Unlocking Low Cost Renewables in South East Europe

Case Studies on De-risking Onshore Wind Investment

ANALYSIS

Agora Energiewende

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IMPRINT

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DISCLAIMER
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Preface

Dear Reader,

With South East Europe already strongly impacted by climate change, it is imperative to rapidly reduce power sector emissions. In a region that relies heavily on old and polluting lignite-fired power plants, renewables, especially wind and solar PV, offer an important, cost competitive solution for power sector modernisation and for reducing greenhouse gas emissions.

However, current market and political conditions in South East Europe restrict the cost-competitive potential of renewable energies. Lack of political commitment and complex regulatory and administrative environments translate into higher investment risks. These risks disproportionally increase the cost of capital of renewable energy investments.

The European Union is therefore pushing to "de-risk" renewable energy investments within the Union and in its neighborhood through regulatory means and through innovative financial measures.

Our study focuses on the potential economic benefits of a new EU budget guarantee mechanism for renewable energy investments that is discussed as part of the new multiannual EU budget. To analyse the likely benefits of the new budget guarantee mechanism, we commissioned experts from the NewClimate Institute to quantify its cost reduction potential alongside other non-financial "de-risking" measures. The report presents our findings for onshore wind investment in Greece and Serbia. The results are very encouraging, which strengthens the case for maintaining the proposed EU budget guarantee mechanism as part of the new multiannual EU budget. Lowest possible financing costs for renewable energies are one important component of coal-to-clean transition debates in South East Europe.

I hope you find this study an inspiring and enjoyable read. Your comments are of course welcome.

Yours sincerely,
Patrick Graichen
Executive Director of Agora Energiewende

Key findings at a glance:

1. **Even when wind and solar conditions are better, investing into renewables in South East Europe is more expensive than in Western and Northern Europe.** The reason: countries in South East Europe face higher financing costs due to perceived higher investor risks. More costly than necessary renewables investments seriously hamper power system modernisation in SEE..

2. **South East Europe could secure low cost renewables by introducing contractual, regulatory and market policies that greatly reduce investor risk and thereby lower financing costs.** "De-risking measures" available to governments will reduce renewable energy project costs to levels comparable or lower than those of fossil fuel investments. Low cost renewable energy projects are thus a real alternative for replacing old and polluting lignite power plants.

3. **De-risking measures will lower the cost of renewable energy projects by 20 per cent. The cost for onshore wind would fall to 46 EUR/MWh in Greece and 54 EUR/MWh in Serbia.** De-risking measures with the highest impact include: (1) the proposed EU budget guarantee mechanism; (2) reliable, long-term renewables remuneration regimes and long-term renewables targets; (3) well-functioning, regionally integrated balancing and intraday markets; and (4) corporate power purchase agreements.

4. **The proposed EU budget guarantee mechanism is a no-regret policy instrument and should be equipped with sufficient resources under the new EU budget 2021-2027.** The budget guarantee alone accounts for 40 per cent of the decline in financing costs attributable to the de-risking measures analysed in this study. Overall, de-risking measures enable the expansion of renewables in South East Europe at lower costs than coal, natural gas or nuclear, with attendant benefits for the climate and for human health

Content

Executive Summary

To date, most South East European countries have relied heavily on conventional generation technologies. However, over the next decade, countries in this region will have to replace around 50 per cent of their existing capacity for age-related reasons.[1] The key question is: What will replace these conventional assets? New power plants fired by coal? By natural gas? By nuclear? Or by renewable energy?

Various factors argue in favour of making renewables the centrepiece of future energy investment in South East Europe (SEE), including recent dramatic declines in the cost of wind and solar PV, the need to rapidly reduce global greenhouse gas emissions, and the vast renewable energy potential of the region.

Renewable energy development in SEE has been limited to date, however. One impediment to scaling up renewables is their higher up-front capital intensity compared to investment in coal or natural gas. Higher up-front costs make renewable energy (RES) investment more sensitive to political and regulatory conditions than projects with lower capital intensity. And since private investors typically consider ventures in South East Europe riskier than investment in Germany or France, RES projects in the region face relatively higher financing and capital costs. The "risk premiums" demanded by investors have a significant effect on the price of renewable power. Past research has shown that higher financing costs could render a wind energy project in, for example, Croatia, twice as expensive as the same project with similar resource conditions in Germany. Bloated financing costs have two effects: first, they support the perception that renewables are costly to consumers and taxpayers. Furthermore, in a high cost of capital environment, renewables may not outcompete fossil-fired generation, even given cheaper system costs.

Against this backdrop, this report explores how various political and financial measures could help to "de-risk" renewables investment. It then estimates how such measures would impact the prices paid by consumers for renewable energy. We take onshore wind investment in two countries in SEE – Serbia and Greece – as case examples. Our estimations of the quantitative effects that result from derisking measures rely on data derived from interviews with private-sector investors and project developers.

Serbia has significant renewable energy potential and is well positioned for investment in utility-scale renewable energy projects. However, there is political support for further investment in lignite-fired power plants. The country's renewables support regime is currently undergoing reform; existing incentives will be revised, and there will be a gradual move to an auction-based system. In Serbia, in particular, three risk categories significantly contribute to higher financing costs:

1) "power market risk",
2) "political risk", as well as
3) "counterparty risk".

According to our analysis, the introduction of targeted derisking measures could lower the cost of equity of onshore wind investment by 6.6 percentage points and the cost of debt by 2.3 percentage points. A public budget guarantee mechanism – as it is currently considered under the new EU budget – would reduce the cost of equity by 3 percentage points and the cost of debt by 1.1 percentage points. This would reduce the weighted average cost of capital (WACC) by over 40 per cent in the cases examined here. Further derisking measures that would considerably decrease financing costs are

1 Agora Energiewende (2018): A clean energy transition in Southeast Europe: Challenges, Options and Policy Priorities

1) a reliable remuneration scheme for renewables;
2) long-term renewable energy development targets; and
3) open and efficient balancing and intraday markets.

According to our analysis, de-risking measures for onshore wind would bring the levelised cost of renewable electricity below that of new lignite plants (5.4 euro cents/kWh compared to 7.3 euro cents/kWh for lignite and not considering CO_2 costs for lignite plants). At present, the LCOEs of these technologies are nearly equivalent.

Greece needs to replace around 60 per cent of its current lignite-based electricity generation capacity by the end of 2030. It has committed to achieving a renewable energy share of 20 per cent in gross final energy consumption by 2020 and of 31 per cent by 2030. Furthermore, Greece aims to increase the share of renewables in the power sector to 40 per cent by 2020 and to 63 per cent by 2030. Although Greece has made some progress in diversifying its power generation mix and increasing the role of renewables in recent years, lignite and natural gas each still cover more than 34 per cent of power demand. And worryingly, the government plans to add 615 MW of new lignite-based power.

Our analysis shows that in Greece, three risks have a particularly strong influence on the cost of capital for investment in onshore wind projects:

1) "power market risk",
2) "social acceptance risk", and
3) "financial sector risk".

Together, financing risks contribute 1.5 percentage points to the cost of equity, while policy risks contribute 0.5 percentage points.

In Greece, derisking measures could lower the cost of equity for onshore wind investments by 4.9 percentage points and the cost of debt by 1.9 percentage points. The strongest effect would result from derisking instruments that target financial sector risk and counterparty/ off-taker risk. Both risks categories would be addressed by the EU budget guarantee mechanism currently discussed as part of the new EU budget for 2021-2027.

Reducing the capital costs would lower the levelised costs of electricity for onshore wind parks in Greece by 20 per cent in relation to a scenario without de-risking measures (from 5.7 euro cents/kWh to 4.6 euro cents/kWh).

The **European Commission** has proposed that the new European budget that will apply from 2021-2027 should offer high cost-of-capital countries in Europe the option of developing renewable energy projects with the **financial backing of an EU budget guarantee mechanism.**

Our analysis shows that using such derisking measures would yield considerable reductions in the financing costs for onshore wind projects in Greece and in Serbia. Furthermore, similar benefits would be likely to occur in other countries of South East Europe, given similar uncertainties for renewable energy investment across the region.

Renewable energy is a no regret option in all energy transition scenarios and the region of South Eastern Europe has a very significant renewable energy potential. However, with wide-spread concerns about rising power prices and energy poverty, developing the renewable energy potential of the region should be done at lowest possible cost to consumers and taxpayers.

Policymakers are therefore well-advised to use all available opportunities for reducing the financing costs of renewable energy. This should include using the new EU budget guarantee mechanism, if it is retained in final negotiations on the future EU budget.

Our analysis also shows that de-risking measures would make onshore wind projects in **South East Europe** cheaper than conventional energy projects such as new lignite. This is important. It means that *economic* advantages can be added to the list of benefits produced by renewable energy development (including energy security, clean air, and climate protection). It thus makes a compelling case for moving faster and further to develop renewables in South East Europe.

1. Introduction

By 2030, South East European (SEE) countries will have to replace around 50 per cent of their existing conventional power capacity for age-related reasons.[2] To date, most SEE countries have relied heavily on conventional power for their electricity production, while renewable energy use is still limited. Therefore, these countries are at a crossroads between investing in and expanding renewable energy capacity or upgrading and renewing their old conventional power plants.

Although the cost of renewable energy systems has decreased significantly in recent years – even reaching cost parity with, for example, natural gas fired power plants, which are the least expensive fossil fuel-based energy systems in many markets – renewables are still perceived as a riskier investment by financial institutions. As a result, renewables face higher cost of capital rates, which increases the electricity prices paid by end consumers, particular in fully liberalised electricity markets. It should be noted that renewable energy has very low operating costs and, as such, initial capital expenditures represent the majority of lifetime costs.

Higher up-front capital intensity means higher sensitivity to political and regulatory and conditions, an area of uncertainty and risk in many countries. Fossil-based generation, by contrast, due to its lower upfront costs, is less sensitive to fluctuations in the political and regulatory environment.

While the SEE region comprises a number of countries with high potential for renewables expansion and investment, the region has been suffering from high financing costs for renewable projects, due to perceived risks on the part of investors. Accordingly, renewables capacity remains relatively low to date.[3]

The investment environment for renewables in SEE countries could be considerably strengthened if political and regulatory risks were mitigated, leading to lower financing costs that are comparable or even below that of traditional fossil fuel investments in the region. Governments can address specific investment risks by introducing policies, programmes, and financial measures that "de-risk" investment decisions.

This report explores how various policy and financial instruments could impact the financing costs of renewable energy investment in SEE countries, specifically examining onshore wind investments in two SEE countries – Greece and Serbia – as case examples. In particular, it shows the significant cost reduction potential for investment in renewable energy sources (RES) that could result from inclusion of derisking measures in the new EU budget framework, in conjunction with the implementation of the new Renewable Energy Directive (RED II).

EU energy policy background

In 2016, the European Commission proposed revisions to the EU Renewable Energy Directive. Creating a regulatory framework that would reduce the cost of capital for renewable energy projects was one aspect of the proposed revisions.[4] The proposal of such a measure was motivated by empirical findings regarding

2 Agora Energiewende (2018): A clean energy transition in Southeast Europe: Challenges, Options and Policy Priorities

3 Ibid.

4 Article 3.4 Renewable Energy Directive Recast.

1) the growing relevance of financing costs for the overall economic viability of renewable energy projects[5];
2) the widely divergent financing costs for renewable energy investment across the European continent[6]; and
3) the significant impact of renewable energy financing costs on the potential for developing cost-competitive renewable energy, particularly in lower per capita GDP countries in East and South East Europe.[7]

Against this backdrop, there is increasing political recognition that reducing renewable financing costs to "best in class" levels across the European continent would be both politically and economically desirable, given the imperative to rapidly replace CO_2-emitting power generation with clean alternatives across the continent while also avoiding a multi-speed Europe on renewables.

Hence, the Commission eventually proposed to include in the new EU budget for 2021-2027 a budget guarantee mechanism for the financial de-risking of renewable energy investments within the EU and the EU's neighbourhood.[8] Use of the mechanism would be voluntary. As one source of funding, governments could decide to allocate a share of their future withdrawal rights under the Cohesion Fund for use in the budget guarantee. Once no longer needed as a guarantee, the money would become again available for allocation to other spending purposes.

The new budget guarantee mechanism will gain practical relevance in 2019, when each Member State must develop an integrated national energy and climate plan up to 2030 and will consider how much public funding is needed to achieve EU climate and energy targets.[9] The contracting parties of the Energy Community, which includes the Western Balkan countries, will conduct a similar exercise.

5 See Ecofys and eclareon (2018): Cross-Border Renewables Cooperation. Study on behalf of Agora Energiewende.

6 See Ecofys et al. (2016) DIA-CORE - The impact of risks in renewable investments and the role of smart policies - Final Report and Ecofys (2017) Mapping the cost of capital for wind and solar energy in South Eastern European Member States,

7 IRENA (2017). Cost-competitive renewable power generation. Potential across South East Europe

8 European Commission proposals on Common Provisions Regulation and InvestEU fund.

9 For more information, please see European Commission (2019), National Energy and Climate Plans.

2. Methodology

General approach

This report analyses how a given set of policy and financial instruments could reduce RES investment risks and associated financing costs, given their adoption in the new EU budget framework and the full implementation of the RED II. Financing costs represent all expenses, including interest charges, associated with borrowing or using capital to finance a project. The Weighted Average Cost of Capital (WACC), which is typically used to evaluate investments, is a key metric in this regard. The WACC varies depending on the method of financing: cost of equity (CoE) describes the return an investor needs to make on pledged capital, while cost of debt (CoD) describes required return on borrowed capital. Projects often include a mix of both equity and debt financing.

The WACC affects the Levelised Cost of Electricity (LCOE), which can be used to compare different generating plants and to determine the minimum price of electricity needed in order to break even over the lifetime of the generating asset. LCOE values are calculated on the basis of the WACC, used as the discount rate, anticipated operating costs, and anticipated fuel costs in order to obtain the Net Present Value of a unit of electricity over the lifetime of a generating asset.

In this report we quantify how derisking measures would impact the cost of capital and LCOE of onshore wind plants. Our estimations rely on data from structured interviews with private sector investors and project developers. We do not evaluate the costs associated with enacting and administering the considered instruments as this was not a focus of the study and relevant data availability is in any case poor.

We examine two SEE countries as case examples: one EU member state, Greece; and one Western Balkan State, Serbia. We also focus on onshore wind, which is a technology with a large deployment potential in the region.

Process and assessment steps

In a first step, we assess the current policy and investment environment in Greece and Serbia based on input provided by our local partners in SEE – namely, the Serbian Association for Sustainable Development (ASOR), the Greek National Observatory of Athens (NOA), and FACETS, S.A. This assessment includes the identification of the most important barriers as well as political, regulatory, administrative and financial risks to onshore wind investment in the two countries. In addition, we select the most relevant policy and financial instruments to mitigate those risks, taken from the EU budget framework, the related Renewable Energy Directive II (RED II), and a potential Cost Reduction Facility (CRF) that is currently at the proposal stage.

Based on the identified main investment risks, our local partners carried out structured interviews with project developers and investors on a confidential basis. Interviewees were provided beforehand with information regarding the objective of the project, including the study's key definitions, assumptions, and questions, in order to ensure comparable results. Based on the interviews, we quantified financing costs for onshore wind projects in Greece and Serbia. In a second step, we quantified the expected effectiveness of the previously chosen public and financial instruments and their potential impact on financing costs.

The second part of the analysis focuses on the modelling of LCOE in a pre- and post-derisking scenario, including comparison to a baseline technology where appropriate data are available. For this task, we use the LCOE tool developed by UNDP under their "Derisking of Renewable Energy Investments (DREI)" framework.[10]

Key data and assumptions were gathered partly through the interviews and partly through additional research by our local partners. This included research on capacity factors, operational expenditures, and discount rates, among others, for both a non-renewable investment alternative and onshore wind. To increase the robustness of the results, a sensitivity analysis was also carried out.

Current price developments, as evidenced by recent auction outcomes, are highly dynamic. Accordingly, some of the data cited in this report may be outdated, as they are based on an analysis undertaken between December 2018 and February 2019. However, our overall findings remain valid.

10 For more information, please see UNDP (2019), Derisking Renewable Energy Investment

3. EU Background

The existing European regulatory framework for renewable energy, most prominently the Renewable Energy Directive[11] and European rules on electricity market design[12], includes several elements that – if properly implemented by Member States – will lower the investment risk for renewable energy and thereby contribute to lowering the cost of capital.

Key "de-risking" elements in the revised EU Renewable Energy Directive include obligations on Member States:

- → to publish a long-term schedule for the expected allocation of support to renewable energy projects, indicating the timeline, budget, and capacity for at least the next three to five years (Art. 6)
- → to avoid retroactive changes to support previously granted (Art. 6)
- → to establish administrative one-stop shops and maximum time limits for permit-granting processes of 2 years for new projects and 1 year for repowering (Art. 16)
- → to simplify permitting for the re-powering of renewable projects (Art. 16)
- → to remove administrative barriers to corporate long-term power purchase agreements (Art. 15)

The revised EU Renewable Energy Directive also obliges the Commission to enable high ambition on the part of Member States through enhanced use of EU funds, especially in view of reducing the cost of capital for renewable energy projects (Art. 3.4). The Commission seeks to meet this obligation by, among other things, proposing a new EU budget guarantee mechanism as part of the new multiannual EU Budget (2021-2027) that would lower the financing costs of renewable energy projects in Member States and neighbouring countries with higher than average cost of capital rates.

Important "de-risking" provisions in the area of electricity market regulation include:

- → Advancing of "no regret" measures to make power markets more flexible and better integrated, such as product lengths on intraday markets and an imbalance settlement period of 15 minutes (Art. 7)
- → Curtailment of RES as a last resort; compensation of 90% of financial support for curtailed energy (Art. 12)

As a supplement to new EU laws on power market design and renewable energy, the new EU budget for 2021-2027 should become a key enabler of lower cost of capital for RES investors. Specifically, the European Commission's budget proposal foresees a new financial instrument as part of the "Invest EU" Fund. It would enable a Member State to transfer at least 5% of allocated Cohesion and Structural Funds to a European guarantee scheme that would be used to reduce investment risk in that Member State and thus lower the financing costs for renewable energy projects.

Beneficiaries of this policy would primarily be high cost-of-capital countries in Central and South Eastern Europe. The scheme would enable decision-makers in these countries to move faster and further in developing their respective domestic renewable energy potential at lower cost to consumers and taxpayers.[13]

11 Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources (recast).

12 Regulation (EU) 2019/943 on the internal market for electricity.

13 See Agora Energiewende (2018): Reducing the cost of financing renewables in Europe. Report of a multi-stakeholder dialogue on the proposed EU Renewable Energy Cost Reduction Facility

The new EU budget guarantee mechanism will encourage risk premium convergence between low and traditionally high risk countries. Essentially, the scheme is similar to an export credit guarantee.

Potentially, access to financing will be made contingent upon additional Member State commitments, including domestic measures to minimise financial and regulatory risks. However, rules in this regard have not yet been developed.

In addition to the aforementioned budget guarantee for EU Member States, the European Commission is developing a similarly tailored new guarantee instrument for the Western Balkans under the umbrella of the "Western Balkans Investment Framework". At the time of writing, this guarantee scheme for the Western Balkans, which will be available for renewables as well as energy efficiency projects, will be initially endowed with 150 million euros in 2019 and 2020.[14]

14 EU - WESTERN BALKANS: ATTRACTING INVESTMENT. Factsheet, July 2018.

4. Current status of RES investment in the SEE region

Some 60 per cent of annual electricity generation in the SEE region comes from coal and lignite, and is produced by power plants with an average age of over 40 years.[15] Investment in renewable energy capacity is still minimal, and only a few countries, including Greece, Bulgaria, and Romania, have significant solar PV and wind energy capacities. Large potential remains untapped.[16]

The following sections provide additional insight into the status of RES investment in our two case countries, Serbia and Greece.

Serbia

Serbia's power sector is characterised by a high dependency on lignite and, to a lesser extent, hydropower (which comprised 70 and 30 per cent of the electricity generation mix in 2016, respectively). The national power utility EPS has a monopoly in the market, owning most generation capacity and distribution grids.[17]

Serbia is committed to increasing its RES share to 27 per cent by 2020, up from 22 per cent in 2015. The Energy Community is expected to release mandatory RES targets in 2019. The proposed target for Serbia is a 27 per cent and 35.5 per cent RES share in gross final energy consumption by 2020 and 2030, respectively.[18,19]

Serbia's RES support regime is currently undergoing reform. Serbia aims to revise incentives and gradually move toward an auction system for RES support. The current feed-in-tariff regime has only been prolonged until the end of 2019.[20] The current reform proposal would allow an additional 450 MW of wind to be awarded in technology-specific auctions over the next three years. In this way, there is uncertainty regarding long-term support for renewables in Serbia, which increases risk premia on RES investment.

At the same time, Serbia has significant renewable energy potential. Endowed with good wind resources, Serbia is well positioned for the development of utility-scale renewable energy projects. IRENA estimates its additional cost-competitive wind potential at 5.6 GW.[21] Wind energy provides an opportunity for Serbia to improve its energy security while also meeting its emission reduction obligations as a member of the EU Energy Community and signatory to the Paris Agreement.

Nevertheless, there is appetite for further investment in lignite power plants. The country has 4.5 billion tonnes of proven lignite reserves and

15 REKK (2019). The Southeast European power system in 2030: Flexibility challenges and regional cooperation benefits. Study on behalf of Agora Energiewende

16 energypost.eu (2018), Energy Community sets stage for clean energy transition in South-East Europe

17 Bankwatch Network (2017), The energy sector in Serbia

18 For example, https://bankwatch.org/the-european-energy-community

19 TU Wien (2019), Study on 2030 overall targets (energy efficiency, RES, GHG emissions reduction) for the Energy Community

20 Balkan Green Energy News (2018), Serbia pushed back introduction of renewables auctions by a year

21 IRENA (2017), Cost-competitive renewable power generation: Potential across South East Europe

actively plans on using them. A new 350 MW lignite plant (Kostolac B3) is at the pre-permit stage and planning for an additional 1,750 MW of capacity has been announced.[22] However, new lignite plants have conversion efficiencies of below 40 per cent and high O&M costs, which impairs their economic viability. Furthermore, O&M costs, including refurbishment measures, will increase over time for older power plants, in part due to more stringent environmental standards.

At the same time, Serbia faces a range of barriers to onshore wind investment,[23] including:

- → Permit risks: Inconsistent and ambiguous decision making; long time-frames for obtaining licences and permits;
- → Grid and transmission risks due to deficient operational/technical management by the transmission system operator (TSO);
- → Power market risks: A monopolistic balancing market and cap on wind power set at 500 MW;
- → Regulatory/political risk due to uncertainty regarding the future regulatory environment;
- → Financial sector risk: An illiquid capital market and a preference for small wind projects;
- → Social acceptance risk related to "Not in my backyard" (NIMBY) resistance;
- → Developer risk due to lack of experience; uncertainty regarding project implementation;
- → Counterparty/off-taker risk, and
- → Currency/macro-economic risk.

As a result of these factors, investment and O&M costs for renewables are rather high: new capacity development currently runs at 1.5–1.6 million euro/MW, while annual O&M costs stand at close to 35,000 euros/MW.

22 Coalswarm (2019), Global Coal Power Plant Tracker

23 For a full overview of investment risks in Serbia, please see the Annex.

Greece

Greece's power sector is characterised by a strong reliance on oil and natural gas imports.[24] By 2030, the country plans to decommission about 60 per cent of its aging lignite power plants while adding 615 MW of new lignite based power. Also by 2030, Greece plans to develop 4400 MW of wind power and 4200 MW of solar power.[25] Greece has committed to achieving a renewable energy share of 20 per cent in gross final energy consumption by 2020 and of 31 per cent by 2030. It has also pledged to increase its RES share in power production to 40 per cent by 2020 and 63 per cent by 2030.[26]

Greece has diversified its generation mix in recent years, with natural gas and renewable energy sources gaining ground. Lignite and natural gas each comprise approx. 34 per cent of generation. At the same time, production costs for lignite have become comparatively less favourable, owing to lower electricity consumption, rising air pollution, environmental restrictions, and low gas prices.[27, 28]

Greece is pursuing policies to liberalise and deregulate its wholesale and retail power markets. In line with the EU's new rules for electricity markets, it is shifting from a market dominated by the vertically integrated state utility Public Power Corporation S.A. (PPC) to arrangements that enable competition in forward, day-ahead, intraday, and balancing markets.

24 IEA (2017), Energy Policies of IEA Countries, Greece 2017 Review.

25 Greek NECP as submitted to EC on 29 January 2019.

26 ibid.

27 IEA (2017), Energy Policies of IEA Countries, Greece 2017 Review.

28 Lalas and Nikos (2018), Lignite in Greece: An Assessment.

In 2015, Greece ended its generous Feed in Tariffs (FiT)[29] support scheme and in 2018 shifted to auctions[30] for wind and solar (currently auctioned both together and separately). Since then, three auctioning rounds for onshore wind have taken place. The second auction, in December 2018, reached 160 MW of onshore wind power with record low bids of 55–65 EUR/MWh.[31] A third, technology-neutral auction, held in April 2019, included only one successful offer for 66 MW of onshore wind at 60 EUR/MWh. The record low LCOEs achieved in these auctions could be attributable to numerous factors, including potential underbidding by investors eager to enter the market, or bidding by foreign developers with access to better financing conditions. Previous studies have estimated a WACC of 12 per cent for onshore wind projects in Greece.[32, 33, 34]

Despite falling wind technology costs, Greece faces a series of barriers to onshore wind investment, including:[35]

- → Permit risk: A lack of institutional capacity, with long time-frames for obtaining licences and permits as well as inconsistent legislation and/or costly procedures;
- → Grid and transmission risk: Technical constraints of the Greek grid, including lack of grid reinforcement measures, high congestion levels, and transmission capacity restrictions;
- → Power market risk: There is uncertainty related the expansion of day-ahead trading to include day-ahead, intraday, forward, and balancing energy trading, especially given balancing obligations and barriers to access the balancing market;
- → Regulatory/political risk: An unstable and unknown regulatory environment as well as conflicting short-term political interests are at odds with the need for long-term strategy and planning;
- → Financial sector risk: Greek banks are under pressure because of their high exposure to non-performing loans, which has led to general capital scarcity, high cost of capital, high return expectations, and high debt-service cover ratios (DSCR).[36] Banks' risk aversion translates into very thorough and long risk assessment and due diligence processes;
- → Social acceptance risk: Social and political resistance related to NIMBY concerns and biodiversity threats;
- → Developer risk: Local developers have limited resources to develop bankable projects;
- → Counterparty/off-taker risk: Payment delays and re-structuring of signed PPAs bring financial uncertainty to investors.

29 Feed-in-Tariffs: Fixed electricity prices that are guaranteed to renewable energy producers for each unit of energy produced and fed into the electricity grid.

30 Under an auction regime, the government tenders a certain amount of energy capacity. RES producers bid offers to the government. Based on criteria such as price, the government chooses the best offers.

31 WindEurope (2018), Lower prices for onshore wind in second Greek renewables auction.

32 Angelopoulos et al. (2016) Risks and cost of capital for onshore wind energy investments in EU countries

33 Angelopoulos et al. (2017) Risk-based analysis and policy implications for renewable energy investments in Greece

34 Ecofys (2016). See Footnote 6.

35 For a full overview of investment risks in Greece, please see the Annex.

36 The DSCR is a measurement of the cash flow available to pay current debt obligations, stating net operating income as a multiple of debt obligations due within one year.

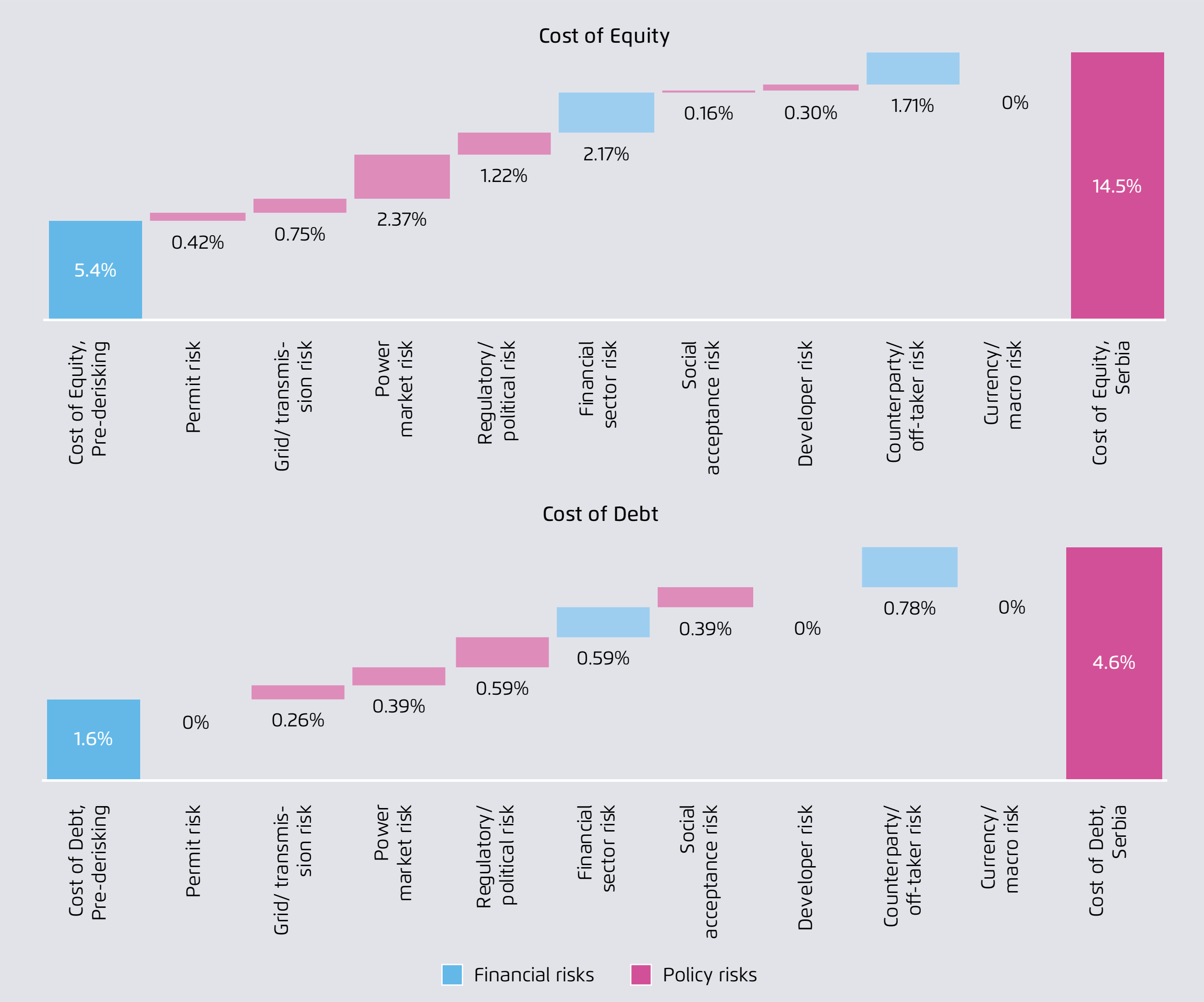
5. Results: The cost reduction potential of RES derisking policies

Serbia

Financing costs for onshore wind projects in Serbia are high: cost of equity (CoE) averages at 14.5 per cent, while cost of debt (CoD) averages at 4.6 per cent. Compare this to Germany, which has a CoE of 5.4 per cent and CoD of 1.6 per cent.[37]

37 Ecofys and eclareon (2018), Cross-Border Renewables Cooperation: The impact of national policies and regulation on the cost of onshore wind across the PENTA region and priorities for cooperation

Pre-derisking Cost of Equity and Cost of Debt in Serbia. Figure 1



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In a modelling exercise, we quantify how individual risk categories increase the cost of capital in Serbia (Figure 1).

Three risk categories in particular make a significant contribution to higher financing costs:

1) "power market risk", i.e. risks related to the regulation of the power market, including the need for well-functioning, transparent mechanisms for electricity trading;
2) "political risk"; and
3) "counterparty risk", i.e. risk related to the reliability and credibility of the electricity buyer.

In more specific terms, the prime drivers of high risk perception and, by extension, high financing costs are: uncertainty surrounding the shift from feed-in-tariffs to auctions; restrictions on development due to the cap on wind power capacity; a monopolistic balancing market; restrictions on off-taker arrangements; and mixed signals on future RES policy.

Compared to Germany, investors demand a risk premium of 9.1 percentage points when investing in Serbian RES. Some 3.8 percentage points of this gap are attributable to financial risks, while 5.3 percentage points are attributable to policy risks (see Figure 1).

By introducing a range of de-risking instruments tailored to Serbia (see *Table 1* and the methodology section for more details), the financing costs for onshore wind investment could be lowered by 6.6 percentage points (CoE) and 2.3 percentage points (CoD) (Figure 2).

Our estimations indicate that an RES Cost Reduction Facility aimed at minimising financial risks[38] would reduce CoE by 3 percentage points and CoD by 1.1 percentage points. A RES CRF would thus elimi-

38 The regulatory/ political risk includes both policy and financial risk but is not addressed by the RES CRF.

39 For a detailed overview of investment risks and associated derisking instruments, please see the Annex.

RES investment risks and derisking instruments – Serbia[39]. Table 1

	RISK CATEGORIES	LIST OF DERISKING INSTRUMENTS	
		Policy instrument(s)	**Financial instrument(s)**
1	Permit Risk	Streamlined permitting	
2	Grid/Transmission Risk	Grid development; up-to-date grid connection code implementation; continuation of shallow-charging approach	
3	Power Market Risk	Stable RES remuneration scheme; abolishment/reform of fossil fuel subsidies; opening up balancing markets across borders; implementing intraday markets	
4	Regulatory/ Political Risk	Stable RES remuneration scheme; 2030 targets adopted	Curtailment rules with financial compensation
5	Financial Sector Risk	Implementation of RED II	RES Cost Reduction Facility
6	Social Acceptance Risk	Public campaigns	
7	Developer Risk	Streamlined processes and good RES framework	
8	Counterparty/ Off-taker Risk	Revised PPA/CfD structure, including provisions of self-consumption; stable RES remuneration scheme implemented; enabling of corporate PPAs	RES Cost Reduction Facility
9	Currency/Macro Risk	Indexing/inflation adjustments, also for new auctions	RES Cost Reduction Facility

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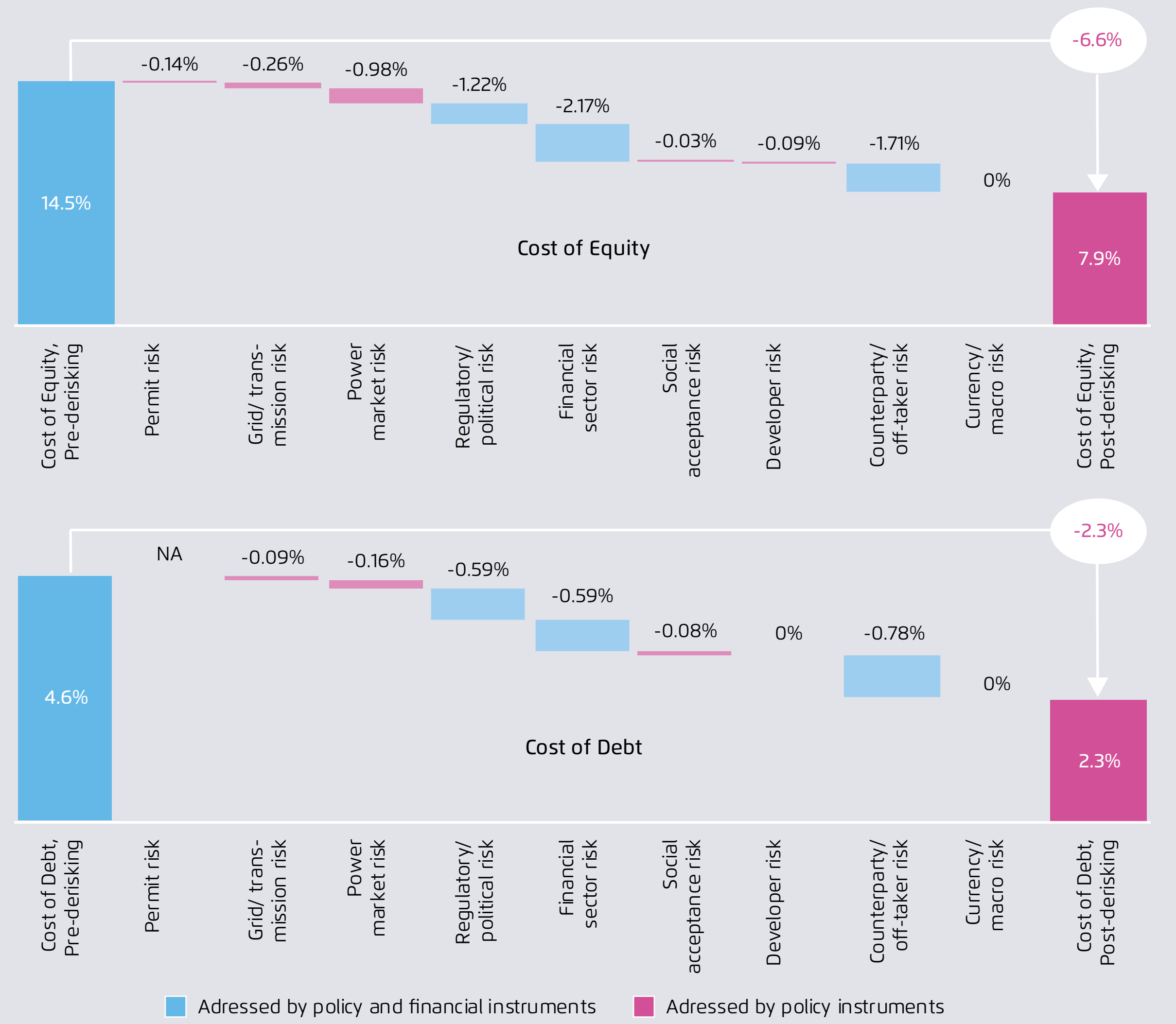
Post-derisking Cost of Equity and Cost of Debt in Serbia. Figure 2



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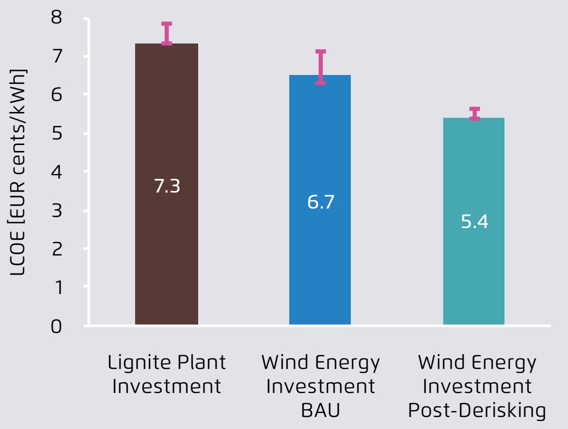
nate around 40 per cent of the higher cost of capital in the case studied here.

Other derisking instruments that could considerably decrease financing costs include a reliable RES remuneration scheme, long-term RES targets, as well as open and well-functioning balancing and intraday markets.

The derisking measures also contribute significantly to lower LCOEs for onshore wind. Additional analysis shows that while in a pre-derisking environment, the LCOE of onshore wind is similar to that of lignite (the technology predominantly discussed in the energy policy context of the country), in a post-derisking environment, wind energy generation costs fall significantly (from 6.7 euro cents/kWh to 5.4 euro cents/kWh), thus becoming 27 per cent cheaper than lignite (which costs 7.3 euro cents/kWh). This would further augment the attractiveness of onshore wind parks as a replacement for ageing fossil fuel plants (Figure 3).

LCOE comparison[40] - Serbia Figure 3



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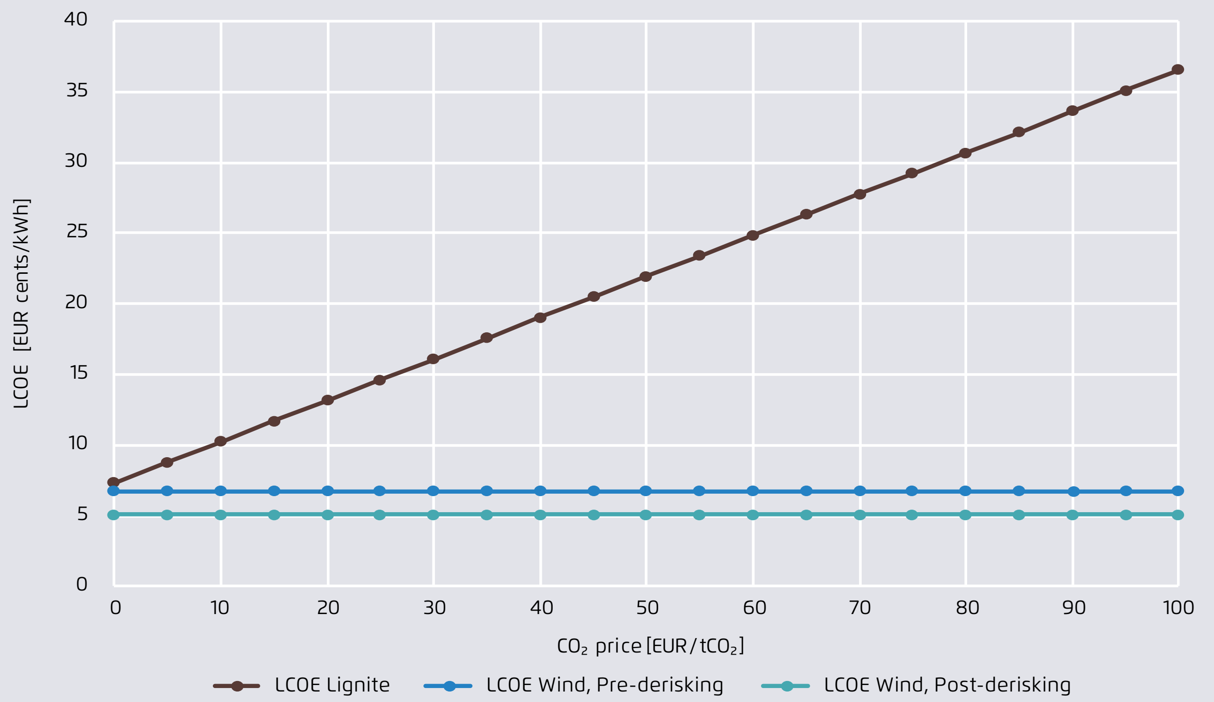
By significantly reducing the cost of RES investment, derisking policies thus appear to be an effective tool for supporting the development of renewables in Serbia. Beyond helping legislators to meet climate and energy targets, such policies would generate various positive knock-on effects, including improved air quality.

Lower reliance on fossil fuels would additionally reduce risks related to the future implementation of carbon pricing regimes (Figure 4).

40 With a view to the lignite plant investment, the range reflects a 10 per cent increase in fuel costs. For the pre- and post-derisking LCOE of wind power, the lower and higher ranges reflect a 1 percentage point increase/decrease of financing costs, as based on conducted interviews.

LCOEs in Serbia given varying carbon price levels. Figure 4



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Greece

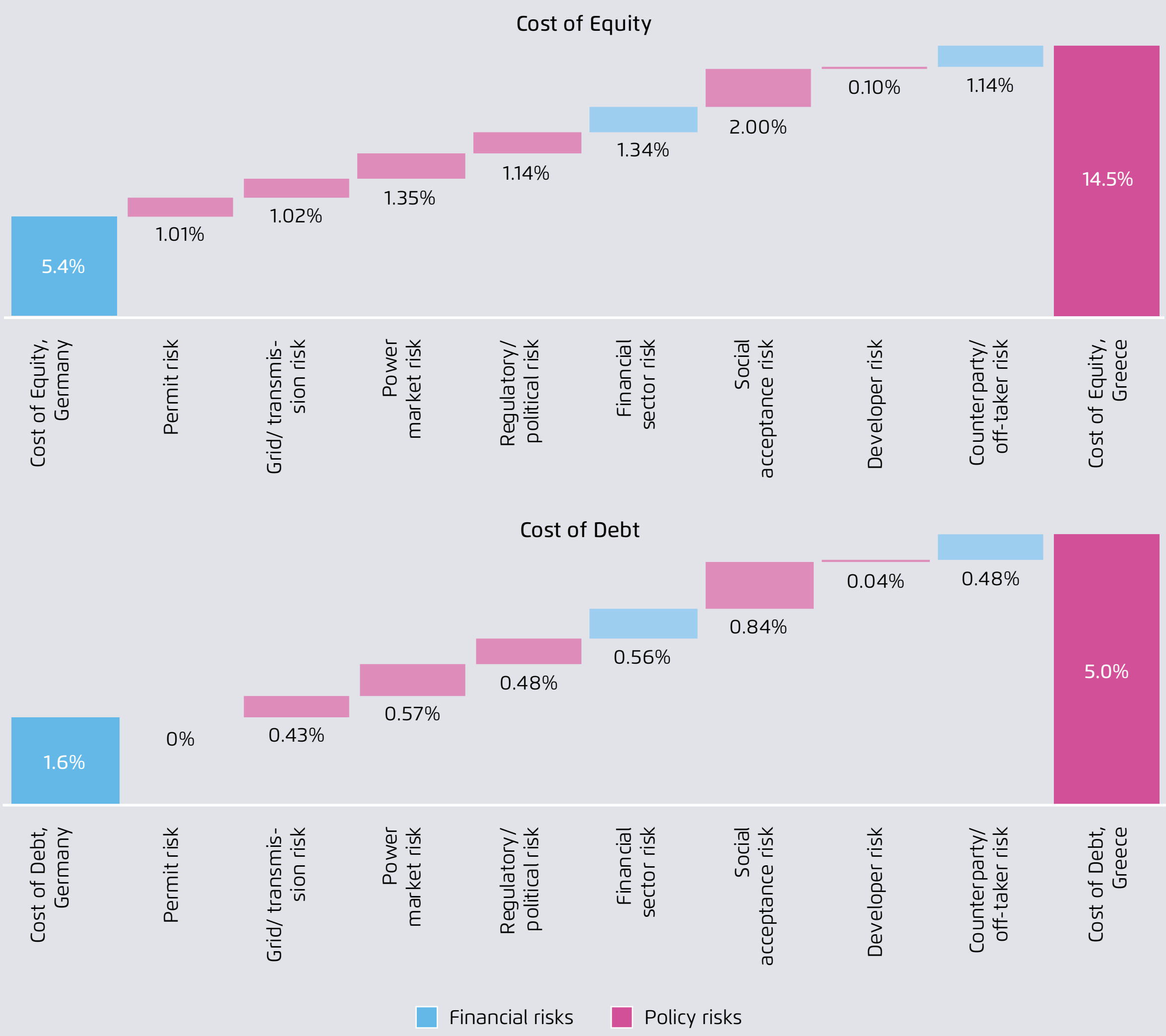
Onshore wind power projects in Greece are already economically attractive, yet bureaucratic obstacles, financial instability, and other barriers to investment have led to high financing costs, which are hampering the rapid expansion of onshore wind energy.

Onshore wind projects in Greece have a CoE of 14.5 per cent and CoD at 5 per cent. These figures have fallen rapidly in the last 2–3 years. Particularly the CoD for onshore wind parks has decreased considerably since 2016, when it stood at around 7 to 11 per cent.[41]

In line with our assessment for Serbia, we quantify how different risk categories contribute to increased cost of capital, as shown in Figure 5.

41 Ecofys and eclareon (2016), DIA-CORE - The impact of risks in renewable investments and the role of smart policies

Pre-derisking Cost of Equity and Cost of Debt in Greece. Figure 5



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Three risk categories have a particularly strong influence on the cost of capital:

1) "power market risk", i.e. risks related to power market regulation, including uncertainty related to transition to a market model that includes balancing obligations for wind;
2) "social acceptance risk", i.e. social and political resistance related to NIMBY concerns and biodiversity threats; and
3) "financial sector risk", i.e. capital scarcity and protracted due diligence by banks.

Of the 9.1% gap in equity financing costs between Germany and Greece, 2.5 percentage points are attributable to financial risks and 6.6 percentage points are attributable to policy risks.

By introducing a range of de-risking instruments tailored to Greece (see Table 2), cost of equity could be lowered by 4.9 percentage points and cost of debt by 1.9 percentage points (see Figure 6).

Our estimations indicate that an RES Cost Reduction Facility aimed at minimising financial risks would reduce CoE by nearly 2 percentage points and CoD by 0.8 percentage points. An RES CRF would thus almost eliminate 40 per cent of the cost of capital gap in the case studied here.

Derisking induces a lower WACC, which in turn reduces the LCOE of onshore wind parks by around 20 per cent, from 5.7 EUR cents/kWh to 4.6 EUR cents/kWh (see Figure 7). Based on the conducted interviews, the range varies by approximately 1 percentage point (pre-derisking: 4.5 to 7.5 EUR cents/kWh; post-derisking: 3.8 to 6 EUR cents/kWh). The post-derisking LCOE significantly increases the economic attractiveness of onshore wind energy. The expansion of onshore wind in Greece would thus be a cost-effective option for replacing old conventional power plants. It should be noted that these LCOE values are estimated based on the mean values for equity, debt, and overall capital expenditure yielded in a survey conducted between

RES investment risks and derisking instruments – Greece. Table 2

	RISK CATEGORIES	LIST OF DERISKING INSTRUMENTS	
		Policy instrument(s)	**Financial instrument(s)**
1	Permit Risk	Streamlined permitting	
2	Grid/Transmission Risk	Grid development; up-to-date grid connection code implementation; continuation of shallow-charging approach; establishment of curtailment rules for RES with financial compensation; increase storage facilities	Compensation of curtailed energy at 90%
3	Power Market Risk	Implementing intraday markets and balancing market reform; better market coupling with neighbours	
4	Regulatory/Political Risk	Stable RES remuneration scheme with a long-term schedule for RES auction volumes	
5	Financial Sector Risk	Stable RES remuneration scheme with a long-term schedule for RES auction volumes	RES Cost Reduction Facility
6	Social Acceptance Risk	Public campaigns	
7	Developer Risk	Streamlined processes and good RES framework	
8	Counterparty/Off-taker Risk	Enabling of corporate PPAs	RES Cost Reduction Facility

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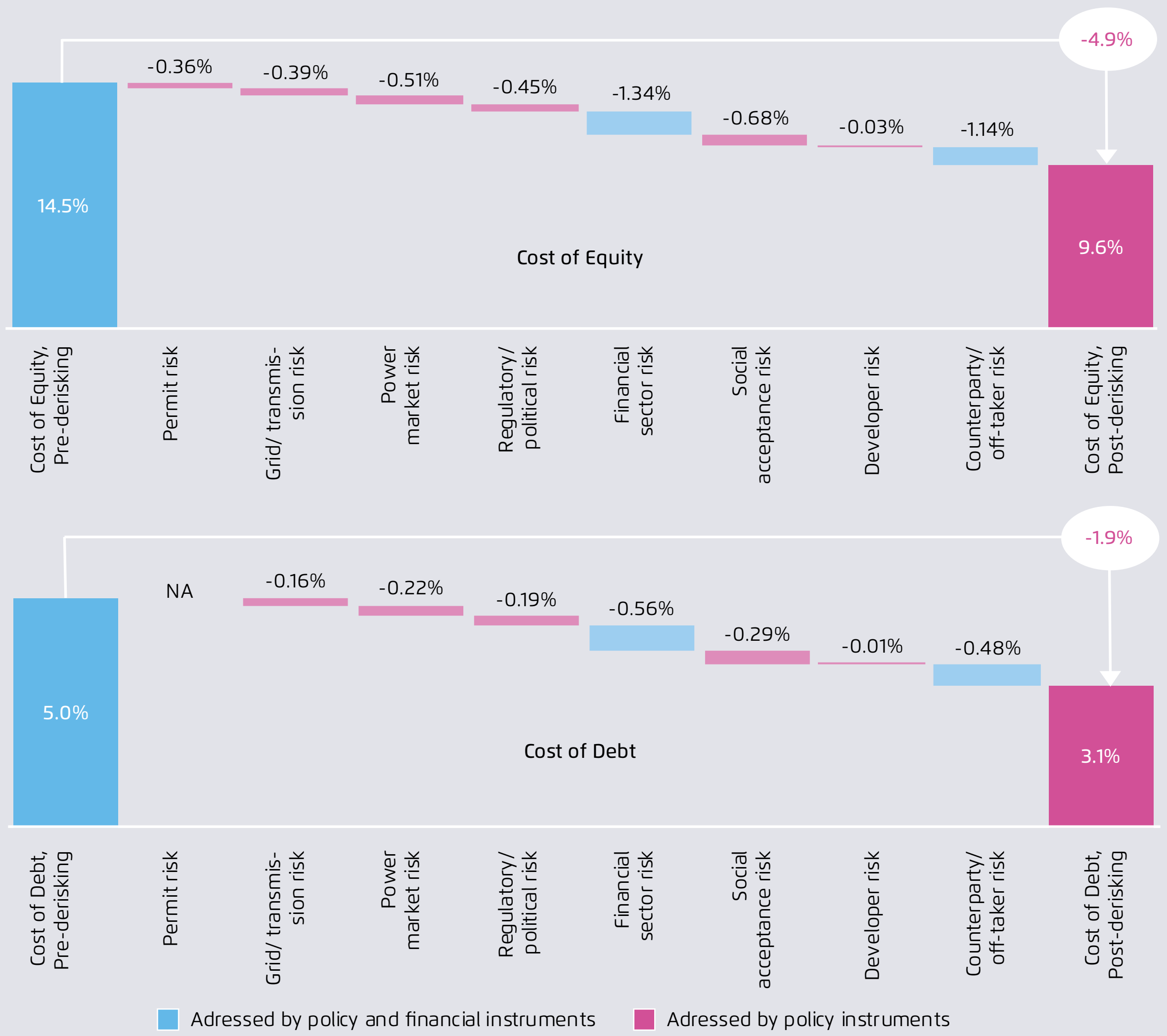
Post-derisking financing costs – Greece. Figure 6



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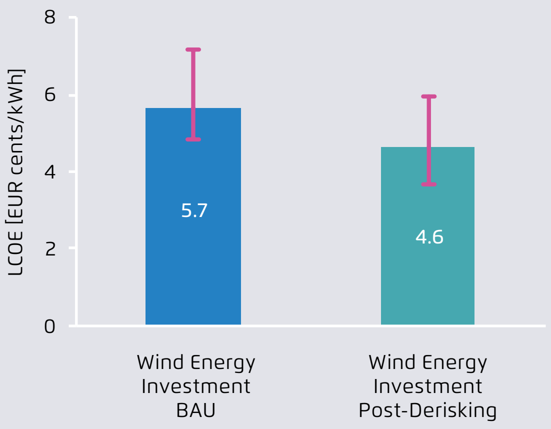
December 2018 and February 2019. If we instead use the lowest values from the survey, the LCOE falls to 4.5 EUR cent/kWh.

The attractiveness of onshore wind investment becomes even more apparent when we consider a range of possible future CO_2 prices (Figure 8). The higher the carbon price, the greater the discrepancy between onshore wind power and conventional generation. While LCOE values range from 5 to 8 EUR cents/kWh for all technologies when the carbon price is zero, lignite LCOE values exceed 40 EUR cents/kWh at a carbon price of 100 EUR/tonne.

By significantly reducing the cost of RES investment, the aforedescribed derisking policies would thus appear to be an effective tool for supporting the development of renewables in Greece. As is the case for Serbia, beyond helping legislators to meet climate and energy targets, such policies would generate various positive knock-on effects, including improved air quality. Lower reliance on fossil fuels

Greece LCOE before and after derisking[42] Figure 7



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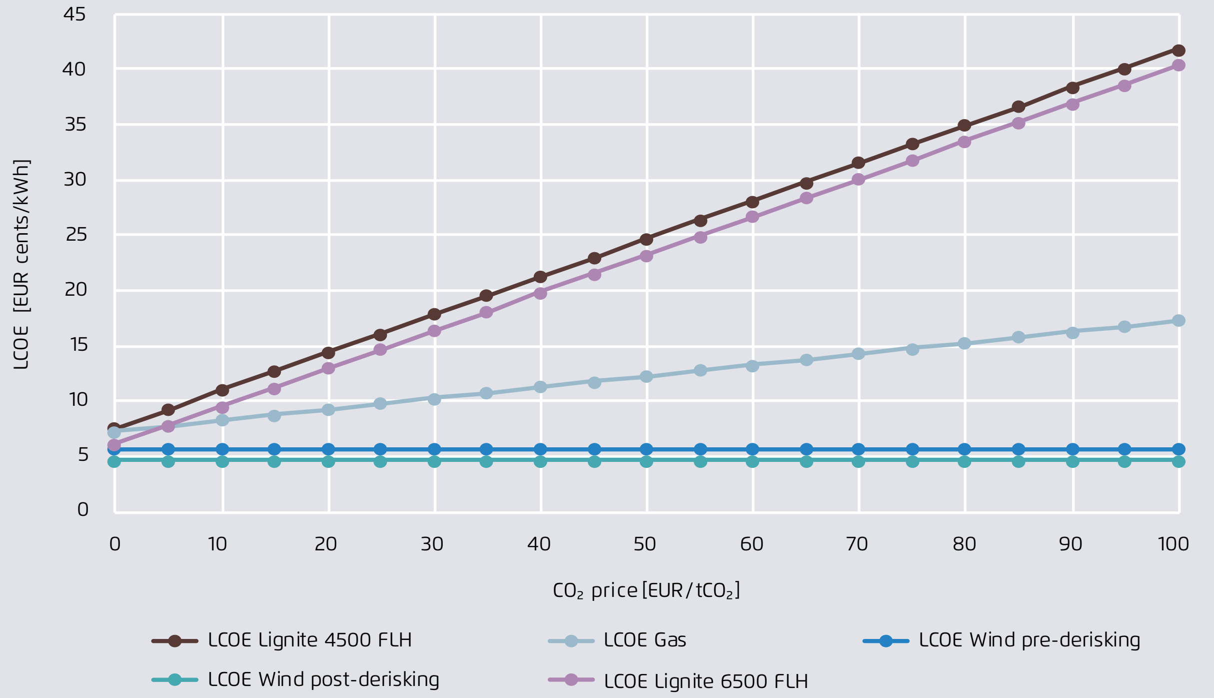
would additionally reduce risks related to the future implementation of carbon pricing regimes.

42 The lower and higher ranges reflect a 1 percentage point increase and decrease in the financing costs identified by interview participants.

43 This graph represents a simplified linear sensitivity analysis of CO_2 prices, which does not differentiate between older and newer coal power plants, but rather only between full load hours (FLH) or future coal and natural gas prices. Lalas and Gakis (2018) depict in greater detail how CO_2 and fuel prices impact the cost of electricity in Greece.

Greece LCOE at varying carbon price levels. Figure 8



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6. Conclusion and policy recommendations

The deployment of renewables in SEE countries has been limited to date. Traditionally, conventional energy, backed by generous government subsidies[44], has covered the majority of electricity demand. However, a large proportion of conventional power plants in the region are at an advanced age. The next few years are therefore critical for the energy transition in the region: if governments in SEE countries replace existing facilities with new conventional generation, they will either lock in high emissions or create costly stranded assets once more ambitious climate policy kicks-in. Such developments can and should be avoided by supporting the large-scale deployment of renewable energy at lowest possible cost.

While the technology cost of renewables has experienced continuous decline, SEE countries still face high financing costs for RES investment, which is hampering its deployment.

Our analysis indicates that financial derisking measures are promising tools for enhancing RES deployment rates. **They can have a considerable impact on RES financing costs, thus lowering the LCOE of onshore wind energy by 20 per cent, as demonstrated by our analysis of Greece and Serbia.** Yet given the rapid pace at which renewable energy systems have become cheaper in recent years, even larger cost advantages could occur in the future,[45] with corresponding benefits for taxpayers and consumers.

The **derisking measures with the highest projected impact** include:

1) the proposed **EU budget guarantee** mechanism;
2) **reliable, long-term RES remuneration** regimes and/or support schemes, including long-term RES targets;
3) **provisions to allow corporate PPAs**; and
4) open and well-functioning **balancing and intra-day markets** that are regionally integrated.

Of the derisking instruments discussed in the foregoing, the EU budget guarantee alone accounts for some 40 per cent of the estimated financing cost decline in Serbia and Greece (Table 3).

Derisking potential of the EU budget guarantee in Serbia and Greece (compared to total derisking potential of all instruments). Table 3

	Serbia	Greece
Equity	-3% (41%)	-2% (37%)
Debt	-1.1% (42%)	-0.8% (40%)

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Our study does not weight the economic benefits of de-risking measures against potential administrative costs of developing sound domestic renewable energy frameworks. The reason is simple: all EU Member States are obliged under the EU Treaties to fully implement EU laws domestically and also countries in the Energy Community will seek to implement these rules, particularly if they plan to accede the European Union in the future.

44 See Miljević, Mumović, Kopač (2919): Analysis of Direct and Selected Indirect Subsidies to Coal Electricity Production in the Energy Community Contracting Parties

45 For example, onshore wind electricity costs have decreased by around 25 per cent since 2010: IRENA (2018), Renewable Energy Generation Costs in 2017

In conclusion, SEE countries should comprehensively implement the revised EU rules on renewable energy and thereby signal their commitment to create a policy framework that is conducive to the rapid expansion of renewables. In addition to demanding regulatory reform, the EU will help lowering deployment costs support through the proposed new EU budget guarantee mechanism and through other EU funds that can be used to upgrade energy system infrastructure.

Clearly, the specific de-risking effects of the new EU regulatory and financial framework on the costs of renewable energy investments vary from country to country. However, our research also shows that the package of de-risking measures embedded in the new EU regulatory and financial framework will significantly aid the expansion of renewables in Greece and Serbia. It opens new opportunities for the rapid scaling of renewables at lower costs than conventional energies such as coal, gas or nuclear, with attendant benefits for the environment and for human health.

Annex

Our modelling generally follows the methodology set forth in the UNDP Derisking Renewable Energy Investment Report.[46] Our adjustments take into account the country-specific context as well as the objectives of our analysis.

This annex is organised based on the different stages of the analysis, similar to the DREI report's framework:

- → The Risk Environment Stage (Stage 1),
- → the Financing Cost Stage (Stage 2),
- → the Levelised Cost Stage (Stage 3),
- → and the Evaluation Stage (Stage 4).

Lastly, we discuss the limitations of the study.

In addition, our analysis uses the LCOE Financial Tool (in Microsoft Excel) created for the DREI framework. The financial tool is denominated in 2018 EUR and covers a core period from January 1, 2018 (approximating the present time) to December 31, 2030 (the horizon for Greece's and Serbia's envisioned RE targets). Generation technologies may have asset lifetimes that extend beyond 2030, and the financial tool accounts for this fact.

Risk Environment (Stage 1)

The data for the Risk Environment Stage come from three principal sources:

- → 9 structured interviews with onshore wind investors (both equity and debt) and developers in Greece and 7 structured interviews with onshore wind investors (both equity and debt) and developers in Serbia
- → "Best-in-Class" onshore wind financing cost data, from a study by Agora Energiewende et al.[47]
- → Additional insights and research by the two country partners, the Serbian Association for Sustainable Development (ASOR) and the Greek NOAA/facets

Interviews with local investors and developers were conducted by the local partners in Greece and Serbia between December 2018 and February 2019.

Deriving a Multi-Stakeholder Investment Barrier and Risk Table & Public Instruments for their Mitigation

The multi-stakeholder barrier and risk tables for onshore wind energy for both countries are based on the generic table for large-scale, renewable energy introduced in the DREI report and subsequently modified to fit our assessment. It is composed of a range of risk categories and underlying barriers, as presented in Table 4 and Table 5.

The tables illustrate a set of key investment risks for onshore wind, as well as their underlying barriers in both Serbia and Greece.

Table 6 and Table 7 detail the proposed public derisking instruments (including both policy and financial instruments) to mitigate the formerly identified investment risks and underlying barriers.

The tables were compiled based on discussions with the project team members, including the local country partners and ELETAEN, the Greek Wind Energy Association.

46 For more information, please see UNDP (2019), Derisking Renewable Energy Investment

47 Agora Energiewende, Ecofys and eclareon (2018), Cross-Border Renewables Cooperation: The impact of national policies and regulation on the cost of onshore wind across the PENTA region and priorities for cooperation

RES investment barriers – Serbia.

BARRIERS		
Risk Category	**Description**	**Country context**
1. Permit Risk	Lack of public sector capacity to effectively and transparently manage permit system	Lack of institutional capacity Inconsistent decision-making; e.g. Serbia and UEA signed an agreement in 2013, giving UEA companies advantage when investing in Serbia (e.g. by skipping tender procedures)
2. Grid/Transmission Risk	Limits to grid management and transport infrastructure	Technical limits of the system for wind power approx. 1000 MW without any grid reinforcement Limited experience of the TSO with regard to commissioning of wind parks (as well as their operation) The cost of the connection (HV line, substation) is borne by the investor and after construction all rights are transferred to TSO (to own and operate it)
3. Power Market Risk	Limits and uncertainty related to energy markets, including market access	Market distortions: high fossil fuel subsidies There is one single balancing service provider (the incumbent utility) No new entrants to the balancing market nor regional balancing market in place that would decrease balancing costs The cap on wind power (525 MW) is due to economic reasons (to limit price increases for final consumers) Unclear auctioning regime
4. Regulatory/ Political Risk	Risks arising from a mix of political, economic, institutional and social characteristics	Governance: Unstable and unknown regulatory environment (policy risk); RES expansion generally not on political agenda; Conflicting short-term political interests bound by a 4-year mandate (or less) vs. much needed long-term strategy and planning
5. Financial Sector Risk	Lack of capital/investment in the country; no expertise/experience in financing large RE projects	Generally underdeveloped domestic financial sector and very few lenders, non-liquid capital markets Development banks are also the ultimate controller of the developers' integrity as all projects and their owners have to satisfy bank's strict KYC criterion before financial closure
6. Social Acceptance Risk	Lack of awareness and resistance to renewable energy among the public	Lack of awareness among end users; Wind power perceived as "too expensive"; concerns about electricity price increases
7. Developer Risk	Risks arising from use of the renewable energy resource and technology (resource assessment; construction and operational use; hardware purchase and manufacturing)	Local developers typically lack experience and resources to develop bankable projects Some local developers are pursuing lawsuits between each other, which slows their projects' financial closure, in addition to creating an uncertain environment
8. Counterparty/ Off-taker Risk	Risks arising from the utility's poor credit quality and an IPP's reliance on payments	Disputes between TSO (who owns the substation) and utility or off-taker (who provides energy to the substation) during commissioning and construction phase vis-a-vis technical and legal issues related to on-site consumption: they file claims against each other The off-taker provides only promissory notes as collateral for the fulfillment of obligations
9. Currency*/ Macro Risk	Currency risks (volatility), inflation, trade issues	FIT expressed in EUR and indexed to EU inflation; it is not clear how this issue will be treated in auctions, however (it is reasonable to presume that the auctions would be in EUR as well). Massive imports of wind turbines during 2018 have made significant impact on foreign trade balance

NewClimate Institute and ASOR

Table 4

Underlying Barriers	**Key Stakeholder Group**
Long time-frames for obtaining licenses and permits	Public sector administration Developers Investors
Unfair competition	
Limits to grid infrastructure	TSO Developers
Operational risks due to inexperienced TSO	
All equipment in the substation/HV line has to be approved by the TSO – this may cause delays and higher costs Delays caused by commissioning procedures	
RES have a disadvantage on the market, underperformance in bidding procedures	Government Policy makers Utilities
Monopolistic balancing market; Difficult market access	
Uncertainty regarding RES development and restrictions to market development	
Mixed/ ambiguous policy signals with resulting uncertainty and risk for developers/ investors. New regulation (auctioning) could increase the cost of operations; Uncertainty for investors; A wait-and-see approach will slow down the transition; investment activities often on-hold due to frequent elections	Government Policy makers Developers Legislators Regulators
Capital scarcity and high cost of equity capital, high return expectations; high required DSCR (preference of small projects)	Investors Commercial banks Development banks IFIs
Protracted due diligence by banks leads to huge delays (up to 9 months)	
Resistance: Social and political resistance related to NIMBY concerns; special interest groups	General public Media Politicians Developers
Lack of C-suite talent and experience to ensure effective execution (business planning, securing financing, resource assessment, plant design, operations and maintenance) and to manage challenges (limited information, unforeseen events)	Developers
Uncertainty over project implementation	
Restrictions affect off-taker arrangements and some technical issues (e.g. lack of substation in operation)	Utility (off-taker)
Possible limitations in debtors' ability to provide sufficient funds	
Potential macro risk for new projects	Government (ministry of finance, ministry of energy) Investors
Potential macro risk for new projects	

*Note this risk category only applies if financing is in hard currency.

RES investment barriers – Greece.

BARRIERS		
Risk Category	**Description**	**Country context**
1. Permit Risk	Lack of public sector capacity to effectively and transparently manage permit system	Lack of institutional capacity
		Inconsistent and non-transparent decision-making
2. Grid/Transmission Risk	Limits to grid management and transport infrastructure	Technical limits of the system for wind power without any grid reinforcement
		Congestion and transmission capacity restrictions infrequently reviewed
		The cost of the connection (HV-MV line, substation) is born by investor and after construction all the rights are transferred to TSO (to own and operate it)
3. Power Market Risk	Limits and uncertainty related to energy markets, including market access	Uncertainty of timing and operation of the target model and balancing obligations related to wind power
4. Regulatory/Political Risk	Risks arising from a mix of political, economic, institutional and social characteristics	Governance: Unstable and unknown regulatory environment (policy risk); Conflicting short-term political interests bound by a 4-year mandate (or less) vs. much needed long-term strategy and planning
5. Financial Sector Risk	Lack of capital/investment in the country; no expertise/experience in financing large RE projects	Financial sector under pressure due to NPLs
		Risk aversion on part of banks
6. Social Acceptance Risk	Lack of awareness and resistance to re-newable energy among the public	Resistance from NGOs related to biodiversity threats; myths still believed
7. Developer Risk	Risks arising from use of the renewable energy resource and technology (resource assessment; construction and operational use; hardware purchase and manufacturing)	Local developers have limited understanding of how to implement bankable projects
8. Counterparty/ Off-taker Risk	Risks arising from the utility's poor credit quality and an IPP's reliance on payments	Payment delays
		Re-structuring of signed PPAs with haircut

NewClimate Institute and NOA/FACETS

Table 5

Underlying Barriers	Key Stakeholder Group
Long time-frames for obtaining licences and permits	Public sector administration
Malfunctioning judicial system (delays, overlapping/inconsistent legislature, costly procedures)	
Limits to grid infrastructure	TSO Developers
Operational risks due to inexperienced TSO	
All equipment in the substation/HV line has to be approved by the TSO – this may cause delays and higher costs Delays caused by commissioning procedures	
Balancing obligations Access to balancing market	Government Policy makers Utilities
Acrimonious political climate; upcoming elections	Government Policy makers Developers Legislators Regulators
Capital scarcity and high cost of capital (equity); high return expectations; high required DSCR (preference for small projects)	Investors Commercial banks Development banks IFIs
Protracted due diligence by banks	
Social and political resistance related to NIMBY concerns; special interest group high-jacking	General public Media Politicians Developers
Country risk	Developers
RES levy operation and RES account financing sources Aggregator trustworthiness	Off-taker
Political interventions	Aggregator

Public derisking instruments – Serbia.

	PUBLIC INSTRUMENTS	
Risk Category	Policy Derisking Instruments	
	Activity	Description
1. Permit Risk	Streamlined permitting	Establish one-stop shop/single point of contact to guide and facilitate entire permit application and approval process. Maximum time-limits for permit-granting process of 2 years (1-year repowering) → Art. 16 RED II
2. Grid/Transmission Risk	Grid development	The energy community has agreed on electricity grid development (part of a list of projects of the Energy Community interest „PECIs“) between Serbia and its neighbouring countries as well as within Serbia
	Up-to-date grid connection code implementation	Implementation of ENTSO-E Network Code on Requirements for Generators (if not yet adopted)
	Continuation of shallow-charging approach	Shallow-charging methodology seems to be implemented. Continue as best practice
3. Power Market Risk	Abolishing/reforming fossil fuel subsidies	Assessment of fuel subsidies, phase out/down of subsidies, awareness campaigns to increase public understanding of the topic
	Opening up balancing market across borders; allowing RES and IPPs to supply balancing services; implementing intraday markets	Balancing responsibility for RES > 500 kW (Art. 4 Electricity Market Regulation) implies larger risks given monopolistic balancing market. Balancing market and spot market should be reformed in alignment with new electricity market regulation (Art. 4 and 7): Intraday market implementation with 15 minute product lengths and 15 minute imbalance settlement periods for Balancing Responsible Parties
	Stable RES remuneration scheme implemented with a long-term schedule of RES auction volumes	Long-term auction schedule anticipating the expected allocation of support, covering at least the next five years (or three years in case of budgetary planning constraints), including indication of tendering frequency and expected capacity (Art. 6 RED II)
4. Regulatory/ Political Risk	Stable RES remuneration scheme implemented. 2030 targets adopted	Long-term schedule anticipating the expected allocation of support, covering at least the next five years (Art. 6 RED II) to enable revenue stabilisation for RES given fossil fuel subsidy distortions; no retroactive changes to support should be implemented (Art. 6 RED II); National Energy and Climate Plans for 2030 and 2030 targets for RES energy should be adopted to lower uncertainties for investors and improve market outlook
5. Financial Sector Risk	Thorough implementation of RED II and market design reform in light of EMR and EMD (electricity market regulation and directive)	Stable RES policy framework will lower investor risks; this will reduce WACC for investment projects and encourage lenders to provide financing
6. Social Acceptance Risk	Implementation of public campaigns, 2030 target implementation, broader enabling framework for prosumers	Hypothesis: new 2030 climate & energy framework of EU, once implemented by Energy Community countries, will lead to lower RES acceptance issues
7. Developer Risk	Streamlined processes and good RES framework	Streamlined processes and good RES framework lowers requirements for developers
8. Counterparty/Offtaker Risk	Revised PPA/CfD structure to include provisions for on-site energy consumption	Effects unclear and/or no straight-forward way to address this risk (and to what extent it can be lowered through the EU RES framework)
	Implementation of stable RES remuneration scheme; corporate PPAs enabled.	Auction scheme with sliding premium payment levels has been implemented. Remaining barriers to corporate PPAs need to be removed (Art. 15 RED II)
9. Currency/ Macro Risk		
	Soft measures: addressing / highlighting local economic benefits, even though technology is imported	

NewClimate Institute, ASOR and Agora Energiewende

Table 6

Financial Derisking Instruments	
Activity	**Description**
Establish curtailment rules for RES with financial compensation	Curtailment of RES as last resort and based on objective, transparent, and non-discriminatory criteria; compensation of 90 per cent of financial support for curtailed energy (as opposed to current practise of extending support period beyond 12 years for periods of curtailment) → Art. 12 Electricity Market Regulation
RES CRF implemented	
RES CRF implemented	Tariff-related risks are reduced through the RES CRF, thus lowering required returns on equity and debt financing
RES CRF implemented	Auction premium scheme implemented with RES CRF in parallel to lower/minimise off-taker risks
„Business as usual" design for new auctions with indexing/ inflation adjustment	
RES CRF implemented	As an EU instrument, RES CRF funds likely to be denominated in EUR

Public derisking instruments – Greece.

	PUBLIC INSTRUMENTS	
Risk Category	Policy Derisking Instruments	
	Activity	Description
1. Permit Risk	Streamlined permitting	Establish one-stop shop/single point of contact to guide and facilitate entire permit application and approval process. Maximum time-limits for permit-granting process of 2 years (1-year repowering) → Art. 16 RED II
2. Grid/Transmission Risk	Establish curtailment rules for RES with financial compensation; build storage capability	Curtailment of RES as last resort and based on objective, transparent, and non-discriminatory criteria; compensation equal to 90 per cent of financial support for curtailed energy → Art. 12 Electricity Market Regulation
	Grid development and storage deployment (e.g. complete planned island and transboundary connections)	Increase interconnector capacity; connect islands; create incentives for storage
	Implementation of up-to-date grid connection code	Implementation of ENTSO-E Network Code on Requirements for Generators
	Continuation of shallow-charging approach	Shallow-charging methodology seems to be implemented. Continue as best-practice
3. Power Market Risk	Implementing intraday markets and balancing market reform allowing RES to supply balancing services; Better market coupling with neighbours	Balancing responsibility for RES > 500 kW (Art. 4 Electricity Market Regulation) implies larger risks. Balancing market and spot market should be reformed in alignment with new electricity market regulation (Art. 4 and 7): Intraday market implementation with 15 minute product lengths and 15 minute imbalance settlement periods for Balancing Responsible Parties; market-coupling project has been implemented for day-ahead, intraday and balancing markets
4. Regulatory/ Political Risk	Stable RES scheme implemented with a long-term schedule of RES auction volumes	Long-term schedule anticipating the expected allocation of support, covering at least the next five years (Art. 6 RED II) to enable revenue stabilisation for RES given fossil fuel subsidy distortions; no retroactive changes to support should be implemented (Art. 6 RED II); National Energy and Climate Plans for 2030 and 2030 targets for RES energy should be adopted to lower uncertainties for investors and improve market outlook
5. Financial Sector Risk	Stable RES scheme should be implemented with a long-term schedule of RES auction volumes	Long-term auction schedule anticipating the expected allocation of support, covering at least three years, including indication of tendering frequency and expected capacity (Art. 6 RED II)
6. Social Acceptance Risk	Implementation of public campaigns, 2030 targets, broader enabling framework for prosumers	Hypothesis: new 2030 climate & energy framework of EU, once implemented by Energy Community countries, will lead to lower RES acceptance issues
7. Developer Risk	Streamlined processes and good RES framework	Streamlined processes and good RES framework will lower financial return required by developers
8. Counterparty/ Off-taker Risk	Enabling of corporate PPAs	Removal of any remaining administrative barriers to corporate PPAs (Art. 15 RED II)

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Table 7

Financial Derisking Instruments	
Activity	**Description**
Compensation of curtailed energy at 90%	
RES CRF implemented	Tariff-related risks lowered through the RES CRF, thus lower returns on equity and debt required
RES CRF implemented	Ensures that payment delays by public off-taker are avoided

Financing Costs (Stage 2)

Calculating the elevated financing costs associated with each risk category

Our model estimations are based on data collected in interviews with onshore wind energy investors and developers. The interviews were performed on a confidential basis, and all of data gathered across interviews were aggregated together.

The interviewees were asked to score each risk category according to

(i) the probability of occurrence of negative events (the country specific investment risks) and
(ii) the level of financial impact of these events (should they occur). They were additionally asked to score
(iii) the expected effectiveness of public instruments to address each risk category. Moreover, investors were asked to provide estimates of their cost of equity, cost of debt, capital structure and loan tenors.

The data gathered in these interviews were then assessed. The methodology applied in this study involves identifying the total difference in the cost of equity or debt between the assessed country (Greece or Serbia) and the best-in-class country (Germany). The identified cost gap constitutes the total additional financing cost in the assessed country.

The interview scores provided for each risk category address both components of risk: the *probability* of a negative event occurring above the probability of such an event occurring in the best-in-class country, as well as the *financial impact* were such an event to occur. These two ratings were then multiplied to obtain a total score per risk category. These total risk scores were used to prorate and subdivide the total difference in the cost of equity or debt.

In addition, the following key steps were taken to analyse financing costs:

- → In order to make interview responses comparable, investors were asked to provide their scores while taking into account a list of key assumptions regarding onshore wind energy investments, as set out in Table 8 and Table 9. To maintain consistency, these assumptions subsequently informed the LCOE calculation for renewable energy in Stage 3.
- → Equity investors in renewable energy typically have greater exposure to development risks. The modelling uses the full set of risk categories for equity investors. The "permit risk" is removed for debt investors, as we assume banks will impose loan qualification criteria – such as a valid permit, feasibility studies, and/or available equity financing. Accordingly, the modelling uses one less category for debt investors.
- → The modelling selects Germany as the example of a best-in-class investment environment for onshore wind energy. Germany is generally considered by international investors to have a very well-designed and implemented policy and regulatory regime, with minimal risk for all the investment risk categories. In this way, Germany serves as the baseline – the left-most column in Figure 1 and Figure 5. Due to the small number of debt investors in the sample, answers from equity investors and from debt investors were combined for the analysis.

The following is a summary of the key approaches taken to assess the effectiveness of the two types of derisking instruments:

- → *Policy derisking* instruments: Estimates regarding the effectiveness of policy derisking instruments in reducing financing costs are based on the structured interviews with investors, and then further adjusted as part of our analysis. In particular, we allow for a potential effectiveness of up to 100 per cent. However, since policy derisking instruments take time to become maximally effective, a linear ("straight-line") approach to time effects is modelled over the target investment

Key assumptions – onshore wind investment in Serbia. Table 8

Category	Assumptions
Timeframe:	Please answer all questions based on the current subsidy regime for renewables – that is, auctions with sliding premiums (since new projects are no longer granted FiTs).
Project size:	Assume you have the opportunity to invest in a 100 MW onshore wind park.
Wind turbines:	Assume installation of 3–5 MW turbines from a high-quality manufacturer with a proven track record.
O&M:	Assume an O&M insurance contract is in place (thus eliminating certain technology risks).
Grid connection:	Assume that transmission lines with free capacity are located relatively close to the project site (within 10 km).
Business model:	Assume a build-own-operate business model and a construction sub-contract with high penalties for contract breach (thus eliminating certain technology risks).
Finance model:	Assume a project financing structure.

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Key assumptions – onshore wind investment in Greece. Table 9

Category	Assumption
Timeframe:	Please answer all questions based on the current subsidy regime for renewables – that is, auctions with sliding premiums (since new projects are no longer granted FiTs).
Project size:	Assume you have the opportunity to invest in a 20–25 MW onshore wind park.
Wind turbines:	Assume installation of 2–3.5 MW turbines from a high-quality manufacturer with a proven track record.
O&M:	Assume an O&M insurance contract is in place (thus eliminating certain technology risks).
Grid connection:	Assume that transmission lines with free capacity are located relatively close to the project site (within 10 km).
Business model:	Assume a build-own-operate business model and a construction sub-contract with high penalties for contract breach (eliminating certain technology risks).
Finance model:	Assume a project financing structure.

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period – we refer to this as the discount rate for time effects (which is set at 50 per cent for policy derisking instruments).

→ *Financial derisking instruments:* Estimates regarding the effectiveness of policy derisking instruments in reducing financing costs are based on the structured interviews with investors, and then further adjusted for as part of our analysis. In particular, we allow for a potential effectiveness of up to 100 per cent. No time discount effect is assumed for financial derisking instruments as they can become 100 per cent effective immediately.

Investor input regarding the effectiveness of all instruments was also taken into account.

Cost of administering public instruments

The study does not estimate the cost associated with adopting and administering the public instruments, for the following reasons:

→ Most derisking instruments will be implemented in both assessment countries, creating no additional costs (at least in the long term) beyond what would be required anyway
→ Reliable data are very difficult to access
→ The cost component of the derisking instruments was not a key focus of the study

Levelised Costs (Stage 3)

Levelised Cost of Electricity (LCOE) Calculation

The 2013 DREI report's financial tool is used for the LCOE calculations. The financial tool is based on the equity-share based approach to LCOEs, which is also used by IEA and NREL.[48]

48 Also see IEA (2011), Multi-national Case Study of the Financial Cost of Wind Energy, and NREL (2011), Renewable Energy Cost Modeling: A Toolkit for Establishing Cost-Based Incentives in the United States

Table 10 sets out the LCOE formula used. In this approach, a capital structure (debt and equity) is determined for the investment, and the cost of equity is used to discount the energy cash flows.

Country specific inputs, such information on public costs, tax rates, fuel costs, etc. were provided by the local country partners.

Baseline Energy Mix Levelised Costs and Emissions

To keep the analysis manageable and in line with the defined scope of the project (SEE countries needing to replace part of their ageing conventional power plants), a 100 per cent build margin is used for both countries. Hence, the modelling compares the LCOEs of newly installed conventional capacity with that of newly installed onshore wind technology. It is assumed that no conventional power plant will be shut down prematurely in favour of renewable energy generation. A private sector perspective to baseline investment is used and, as such, private sector financing costs are modelled. This reflects the assumption that both Serbia and Greece are seeking to attract private-sector investment irrespective of energy technology.

Additionally, it is assumed that newly installed conventional capacity in Serbia would be comprised of 100 per cent lignite (owing both to the outline/objective of the report and the fact that the required data are only available for lignite). In Greece, due to better data availability, it is assumed that newly installed capacity would mirror the current baseline technology mix. Additional costs for CO_2 allowances have been added to the fuel costs in the Greek analysis.

Evaluation (Stage 4)

Sensitivity Analysis

To increase the robustness of results, the modelling includes a sensitivity analysis:

Sensitivity to fluctuations in the following factors was considered:

- → Investment costs and O&M costs
- → Full load hours (only for Greece)
- → Fuel costs
- → CO_2 price
- → Financing costs

The results of this analysis are included as ranges in Figure 3 and Figure 7 as well as in Figure 4 and Figure 8.

The LCOE modelling formula. Table 10

$$\frac{\%\,\text{Equity Capital} * \text{Total Investment} + \sum_{\tau=1}^{T} \frac{(\textit{O\&M Expense})_\tau + (\textit{Debt Financing Costs})_\tau - \textit{Tax Rate} * (\textit{Interest Expense}_\tau + \text{Depreciation}_\tau + \textit{O\&M Expense}_\tau)}{(1 + \textit{Cost of}\ \text{Equity})^\tau}}{\sum_{\tau=1}^{T} \frac{\textit{Electricity Production}_\tau * (1 - \textit{Tax Rate})}{(1 + \textit{Cost of}\ \text{Equity})^\tau}}$$

- → % Equity Capital = portion of the investment funded by equity investors
- → O&M Expense = operating & maintenance expenses
- → Debt Financing Costs = interest & principal payments on debt
- → Depreciation = depreciation on fixed assets
- → Cost of Equity = after-tax target equity IRR

UNDP (2019)

Disclaimer

Despite the many benefits of an LCOE analysis, which discounts the cash flows of a given unit of energy and thus enables a comparison of different variables and technologies, there are also a number of limitations to this approach that may affect our results.

These include:

→ Full load hour data and estimates are for 2017–18. Over time, full load hours may vary both for renewables and conventional power sources. For example, with a higher share of renewables, some of the conventional power plants may only need to cover peak demand times. At the same time, full load hours for renewables might increase with system optimisation (for example, in combination with storage). This is not reflected in our analysis.
→ Relatedly, we assume that RES energy will have priority dispatch, which could potentially lead to congestion and thus lower full load hours, which is not considered in our analysis.
→ Grid integration costs are only taken into account marginally and system flexibility costs are not accounted for.
→ Auctioning costs for onshore wind in comparison to LCOEs pre- and post- derisking: The LCOE for onshore wind in the post-derisking scenario in Greece is found to be slightly higher than the winning bids in the country's last onshore wind auction in December 2018. This might be due to several reasons, including potential underbidding of investors to enter the market.
→ Choice of best-in-class country. Although Germany has the lowest cost of capital in the EU, which defines it as "best-in-class", other costs such as labour, compliance, etc. are in fact higher than in SEE countries and might also influence investment considerations by investors and developers; cost differentials in this regard are not considered in our analysis.
→ Given the scope of our analysis, we do not consider that SEE countries need flexible power plants to complement renewable energy, or how much reserve capacity would be needed. However, our analysis does not assume that SEE countries will go 100 per cent renewable in the short to medium term; rather, instead we evaluate the impact and attractiveness of one RES technology and how a predefined set of derisking measures could influence their financing costs. Also, the cost of integrating renewables is rather low; cross-border power system integration and regional cooperation significantly reduce the integration challenge.[49, 50]
→ The study does not provide estimates concerning the cost of implementing and administering public instruments, as this was not a focus of our study and data availability is poor.

49 For comparison, the additional cost of integrating vRES into the grid is in the range of 0.5 to 2 EUR cents/kWh. See Agora Energiewende (2015): The Integration Cost of Wind and Solar Power: An Overview of the Debate on the Effects of Adding Wind and Solar Photovoltaic into Power Systems.

50 REKK (2019). The Southeast European power system in 2030: Flexibility challenges and regional cooperation benefits. Study on behalf of Agora Energiewende.

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