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The cost of financing for renewable power

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About IRENA

The **International Renewable Energy Agency (IRENA)** serves as the principal platform for international co-operation, a centre of excellence, a repository of policy, technology, resource and financial knowledge, and a driver of action on the ground to advance the transformation of the global energy system. A global intergovernmental organisation established in 2011, IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security, and low-carbon economic growth and prosperity.

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Key insights

The cost of capital (CoC) for renewables matters. The CoC is a major determinant of the total price to purchasers of electricity from renewable power generation technologies. If assumptions used for the CoC are not accurate – over time, between countries or technologies – then the cost of electricity might be significantly misrepresented and result in poor policy making.

A comprehensive database on renewable energy financing. This IRENA report presents new CoC data, obtained from an expert survey and interviews covering all major world regions for onshore wind, offshore wind and solar photovoltaic (PV). The coverage of this survey – both in terms of geography and technology – is believed to be among the most wide-ranging of any existing database on renewable energy financing.

Material differences exist in the CoC across countries and technologies. The weighted average CoC obtained through a survey of experts in 45 countries varied from as little as 1.1% (onshore wind in Germany) to above 10% (solar PV in Ukraine), all in nominal terms, for the period 2019-2021.

The regional average CoC in mature markets across the three renewable energy technologies considered (4.4% in Europe and 5.4% in North America) is lower – sometimes considerably lower – than in emerging markets, for instance, in the Asia-Pacific region (5.6%) or Latin America (6.9%). Rates in the Middle East and Africa are the highest, at 8.2% on average. In general, across regions, the CoC for the renewables covered in this report is 200-300 basis points above the country risk. [1]

There is no single value for the CoC within a market for a given technology. The survey results revealed that in individual markets the CoC for a given technology varied, sometimes significantly, across respondents. For solar PV in Spain, for instance, the CoC ranged from 36% below to 72% above the average, while for Italy the range was from 43% below to 44% above. The CoC depends on the developer, offtake arrangements and other project-specific factors.

The survey and interviews are part of an integrated, three-pronged approach to collecting data on the CoC. Where survey and interview data are absent, a benchmark tool may be used to estimate the CoC for various technologies. This allows updated CoC estimates to be generated as underlying base rates change in response to macroeconomic conditions. Combining several data sources and expert elicitation approaches allows for the derivation of robust CoC values across the widest possible range of countries.

A benchmark tool to calculate country- and technology-specific CoC values can yield robust estimates after calibration with survey data. The CoC estimates generated by the CoC benchmark tool developed for this project provided reasonably robust estimates of the CoC for renewable power generation technologies in different markets. However, technology and market drivers in some countries are inevitably at variance to a simple benchmark tool value. Calibrating the benchmark tool with findings from the stakeholder survey greatly improves the tool's results, but further work to refine this process is warranted.

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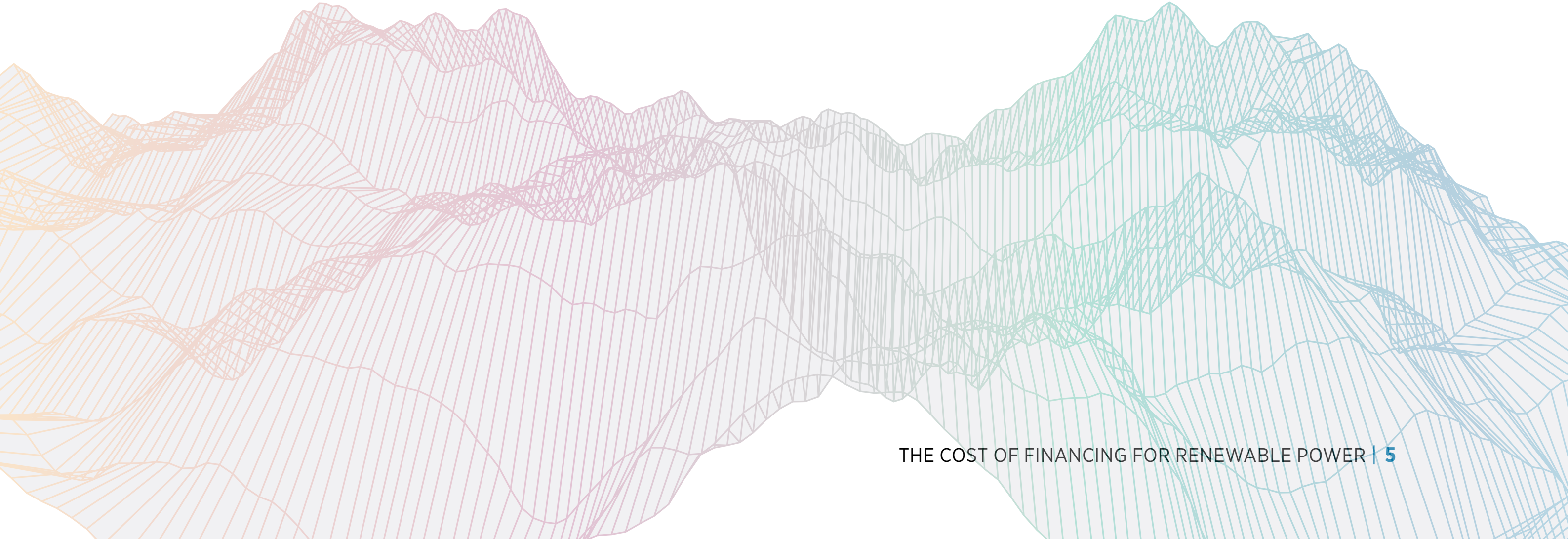
[1] *The "country risk" or "country risk premium" typically refers to a premium in interest representing the increased risk of default in a given country, relative to a "riskless" benchmark (which is typically the United States, given the crucial role of the US dollar in the global economy).*

Before the crisis in Ukraine, experts expected a slight decline in the CoC by 2025. In most regions, the CoC was expected to decline slightly or stay constant from 2019-2020 to 2025 in nominal terms, but this will depend on (among other things) the inflation situation in 2025. Experts anticipate the sharpest decline for offshore wind in the Asia-Pacific and solar PV in Europe, and the Middle East and Africa (all above 100 basis points).

Differentiated CoC data improve energy and climate modelling as well as our understanding of cost drivers, and support better policy making. The results from this survey can be used by policy makers, research institutions, energy and climate modellers, and other stakeholders to re-calibrate and verify renewable energy cost estimates. The survey results also improve our understanding of the drivers of the cost of financing and their interactions with one another, a topic previously supported more by anecdotal evidence than a systematic examination.

More work on this topic needs to be done. The survey produced substantive estimates of the CoC in active markets with liquid capital markets. Survey response rates were, however, often lower in smaller markets. More data for these markets would help improve CoC estimates. Regular additional surveys are also needed to track the changing financing drivers in emerging markets to avoid over or under-estimating the CoC, and also to reflect the impact of policy changes and macroeconomic developments. Finally, addressing unique policy questions (*e.g.* what can policy makers do to reduce CoC premiums in emerging markets?) requires a specific survey design and engagement with stakeholders, and would add additional insights.



Introduction

The cost of capital (CoC) for renewable power generation technologies is a very important driver of total costs. CoC[2] is a major determinant of the cost of electricity from renewable power generation technologies. For instance, for a representative solar photovoltaic (PV) project or onshore wind project, the total cost of electricity[3] increases by 80% if the CoC is 10% rather than 2%.[4] Even small differences in CoC that are not properly accounted for between countries and technologies can result in significant misrepresentations of renewable energy costs and lead to poor policy making. Reliable data and an enhanced understanding of the composition of the CoC and its drivers are therefore critical to developing tailored support mechanisms and market designs that take different technology and country risks into account.

Reliable financing data, differentiated by country and technology, have not been readily available to stakeholders. Despite the vital importance of the CoC in calculating the cost of energy, reliable data for individual countries across all world regions, renewable energy technologies (RETs) and time periods remain sparse. Project finance data are almost always proprietary in nature – even when public financing is secured – and when they are available to policy makers, they are often outdated or limited to a few countries. The absence of up-to-date, differentiated CoC data has become a major challenge. The improvement in overall financing conditions (lower interest rates) and the risk premiums for RETs, in particular in the past decade, whether due to support schemes and/or technology maturity, mean that standard assumptions are increasingly inaccurate (IRENA, 2021).

The results in this report can be used by policy makers, research institutions, energy and climate modellers, and other stakeholders to re-calibrate and verify renewable energy cost estimates. The survey results also improve our understanding of the drivers of the cost of financing and their interactions, a topic previously supported more by anecdotal evidence than a systematic examination.

IRENA has recognised the need for improved CoC data for some time, given falling borrowing costs and the growing maturity of solar and wind power technologies. In past work, in an approach common to other organisations, IRENA has used a fixed, generic CoC, differentiated only by large groupings of countries. For instance, IRENA's *Renewable power generation costs* series of reports assumed a 7.5% (real)[5] CoC for the Organisation for Economic Co-operation and Development (OECD) and China, and 10% for the rest of the world up until its 2021 report. As an interim solution, while awaiting the results of this project, IRENA's *Renewable power generation costs in 2021* report assumed these values declined linearly to 5% and 7.5%, respectively, between 2010 and 2021 (IRENA, 2022). While the lack of granularity in CoC estimates was clearly undesirable when comparing renewable energy costs across countries and to fossil-fuel-based technologies where the capital component of the cost of electricity is lower than for RETs, this has not been uncommon in energy modelling (*e.g.* by the International Energy Agency [IEA], National Renewable Energy Laboratory, US Energy Information Administration and many others) due to the absence of accurate CoC by country, technology and over time.

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[2] *The terms "cost of capital" (CoC) and "weighted average cost of capital" (WACC) are used interchangeably in this report.*

[3] *The terms "total cost of electricity" and "levelised cost of electricity" (LCOE) are used interchangeably in this report.*

[4] *Assumes an installed cost of USD 700/kilowatt (kW) for PV, with an 18% capacity factor, and USD 1300/kW for onshore wind, with a 38% capacity factor.*

[5] *In this report, "real" refers to a CoC adjusted to account for the long-run impact of the cost of inflation.*

This relatively uniform treatment of CoC was justifiable in the early part of the past decade, when deployment was limited to just a few markets and installed costs were much higher. But amid a growing number of markets with significant new deployment volumes and the increased maturity of renewable energy generation technologies, this has become increasingly inappropriate and misleading in many cases. For example, inaccurate CoC assumptions that do not account for the sovereign risk premiums in developing countries might lead to support schemes that are inadequate to incentivise renewable energy build-out, or to deployment targets that do not fully consider the economic potential of renewables.

A CoC-focused survey of stakeholders was designed to address this risk and enable the use of more accurate and realistic CoC assumptions that are informed and validated by empirical data. IRENA, in conjunction with ETH Zurich's Energy and Technology Policy Group and the IEA Wind Technology Collaboration Programme (IEA Task 26),[6] developed and conducted a global, tailor-made survey of finance professionals on the CoC of renewable energy. This was complemented by a set of in-depth interviews to derive insights on the drivers and contextualising factors affecting renewable energy finance. The combination of these two data elicitation methods helped assess current and expected CoC conditions, supplemented by a rich understanding of the relevant contextual factors.

Together, these approaches addressed the following questions, which are the key to a better understanding of renewable power projects' CoC:

- What were market rates for the CoC of RETs (*i.e.* onshore wind, offshore wind and solar PV) in key markets between 2020 and 2021?
- What were market rates for the constituent components of CoC (*i.e.* cost of debt, cost of equity and debt share) in key markets between 2020 and 2021?
- What was the degree of uncertainty associated with CoC rates for a given country and RET?
- What were the key drivers and contextualising factors affecting the CoC of renewable power generation technologies?
- How might CoC rates for RETs evolve by 2025?

The survey and interviews have yielded a first-of-its-kind database of the CoC for solar PV, onshore and offshore wind across all major markets. The database is a reliable, replicable and well-documented source of up-to-date CoC information based on a consistent methodology. The database enables IRENA, its member countries and the wider energy modelling community to recalibrate current and future levelised cost of energy (LCOE) estimates to reflect conditions on the ground and specific to a country or region, technology and time period. In addition, the development of a benchmark CoC tool allows updated weighted average cost of capital (WACC) assumptions to be generated as base interest rates change. Annual updates to WACC assumptions are now possible. This does not obviate the need for regular additional surveys in order to track changes in technology- and country-specific premiums, but does ensure more accurate WACC assumptions can be generated each year as market conditions change.

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[6] *The IEA Wind Task 26 ("Cost of Wind Energy") is an international consortium of 13 research organisations operating under the auspices of the IEA. The IEA Wind Technology Collaboration Programme was founded in 1977 and sponsors co-operative research tasks among its 21 member countries and others.*

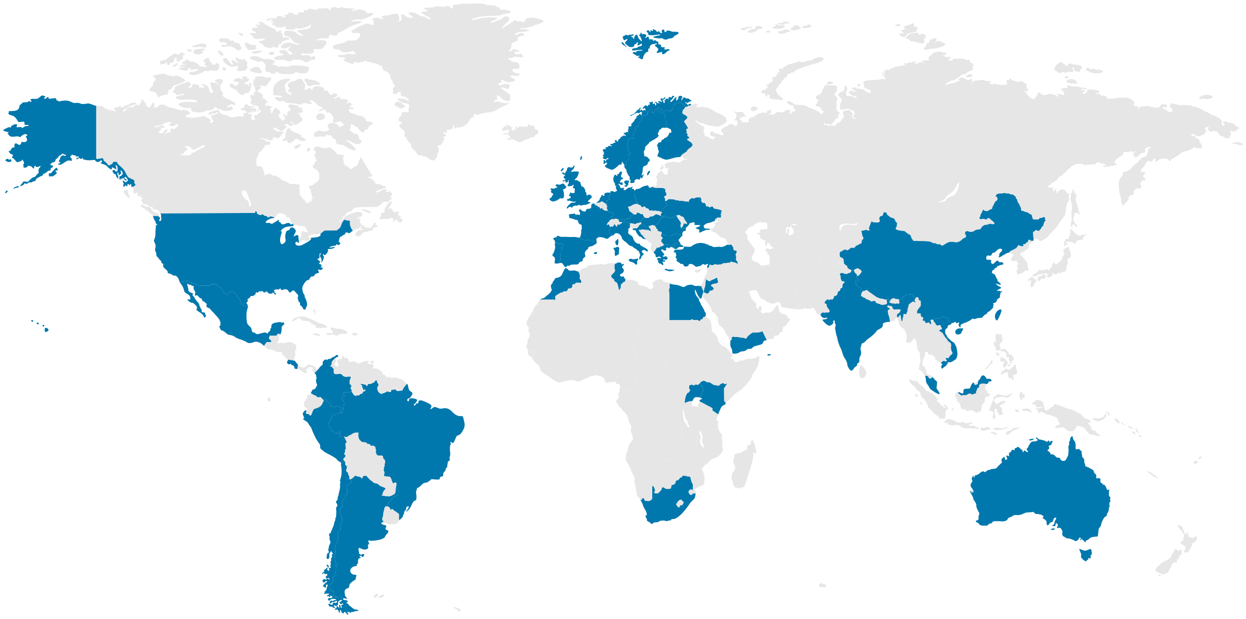
Results for the cost of capital of solar PV, onshore wind and offshore wind

Validated **survey and interview results** for the CoC of renewable power generation technologies were obtained **for 45 countries on six continents**. A total of 172 valid survey and interview responses were elicited from 56 experts through the survey and 33 experts in semi-structured interviews.

The responses provide CoC data from 45 countries for at least one RET and cover all major markets (Figure 1), while for many of the major markets multiple responses by individual technology and country were received (*e.g.* there were seven responses for solar PV in Spain). To the best of the authors' knowledge, the geographical coverage of this database is the most comprehensive available for the CoC for renewable power generation technologies. The 45 countries represented in survey responses account for 88% of the new capacity added during 2020 in the case of solar PV, for 98% of the new onshore wind capacity additions and for 87% of the new offshore wind capacity additions. The data collected relate predominantly to financing conditions in 2020/2021, but for some smaller markets may also cover projects financed in 2019.[7]

The ten countries with the most registered responses are Germany, the United States, Denmark, Spain, the United Kingdom, Chile, Viet Nam, China, Mexico and the Netherlands. The results of the survey are presented in the following sections, providing an overview of the renewable energy financing context (*e.g.* the extent of merchant exposure), and the current CoC for onshore wind, offshore wind and solar PV across 45 countries, including a deep-dive into debt and equity components by region. This is followed by a discussion of the responses about expected future trends until 2025 by region and technology, and ends with a discussion of the insights gained concerning the drivers of these results.

Figure 1 Expert elicitation survey and interview response coverage



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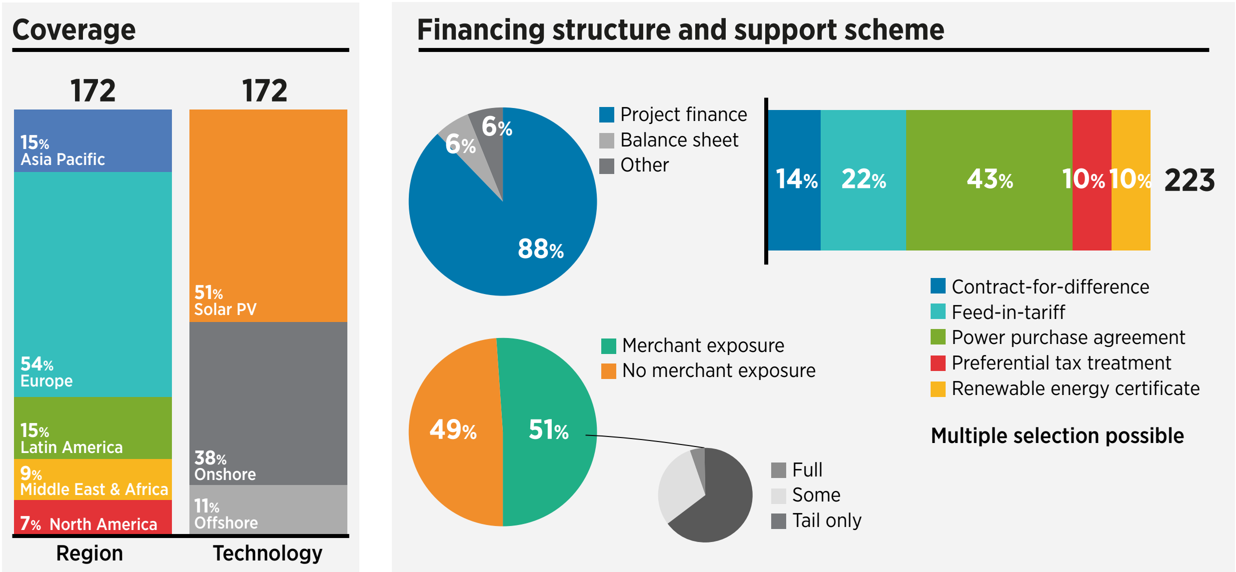
[7] *Responses that referenced CoC data for 2019 were restricted to small markets for renewable power generation technologies in emerging markets.*

Understanding the contextual factors underlying the cost of capital

Project finance dominates. The majority of responses were registered in Europe, which has a long history of supporting renewable deployment and where financing is undertaken in an environment where financial institutions and developers often bring long experience to the table (Figure 2, left side). Around half of all responses were registered for solar PV (51%), followed by onshore wind (38%) and offshore wind (11%). This split aligns well with recent renewable power capacity deployment, with the number of countries with large markets for new capacity additions of each technology also aligning closely. Interestingly, for the responses received, renewable finance deals were structured almost exclusively via project finance. The few balance sheet projects were distributed equally between solar PV and onshore wind (Figure 2, right side). These examples of balance sheet financing mainly occurred in China, with one mention each in Chile, Bulgaria, Peru and Romania. For these deals, the regulatory environment may be more uncertain and hence project finance structures without recourse might entail too much risk to be a viable option, driving debt costs to uncompetitive levels.

Figure 2 Survey coverage and contextual factors influencing the cost of capital responses



Note: The right side shows responses from 48 of 56 experts, representing 145 of 172 country-technology combination data points.

Merchant exposure is common. Some merchant exposure was noted by slightly more than half (51%) of respondents for renewable power projects financed (Figure 2, right side). While in the past, many renewable power projects could only be financed if they received a guaranteed price for electricity produced from a credible offtaker – often utilities or a government entity – today they are increasingly financed with merchant exposure. However, *full* merchant exposure remains rare. The majority of projects facing merchant exposure either have some merchant exposure during their lifetime (*e.g.* a price floor or less than 100% of output covered by a fixed-price contract) or a tail exposure only (*e.g.* exposure after the end of the contracted period of the guaranteed price by the trusted offtaker). The extent of tail exposure varies depending on the support scheme in place, or contract duration, and can range from minimal to 10-15 years or more. As renewable power generation economic lifetimes grow, however, these "tail only" merchant exposures are likely to become more prevalent and important in scope. It is not clear if this will have a material impact on financing conditions for project developers, but there will be an increasing market in the future for refinancing by asset owners near the end of what is today considered the projects' economic lifetime. Contractual arrangements for securing revenue flows of existing assets part way through their operational lifetime (*e.g.* through a power purchase agreement [PPA] with a corporate buyer), will thus become more important through time.

Revenues are secured by a range of mechanisms. With upfront capital costs dominating the cost of electricity, renewable power generation projects typically need to demonstrate that they have secured sufficient revenues over an extended period of time (typically less than the economic lifetime, however) to be able to access finance on reasonable terms. Different markets feature different approaches to this, depending on who is driving the policy requirement (*e.g.* this is often governments, but sometimes procurement is then delegated to utilities), the institutional arrangements, regulatory environment and electricity market structures.

One of the most common mechanisms to secure revenues is the PPA (reported as the top option by 43% of survey respondents). This can be with governments (or government-backed financial vehicles to provide a *de facto* sovereign guarantee), utilities or corporate buyers. Other common options are feed-in tariffs (accounting for 22% of responses) and contracts-for-difference (CfDs), at 14% of responses. The contractual details of all these approaches can vary in important ways, including their duration, pricing arrangements (*e.g.* nominal or indexed to inflation, capped or uncapped, currency of payment, penalty clauses, *etc.*), volumes, responsibilities relative to the market, *etc.* (see IRENA, IEA and REN21 [2018] for more details). These differences can be just as important between a PPA in one country and a PPA in another. The important point, for the purposes of this report, is that these arrangements provide the revenue security that can be used to make a project "bankable" and ensure access to reasonable (for the market and taking into account the details of contractual arrangements) financing conditions.

The structure of offtake arrangements may also involve more than one type of mechanism, with government-backed CfDs or PPAs covering a portion of the plant's output and merchant exposure anticipated to be hedged with corporate PPAs. Given that corporate or utility PPAs tend to have shorter durations than those provided by governments, this portion of the output might need to be offered to the market more than once over the life of the asset.

Renewable power generation cost of capital

Different metrics for the CoC exist. For this report, we show the most relevant decision criteria for investors and policy makers, namely the nominal "CoC after tax" often also referred to as nominal "post-tax WACC" (Equation 1). The terms K_D and K_E denote the cost of debt and the cost of equity, respectively; L denotes the leverage (or debt share) and T denotes the tax rate.[8]

$$CoC = K_D \times L \times (1-T) + K_E \times (1-L) \quad \text{(Eq. 1)}$$

These rates are expressed in nominal terms throughout this report, meaning that they are not adjusted for inflation. Respondents noted a mix of solutions, financing in local currency, US dollars or euros.

The current CoC ranges from 1.1% to 12%. The CoC values for 2020-2021 elicited in the survey ranged from a remarkable minimum of 1.1% for onshore wind in Germany to over 12% for solar PV and onshore wind in Ukraine (Figure 3). Other countries with a high CoC include Mexico, Egypt and Tunisia. For all renewable power technologies surveyed, Germany is the country with the lowest financing cost (1.1% onshore, 1.4% solar PV, 2.4% offshore). Values for onshore peak at 12.2% in Ukraine, and for offshore at 8.1% in Viet Nam (Figure 4).

As reported by survey respondents, the simple average of the regional CoC for utility-scale solar PV was 3.9% in China, 6.1% in other Asia-Pacific countries, 4% in Western Europe, 7.7% in Eastern Europe, 8.7% in the Middle East[9] and Africa, 6.6% in Latin America and 5.4% in North America.

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[8] *For a more detailed discussion of the components of the cost of debt and equity see Annex A.*

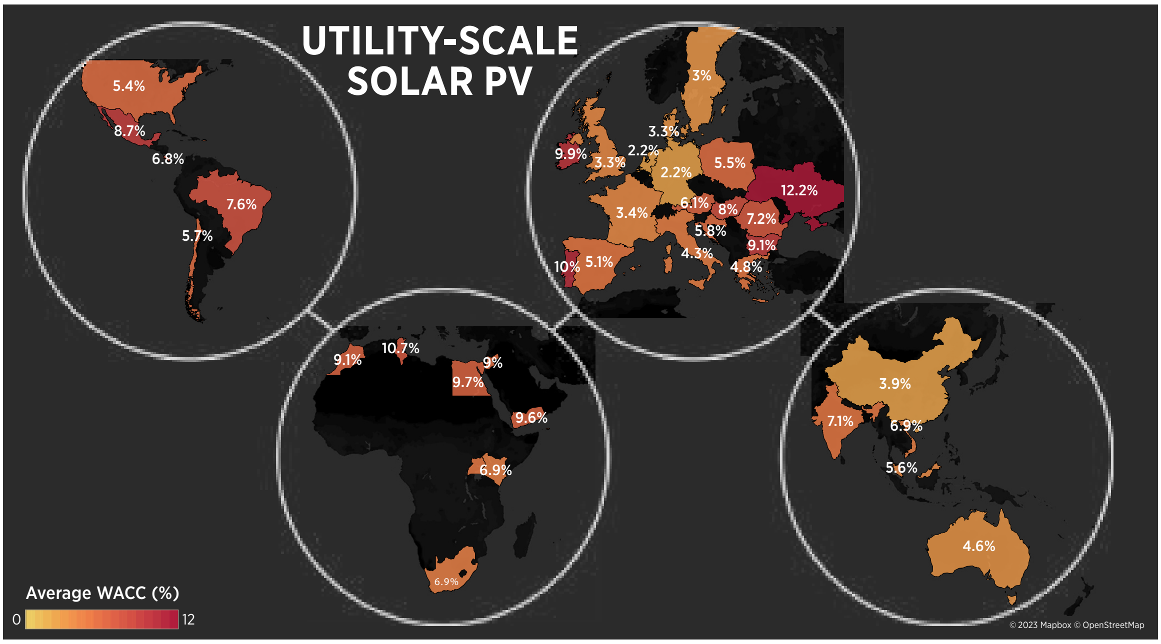
[9] *The average reflects the fact that no respondents offered CoC estimates for countries of the Gulf Co-operation Council, which have dramatically lowered borrowing costs and are very competitive markets for new PV capacity auctions that in turn place significant pressure on lending and equity margin expectations.*

The simple average of the regional CoC for onshore wind was 3% in China, 7.2% in other Asia-Pacific countries, 3.3% in Western Europe, 7.2% in Africa, 6.4% in Latin America and 5.1% in North America.

The simple average of the regional CoC for offshore wind was 2.8% in China and 7.1% in other Asia-Pacific countries, 4.2% in Western Europe and 5.2% in North America.

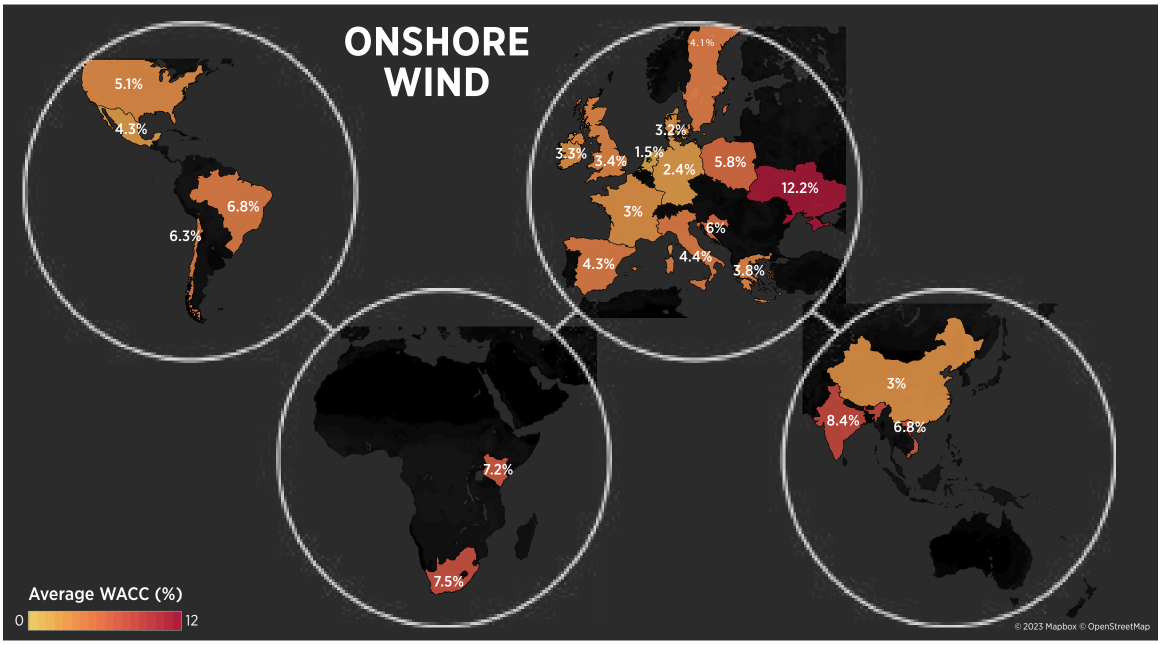
Overall, there is less variance between countries for offshore wind, likely because deployment is concentrated in a small number of OECD countries and China, where policies support deployment and facilitate access to low-cost capital (Figure 5).

Figure 3 The cost of capital of utility-scale solar PV by country, 2019-2021



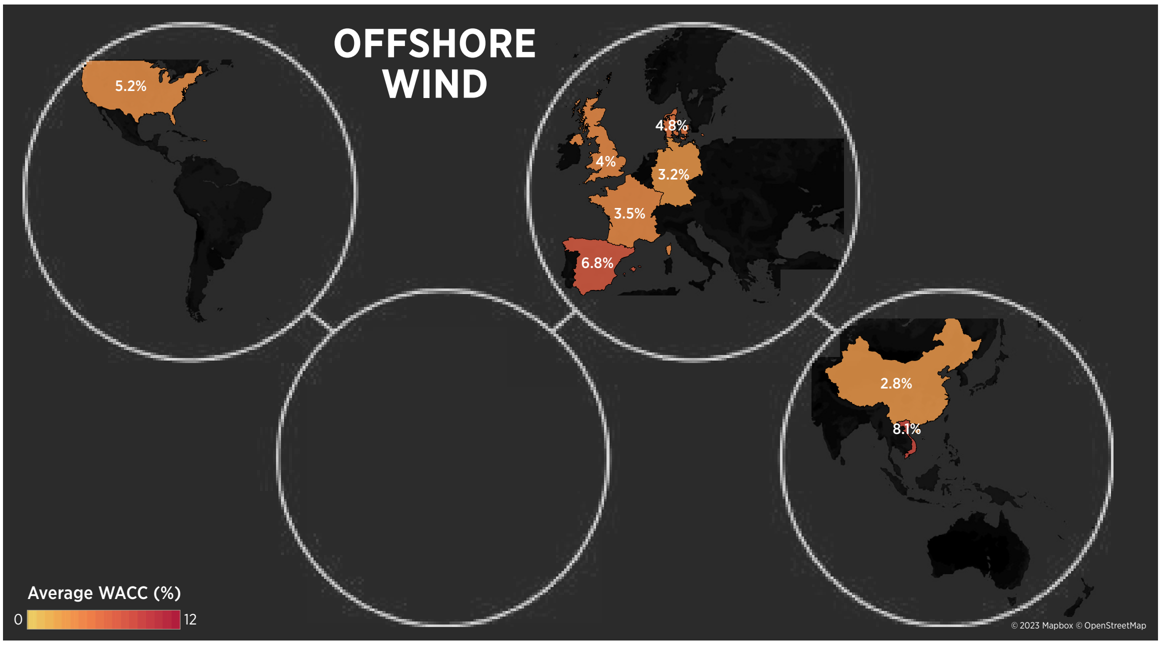
Note: WACC = weighted average cost of capital.

Figure 4 The cost of capital of onshore wind by country, 2019-2021



Note: WACC = weighted average cost of capital.

Figure 5 The cost of capital of offshore wind by country, 2020-2021



Disclaimer: This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

Note: WACC = weighted average cost of capital.

However, given offshore wind's earlier stage of development and the more complex nature of related project planning and execution, respondents identified its average technology premium as higher than that of solar PV and onshore wind.[10] On average, the implied premiums above the local government bond for the WACC of onshore wind, offshore wind and solar PV hover around 200-300 basis points (bps), with some significant variation still evident in less mature markets.[11] However, for onshore wind and solar PV, we observe some negative values, too. This is unlikely to imply that renewable power projects can be financed below the cost of refinancing of the national government, but that in some cases international developers have access to debt in international markets at lower cost.

Mature markets with access to low-cost debt can achieve very low CoC values, suggesting very competitive LCOEs. Figure 6 disaggregates the overall CoC estimates shown in Figures 3, 4 and 5 into debt and equity components, and shows regional technology-specific averages for comparability. As shown in Equation 1, the CoC consists of two key parts: the cost of debt and the cost of equity, with the cost of equity generally being higher than the cost of debt to compensate for the greater exposure to risk. The cost of debt is the cost to finance a loan on the renewable energy asset – typically provided by a bank. The cost of equity is the return on equity required by the owner – typically the project developer – and varies depending on its assessment of the project risk and minimum return on investment. The debt-to-equity ratio determines the relative contribution of these two values to the total CoC.

The data on the CoC in Figure 6 provide four key insights for financing in the period 2020-2021:

1. **Regional differences are larger than differences between RETs within a region,** driven primarily by differences in country risk premiums. Within any given region, the spread between technologies is usually in the range of 100-200 bps.
2. **China, North America and Western Europe had very low CoC, in the range of 3-5%**. In these locations, renewable energy financing is underwriting the deployment of renewable power generation capacity. The impact of the degree of market maturity on CoC is notable. In Western Europe, rates are systematically lower than in the newer markets of Eastern Europe. The range is not only noticeably wider, but cannot be fully explained by differences in country risk premiums alone.

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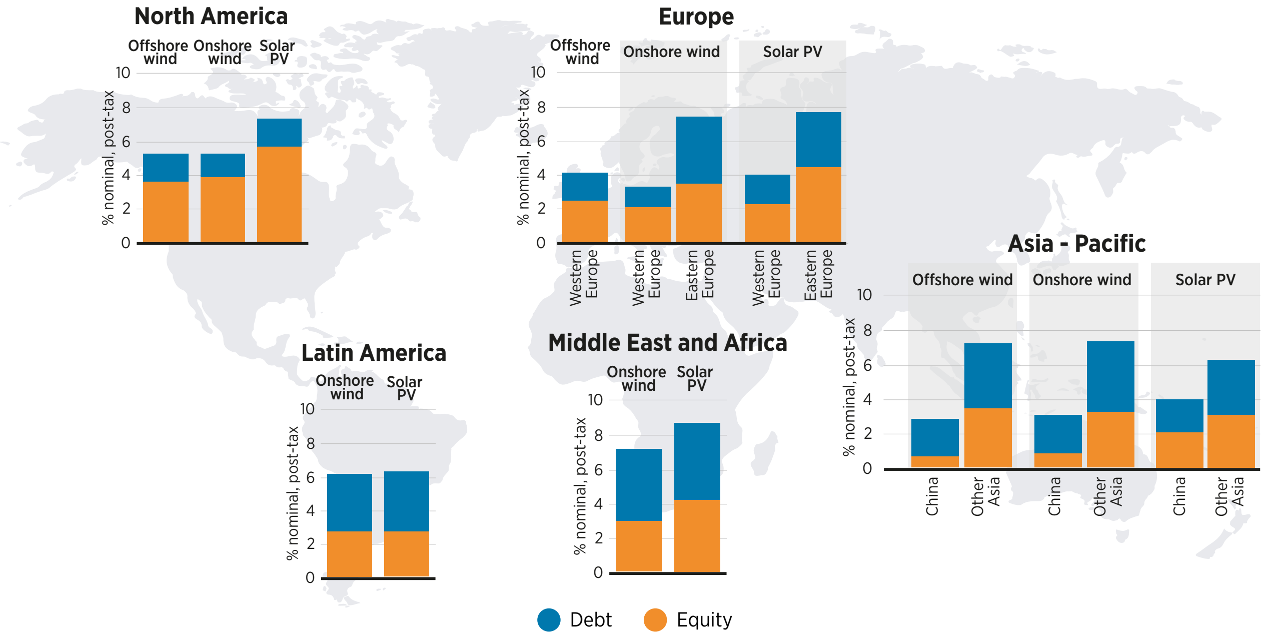
[10] *The technology premium is defined as the average premium of the technology-specific CoC over the average underlying country rate (the risk-free rate plus the country risk premium). See Annex I for more discussion of the detailed CoC composition.*

[11] *A basis point (bps) is a common unit in finance equal to 0.01% (e.g. 100 bps equals 1%).*

3. **In North America and Western Europe, the share of debt in the CoC is low, though for different reasons.** In North America, the debt share is typically low (35%-65%) because the tax credits used to accelerate solar and wind deployment incentivise the use of equity.[12] Due to this policy environment, North American renewable power generation assets contain more equity, but the cost of equity is typically lower than elsewhere, due to the benefits of the tax credits. In Europe, the debt share is typically larger (80% or more), but the cost of debt is very low. This is driven by very low base rates and also because the European (just as the US) banking sector is very comfortable and experienced in financing renewable power generation projects. Both financing set-ups (low debt share or high debt share with low cost of debt) lead to a small share of the total cost of finance from debt.
4. **Outside the OECD, the CoC is higher, but is still low enough to support competitive renewable power[13] generation projects.** The CoC rarely exceeds the rates previously assumed as a representative value for non-OECD countries. With post-tax nominal values of between 6% and 7%, the benefits of robust policy support and the technological maturity of wind and solar are clear.

Figure 6 Debt and equity contribution to the total weighted average cost of capital



Note: PV = photovoltaic.

Expected trends in the cost of capital to 2025

Survey respondents generally expect little change in the CoC by 2025. Future electricity system planning often hinges on cost predictions, for which the CoC is an integral component. In order to assist stakeholders with understanding these trends, the project also surveyed expectations for CoC values in 2025. Expectations around the trend in CoC to 2025 varied among respondents. Many provided estimates based on similar macroeconomic conditions prevailing today, essentially therefore estimating the change in the cost of capital premiums over benchmark rates. Of the 122 responses for country and technology combinations for 2025 CoC, 97 included details on the changes expected in the cost of debt and (separately) the cost of equity as well as the debt-to-equity ratio, while the balance (25) included both the total CoC and at least one other detail.

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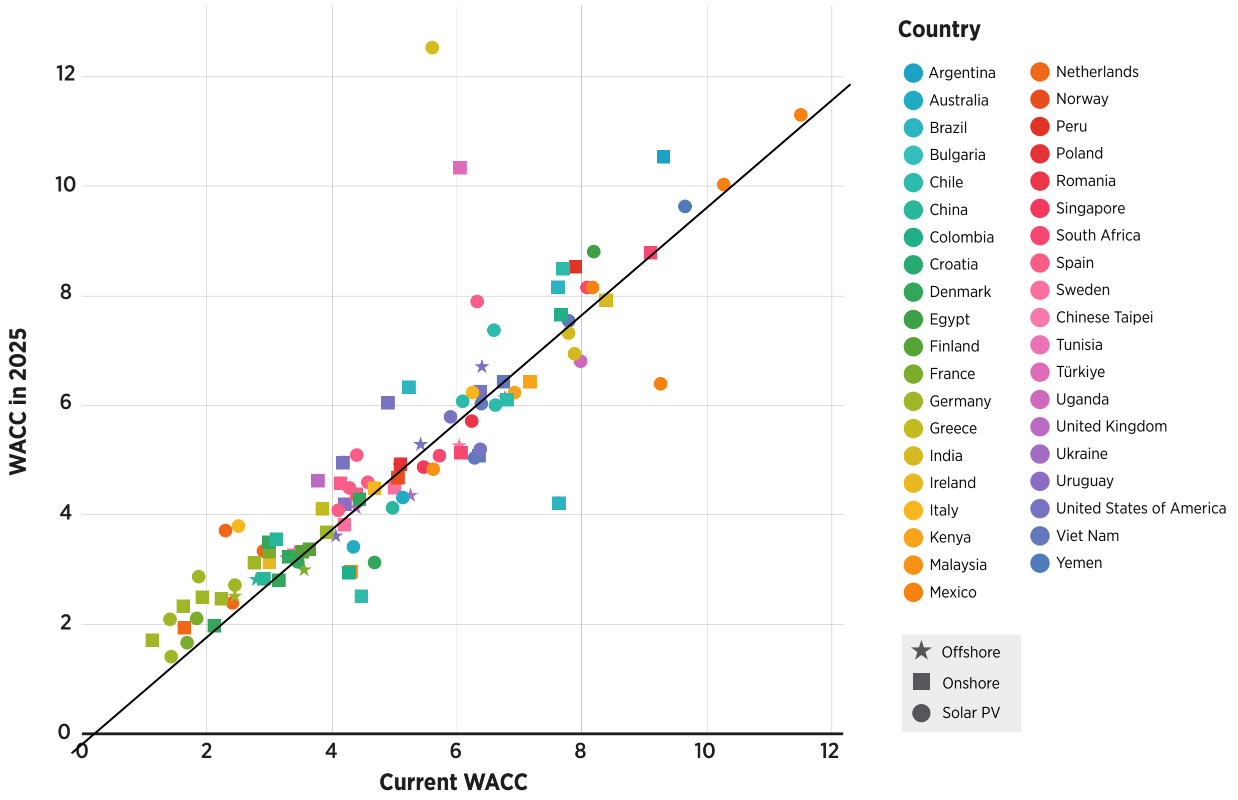
[12] *To take full advantage of the tax credits (either the investment tax credit or production tax credit), greater equity shares are needed than what is typical in other countries. The survey results also tend to suggest, because of the financial intermediary process to distribute the tax benefits to entities that can fully absorb them, that expected equity returns are higher than in Europe.*

[13] *This conclusion draws on the IRENA Renewable Cost Database for total installed project costs and capacity factors, given that the survey itself did not explicitly include a question on the cost competitiveness of electricity generation for renewables.*

Figure 7 shows the current CoC estimates (x axis) plotted against the 2025 CoC estimates where each dot represents a renewable energy technology in one country. If a dot is situated on the black line at 45°, the experts on average expect no change to the CoC in 2025. For dots below the line, experts expect a reduction of the CoC for 2025, whereas for dots above the line they expect an increase. In general, survey respondents typically did not anticipate large changes in the CoC between now and 2025, with some exceptions.[14] Across all countries and technologies the scatter does not tend to support a clear trend. However, by technology, the average expectation is for a small 0.02% (in percentage points, so 2 bps) increase for onshore wind, a 0.08% (8 bps) reduction for solar PV and a more substantial 0.25% (25 bps) reduction for offshore wind. However, caution should be taken when looking at the data from this global perspective, as it was clear from the interviews that different drivers are at work in different markets.

Where experts pointed to the possibility of an increase in the CoC by 2025, they highlighted increased uncertainty or deteriorating prospects for political stability, macroeconomic conditions or support schemes, in Latin America in particular. In Europe and North America, the key concerns related to uncertainty regarding how renewable deployment would be supported in the future, increasing merchant exposure and the possibility that capture prices (that is to say, the average price received by hour of generation) might decline for corporate PPAs as variable renewable penetration increases.[15] On the other hand, increased rates of deployment and project experience among developers and the financial community, as well as institutional investors' increasing interest in renewable power projects, were stated as reasons to reduce the costs of both debt and equity over time, even in mature markets with very low CoC today.

Figure 7 Estimated cost of capital change between 2019-2021 and 2025



Note: PV = photovoltaic; WACC = weighted average cost of capital.

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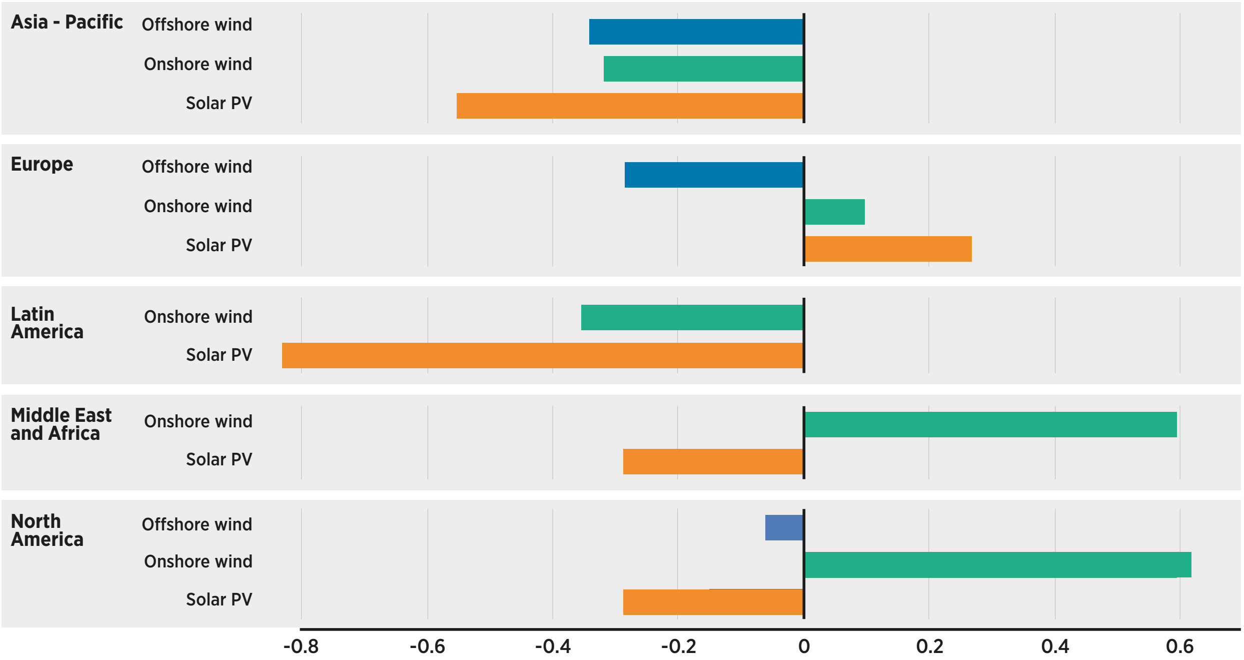
[14] *Given rising inflation expectations in 2022, particularly after the onset of the crisis in Ukraine, these results for OECD countries are best interpreted as expected changes in premiums above base rates.*

[15] *It is interesting to speculate how material these concerns might be if the survey were run today, given that most of the surveys were conducted before the full impact of the fossil fuel energy crisis became clear. It is possible that stakeholders might take an opposing view today and be less inclined to think that the premium might rise over base rates.*

Figure 8 Expected average change in cost of capital between 2019-2021 and 2025 by region and technology



Note: Excludes the India outlier from Figure 7; PV = photovoltaic.

Expected CoC movements differ by region and technology. While a clear overall trend is not evident from the data, there are technology and regional patterns (Figure 8). The data presented here are designed to give an understanding of survey respondents' expectations. In some cases these may not be representative of all market players, so alternative views are possible.

The CoC for offshore wind in the **Asia-Pacific region** was expected to decline by around 34 bps (0.34%), likely driven by the same drivers that have seen the CoC for offshore wind decline in Europe as the technology matured, local supply chains scaled up, project experience grew and financial institutions better understood project risks and could price debt and equity costs without large margins for uncertainty. Survey respondents expect the CoC for onshore wind to fall by 2025, by around 32 bps (0.32%). Excluding the outlier (India) from Figure 7, survey respondents expect the CoC for solar PV to decline by 55 bps (0.55%) by 2025 (12 respondents) as experience with solar PV in the region grows and financial institutions become more familiar with lending to solar PV projects from established developers.[16]

Survey respondents expect the CoC for solar PV in **Europe** to increase by an average of 27 bps (0.27%). In particular, increases in France, Germany, the Netherlands and Spain would be only partially offset by lower CoC expectations in 2025 in Denmark, Poland and Romania. Respondents also expected the CoC of onshore wind to increase by 10 bps (0.1%) with increases expected in France, Germany, Greece, Ireland, the Netherlands, Spain and the United Kingdom; and with declines in Denmark, Italy, Finland, Norway, Poland and Sweden. Respondents expected the debt and equity cost premiums of offshore wind over solar PV and onshore wind to continue to fall by an average of 29 bps (0.29%) by 2025.

With 23 responses by country/technology, respondents expected the CoC for both onshore wind and solar PV in **Latin and South America** to decline by 2025, by 36 bps (0.36%) and 83 bps (0.83%), respectively. Given the importance of financing costs in determining the lifetime cost of renewable power and the excellent renewable resources in the region, these expected changes would drive a material reduction in renewable electricity costs in 2025, if realised.

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[16] *The outlier, India, would see a small (2 bps or 0.02%) increase in average CoC expectations for 2025 compared to today.*

For the **Middle East and North Africa**,[17] respondents expected onshore wind CoC to increase; this is driven by Türkiye, with respondents expecting reductions in Kenya and South Africa. For solar PV, the CoC is expected to decline by 29 bps (0.29%) on average due to expected reductions in Kenya, South Africa and Uganda.

The data for CoC expectations in 2025 for **North America** are modest, but suggest an increase for onshore wind, primarily related to uncertainty over the expiration of the production tax credits, with a reduction possible for solar PV. Offshore wind deployment is only just gearing up in the United States, so it is perhaps not surprising to see a slight decline expected by 2025.

Comparing benchmark values to survey data

Benchmark tools may yield conservative CoC values without adequate access to specific renewable project financing data. Surveying the entire spectrum of renewable technologies in every market around the world would be a mammoth undertaking involving significant time and resources. The results of this project, however, suggest that relatively robust data on CoC of renewable power projects can be obtained by engaging with experts with a direct understanding of financing conditions. When their knowledge is combined with a benchmark tool that relies on publicly available data, broad country market CoC estimates can be derived. Regular follow-up surveys, potentially of a smaller subset of markets, could then ensure regular calibration of the benchmark tool (with a sufficiently large expert sample) in order to provide reliable CoC estimates going forward.

It is interesting to note that the CoC values estimated using the benchmark tool developed as part of this research project tended to be above the survey values (*e.g.* the values above the 45° line in Figure 9), particularly for onshore wind and solar PV. In some notable outliers (Argentina and Yemen), the benchmarking yields values that are considerably higher than those provided by the surveyed experts, albeit with just one response for each. For Hungary, the benchmark value was much lower than the expert estimate, but this seems to be an anomaly.

The average overestimation of the benchmark tool compared to survey responses, excluding outliers for the three countries mentioned, was 88 bps (0.88%) for offshore wind, 71 bps (0.71%) for onshore wind and 67 bps (0.67%) for solar PV. For offshore and onshore wind, the benchmark tool overestimated the CoC by 187 bps and 129 bps, respectively, in the Asia-Pacific; while for solar PV the largest overestimation, of 119 bps on average, occurred in Europe. In one notable instance the benchmark tool underestimated the CoC relative to survey respondents' values; this was for solar PV in Latin America, underestimated by around 58 bps (0.58%).

In many respects, the performance of the uncalibrated benchmark tool was reasonably good (Figure 9), on average, but the results highlight two important points:

1. **Benchmark tools not specifically calibrated with project finance cost data may overestimate the CoC for renewables.** It is important to survey actual financing conditions, given that some average values by country/region vary quite significantly from the uncalibrated benchmark tools performance.

2. **There is no single value for the CoC in a market** for a given technology. Different actors with different levels of experience and business models face different CoC conditions, and indeed these will vary between projects even for an individual developer.

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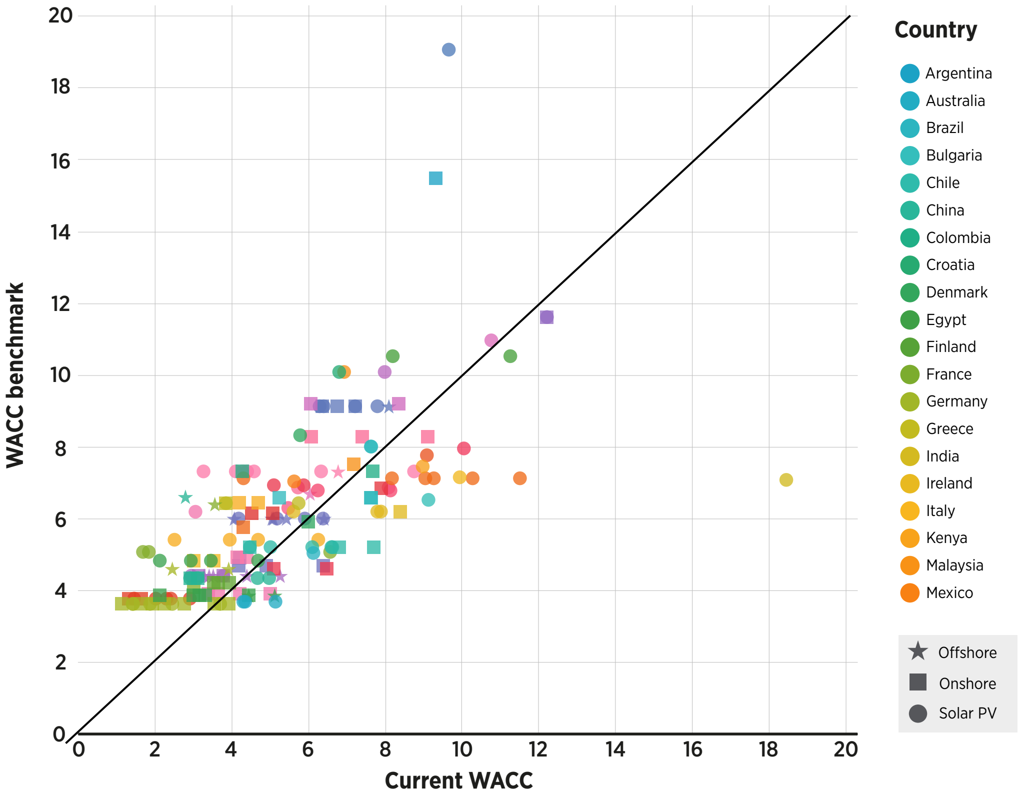
[17] *Including Türkiye, given that its financing conditions for renewables are less closely aligned with those of Europe.*

These two points suggest that a benchmark tool that is calibrated using expert elicitation responses could provide reasonably accurate CoC estimates for countries that have not been surveyed in order to calculate country-specific LCOEs more accurately. When the underlying financing conditions in the economy change, the core underlying drivers (*e.g.* the risk-free rate and country risk premiums) would need to be updated in the benchmark tool. Among common options, even relatively sophisticated benchmark tools that try to extract premiums from financial market data from energy utilities may not yield better precision than the benchmark tool presented here.

A calibrated benchmark tool – adjusted using surveyed CoC project costs – could therefore provide a way to make CoC estimates more granular, representative, timely and transparent, an important caveat being that single-point estimates for CoC for a country and technology are only ever approximate, and will range around that average for different projects. This presents modellers with a challenge, given that the distribution of CoC by country and technology is unlikely to be known with any certainty without more extensive surveying of market participants.

IRENA has already taken the first step in using the results of this research project. The CoC data are being used by several IRENA projects to ensure forthcoming work includes realistic and differentiated CoC values in areas where quantitative estimates of renewable power costs are required.

Figure 9 Comparing survey data with estimates from the benchmark tool



Note: PV = photovoltaic; WACC = weighted average cost of capital.

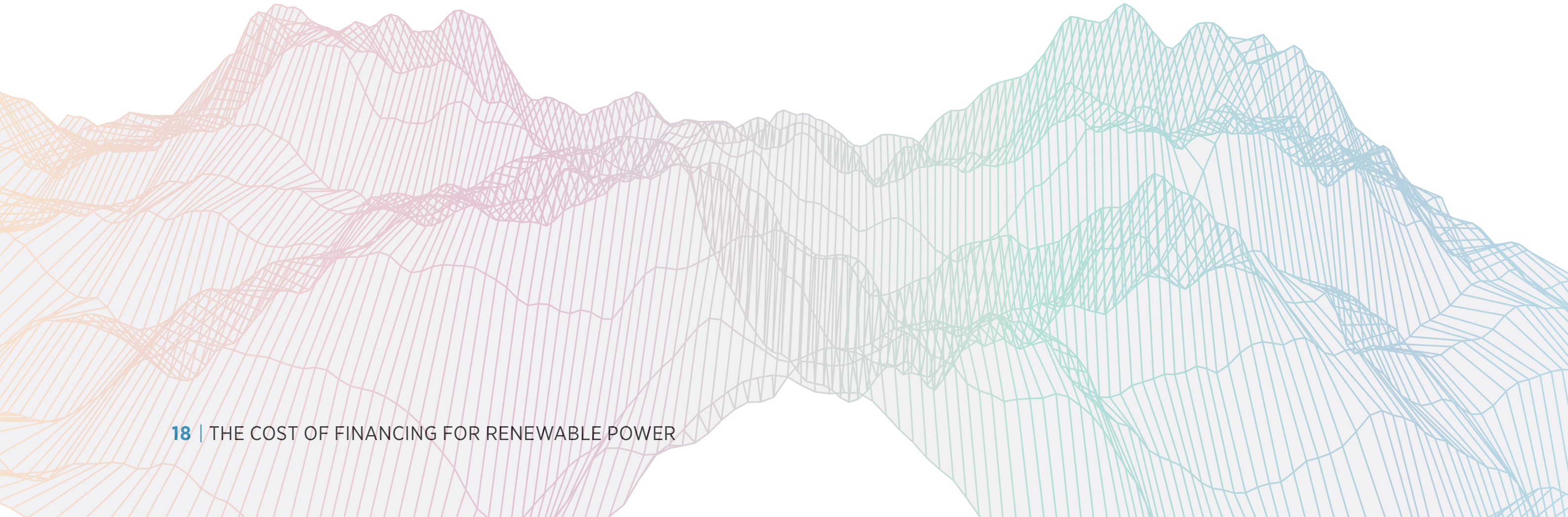
Insights from the interviews

The following discussion summarises three key insight areas from the semi-structured interviews.

Multiple drivers influence the CoC. The factors that influence CoC are project and country specific. Yet, some general conclusions can be drawn from interview responses. A major CoC determinant is the macroeconomic environment, such as the prevailing interest rates. The experience in financing and standardisation matters. Across many markets, capital seems abundant and sound projects have not had difficulty financing their projects in recent years, in part because of new capital providers (*e.g.* pension funds) increasing the availability of funds. This trend has reduced the CoC for renewable power projects. Uncertainty about the revenue to be expected increases CoC. Such uncertainty is often a direct consequence of the nature of support schemes or regulatory regimes and increasing merchant exposure. Interviewees often highlighted how changes in support schemes affected project CoC; in particular, uncertainties regarding future support or remuneration schemes up to 2025 were seen to increase it.

Risk varies between countries and technologies. The impact of the variation in risk between projects and (to a lesser extent) technologies tends to be captured primarily in the debt share available to projects, followed by the cost of equity and less frequently in the cost of debt which is often relatively standardised within a market. For the cost of debt, differences in the country risk seem to be the primary distinguishing factor. In practice, this means investment decisions are structured around the level of debt that the project risk profile can support from the financiers' perspective. The target rate of return on equity reflects the risk profile the developer expects, and is also influenced by the overall electricity cost the market will support. Clearly a stable regulatory environment helps lower the CoC below what it would otherwise be.

Development banks can lower the CoC significantly. In early emerging markets, financing is often facilitated by multilateral development banks and sovereign guarantees. The merchant component is relatively small, if present at all, with greater levels of insurance also required. In developed markets, (semi-)public investment and development banks have also played a major role (*e.g.* Kreditanstalt für Wiederaufbau [KfW]). Mature markets, with stable regulatory environments and financial systems with extensive experience with renewable energy projects can see very high debt shares. This has allowed some of the very competitive CoC results observed (*e.g.* in Western Europe) given the exceptionally low-interest rate period in 2020-2021.



Approach and methodology

This project was instigated to improve IRENA's and the wider energy communities' understanding of the CoC for renewable power generation technologies. The work developed in three stages:

1. In late 2019, an **expert workshop** co-hosted by IRENA and IEA Task 26 assembled experts to discuss the state of renewable energy financing, the challenges to collecting improved data and feasible data collection methods. Participants endorsed the need for better data and an IRENA-co-ordinated effort to collect such data.

2. In 2020, the project partners **surveyed the literature** and **developed a methodology** and **project plan** to address the identified data scarcity.

3. In 2021, the partners **developed an online survey**, the playbook for **semi-structured interviews** and **a benchmark tool**, and l**aunched the survey and conducted the semi-structured interviews** with the guidance of other supporters of the project, including the IRENA Coalition for Action, SolarPower Europe and the Global Wind Energy Council.

A three-pronged approach to the collection of data on renewable energy financing conditions was at the heart of a pragmatic solution to the confidentiality challenge and the need to provide modelling inputs for as many countries as possible. The three pillars of the project were the:

1. **Benchmark tool,** designed to not only support the survey and interviews with seeded values for "sanity" checking results, but to be re-calibrated with the survey and interview results in order to provide useful first approximations of the CoC in markets without survey/interview data.

2. **Expert elicitation survey (n = 56),** distributed widely to knowledgeable finance professionals that had a detailed understanding of the financing conditions. A range of participants were targeted to ensure good regional coverage of all major renewable power generation markets.

3. **In-depth, semi-structured interviews (n = 33)** that targeted a small number of finance professionals involved in the financing of renewable projects to collect data on CoC financing conditions in specific markets, and to elicit the contextual factors that are driving costs or differences in costs across markets and technologies.

The benchmark tool

The benchmark tool[18] was developed as a precursor to the expert interviews and elicitation survey. It formalises the calculation of the CoC through integrating the constituent CoC components (*e.g.* country and equity risk premiums, base rates, *etc.*) and their interaction with key drivers and contextualising factors. Among others, the benchmark tool considers market maturity and financial community familiarity with renewable energy projects and their effect on risk premiums.

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[18] *We have chosen to refer to this as a tool, but it could also be considered a simple model of the CoC.*

The benchmark tool was designed to perform two functions: first, to provide a replicable method in calculating a first approximation of the CoC for all country and technology combinations, and second to inform the survey and interview processes.[19] For this second purpose, the benchmark values were used as a reference for "bounding" the responses from experts and to identify outliers that required further explanation. Finally, the tool might also be utilised in the future by IRENA or other stakeholders to arrive at an understanding of possible future trends in CoC by market and technology by defining scenarios of how the underlying CoC drivers (*e.g.* country risk-free rates) might evolve, to arrive at an understanding of possible future trends in CoC by market and technology.

The benchmark tool was developed in a series of steps:

1. A literature review was undertaken to identify the existing knowledge base and approaches to CoC estimation.
2. The lessons from the literature were used with the project teams' understanding of renewable power markets for new capacity to develop a methodology to decompose the CoC into specific drivers (see Annex A) and quantify their relationships.
3. Data sources were then identified, and publicly available data were collected to represent or proxy these CoC components.
4. A Microsoft Excel tool was then developed to allow for an easily updatable process to generate CoC estimates for solar PV, onshore wind and offshore wind across 100 countries.

The benchmark values generated by the tool were used as a reference and validation point for the two expert elicitation modes, semi-structured interviews and the expert elicitation survey. For IRENA's *Renewable power generation costs in 2021* report (IRENA, 2022), the data collected in the expert elicitation survey and semi-structured interviews were used to recalibrate the benchmark CoC tool. The recalibrated benchmark tool was then used to fill in the remaining gaps in CoC data estimates for smaller markets. The simple process required to update the tool with underlying CoC drivers means future updates of this project can also be undertaken more easily, by surveying a smaller subset of markets to validate the benchmark tools' continuing accuracy.

The expert elicitation survey and semi-structured interviews

The expert elicitation **survey**[20] served the purpose of generating primary CoC metrics by collecting data from a wide array of finance and industry professionals (*e.g.* debt providers, equity sponsors, developers, *etc.*) from a range of countries in different world regions. It is complemented by the **in-depth semi-structured interviews** that not only created primary CoC data, but enhanced our understanding of the drivers and contextualising factors that generate the differences in CoC across technologies and markets, greatly enhancing the policy relevance of the conclusions.

The project elicited current and future CoC values for renewable power generation technologies from experienced professionals involved in the financing of renewable power plants. As a structured procedure to gather knowledge, expert elicitation surveys are a practical means of developing credible quantitative estimates when data are sparse or lacking – as in the case of CoC, due to confidentiality issues – or when projections are sought for future conditions that are different from past conditions. Expert elicitation approaches have been found to be well suited for research questions that are associated with complicated technical problems and conflicting conceptual models. These features are present in renewable energy finance data. It is often not clear what the CoC drivers are and how different components influence (quantitatively) high-level metrics, such as the CoC. Perhaps the deciding factor, however, is that project-level CoC data are impractical to gather broadly, given that they are typically confidential.

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[19] *The need to address potentially small sample sizes for individual technology and country combinations and exclude potential outliers was an important part of the design methodology.*

[20] *The survey was implemented using the online Qualtrics platform (see: www.qualtrics.com).*

Semi-structured expert interviews. These complement the expert elicitation survey and were conducted via video conferencing tools and over the telephone between analysts (one to four) and an expert. They allow clarifying questions, discussing answers and understanding contextualising factors that influence the CoC with interview partners from the financial sector. The setting also allows for dialogue during which the analyst can control more directly how much time is devoted to "de-biasing". For instance, during several interviews, the analysts were able to clarify that CoC terms were intended to be representative of a market or technology rather than applicable to only a single project, thereby ensuring a common reference.

A careful **selection of experts** was identified as critical to ensure high-quality responses, a sufficient response rate and a variety of perspectives. Stakeholders also highlighted the fact that interviewing key professionals with extensive knowledge and experience can ensure robust results for country/technology combinations, even from small sample sizes. Experts vary in their experience, geographic location and sectoral background (*e.g.* banking, private equity, consultancy), among other attributes. Participants in the interview and survey elicitation were motivated by a clear presentation of the research problem, desired goals and outcomes, the benefits that would flow to better policy making as a result of the project, as well as through early access to a summary Microsoft PowerPoint presentation and short report ahead of the official release date of the survey results.

We chose experts from professional networks of survey analysts and based upon recommendations by participants from IEA Task 26 in a two-stage process:

1. Pre-defined criteria:
    - Seniority level: Roughly equal to at least "vice president" (corresponding to >10 years of professional experience).
    - Expertise: Part of a top-tier institution (*e.g.* as proxied by renewables financing transaction volume) or recognised for their sector expertise by their peers.
    - Diversity: The expertise of interviewees cover all world regions and RETs and ensure some diversity in institutional affiliation (*e.g.* across debt and equity sponsors, deal advisors and insurance).
    - Chance of response: The facilitator group determines the chance for a response from the prospective interview candidate based on prior interaction and relationships with the survey team/IRENA.

2. Snowball sampling method to ensure interviewee recommendations via peer groups.

    A snowball sampling method was used in prior CoC surveys. This method supplements project members' and stakeholders' recommendations, with sample selection via interviewees, by asking whether any crucial insights are missing and/or to recommend additional interviewees at the end of each interview. Feedback is included iteratively in the first few interviews until no additional insight is observed. Additional interview partners are recruited based on the recommendations from previous interviewees until adequate coverage is achieved.

    Using these methods, a large sample group of 200+ individuals was identified, with subsequent outreach and adjustment as responses were obtained, resulting in the identification of a total of 56 experts for the online survey, and an additional 33 experts to be interviewed. An evaluation of respondents was conducted *ex post* to ensure reasonable diversity across sectors and geographical locations in order to provide robust results.

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Annex A: Benchmark tool methodology

This annex summarises the approach used to calculate benchmark values for the weighted average cost of capital (WACC) for solar photovoltaic, onshore wind and offshore wind projects in countries of interest.

The WACC benchmarks were calculated using a standard corporate/project finance approach, which combines the cost of debt and cost of equity of a given project as in Equation 1 in the main text. The approach and data sources are detailed for each cost of capital component below.

1. Cost of debt

In the WACC formula, the cost of debt is composed of the following:

Cost of debt = (global risk-free rate + country default spread + lender margin + technology premium beyond lender margin) x (1 – tax rate)

Table A.1 Cost of debt components

Global risk-free rate	For the *global risk-free rate*, we use the nominal yield of 10-year US treasury bonds (1.68% at the time of benchmark creation in March 2021), to which we then add country-specific default spreads.
Country default spread	The *country default* spreads are based on the work of Prof A. Damodaran at the NYU Stern School of Business, who derived them from either (depending on data availability) credit ratings of sovereign bonds or the existing spreads between the 10-year US treasury bond and a country-specific sovereign bond of similar duration that is denominated and traded in US dollars or euros (Damodaran, n.d.). The values for credit ratings and default spreads used in Damodaran's calculations are based on data from January 2021. (Note that the euro is considered equivalent to the US dollar in Damodaran's approach, as the euro provides similar inflation expectations and the most traded euro bonds are traded at similar rates as the 10-year US treasury bond.) For countries which do not issue bonds denominated in US dollars or euros, Damodaran uses the bond ratings of similar countries which issue bonds in both national currencies and US dollars to arrive at a default spread from a foreign-currency/US dollar perspective (Damodaran [2020: 42-50] provides more details on this methodology). These country-specific default spreads thus constitute a country-specific risk premium (relative to the United States) for debt financing. Note that country-specific risks therefore include currency risks and inflation risks *vis-à-vis* the US dollar.
Lender margin	A value of 2% is used as a global baseline for lending margins for large private infrastructure debt. This value contains *both* typical risk-free returns for the lender as well as technology-/project-specific risks (but not country-specific risk), which the lender bears when debt-financing an infrastructure project. The 2% baseline is based on the report by the EDHEC Infrastructure Institute (2019: 58), which is corroborated by the reports by DWS (2021: 1) and Schroders (2017: 2). Jointly, these reports cover data from the years preceding 2021. Geographic variation is small but is represented here based on regional premia over the EMEA (Europe, the Middle East and Africa) baseline, from estimates by the EDHEC Infrastructure Institute (2019: 40, Table 13, post-2015 values). Greater country-specific variation is likely, but no data were available. The data provided in the EDHEC (2019) report are relative to sovereign bond yields; hence, it includes technology-specific risks which the lender bears, whereas country-specific risks are accounted for separately. For this reason, technology-specific risks (which are explained in Table A.2 for cost of equity components) are not added to the lender margin – instead, we only add technology-specific risks to the degree that the calculated technology risk premium exceeds the lender margin.
Technology premium	See Table A.2 for a detailed explanation of the *technology risk premium*. As described above, the technology premium is partly accounted for by the *lender margin* term when calculating the cost of debt.

Tax rate	Debt financing usually benefits from tax privileges; hence, the cost of debt must be discounted by country-specific corporate taxes. Note that this assumes that the investor is domiciled in the country of the infrastructure project and enjoys no tax exemption privileges. This may be questionable, especially regarding investments in developing countries. Further, the renewable energy infrastructure projects that are of interest for this survey may be eligible for various tax mitigations, which this methodology ignores. We retrieved values in March 2021 from a database by KPMG, which stores values for corporate tax rates by country (KPMG, 2021).
Debt share	The debt share is taken to be 80% for mature markets, 70% for intermediate markets and 60% for new markets. Newer markets are riskier, making the availability of debt financing lower. Market maturity for a given generation technology is defined by the installed capacity of said generation technology (based on IRENA [2018] estimates) as a proportion of overall generation capacity (based on Central Intelligence Agency [CIA, 2016] estimates). Mature markets are defined as those in which over 10% of installed electricity generation capacity is comprised of photovoltaic (PV) or onshore generation capacity, and over 6% for offshore generation capacity. For intermediate markets, a threshold of 5% is assumed for PV and onshore wind (over 3% for offshore). Markets in which renewable generation capacities fall below these thresholds are defined as new markets. (See also *technology premium* in Table A.2.) The value for the 80% of debt financing for mature markets is based on the industry report on infrastructure financing by the Infrastructure Finance Group at the EDHEC Infrastructure Institute (2019: 13) and the asset manager Schroders and is in line with other sources (see Schroders, 2017: 3). In addition to its own data, Schroders cites the Association for Financial Markets in Europe who corroborate this estimate. The “new markets” value is based on the PricewaterhouseCoopers report (PwC, 2020), which cites the level of debt financing for the initial years of onshore wind development to be 60%. “Intermediate markets” are assumed to have a 70% debt ratio.

2. Cost of equity

The components of cost of equity are broken down as follows:

Cost of equity = (global risk-free rate + equity risk premium + country premium + technology premium)

Table A.2 Cost of equity components

Global risk-free rate	As mentioned in Table A.1, for the global risk-free rate, we use the nominal yield of 10-year US treasury bonds.
Equity risk premium	A mature market (United States) equity risk is used and country-specific equity risk premium is added separately (see below), based on data from Damodaran. US equity risk premium is based on the US sovereign bond premium, adjusted for (multiplied by) the volatility of the S&P 500, the most important US equity index. The bond rates and volatility values used in Damodaran’s calculations are based on data from January 2021 (Damodaran, n.d.).
Country premium	Overall country risk premia are calculated by Damodaran. Country-specific equity risk premia are calculated relative to mature market (United States) equity risk premia. They are based on the relative sovereign default spreads in the respective country, multiplied by the volatility of said country’s leading equity index – that is, multiplied by the ratio of the standard deviation of daily values of the leading national index over the past year, relative to the standard deviation of the S&P 500 (Damodaran [2020: 66-79] provides more detail on this methodology). The default spreads and volatility values used in Damodaran’s calculations are based on data from January 2021.

Technology premium (specific to each country)	The technology risk premium is based on the maturity of the given technology (solar photovoltaic [PV], onshore wind or offshore wind) in each national market (see also debt share in Table A.1). Maturity is defined by the ratio of installed renewable capacity to overall installed electrical capacity in a given country. Renewable installed capacity figures are based on IRENA (2018) data, whereas overall installed capacity figures are based on CIA (2016) data. Thus this technology premium is only based on the maturity of a given technology in each national market, and not on any inherent/constant risks of solar vs onshore wind vs offshore wind. Mature markets are defined as those in which over 10% of installed electricity generation capacity is comprised of PV or onshore generation capacity, and over 6% offshore generation capacity. For intermediate markets, a threshold of 5% is assumed for PV and onshore wind (over 3% for offshore). Markets in which renewable generation capacities fall below these thresholds are defined as new markets. The specific thresholds (of 10% and 5% for onshore and PV, and of 6% and 3% for offshore) are based on the relationship between the rise in renewable installed capacity and risk premia in select countries. The PricewaterhouseCoopers (PwC, 2020) study on offshore wind financing conditions is used to define maturity thresholds for offshore wind projects, and for the absolute risk premium values at each maturity level for all technologies. The PwC study provides project data for Germany, the United Kingdom, Belgium and the Netherlands. These countries saw the penetration of offshore capacity increase from 2011 to 2019, from virtually zero to a range of just over 3% to as high as 12%, resulting in a simplified segmentation of maturity thresholds in two 3-percentage-point increments (3% and 6%). Further, the paper by Egli (2020) on renewable energy project risks for PV and onshore wind reports a continuous drop in risk premia from over 3% to an average of 1.7% for Italy, Germany and the United Kingdom, as renewable penetration rose from around 4% for wind and PV in 2008 to just under 10% in 2012, to around 16% in 2016, leading to the creation of simplified market maturity segments, or “bins”, at two 5-percentage-point increments (5% and 10%). The actual, concrete risk premium values for mature, intermediate and new markets for all three technologies are based specifically on the 2020 PwC study on financing conditions for offshore wind projects in North West Europe, which saw premia for offshore wind go from 3.25% to 1.5% over the LIBOR (London Inter-Bank Offered Rate) as the technology matured (PwC, 2020: 10), and projects became less risky. Offshore wind risk premia were used as more country data were available by way of the PWC study. This yields a somewhat conservative estimate for generic technology risk premia, as PV and onshore projects are not likely to have a higher technology risk than offshore projects. Since LIBOR rates, and not country-specific bond rates, are used as reference rates here, the lender margin must be subtracted when the cost of debt is calculated, which happens in the cost of debt calculation itself (*technology premium* is set to 0 if this would yield a negative value). Conversely, the full technology risk premium is used when calculating the cost of equity.
Debt share	See Table A.1 for the detailed explanation/basis for the debt share. In the WACC calculation, the cost of equity value is multiplied with the complement of the *debt share* percentage (1 – *debt share*).

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