approx. 37 €ct/kg). For PV plants (with high capacities) the tax means a significant additional financial burden which is also confirmed by investors in the PV sector. In addition, the environmental tax has to be declared to the tax authority which means an another administrative burden for plant operators. According to the Hungarian Solar Association, the political constraints including the taxation policy have led to the fact that Hungary has the highest payback time for PV installations/plants in the European Union.

Uncertainties concerning the new remuneration scheme as of 2017 *(Risks caused by policy design)*:

[22] http://www.energiaklub.hu/blog/szabad-csak-nem-lehet

In Hungary, the long-awaited new support scheme for renewable energy will be introduced by 1 January 2017. The reform of the current obligatory electricity feed-in tariff scheme has been planned since 2011. The long period of implementation has led to uncertainties concerning investment planning. However, the new scheme might fall victim to corruption too with regards to the current problems with tendering procedures for investment funds financed through subsidies by the European Union in Hungary. Nevertheless, the risks are moderate since only plants with a greater capacity than 0.5 MW will be obliged to participate in tenders and therefore only a small circle of actors are affected in the PV sector. Furthermore, clear rules of the new scheme are still undefined.

The construction of new nuclear reactors affects the political support for RES as well as the grid development *(risks caused by policy design)*:

Experts are certain that the long-term decision to extend the capacity of Hungary’s nuclear power plant (Paks II) will have a negative effect on the development of RES in Hungary. Furthermore, experts have raised concerns that due to the political line which is clearly pro nuclear energy, the support for the PV sector could be cut anytime following the example of wind onshore which has been practically banned in mid-2016 through one governmental decision. The political uncertainty and arbitrary decisions are the main reasons for missing investments in the PV sector as well as accessible loans according to the experts.

De-risking mechanisms

The currently implemented renewable energy policies to reduce renewable energy investment risks are not effective to serve as de-risking mechanisms for project financing. The interviewed experts unanimously agreed on this. Therefore, the average score is 1. However, the new support scheme METÁR which will be introduced in January 2017 is expected to bring a new upturn at least to the PV-market. Considering wind onshore, no change is awaited as long as the government is in place (until 2018 at least). Therefore, there are no expected values available.

Measures as mentioned below should be taken to make the cost of capital for renewable energy projects in SEE countries comparable to Western European countries:

It is recommended to reduce the levied taxes (environmental tax on solar panels and the value added tax) in order to create better financial terms for PV in Hungary. The payoff time for PV projects is 10 years on average.

In order to enable loan-based financing for RES-E plants (especially middle-sized PV plants), the banks should resolve contradictions concerning the requirements for loan.

The implementation of stricter monitoring mechanisms for tendering procedures in Member States (where the risk of corruption is high and funds from the European Union are distributed for RES-projects) is strongly recommended. According to experts, it is not understandable that mechanisms like this are missing since the funds rather distort the market than help them to evolve.

The tendering procedures have to be more transparent and accessible to a broader range of actors (predominantly the private sector) as well as to a diversified range of RES technologies.

The DSOs are advised to harmonize their statutory provisions in order to reduce uncertainty when it comes to site selection. Furthermore, the legislator should incentivise the connection of RES-E plants to the distribution grid in order to support the dissemination of RES-E plants financed by small and medium-sized enterprises: Currently, the level of costs for grid extension might impede the realisation of an investment project for that group of actors.

The Hungarian government should generally offer incentives to the DSOs to improve the grid structure since the existing Hungarian network is considered obsolete and insufficient to adhere to the needs of RES-E plants. Local DSOs who also do business in other countries stated that the conditions for grid investment are relatively better in neighbouring countries (like the Slovak Republic).

Romania

Key Ideas

Inputs for onshore wind were provided by (1 regulatory agency, 1 association, 1 developer); inputs for ground based PV were provided by (1 regulatory agency, 1 investment company).

- since 2013/2014 the regulatory framework in Romania is characterised by high fluctuations with the primary and secondary legislative suffering a major content change approximately every 6 months
- this continuously changing regulatory framework and the worsening conditions have transformed the Romanian RES market into a very risky and investor-unfriendly environment without the possibility of a realistic project planning; the conditions under which investors have taken loans from banks and have based their business plans on were changing dramatically without notice
- under these circumstances many big companies have already abandoned their projects and have exited the Romanian market; this continuing exit of the market has constituted also a serious challenge for the conduct of interviews
- the Romanian RES market and especially the wind sector are recording enormous losses since 2014: according to a study conducted by an audit company based on the financial situation of all wind companies recorded in 2014 and 2015 at the Romanian Trade Register, the wind sector has suffered losses of approx. 1 billion EUR only in the two mentioned years.
- besides assets depreciations, many onshore wind and PV in Romania investors go bankrupt.
- newest recalculation show that the investments for wind parks could be recovered in 30 years, while the economic lifetime of a plant is only 20 and the financial support scheme in Romania awarded for a period of 15 years
- while the PV sector has not been hit has hard as the wind sector, PV producers are also in the process of restructuring the already obtained loans and prolonging the debt term
- under these conditions, banks do not award credits for wind and PV plants any longer; due to these most banks have declined participating in this study
- authorizations for the erection of wind parks have not been awarded in a long time; at the same time, the latest parks to be erected have obtained the authorization long time before they were commissioned, usually before 2014
- at the same time the Romanian market has been characterized by a huge abandon in the first 2-3 years of a project (over 2000 MW) after receiving an authorization
- given the sombre perspectives and conditions on the RES Romanian market, all interviewees avoided naming or evaluating figures, while being very much interested in addressing the aspects related to risk evaluation and management
- a deep mistrust in abstract numeric correlations and figures is affecting the Romanian market at the time: even figures, which one might have expected that everybody would be agreeing on, were dismissed (ex. the fact that Romania has reached the 2020 targets regarding the share of RES energy consumption)
- all interviewees agreed that the regulatory risk is decisive for the functioning of a RES

market in general; they all see the instability caused by the numerous amendments to the law as the main factor for the state of the sector

- one PV investor mentioned that the WACC could have been two points lower than the figure estimated by our model, which he agreed with, if the regulatory risk would not have been so high
- many of the interviewees for both wind and solar expect a rise in the cost of debt, should the legislation be amended once more
- nevertheless a further amendment in form of an emergency ordinance is under public debate and awaiting adoption

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio PV	60/40	**Opinions divided**	• The ratio has been seen as too low; a more appropriate was seen to be 70/30; however this ratio describes the situation in Romania before the last intervention and modification of the law (2014); ratio is expected to change due to need of refinancing credits • One of the interviewees for wind compared the wind ratio with the one for PV and mentioned, this would be somewhere 50/50
Debt/Equity ratio wind onshore	50/50	**Opinions divided**	• Interviewees were very reticent in naming any ratios for wind, since there has been no market development/growth for the last 2-3 years • One of the interviewees mentioned the ratio used to be 70/30 before of the last major law modification (2014)
WACC PV	7.4%	**Agreement on figure**	• Interviewees found the modelled WACC figure to be realistic for PV projects • It has been nevertheless mentioned, that this high WACC figure would have been 2% lower without the current extreme high regulatory risk. In other words, investors think, that with a more stable regulatory framework their cost of capital for developing RES projects would also drop. This also

			means, that the regulatory framework is considered to have a decisive influence on the cost of debt and equity of projects.
WACC wind onshore	7.9%	**Shared opinion**	• All interviewees agreed that it is not realistic to predict WACC figures for wind onshore for Romania, since there are no banks willing to finance RES projects any longer and there are no additional wind parks being built
Cost of Equity PV	10%		• 10% cost of equity is realistic (if the conditions remain the same)
Cost of equity wind onshore	10%		• No feedback was received on the cost of equity.
Cost of debt PV	6%		• 6% cost of debt is also realistic; if the law changes, the interest rates are expected to rise. This expectation is based on the prior experience with the effects the amendments to the core law have had to the market. However, the statement is based on the assumption that further amendments will be to the worse and to the detriment of the sector. Nevertheless, even if the regulator would introduce changes to support the RES producers, another amendment will on the short term shaken the market again and increase the regulatory risk due to the continuing alterations and thus instability.
Cost of Debt wind onshore	6%		• No feedback was received on the debt term.
Debt term PV	10 years	**Agreement that the figure is too low**	• Most projects are in a period of credit restructuration. When the originally credits have been received, the conditions on the Romanian Green Certificates have been very different then today. The conditions for producers and the level of lucrativeness is on a descending path for over two years now. Since the predicted income level could not be achieved, the conditions for the credits need to be changed. The most common restructuration measure is to prologue the period over which the credit needs to be paid back. Thus the debt term would increase way beyond the

			previously assumed 10 years.
Debt term wind onshore	10 years	**Agreement that the figure is way too low**	• Most projects are in a period of credit restructuration. When the originally credits have been received, the conditions on the Romanian Green Certificates have been very different then today. The conditions for producers and the level of lucrativeness is on a descending path for over two years now. Since the predicted income level could not be achieved, the conditions for the credits need to be changed. The most common restructuration measure is to prologue the period over which the credit needs to be paid back. However, the situation for onshore wind projects is critical in Romania. At the current level of turnovers it is estimated that investments for wind parks could be recovered in 30 years. Paradoxically, the lifetime of a plant is much shorter than that.

Typical wind onshore and PV project used for estimations for COUNTRY Romania:

For our estimations, we used typical wind onshore and PV-projects:

Wind onshore	Model estimations	Interviewees
Size	10 MW (3-5 wind turbines)	40 MW
CAPEX	1,375 €/kW	Two exact figures were named: 1,6 €/kW and 1,328/kW (in 2015).
OPEX	10%	N.A.
Economic lifetime	10-20 years	Over 20 years

Additional feedback and comments from the interviewees:

- Interviews for the wind sector were difficult to conduct. The sector is badly damaged after the last series of changes to the regulatory framework. Many international companies have already left the Romanian market, several parks have been already dismantled and already first parks have been lost and moved in the property of banks due to the inability of paying back loans.

- The atmosphere is extremely burdened since the predictions for 2017 are even worse. Under these conditions none of the interviewees was interested in discussion other "safe projects", since they thought that the RES sector in Romania was one of the safest and most mature in Europe, in 2008, when the first version of the law had been adopted

PV	Model estimations	Interviewees
Size	1 MWp, ground-based	Agreement of figure
CAPEX	1,600 €/kW	Confirmation of 1,600 €/kW twice and disagreement once, stating a more appropriate figure would be 1,198 €/kW (for 2015)
OPEX	12%	n.a.
Economic lifetime	10-20 years	20-25 years

Additional feedback and comments from the interviewees:

- RES investments in Romania are not seen as safe anymore. Safe projects would be those in streets and infrastructure overall
- One of the interviewees said, the safest investments are those, where there is a bilateral agreement with the Romanian state; overall agreements/frameworks for a whole topic are to be avoided.
- Safe investments in Romania have:
    - a good risk/ return profile
    - predictable cash-flows
    - a manageable market risk
    - manageable WACC
    - simple concept for banks to evaluate and decide upon a financing plan
    - even non-recourse financing possible (leverage 60-700%)
- in comparison: RES projects (besides of barriers due to the regulatory framework) – have much longer processes of obtaining all authorizations

Renewable energy investment risks

The most important RES investment risk is the risk of the regulatory framework. This risk permits no predictability and project planning. In the last years, more than 20 changes have been made to the primary and secondary legislation.

The most important difference between wind and PV projects: all big PV projects are secured through long-term green certificates purchase agreements with electricity traders, sharing profits with them in return for a secured sale of GCs. These means, that regardless of the situation, the company gets rid of its GCs, even if at the minimum price safeguarded by law. This is usually the case with big companies, while small players have small to no chance of selling GCs. There is already a surplus of a couple of millions of GCs. This surplus is expected to grow even further, when suspended GCs will be issued beginning with 2017.

Impact of policy changes

Law No. 220/2008 regulates the Romanian system of promoting renewable energy sources (RES). It introduces a quota system based on green certificates (GCs). Basically, each RES installation receives a certain number of GCs for each MWh produced over 15 years from the time being commissioned. The GCs are being sold to the suppliers for a price between a minimum and a maximum dictated by the law; the suppliers must buy as many GCs as they need to achieve the obligatory quota, also imposed by law. In the end, the ones baring the costs of the development of the RES market are the consumers, both household and non-household ones. The produced energy is being sold separately from the GCs.

This support scheme has attracted a lot of investments short after its introduction and has caused an unexpected booming (for ex. the investments only in the wind sector have been of around 5 billion EUR, by far the biggest investment in the Romanian energy system after 1989). In the first years of its implementation, soon it became clear, that the end consumer will not be able to support all these costs at a time. At the same time, big disparities rose in terms of the ROI, some technologies receiving better conditions then the others (overcompensation).

Under this circumstances there have been several amendments to the primary and secondary legislative regulations after 2013:

- In order to address the matter of the overcompensation, the number of received GCs has been reduced for wind, solar and hydro
- Some of the GCs were suspended and should be awarded only after 2017.
- The obligatory quota has been modified: not only will it be different from the proposed trajectory of the law 220/208, but it will be modified yearly and announced only a couple of months/weeks before it comes into praxis (the quota for 2016 was announced on 30. December 2015)
- The quota is lower than originally set in 2008 by 5 to 6 points and a drop off of 30-40%
- The validity of the certificates has been reduced
- The big industry consumers have been exempted from paying 85% of the costs resulted from the RES quota
- Increasing the connection costs and asking for high upfront payments
- Increasing the costs for some permits
- Eliminating the possibility to build on pastures

After the Energy Regulatory Authority had calculated in March a quota of approx. 8.3% for the next year (about half the one predicted by the original law 220/2008) the bankruptcy of the sector would have been imminent. In order to address the situation, the Ministry of Energy had commissioned a report from a British consultancy company, Economic Consulting Associates (ECA). This had been funded by the BERD. ECA presented 10 scenarios, which could help the market recover and bring stability and thus investors back on the long term. However, an improvement would arise only after a couple of years, which might be too long for many producers. The first phase would reach only damage containment.

Based on this report, the Ministry of Energy had published at the beginning of October the text for an Emergency Ordinance, which would be amending law 220/2008 once again. The proposal is under public debate and presents a series of further regulatory changes (a selection).

Another contentious point with the RES producers is the amendment to the energy and gas law 123/2012. While the president of Romania has refused to sign the law and sent it back to the Parliament for revision, the law has been voted upon and passed in the last plenary session. Some claim, that the new amendments are harming the RES sector. This new form of the law 123/2012 is however not in concordance with the EU Directive CE 28/2009. Thus an infringement process is very probable, also according to Corina Popescu, the State Secretary of the Ministry of Energy.

At the same time many events with litigation lawyers have been organized in Romania. Some interviewees feel that law suits are not improbable in Romania, due to the repetitive retroactive altering of the core law. This would damage the Romanian market highly, a market which has been regarded between 2008 and 2012 as very trustworthy.

De-risking mechanisms

The most important de-risking mechanisms is seen in stabilizing the legal framework. These measures would have an impact on all financial figures (WACC, cost of equity, cost of debt, debt/equity ratio), since it would lower the regulatory and market risks.

Due to the very severe situation in RO, a prediction of how big the change would be in % is not realistic and no one wants to make such forecasts. However, the implementation of de-risking mechanisms is not expected to bring immediate changes, but to have middle to long term effects. While this might stabilize the market in the future, many producers will not survive as long as to see this stabilization of the market. Nevertheless, this would have a serious impact on the image and the trustworthiness of the market.

Slovak Republic

Key Ideas

Number of interviews: 10 (3 PV and wind project developers, 1 utilities, 1 ministry, 2 wind association, 1 photovoltaic association, 1 non-profit organization, 1 energy consultancy company, 1 member of parliament)

- The debt/equity ratios for wind onshore as well as for solar PV are estimated as the same. Both ratios range from 80/20 to 60/40. Two major developers estimate the photovoltaic value in SK as almost the same (77/23, respectively 75/25). The character and nature of the owner, level of technology, as well as the experience with projects in RE are identified as the most crucial factors influencing the value.
- The WACC value for solar PV is estimated in the range from 4.0 to 6.0%. The estimations for wind onshore do not differ significantly (4.0-5.0%) and can be considered as almost the same. The problem of the wind energy sector is its insufficient development or its nonexistence, therefore, all wind energy financial estimations have to be considered as very hypothetical.
- There is a broad consensus that the cost of equity model value in PV (9.0%) is too high. The parameter is significantly lower; from 5.0 to 6.0%. The same applies for wind onshore plants with the final 6.0% estimation of cost of equity.
- The cost of debt for PV is in the range of 4.0-6.0% with the most frequent valuation of 5%. The estimation of the value is in the interval of 5.0 to 6.0% in case of wind plants.
- The most fundamental barrier in the development of both sectors is the state policy, which prefers the fossil fuels import instead of RES (including wind plants and PV installations). According to the Director of the Slovak Photovoltaic Industry Association (SAPI), *'there is no onshore wind nor solar ground-mounted installations in the Slovak Republic'*.
- Renewable energy, including wind plants (5 MW in total) and PV (590 MW in total), is more open to minor and less significant investments. However, those installations also face problems (declining state-purchasing prices, full environmental impact assessment without exceptions etc.).
- In the Slovak Republic the wind energy sector is not sufficiently developed. The cumulated capacity of all wind energy plants together is only 5 MW (one of the least significant sources of all renewable energy sources).
- The boom in the PV sector has stopped. The level of support was reduced. In the middle of 2011 there was a big change in this sector. Since 2011 only roof-top installations and no ground-mounted installations are allowed. The new national Green to Households project (2015-2020) has triggered interest in small roof-top PV systems. At least for now, large photovoltaic ground-mounted projects and onshore wind plants are not possible.

Financial parameters

Financial parameter	Model value	Interviews	Comments
Debt/Equity ratio PV	n/a	**Opinions divided** 80-60/20-40	• One interviewee rated D/E ratio at 60/40, maybe less equity in favour of debt (65/35). • A project developer has stated that based on the economic data of 70 PV installations in SK, (cumulative installed capacity of 113 MW, which is approx. one fifth of the national PV capacity) the result is based on the sample 77/23. This evaluation is in accordance with the estimation of another project developer who identified the D/E ratio at the same level (75/25). Another one estimated the D/E value approx. 80-75/20-25. Only one of the given value of D/E ratio reaches approx. 60/40 in case of PV.
Debt/Equity ratio wind onshore	n/a	**Opinions divided** n/a *or* 80-60/20-40	• Due to a very low number of the wind energy plants in SK (5 MW in total), it is not possible to rate or estimate this value (said four interviewees). Therefore, the listed value has to be considered as very hypothetical. • Three stakeholders estimated the value in the stated interval.
WACC PV	4.7%	**Opinions divided** 4.0-6.0%	• According to two respondents, the WACC in PV is slightly higher than 4.7% (estimations are the following: from 4 to 5%, approx. 5% and about 6%). • Indications range between 4 and 6%.
WACC wind onshore	5.3%	**Opinions divided** n/a *or* 4.0-5.0%	• Due to a very low number of the wind energy plants in SK (5 MW in total), it is not possible to rate or estimate this value (said four interviewees). Therefore, the listed value has to be considered as very hypothetical. • One interviewee stated that the WACC parameters between PV and wind, do not differ too much and are basically the same (his estimations are from 4 to 5%). The second stakeholder agreed with the given model value (approx. 5%).
Cost of Equity PV	9.0%	**Opinions divided** 5.0-6.0%	• The interviewees indicated the following values: 5%, 5% and 6%. They agreed that the COE value is significantly lower in comparison to the model value in SK. • Energy legislation – conditions have to be met (COE value in PV is higher in comparison to the COE value in regulated industries).
Cost of equity wind onshore	9.0%	**Opinion** 6%	• Due to a very low number of the wind energy plants in SK (5 MW in total), it is not possible to rate or estimate this value (said four interviewees). Therefore, the listed value has to be considered as very hypothetical.

			• An anonymous project developer in the wind sector stated that the C/E ratio is approx. 6%.
Cost of debt PV	5.0%	**Opinions divided** 4.0-6.0%	• Three stakeholders have agreed with the given data for SK (4-5% and twice approx. 5%). The other respondents estimated this parameter slightly higher 5-6% and up to 5%. • Indications range between 4 and 6%.
Cost of Debt wind onshore	5.0%	**Opinions divided** 5-6%	• Because of the very low number of the wind energy plants in SK (5 MW in total), it is not possible to rate or estimate this value (said four interviewees). Therefore, the listed value has to be considered as very hypothetical. • One stakeholder thinks that the data does not significantly differ from the C/D in PV, and estimated the value in the same way (5-6%).
Debt term PV	10 years	12-15 years	
Debt term wind onshore	10 years	n/a	

Additional Detailed information collected on:

Debt/Equity ratio

According to one interviewee, the D/E ratio is mostly influenced by the market stability as well as the explicitness of the legislation (the banks' reliance upon the legislation in SK). If the RE sector in the country is 'set in a reasonable way', the banks are more willing to provide loans. Another stakeholder thinks that the most influential factor is the character and nature of the owner, e.g. in case the power station is owned by a financial group the D/E ratio is significantly lower. The project developer in PV and wind sector has stated that the levels of technology, as well as the experience with projects in RE, are crucial factors, which affect the D/E ratio in the country. The better the level of the used technology, the lower are the terms of the bank to provide loans. No other factors have been mentioned.

Total WACC

Most of the respondents agreed that the interest rates belong to the most crucial factors. Excluding the project size, no other factors have been identified.

Typical wind onshore and PV project used for estimations for the Slovak Republic:

For the estimations, we used typical wind onshore projects:

Wind Onshore	Model estimations	Interviewees estimations
Size	10 MW (3-5 wind turbines)	1,6 MW (2-4 wind turbines)
CAPEX	1,375 €/kW	1,200-1,600 €/kW
OPEX	10%	10-12%
Economic lifetime	10-20 years	15-20 years

Additional feedback and comments from the interviewees:

'*The presented economic estimations in the Slovak wind energy sector are surprising, whereas there have been installations*[23] *that did not show any economic return. The windiness in SK is insufficient (steady winds with an average speed of 3 m/s practically do not exist), what implies that there are almost no suitable installation places for wind plants. This is the crucial reason why wind farms in SK do not exist.*' This is the official statement of the organization[24] to wind energy in the Slovak Republic and opinions on the mentioned differ very strongly.

One respondent stated that in case of SK, the CAPEX would be significantly higher because of the fragmented land registries. Other reasons why the amount of the wind plants is negligible, is partially caused by the negative influence of the Building Act as well as the objections of ornithologists. There is a great accordance (7 interviewees) on the economic lifetime (15-20 years) of the typical wind onshore installation in SK.

For the estimations, we used typical PV-projects:

PV	Model estimations	Interviewees estimations
Size	1 MWp, ground-based	0,9-1,0 MWp, ground-based
CAPEX	1,600 €/kW	1,200-1,600 €/kW
OPEX	12%	2.5-15%
Economic lifetime	10-20 years	10-20 years

Additional feedback and comments from the interviewees:

The typical size of PV installation in SK is slightly lower than 1 MW. One stakeholder claimed that in case your installation was below 1 MW performance (the most often 999 kW) it was not mandatory to obtain the compliance certification of the investment project with the Energy Policy of the Slovak Republic.

The CAPEX data ranges from 1,200 to 1,600 €/kW (the questioned subjects estimated this value in the following intervals: approx. 1,200, 1,200-1,600, 1,200-1,300 and approx. 1,600 €/kW). The

[23] For example installations in *Cerova, Ostry Vrch* and *Skalite* or other even smaller ones.
[24] Sent to eclareon via e-mail.

historic CAPEX was markedly higher (2,200-2,500 €/kW) in the period when ground-mounted installations were allowed (2010-2011).

According to two major project developers, the OPEX value in Slovak PV is significantly lower than the model value. They have assessed it just to 2.5% and 3%. Another project developer as well as other stakeholders have estimated the mentioned value in PV as significantly higher (12-15%, 11-12% and approx. 10%).

One of the interviewees have identified the economic lifetime to 12-15 years, other two have estimated it to 15-20 years and other two stakeholders have agreed with our model estimations (10-20 years). Moreover, the economic lifetime of the ground-mounted PV installations heavily depend on the state guarantees of price-purchasing prices.

Renewable energy investment options

The safest investment options in SK are investments that are financed by the public sector-state (for example highway R4) as well as regulated industries. The main reason of this is a payment security.

The situation in the sector of renewable energy is different. According to the energy legislation you have to meet certain conditions (COE value in PV is higher, in comparison to COE value in regulated industries). To other safe investment options in SK belong petro chemistry and tank farms (State Material Reserves of the Slovak Republic). Almost all interviewees agreed on the fact that the state guarantees are very crucial.

The other, smaller, group of interviews disagrees with such opinions, and considers the investment conditions in the sectors that are not regulated by the government as the best options. They think that the more regulations or state interventions are conveyed, the higher are the investment risks. They believe that this is what the situation of RES looks like in SK. Therefore, the inalterability of the initial conditions (the stability of legislative environment) and the law enforcement, belong to the crucial features of 'safe' investment option. Those features are not considered to be the characteristic features of the RE sector in SK.

The safest investment options are in real estates, said three interviewees. The investment in the energy infrastructure has been identified as the safest option in the energy sector. One of the interviewees said, that *'in today's world there are no longer any safe investments, including investments in the sector of renewable energy'*.

The WACC difference between the 'safest' projects and RE projects as well as between PV and wind plants cannot be determined. On the contrary, the WACC in the regulated industries investments was estimated to 6.5%. Due to a very low number of the wind energy plants in SK, it is not possible to compare the two researched sectors of the RES (stated four interviewees). Another interviewee thinks that the WACC differences between those two sectors are negligible and the value can be considered as the same. It has also been stated that the WACC value varies on a case by case basis but the WACC in RE is generally lower because RES are considered to be low-risk investments.

Renewable energy investment risks

The highest risk is the state intervention in the RE sector (stability of the legislative environment, retroactive measures, the uncertainty and unpredictability of parameters that are regulated by the state). The biggest issue is the lack of long-term guarantee of the state-purchasing prices. Another problem is that the Slovak RE sector also depends remarkably on subsidies and other state incentives. The incorrect setting of the energetic-legislative framework has been identified as problematic with an unclear definition of the state energy strategy. To minimize the RES influence on prices (via tariff for system operation) seems to be crucial as well. SK is an example of the importance of the mentioned factors in both researched sectors.

Since December 2013, the Slovak sector of RES has been facing a 'freeze status' because of the stop in the license issuing from all three regional distribution systems (excluding small sources up to 10 kW). This means, for example, that 10 wind projects are already prepared but they cannot get the license from the grid operator (Slovenska elektrizacna prenosova sustava, a.s.). The mentioned grid operator has also carried out a study, which says that wind plants with a higher performance destabilize the grid and belong to the category of unpredictable energy sources.

It is discouraging that in order to construct a wind plant with a higher output than 1 MW, a consent of the Ministry of Economy is needed. According to the Ministry of Economy, there are great concerns in SK that if the wind plant projects get realized, they will cause instability in the transmission system. *'Taking into account that there is almost no chance to stop it, the safety of the transmission system would be endangered. A daily need of energy is better reflected by solar energy sources than the wind ones. Solar plants are also less dangerous than the wind ones (the reason is a power fluctuations throughout the day). In general, we can say that the smaller the transmission system is the worse the situation gets.'*

The sector of PV is also struggling with a substantial reduction (approx. 4-times) of the guaranteed state-purchasing prices. Consequently, the situation gets completely different in comparison to the initial investment conditions (the unpredictability of the investment environment).

Impact of policy changes

Many changes have been qualified as retroactive with a missing chronological sequence. The majority of stakeholders have identified the payment for access and connection to the distribution system (tariff for system operation, also known as 'G-component') as the key retroactive measure with negative effects. The judgement of the Constitutional Court of the Slovak Republic ('PL. US 17/2014-132') has declared the G-component as unconstitutional, but the distribution network companies do not accept this decision and further keep applying it (until district courts do not take the judgment of the Constitutional Court into account). Another retroactive measure has been caused by the very unsystematic Law No. 382/2013 Coll. that in 2015, had the consequence that almost a third of all RE producers lost their support[25].

Since the amendment of the Law No. 309/2009 Coll. (July 2011) has become effective, all PV installations have to be placed just on the buildings, and no ground-mounted installations are subsidized. Since then, only the roof installations and the installations on the outer wall of a building, up to the total installed capacity 100 kW, were subsidized[26]. There has been pointed out that the change, which was the ratification of Law No. 30/2013 Coll. constituting that the support of PV production is applicable up to the lower total installed capacity (just up to 30 kW). The boom in the solar energy sector has come to its end.

The state-purchasing price has been gradually declining. The investors who have wished to carry out larger PV installations of rather switched to higher numbers of smaller installations. In a change of policy (January 2014), a so-called 'small source' term (up to 10 kW) was introduced. On the one hand, this has brought an advantage for households (no need for having a business license, either conducting accounting procedures - less bureaucratically demanding). On the other hand, since the households do not belong to entrepreneurs, they cannot apply for a surcharge for electricity generated from RES.

The national Green to Households project (since the end of the year 2015) has theoretically made possible to install small wind plants (up to 10 kW), however, the policy change is inevitable. Based on the current status all wind installations including the micro ones must elaborate 'full environmental impact assessment (EIA)'. According to Pavel Simon (2016), the whole process lasts around a year; the required measurements cost thousands of Euros etc. Another problem is the lack of professionals (installers certified by the Ministry of Economy) who should perform the wind installations[27]. Such small projects will be supported until 2020.

Another expert has noted that in the National Council of the Slovak Republic there existed amendments of the Laws No. 24/2006 Coll. and No. 309/2009 Coll., which proposed also an exception in elaborating of EIA for wind plants with lower performance (e.g. households) and other minor changes in RES[28]. However, such changes have not been supported by the MPs. In spite of this, the Ministry has adopted it and next year wants to introduce changes in the government law proposal.

According to interviewees, despite the activities of the Green to Households project, the conditions in the wind energy sector do not look good at all. The situation in the photovoltaics is completely different and the Green to Households project has arisen a great interest and has awoken the PV market in SK for small installations up to 10 kW. However, the installations with higher power output

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[25] http://www.oenergetike.sk/viac-z-energetiky/distribucne-spolocnosti-sa-este-zapotia/

[26] http://www.atpjournal.sk/budovy/rubriky/prehladove-clanky/legislativne-a-technicke-ramce-fotovoltiky-na-slovensku-1.html?page_id=22372

[27] http://www.energiaweb.sk/2016/09/23/koalicny-nezaujem-o-maly-vietor/

[28] The unsuccessful draft law has aimed at introducing just small amendments: adding all possible certified installers, even the ones who install just small wind turbines on the list, and divide the turbines into three categories based on their size (micro, small and normal).

are in a different position and the electric distribution companies do not accept new application for the grid connection.

All stakeholders have agreed on the fact that the policy changes, in the period of last 5 years, have influenced the investment decisions and it has been definitely in a negative way. A lot of state interventions and unpredictability of the investment environment have been typical for SK. Furthermore, the selected legal provisions have been investigated by the European Commission (EU Pilot) or by the Constitutional Court of the Slovak Republic. The shared opinion of the most RE producers (in PV and wind sector) sounds like, *'do not support us anymore and policy makers should leave us alone'*. In this regards, the investors have mentioned a negative personal experience. It was mainly caused by corruption and the impact of RES on final electricity prices. Renewable energy sources (especially PV) have also a very negative reputation due to the mentioned.

In the upcoming years, it is expected that the level of support will be lowered (said the majority of interviewees). The decision makers expressed their interest in lowering the amount of support in the energy production sector. The goal is to minimize its influence on the final electricity prices. The state strategy includes fewer guarantees and less security for RES as well as its exposure to the market environment (meaning less state interventions).

'We further intend to increase the share of RES in our energy policy but the priority will also be given to their impact on the final price of electricity', said Juraj Novak (2016), a senior advisor at the Department of Energy and Raw Material Policy of the Ministry of Economics in SK[29]. This opinion is in accordance with the official statement of the Minister of Economics of the Slovak Republic (2016) who has claimed that the Ministry aims at restricting the support of 'green' electricity and according to him, *'after the Slovak Presidency of the EU will be one big serious debate about how to deal with the financing of RES. The Ministry has been analyzing the primary energy legislation and has got in touch with a number of parties concerned, on the basis of their experience, to propose amendments to the energy legislation. If it is necessary, the Ministry prepares a draft of amendments'*[30].

In the next years, the electro mobility will be one of the key priorities of the state (for instance, since November 11, 2016 electro mobiles and hybrid cars have been subsidized by the state up to 5000 €/vehicle[31]).

The situation will be also influenced by the mentioned decision ('PL. US 17/2014-132') of the Constitutional Court of the Slovak Republic and by its consequences on the distribution companies. It is also necessary to make amendments of the Law No. 309/2009 Coll. while according to the European Commission the state subsidy established by the mentioned law is not in accordance with the requirements by the EC. The working version of the new law should be finished by the end of 2016.

De-risking mechanisms

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[29] http://www.etrend.sk/trend-archiv/rok-2016/cislo-41/zelene-energie-nadalej-pod-striedmym-rezimom.html
[30] http://venergetike.sk/podporu-obnovitelnych-zdrojov-pri-vyrobe-elektriny-chcu-obmedzit/
[31] http://energia.dennikn.sk/dolezite/elektrina-a-elektromobilita/stat-zadotuje-nakup-elektromobilu-sumou-do-5000-eur/21600/

Three interviewees have rated the effectiveness of current policies at 3 (from the scale 1 to 5). One of them noted that this level used to be higher in the past (5), and another one thinks that there are positive as well as negative factors, which lead to his final ranking 3. The next evaluation with the final result 3 has been justified by the fact that the legislative conditions change quite often.

Other five interviewees have stated that the current RE policies do not mitigate the investment risks at all (1). Moreover, it is believed that the current RE policies raise such risks as well as reduce RE development possibilities in SK.
According to the interviewees, the following de-risking mechanisms should be implemented:

1. The transparent energetic frameworks as well as better state energy policy are more than required in SK.

2. The implementation of mechanisms providing sufficient cash flow in RE projects is very necessary.

3. The energy should be released to the market and the energy traders should compete for it.

4. Instead of the fixed state-purchasing prices, a fixed financial additional payment should be introduced.

5. The state should also take over the part of the financial burden that is related to the development of RES, not only the final power customers (via the tariff for system operation). The tariff for system operation ('TPS') is a part of the final price of the electric energy[32]. This tariff has risen from 2.72 EUR/MWh (2009) to 22.90 EUR/MWh (2016)[33].

6. The best way to reduce the investment risk is to limit and reduce legislative as well as political interventions in RE in SK.

The rest of interviewees do not consider the level of risk to be the main problem in the RE sector in SK and cannot define the specific measures. Other already mentioned problems hinder the development of RES.

According to one interviewee, in order to make the cost of capital for RE projects in SEE countries comparable to Western European countries, no changes have to occur. The stability of the state government belongs to the crucial factors of the capital cost influencing. In general, the banks trust more to stable and business-oriented governments. It depends also heavily on the level of populism of the political parties. One stakeholder said that the state should support the RE projects more, but they could not identify the precise methods.

The guarantee of not taking retroactive measures is serious and according to this, the initial conditions should not be changed in the period of following 15 years. E.g. in the Slovak photovoltaics sector additional fee was introduced about 3 years ago, which almost had a liquidating impact. The new bank instruments were also identified as the key measure (the EIB is preparing projects, which

[32] http://www.energie-portal.sk/Dokument/sietove-poplatky-a-tarifa-za-prevadzkovanie-systemu-102177.aspx
[33] http://www.oenergetike.sk/viac-z-energetiky/europska-komisia-versus-urso/

should support the projects in RE). Some policy transfers from more experienced Western European countries have to occur as well (for instance, information campaigns to boost the RE awareness of public or 'western' RE policies as such).

Annex B – LCOE modelling

Simple cash flow model

For this assessment a simple cash flow model was used to calculate the net present value of the investment. For each country a set of financial input figures was used to calculate the cash flows of the renewable energy project. In order to decide whether the investment is financially interesting, the project should meet the following criteria:

- The net present value (the sum of all cash flows, corrected for the time value of money) of the investment should be equal or larger than 0;
- The Debt Service Coverage Ratio should be equal or larger than 1.2

The outcome of the calculation is the LCOE.

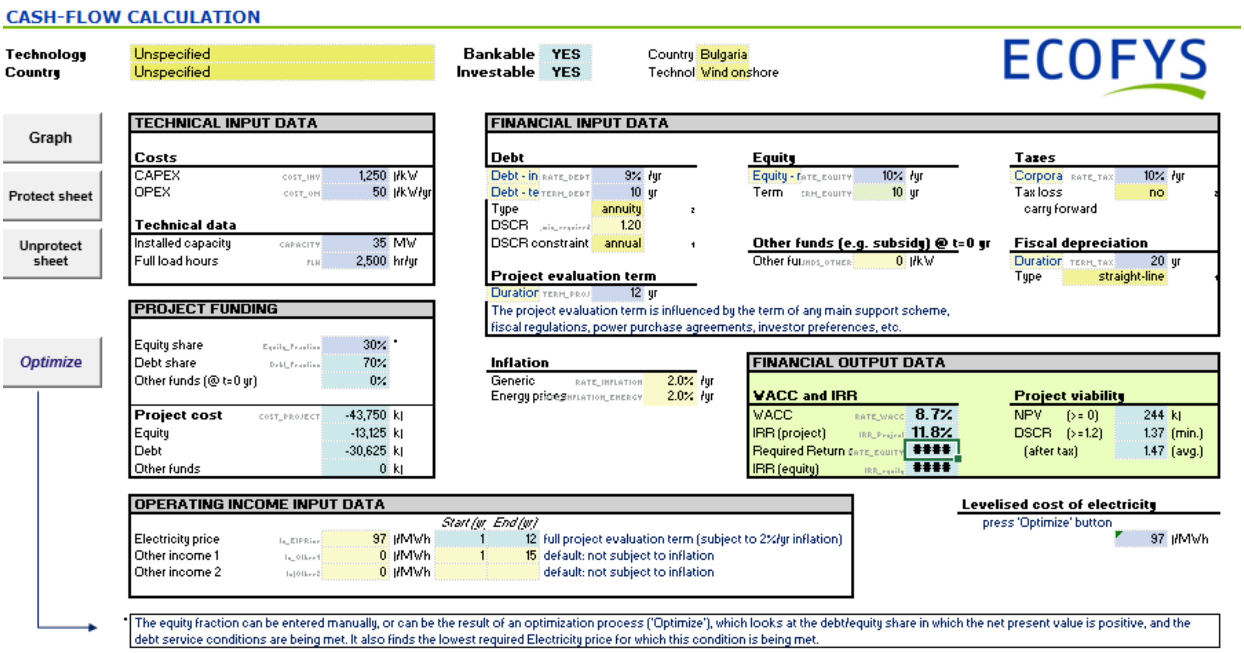

Figure 2: Screenshot of the simple cash flow model

Input figures

Table 7: Input figures for LCOE calculation wind onshore

Parameter	Unit	BU	HR	GR	HU	RO	SK
CAPEX	€/kW	1250	1375	1250	1150	1475	1450
OPEX (% of CAPEX)	%	4%	4%	4%	4%	4%	4%
Full Load Hours	hrs/y	2500	2500	2500	2500	2500	2500
Cost of debt	%	9%	6%	8%	6%	6%	5%
Cost of equity	%	10%	15%	14%	10%	10%	6%
Debt/Equity share	Ratio	70%	70%	65%	70%	70%	75%
Debt term	y	10	10	15	13	13	13
Duration of support scheme	y	12	12	20	15	15	15
Corporate tax	%	10%	20%	29%	19%	16%	22%

Table 8: Input figures for LCOE calculation solar-PV

Parameter	Unit	BU	HR	GR	HU	RO	SK
CAPEX	€/kW	1150	1325	1050	1175	1425	1350
OPEX (% of CAPEX)	%	2%	2%	2%	2%	2%	2%
Full Load Hours	hrs/y	1100	1100	1500	1050	1150	950
Cost of debt	%	8%	6%	8%	4%	6%	5%
Cost of equity	%	10%	15%	13%	10%	10%	6%
Debt/Equity share	Ratio	70%	75%	60%	70%	60%	75%
Debt term	y	10	10	15	13	13	13
Duration of support scheme	y	12	12	20	15	15	15
Corporate tax	%	10%	20%	29%	19%	16%	22%

Table 9: Input figures for LCOE calculation wind onshore - optimised

Parameter	Unit	BU	HR	GR	HU	RO	SK
CAPEX	€/kW	1250	1375	1250	1150	1475	1450
OPEX (% of CAPEX)	%	4%	4%	4%	4%	4%	4%
Full Load Hours	hrs/y	2500	2500	2500	2500	2500	2500
Cost of debt	%	2%	2%	2%	2%	2%	2%
Cost of equity	%	8%	8%	8%	8%	8%	8%
Debt/Equity share	Ratio	80%	80%	80%	80%	80%	80%
Debt term	y	10	10	15	13	13	13
Duration of support scheme	y	12	12	20	15	15	15

Corporate tax	%	10%	20%	29%	19%	16%	22%

Table 10: Input figures for LCOE calculation solar-PV - optimised

Parameter	Unit	BU	HR	GR	HU	RO	SK
CAPEX	€/kW	1150	1325	1050	1175	1425	1350
OPEX (% of CAPEX)	%	2%	2%	2%	2%	2%	2%
Full Load Hours	hrs/y	1100	1100	1500	1050	1150	950
Cost of debt	%	2%	2%	2%	2%	2%	2%
Cost of equity	%	8%	8%	8%	8%	8%	8%
Debt/Equity share	Ratio	80%	80%	80%	80%	80%	80%
Debt term	y	10	10	15	13	13	13
Duration of support scheme	y	12	12	20	15	15	15
Corporate tax	%	10%	20%	29%	19%	16%	22%

Annex C Interviews

List of interviewees per country

Aljosa Pleic		
Tamara Perko		
Marko Lipoščak		
Bojan Rescec		
Natasa Putak		
Suzana Magdić		
Vlado Pehar		
Jurica Gorup		

Interviews Template

Introduction

The Pricetag project is performed by Ecofys and eclareon with support from Reduco Energo j.d.o.o and commissioned by the European Climate Foundation (ECF). This project is a follow-up of the Diacore project that was completed early 2016. In this project, insights were created in the **cost of capital** of onshore wind projects and how these differed among individual EU-28 Member States. The results of this project showed significant differences between individual Member States, especially between North-Western European countries and South-Eastern European countries.

The objective of Pricetag is to update the 2014 **wind onshore** cost of capital data and to provide cost of capital data for **ground-based PV** projects for the year 2016 for six South Eastern European (SEE) Member States: Bulgaria, Croatia, Greece, Hungary, Romania, the Slovak Republic. The ultimate objective is to provide short term support to the EU debate on a de-risking mechanism for renewable energy investments with a focus on SEE countries which have a significant RES potential, but do not yet have fully developed RES markets.

In the first part of this project an estimation is made of the cost of capital for wind onshore and PV projects in the selected countries. The results are presented below. The purpose of this interview is twofold: to verify and discuss our results with financial experts and to gather input on the discussion what de-risking mechanism are needed to lower risks and the cost of capital for renewable energy investments.

The input gathered in these interviews will be used in our report. Of each interview a summary will be made, which will be sent to you for verification. These summaries provide the basis for our result section. We will not make direct reference to your input, but we would like to include the names and organisations of the experts we have interviewed.

We have structured the interview as follows:

- **Investment activities** – general questions about investment decisions (general investments and renewable energy projects)
- **Model results** – asking your feedback on our estimations
- **Investment risks and de-risking mechanisms** - Input on the de-risking mechanism for renewable energy investments, needed in the selected SEE countries

We estimate that the interview will take about half an hour.

Interview questions

Part 1: Investment activities (approximately 5-10 minutes)

What kind of project do you regard as the safest investment option in [Country]? (Roads, bridges, other infrastructure etc.). What characteristics of such a project make it a "safe" investment?

What is a typical cost of equity and WACC for these projects?

Is that cost of equity different from RE (wind and solar)? What is the reason for that difference?

Part 2: Model results (approximately 10 minutes)

In this part of the interview, we would like to share some of our assumptions and results with you, to test how these compare to your estimations.

For our estimations we will use typical wind onshore and PV-projects:

Topic	Wind onshore	PV
Size	10 MW (3-5 wind turbines)	1 MWp, ground-based
CAPEX	1,375 €/kW	1,600 €/kW
OPEX	10%	12%
Economic lifetime	10-20 years	10-20 years

Typical wind onshore and PV projects

Do you agree with these projects being typical projects in [Country]?

What is different?

Debt/ Equity ratio (see Annex for our model estimations)

Based on the results of Diacore, the debt/equity ratio for onshore wind and PV were estimated and presented below. Do you find these ratios reasonable? Have you observed something else?

Which factors exert the highest influence on the debt/equity ratio of a project?

Total WACC (see Annex for model estimations)

In the annex the WACC estimates from the financial model. These figures show nominal post-tax WACC[34] for wind onshore and PV projects at financial close.

Do you agree with our estimation of the WACCs? Should it be lower / higher?

Does the WACC change when project circumstances change (e.g. different country, technology, project size, etc.)?

Cost of Equity (see Annex for model estimations)

Do you agree with our estimation of the Cost of Equity for an onshore wind project in [Country]? Would you say that the Cost of Equity for [Country] is higher or lower? Can you indicate how much higher or lower?

Do you agree with our estimation of the Cost of Equity for a PV project in [Country]? Would you say that the Cost of Equity for [Country] is higher or lower? Can you indicate how much higher or lower?

Cost of Debt (see Annex for model estimations)

Do you agree with our estimation of the Cost of Debt? Should it be lower / higher?

How would this change between the respective technologies?

Part 3: Renewable energy investment risks and de-risking mechanisms (approximately 10 minutes)

Renewable energy investment risks

What risk has the highest impact on renewable energy projects? Is this different for wind onshore and ground-based PV projects?

What changes have been made in policy schemes the past 5 years? What change had the largest impact? Have these changes been retroactively? Did the change affect your investment decision positively or negatively?

Did these changes impact the cost of equity and WACC? If yes, could this be quantified?

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[34] Nominal post-tax WACC, reflects the weighted average costs of capital for a project after tax payments, expressed in nominal terms, i.e. not adjusted for inflation.

Are changes expected in the coming years?

De-risking mechanisms

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)?

What de-risking mechanisms could be implemented to reduce the risks as mentioned under the previous question? How would this impact the cost of equity and WACC of renewable energy projects?

What should change to make the cost of capital for renewable energy projects in SEE countries comparable to Western European countries?

What would be the effect of the changes as mentioned under the previous questions on the other financial indicators (cost of debt and debt/equity ratio)?

Annex

Question 5: Debt/equity ratio

[Include only the country results of the country at hand]

Country	Debt/Equity ratio Wind onshore	Debt/Equity ratio PV
Bulgaria	50%/50%	60%/40%
Croatia	70%/30%	80%/20%
Greece	55%/45%	65%/35%
Hungary	65%/35%	75%/25%
Romania	50%/50%	60%/40%

Question 6: WACC

[Include only the country results of the country at hand]

Technology	WACC
Wind onshore	7.9%
PV ground-based	7.4%

Bulgaria

Technology	WACC
Wind onshore	8.5%
PV ground-based	7.6%

Croatia

Technology	WACC
Wind onshore	13.7%
PV ground-based	12.4%

Greece

Technology	WACC
Wind onshore	8.2%
PV ground-based	7.3%

Hungary

Technology	WACC
Wind onshore	7.9%
PV ground-based	7.4%

Romania

Technology	WACC
Wind onshore	5.3%
PV ground-based	4.7%

The Slovak Republic

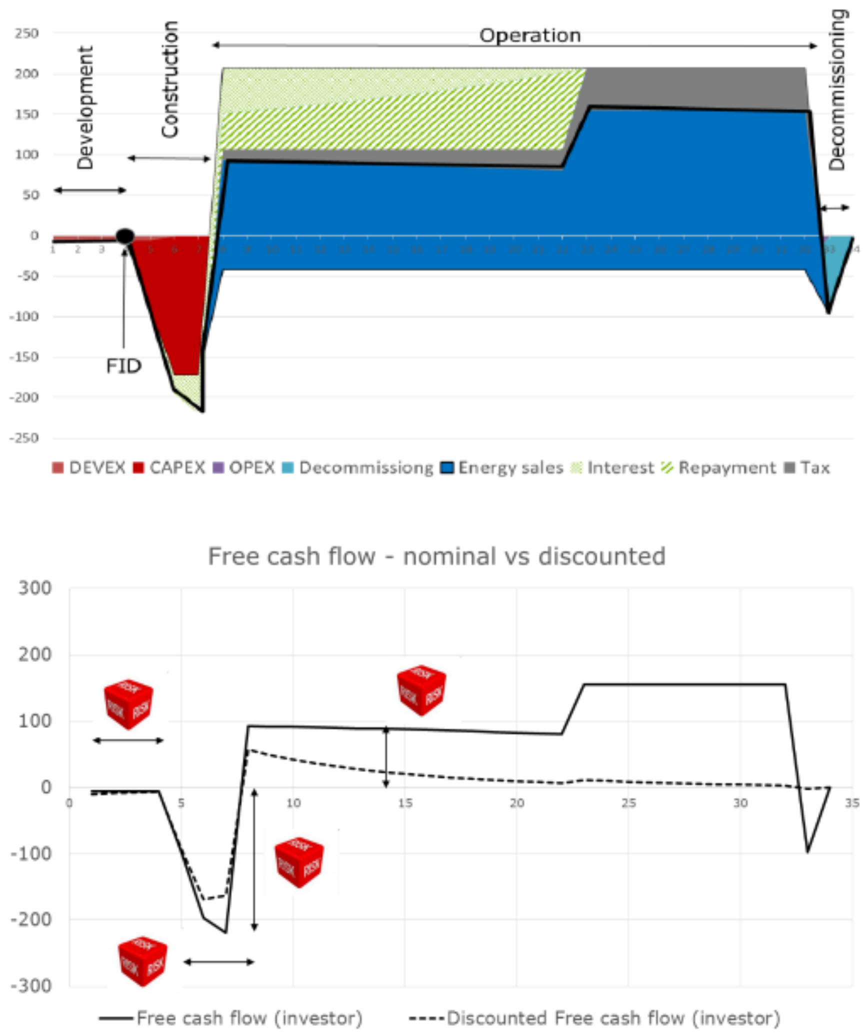

Figure 23: Example of a cash-flow for a 500 MW offshore wind energy project (investor perspective, in M€) (top), and Illustration of the free cash-flow (nominal vs discounted at 15%) of this project with an illustration of the key parameters that are most sensitive in a risk analysis (bottom) FID: Financial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

Question 7: Cost of equity

To estimate the Cost of Equity, we used the following assumptions and data:

[Include only the country results of the country at hand]

Term	Description
Risk free rate:	10 year Bulgarian government bond
Market risk premium:	8%
Cost of Equity:	10% (renewable energy)

Term	Description
Risk free rate:	10 year Croatian government bond
Market risk premium:	7.5%
Cost of Equity:	15% (renewable energy)

Term	Description
Risk free rate:	10 year Greek government bond
Market risk premium:	13%
Cost of Equity:	21% (renewable energy)

Term	Description
Risk free rate:	10 year Hungarian government bond
Market risk premium:	8%
Cost of Equity:	14% (renewable energy)

Term	Description
Risk free rate:	10 year Romanian government bond
Market risk premium:	7%
Cost of Equity:	10% (renewable energy)

Term	Description
Risk free rate:	10 year Slovakian government bond
Market risk premium:	6%
Cost of Equity:	9% (renewable energy)

Question 8: Cost of debt

To estimate the Cost of Debt, we used the following assumptions and data:

Term	Description
Risk-free rate:	1.5% zero swap curve (10 years maturity)
Renewable energy project spread:	3% onshore wind, 3.5% PV
Debt term	10 years
Cost of Debt [Bulgaria]:	Renewable energy: 6%
Cost of Debt [Croatia]:	Renewable energy: 7%
Cost of Debt [Greece]:	Renewable energy: 11%
Cost of Debt [Hungary]:	Renewable energy: 6%
Cost of Debt [Romania]:	Renewable energy: 6%
Cost of Debt [Slovakia]:	Renewable energy: 5%

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