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ESG Economist

Group Economics | Financial Markets & Sustainability Research | 18 July 2024

The impact of a Green LTRO on the energy transition

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- **Energy transition investments are relatively more sensitive to interest rate changes**
- **The current high interest rate environment therefore risks slowing down the energy transition**
- **The ECB could introduce a Green Longer Term Refinancing Operation (GLTRO), which would counter this effect, as it lowers interest rates on green bank loans**
- **We model the effect of such a GLTRO for investments in solar PV, onshore and offshore wind energy for the largest EU economies**
- **At the current high interest rate – so, without a green rate – investments in all these technologies are unprofitable in France and Germany, while in Italy and Spain, investments in solar and onshore wind are profitable**
- **The impact of introducing a GLTRO differs between countries. It is greatest in Germany and France, in particular for solar, and for France in offshore wind**
- **Within Germany our impact assessment of a green rate for 16 different technologies shows large variations in profitability of investments, with less mature technologies considerably less profitable**
- **Compared to the current interest rate, a 200 bps lower green rate would reduce transition costs – associated to existing financial gaps – until 2030, by 23.7% (EUR 3.7 billion), and assuming policy rates are cut to more neutral levels, the GLTRO impact would be even bigger**
- **If we assume the cost of equity decreases with the costs of debt, transition costs could even decline by 52.7% (EUR 8.2 billion)**
- **While effective, a GLTRO would on its own still not be a silver bullet as offshore wind investments remain unprofitable in Europe while in Germany none of the technology investments become profitable**

Introduction

Given the sharp rise of interest rates since 2022, the cost of capital has become an important factor in the energy transition. Higher interest rates are adding to the forces slowing down the energy transition as they impact the profitability of the investments in renewable energy relatively hard. Capital expenditures for such investments represent a higher share relative to operating expenditures. This is because, after initial development and construction costs, operating costs are low as no or reduced fuel input is required. The cost of capital is therefore an important element of the total costs of the energy transition making these investments more sensitive to changes in interest rates. An unfortunate externality of the ECB's restrictive monetary policy is the rise in transition costs.

A green interest rate is an instrument that central banks have globally identified as one of the strongest possible contributions of monetary policy to mitigate climate change (NGFS, 2021). This involves providing funds to commercial banks at an interest lower than the regular monetary policy rate, so that banks use these funds for loans that support the energy transition at a reduced loan rate. Unlike the central banks of Japan and China, the ECB so far has not implemented such a green interest rate, or Green (Targeted) Longer Term Refinancing Operation (GLTRO). Under its new operational framework, the ECB did announce that it will continue to have "structural refinancing operations" that will "aim to incorporate climate change-related considerations" (European Central Bank, 2024).

Following calls from academics, monetary policy economists, and the industry (Lonergan et al., 2022; NVDE, 2023b; Faure et al., 2024), also ECB board members have discussed the possibility of a "green" interest rate (Elderson, 2023; Schnabel, 2023). A green interest rate, whose introduction is expansionary in nature, has become more probable also now that monetary policy is easing, as evidenced by the reduction of the key policy rates in June.

This report aims to increase our understanding of the effects a green interest rate can have on the cost of the energy transition in the Eurozone and wider EU. To that end, it investigates the cost reduction in attaining the 2030 goals for Germany, France, Italy, The Netherlands and Spain. The focus is on three key renewable power technologies, namely: solar PV (fixed axis), onshore, and offshore wind. We run scenarios with the interest rate of the second half of 2023 as a benchmark to green interest rates that are 1%, 1.5%, 2%, and 4% lower than the benchmark. Our results show that a green interest rate is effective in reducing transition costs in these counties, especially when assuming that the costs of equity is also lowered. Countries vary in the extent to which they benefit from lower costs of capital. While green technology investments benefit most from a green rate in Germany, the challenge of getting them profitable remains.

This study starts in section 2 with a discussion of related literature on the sensitivity of investments in renewable energy to interest rate changes. Section 3 describes the methodology to arrive at an estimate of the potential cost reduction through lower interest rates. Section 4 presents the findings. We end with our conclusions.

Related literature

Effect of interest rate on renewable energy investments

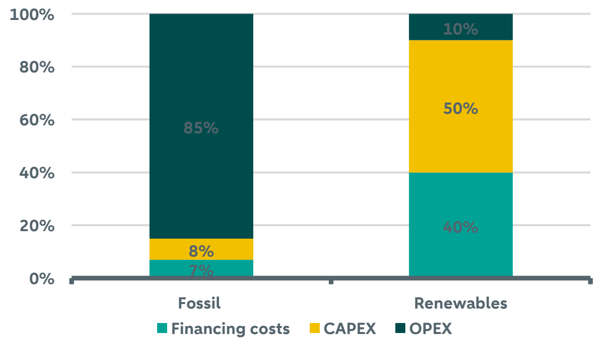
Interest rates are one of the important factors driving the costs of renewable energy technologies. This became evident from studies into the decline in costs of wind and solar over the recent decades. Egli et al. (2022) find that the decline of the interest rate explained 41% and 40% of the Levelized Cost of Energy (LCOE) reduction for solar and onshore wind, respectively, in Germany between 2000 and 2017.

Consequently, higher interest rates might inhibit investments in renewable energy. The reason for this is that capital expenditures (CAPEX costs) represent a significantly higher share relative to operating expenditures (OPEX costs) for investments in renewables. Building wind farms or solar panels is, for instance, associated with high upfront costs but only very low operating costs.

The chart below illustrates an example of this by showing the distribution of CAPEX, OPEX and financing cost for respectively fossil and renewables. Whereas the share of OPEX is 85% for fossil, it is only 10% for renewables. Alternately, CAPEX for renewables is 50% against only 8% for fossil, and hence also the financing cost are much larger for renewables with 40% against only 7% for fossil (Morawiecka & Scott, 2023). The same holds true for other green investments such as those that aim to increase energy efficiency in real estate and industry, reflecting the importance of the cost of capital in the total costs of the energy transition.

Distribution of cost over the lifetime of energy assets

Percentage of total costs



Source: Illustrative example (For the original chart see Morawiecka & Scott, 2023), ABN AMRO Group Economics

Many recent studies confirm the negative relationship between high interest rates and the relative position of renewable energy. A study by the International Energy Agency (IEA) on the projected cost of generating electricity found that an interest rate hike from 3% to 7% would entail an increase of the LCOE of more than 30% for offshore wind and solar PV (IEA, 2020). The same interest rate increase would expectedly raise the LCOE of gas-fired power by only 4% (IEA, 2020). Similarly, Voldsgaard et al. (2022) find that an increase of the cost of capital by 5 to 10% would lead to an increase of the cost of electricity from offshore wind, large-scale PV, and rooftop PV by 47%, 52-54% and 60%, respectively. In contrast, the cost of capital hike would increase the cost of gas-fired electricity by only 8% (Voldsgaard et al., 2022).

Research commissioned by the Dutch Renewable Energy Association (NVDE) calculated that the additional costs to the energy transition resulting from an interest rate increase of 3% for the Netherlands alone are 17 billion euros until 2030 and up to 163 billion euros in 2050 (Bianchi et al., 2023).

Since 2022 such interest rate developments are no longer theoretical. In reaction to the increase in inflation, the ECB raised its key deposit facility rate by 450 basis points (from -0.5% in July 2022 to 4% in September 2023). Only in June 2024, the ECB started to reverse its restrictive stance, cutting its key policy rates by 25 basis points. This (still) record high interest rate is hurting renewable energy investments in the eurozone. In mid-2023, for instance, a study by the Dutch Renewable Energy Association reported that almost 90% of its members estimate that rising interest rates will make it harder to achieve their climate goals, and almost a third has already delayed or even halted projects because of rising rates (NVDE, 2023a). Furthermore, in 2023 large offshore wind projects were canceled mentioning rising interest rates as a main factor (Millard & Moore, 2024). ABN Amro research also found that next to other factors like limited grid capacity, labour shortages and rising costs of raw materials, also rising financing costs are constituting a bottleneck to the development of renewables (Altaghlibi & de Barros Fritz, 2023). Furthermore, the most recent survey on the access to finance of enterprises found that high investment cost and the lack of subsidies do indeed represent an important obstacle for over half of participating firms when it comes to securing climate-related investments (ECB, 2023).

This paper aims to contribute to this discussion by calculating the cost reductions to be expected of a green interest rate for the eurozone that would counter the unintended side effects of restrictive monetary policy on the energy transition.

Methodology

In this section, we explain our methodology to quantify the impact of GLTRO on the energy transition across selected European countries.

In order to reflect the possible impacts of changes in interest rates on the energy transition, we investigate how the business case of some of the main transition technologies within the power sector would alter following the change in interest rate. Our focus on the power sector is motivated by the high emissions levels from this sector and by the maturity of needed technologies to move the transition forward in this sector. That is, we look at how the investment decision in selected transition technologies would respond to changes in interest rates. Furthermore, in order to capture the inherent differences across countries, our analysis spans several selected European countries for each technology.

Our analysis focuses on three leading technologies, namely: solar PV (fixed axis) as well as onshore and offshore wind. We chose these technologies for their envisioned role in the future energy mix of the European Union. However, in order to provide a comparison with other promising technologies, we also provide a snapshot for a wider number of technologies in Germany, where data is available.

In the subsections below, we dive more in depth in main concepts and data gathering.

Levelized Cost of Electricity (LCOE)

The impact of interest rate changes on investment costs is channeled through the change in the Levelized Cost of Electricity (LCOE) of the selected technologies. LCOE is a widely used measure to compare the cost of energy production across technologies and reflects the average revenue needed to recover the development, construction and operation of power plant during an assumed financial life and duty cycle. Accordingly, LCOE is calculated by dividing the discounted costs over the lifetime of the power generating plant by the discounted sum of actual electricity amounts delivered. For our purpose, LCOE is measured in Euro/KWh.

As different investments in renewable technologies are financed through a combination of debt and equity, any change in the interest rate would affect the cost of these investments, and in turn, induce a change in the LCOE.

The financial gap

The profitability of renewable power investments is determined by the LCOE relative to the future electricity price. A high future electricity price would support the business case for investing in renewable power projects. In the case of lower electricity prices, investments in renewable power could be unprofitable. Accordingly, we define the financial gap as the difference between the average future electricity price and the LCOE for the various technologies. That is, a positive financial gap means that the investment decision for a certain technology is viable, and vice versa. The electricity price and the financial gap are measured in Euro/KWh.

By tracking changes in the financial gap across policy scenarios, we capture the impact of interest rate changes on the viability of transition investments across selected countries.

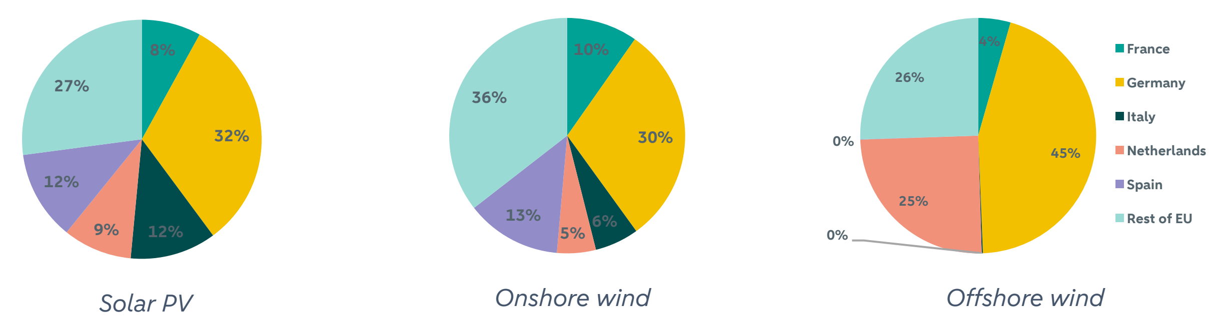
Finally, we track the total change in transition costs per technology for selected countries to meet 2030 capacity targets following the change in interest rates. To do so, we calculate the additional needed capacity, and the corresponding power generated, between 2024 and 2030 and multiply that number by the financial gap.

Selected technologies and countries

As mentioned above, our analysis focuses on three main technologies: Solar PV (fixed axis), Onshore wind and Offshore wind. These technologies are chosen based on their prominent role in the EU's climate policy (see e.g. European Commission, 2022) reflected in their future share in the European energy mix.

Capacity shares in the EU in 2023

%



Source: Ember (2024), IRENA (2024), ABN AMRO Group Economics

The charts above reflects the current share of these technologies within the European Union. As the graphs show, for the selected technologies, the selected countries currently provide the majority of the EU-capacity in 2023. With a total share of 73% for solar PV, 64% for onshore wind, and 74% for offshore wind.

Unfortunately, based on data availability, we could only preform our analysis for the following countries for our selected technologies. However, with a focus on Germany, we provide an overview of potential impacts for other promising technologies. The table below summarizes the analyzed cases between country and technology axes.

Technology	Country	Share of EU total capacity in 2030
Solar PV (fixed axis)	Germany, France, Italy, Spain	72.5%
Onshore wind	Germany, France, Italy, Spain, The Netherlands	61.5 -78.7%[1]
Offshore wind	Germany, France, The Netherlands	59.8%
Combined cycle Gas Turbines (CCGT), CCGT CCS, CCGT Hydrogen, Combined Heat and Power (CHP), Gas recip. Engine, Open Cycle Gas Turbines (OCGT), OCGT CCS, OCGT Hydrogen, Battery 1h, Battery 4h, PV + storage, onshore wind + storage	Germany	NA

Data sources

Levelized Cost of Energy (LCOE)

For our LCOE calculations, we use Bloomberg's Energy Project Valuation Model (EPVAL). This model is based on cost and market data which are biannually updated. Our simulations are based on data from the second half of 2023. The model has different technical assumptions that change from one technology to another and across countries. The model also has three cost scenarios for each technology: Low, Mid, and High. We adopt the "Mid" cost scenario in all of our simulations. Similarly, we adopt the default values (based on 2nd half 2023 database) for market rates (inflation rate, tax type, depreciation rate with a straight line period), CAPEX (Development cost, plant balance cost, and equipment cost) and OPEX (fixed and variable operating costs, carbon price, emission intensity, fuel type) costs, and debt financing assumptions (debt/equity ratio, cost of equity, debt type).

Accordingly, for our purpose, the only variable we vary between our scenarios is the debt interest rate for lending to the selected technologies, reflecting the presumed change by central banks through GLTRO.

Electricity prices

We use the Oxford Global Economic Model to get projections for electricity prices in selected countries. The model employs individual country models that are fully linked through global assumptions about trade volume and prices, competitiveness, capital flows, interest and exchange rates, and commodity prices. For more information about the model see Oxford Economics (2024).

There are different transition scenarios, with three scenarios that represent base, positive and negative possible scenarios, namely: Baseline, Net Zero Transformation (NZT), and Delayed Transition (DT) scenarios, respectively. We use the model output for real electricity (producer) prices in the Baseline scenario in our simulations. These prices are higher under the NZT scenario as power demand grows at a higher rate in this scenario. We reflect on these differences in our analysis when needed. We used Ember's (2024) yearly electricity price data to convert the model indexed outcome to electricity prices levels for the three scenarios.

Current and targeted capacity

The data on production capacity per technology per country in 2023 was sourced from the International Renewable Energy Association (IRENA, 2024). The national capacity targets per technology per country for 2030 were sourced via

[1] The range reflects the minimum and maximum values for 2030 capacity targets.

the Integrated National Energy and Climate Plans that EU member states submit to the European Commission, and the financial press as well as related literature (see Table 1 in the Annex).

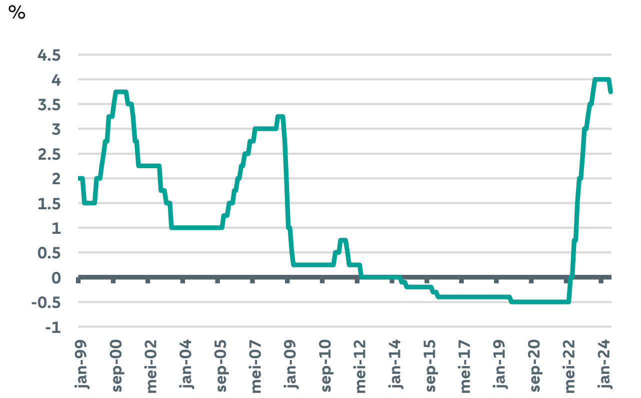
To evaluate the representativity of the technologies and countries covered in the case selection, the relative shares of the production capacity per technology and per country in the EU-level production capacity per technology in 2023 was calculated using Ember's (2024) yearly electricity data. For 2030, the national capacity targets per technology were divided by the EU capacity targets per technology mentioned hereabove.

Policy Scenarios

We aim in our scenarios to quantify the impact of ECB intervention through GLTRO instrument which provide favored rates to banks if they provide loans to certain sectors/technologies considered essential for moving the energy transition forward and reaching climate goals. Accordingly, we adopt the default interest rate in the EPVAL model for our benchmark scenario. This rate reflects market conditions in the second half of 2023, which consists of an ECB deposit facility rate plus a premium which is technology and country specific.

As the chart below shows the ECB's interest rates have not always been this high. With inflation now moving closer towards its medium term objective of 2% further rate decreases are expected. However, for the purpose of consistency we use recent levels as a starting point.

ECB deposit facility rate



Source: ECB, ABN AMRO Group Economics

We assume that the ECB uses the GLTRO tool to reduce its key interest rate for selected technologies by 100 basis points for scenario S100, 150 basis points for scenario S150, and 200 basis points for scenario S200. We also simulate a scenario with 400 basis points which we analyze separately, which would reflect a combination of traditional ECB rate cuts and a lower green rate.

We note that, under our simulated scenarios, we assume that the ECB policy will channel one to one on the cost of debt for the selected technologies. Furthermore, as the transmission channel from ECB rates towards the cost of equity is debatable and hard to quantify, thus, in our main analysis, we keep the cost of equity constant across scenarios. However, for comparison purposes, we present at the end of our analysis a case where the cost of debt and that of equity moves in tandem with each other.

An overview of our scenarios and the associated policy assumptions can be found in the table below.

Scenario label	Interest rate assumption
Benchmark	Default rate (based on 2nd half 2023 data)
S100	Default rate – 100 basis points
S150	Default rate – 150 basis points
S200	Default rate – 200 basis points
S400	Default rate – 400 basis points

Results

We analyze our results with a focus on S100, S150, and S200 policy scenarios. The S400 scenario will be analyzed subsequently in a separate subsection to reflect a case assuming the GLTRO is implemented when the ECB deposit facility rate is back to more 'normal' levels.

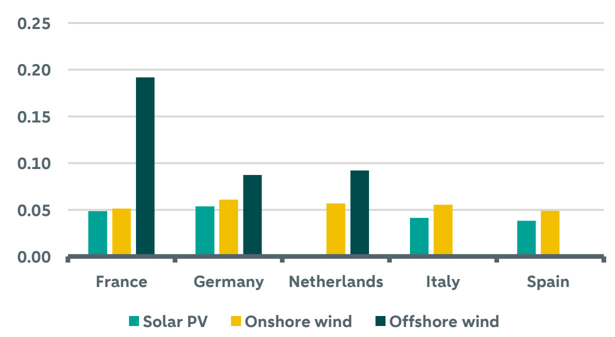
GLTRO impacts on Levelized Cost of Energy (LCOE)

We start our analysis with simulations of the LCOE under our benchmark scenario. The left-hand side of the chart below summarizes the results for our three focus technologies across selected countries. The chart reflects the data availability, which in turn reflects the leading renewable technologies in the selected countries. More explicitly, data for Solar PV is available for France, Germany, Italy, and Spain, while that for onshore wind is available also for the Netherlands. For offshore wind, data is only available for France, Germany, and The Netherlands.

The chart on the right hand side has a specific focus on Germany and depicts all relevant technologies that have a role in the transition of the power sector. Among these technologies, some that rely on natural gas are also included for comparison purposes. For example, Combined Cycle Gas Turbine (CCGT) and Open Cycle Gas Turbines (OCGT) can be compared with their Carbon Capture and Storage (CCS) and Hydrogen variations.

LCOE across countries (Benchmark scenario)

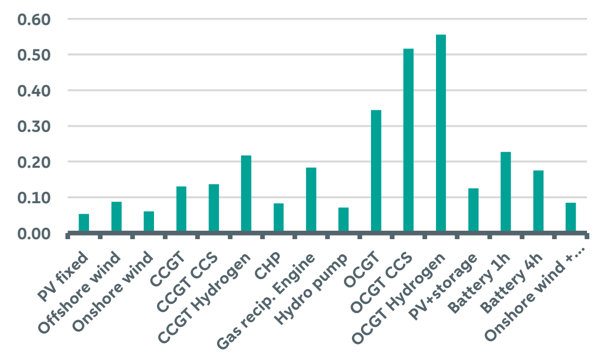
EUR/KWh



Source: Bloomberg, ABN AMRO Group Economics

LCOE for German technologies (Benchmark scenario)

EUR/KWh



Source: Bloomberg, ABN AMRO Group Economics

The left hand LCOE chart above shows that Solar PV is the cheapest source of renewable electricity across selected countries, followed by Onshore and Offshore wind, respectively. Furthermore, the LCOE for Offshore wind development is (by far) the most expensive in France followed by The Netherlands, and Germany. The differences on offshore wind among these countries can be explained by the inherit differences in the technology capacity factor[2], which is highest in Germany (46%) and lowest in France (44%), along with the difference in the CAPEX costs. Strikingly, France's offshore wind CAPEX costs are almost double those in Germany.

For solar PV, differences between countries are mainly due to differences in the capacity factor as CAPEX costs are assumed similar across countries. Thus, Spain with clear and sunny sky has the highest capacity factor of 17.5% for this technology, followed by Italy (16%), France (12%) and Germany (11%).

Onshore wind development is cheapest in Spain and most expensive in Germany. LCOE differences across countries are explained by capacity factor differences (32% for Germany, 35.2% for France, 32.5% for the Netherlands, 38% for Spain and 38.2% for Italy) which impact outweigh the differences in CAPEX costs, where Spain has the highest CAPEX costs, while France has the lowest ones, with German CAPEX costs being almost 54% cheaper than those for Spain.

Moving to the right-hand chart above, here also Solar PV is the cheapest to develop per unit of electricity produced. Pumped Hydro, and Combined Heat and Power (CHP) are also relatively cheap to develop next to Onshore and Offshore wind. OCGT Hydrogen is the most expensive with an LCOE of 0.55 EUR/KWh. There are many aspects that drive LCOE differences between technologies and it is hard to pin point one driver in particular. These differences are

[2] Capacity factor refers to the amount a power plant can produce compared to its maximum potential (yearly) output.

due to differences in technical, market, and financial assumptions such as CAPEX and OPEX costs, capacity factor, fuel costs (if any), the assumed financial structure and the associated cost of finance.

GLTRO impacts on the financial gap

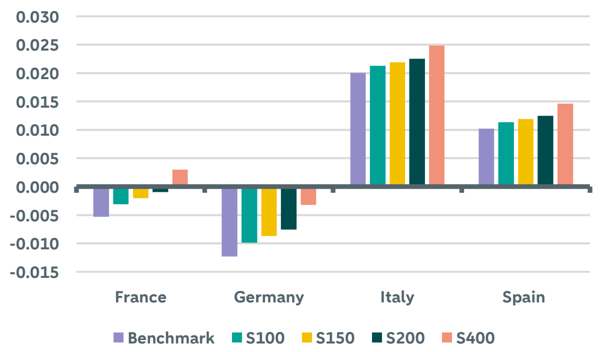
As mentioned above, the financial gap is defined as the difference between the expected average electricity price and the LCOE. If the financial gap is negative, investment in the technology is not economically viable (absent of policy interventions). In this section we investigate the impact of changes in the cost of debt on the financial gap and thus its associated change in project feasibility. Interest rate impacts on the financial gap are channelled through their impact on LCOE. Accordingly, for our purpose, across our policy scenarios, power prices and all other assumptions remain constant and the only change between scenarios is in the cost of debt.

Solar PV (fixed axis)

Results in the chart below (left) show that the financial gap for solar PV is negative for France and Germany and positive for Italy and Spain. This means that for France and Germany the expected electricity price is lower than the LCOE and the development of this technology is still not viable, while for Italy and Spain, this is not the case. There are two reasons for this. First, the expected electricity price is higher in Italy and Spain. Second, as mentioned in the previous, section, the LCOE for solar PV is the lowest in these countries as they have the highest capacity factor for this technology.

Financial gap for solar PV (fixed axis)

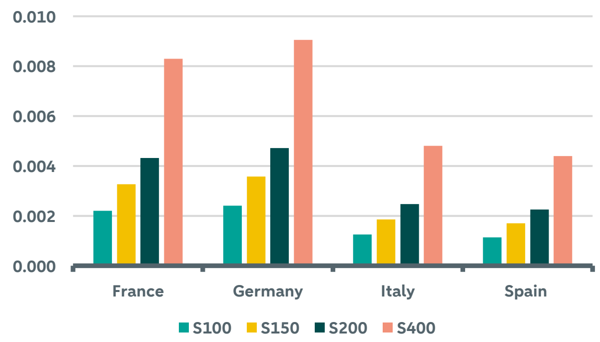
EUR/KWh



Source: Bloomberg, Oxford Economics (2024), own calculations, ABN AMRO Group Economics

Policy impacts from the Benchmark (Solar PV)

EUR/KWh



Source: Bloomberg, own calculations, ABN AMRO Group Economics

The chart further depicts the change in the financial gap as the central bank decreases the interest rate, where the gap decreases for countries with negative value and increases for those with a positive value.

In order to highlight the policy impacts across countries in a more comparable way that sort out all differences in electricity prices between them, the right-hand chart depicts the policy impact as a deviation in financial gap between scenarios from the Benchmark value. Furthermore, as the electricity price is assumed constant between policy scenarios, this chart reflects the difference in LCOE as result of interest rate changes.

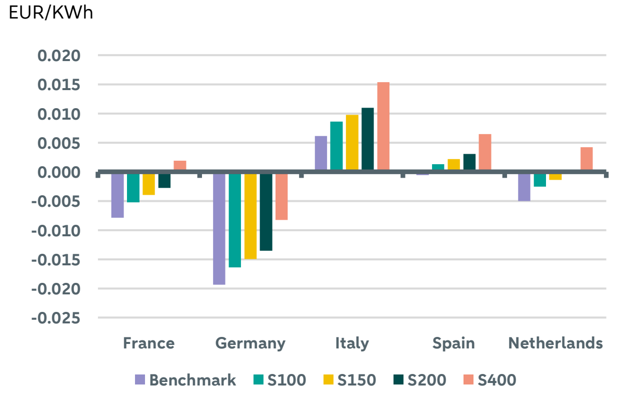
The chart shows that policy impact is heterogenous across countries, with highest impact for Germany and France followed by Italy and Spain respectively. The differences in interest rate impacts are partly due to their heterogenous impacts on the Weight Average Cost of Capital (WACC) across countries. The WACC takes into account the cost of Equity and that of debt along with the debt-equity ratio. Thus, the WACC differ between technologies and across countries. Moreover, the WACC is used as the discounting rate in the calculation of the LCOE. Accordingly, differences in policy impacts across countries are due to inherit differences in the capacity factors and the WACC. We note that the CAPEX and OPEX costs for Solar PV is assumed the same across countries.

Onshore wind

For onshore wind, the left-hand chart below depicts a negative financial gap for France, Germany, and The Netherlands, while Spain is marginally negative for the Benchmark scenario which turns positive in all policy scenarios. Finally, Italy has a positive financial gap. As for Solar PV, here again differences across countries stem from the inherit differences in LCOE and the expected electricity price which we mentioned above.

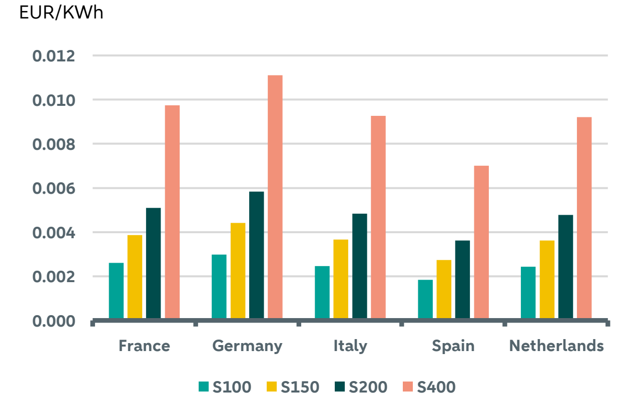
According to these figures, the business case for onshore wind is not viable for France, Germany and the Netherlands under current interest rates. For the Netherlands, a reduction in the interest rate by 200 basis points (S200 scenario) is more than enough to eliminate completely the financial gap and make onshore investments viable again with no need for fiscal support. For France, a more aggressive reduction in interest rates would be necessary. For Germany, the financial gap would remain negative in all scenarios.

Financial gap for onshore wind



Source: Bloomberg, Oxford Economics (2024), own calculations, ABN AMRO Group Economics

Policy impacts from the Benchmark (Onshore wind)



Source: Bloomberg, own calculations, ABN AMRO Group Economics

With regard to the policy impacts from the benchmark scenario, which are summarized on the right-hand side above, we see that these impacts are highest for Germany, followed by France, Italy, Netherlands, and Spain, respectively. The differences in impacts are explained by a combination of several differences across countries. First, the countries differ between each other in the Benchmark value of the WACC, with Germany having the lowest WACC value. This reflects a lower premium on central bank rates in Germany compared to other countries. Accordingly, a change in interest rates has a relatively higher impact on the WACC in Germany than other countries. Second, the total CAPEX costs for onshore wind are the highest in Germany followed by Italy, France, Spain and the Netherlands, respectively. Another factor that also plays a role in the differences in policy impacts, as specified above, the capacity factor where Germany has also the lowest capacity factor for this technology, followed by Netherlands, France, Italy and Spain respectively.

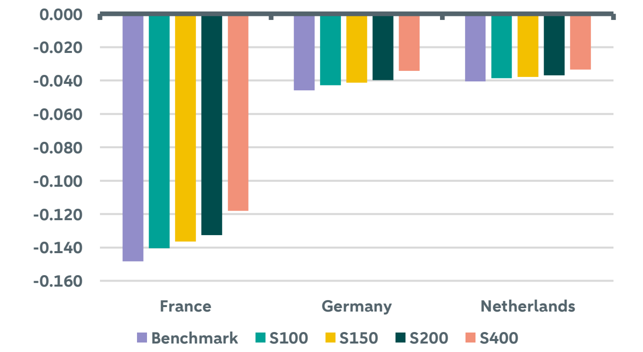
Offshore wind

For offshore wind, the left-hand figure below illustrates a negative financial gap across all countries. This is mainly due to relatively high CAPEX costs associated with the development of this technology. Furthermore, the gap is largest in France followed by Germany and The Netherlands, respectively. Differences in the financial gap between countries are mainly driven by differences in LCOE, which is almost two times higher in France compared to that in Germany and the Netherlands. The main driver for this is the high CAPEX costs associated with the development of offshore wind. More precisely, France's CAPEX cost (particularly construction costs excluding equipment) is almost double of that of Germany and the Netherlands, while at the same time, it has a relatively lower capacity factor for this technology (44% for France versus 45.5% and 46% for Netherlands and Germany, respectively). The negative gaps mean that investing in offshore wind is still not feasible in all countries even with favourable green interest rates.

With regard to the policy impact across countries, as illustrated on the right-hand side below, it is highest in France, followed by Germany, and the Netherlands. Here again the differences reflect net impact of the change in the WACC, along with differences in CAPEX and OPEX costs and capacity factors across countries, on the LCOE.

Financial gap for offshore wind

EUR/KWh



Source: Bloomberg, Oxford Economics (2024), own calculations, ABN AMRO Group Economics

Policy impacts from the Benchmark (Offshore wind)

EUR/KWh

Source: Bloomberg, own calculations, ABN AMRO Group Economics

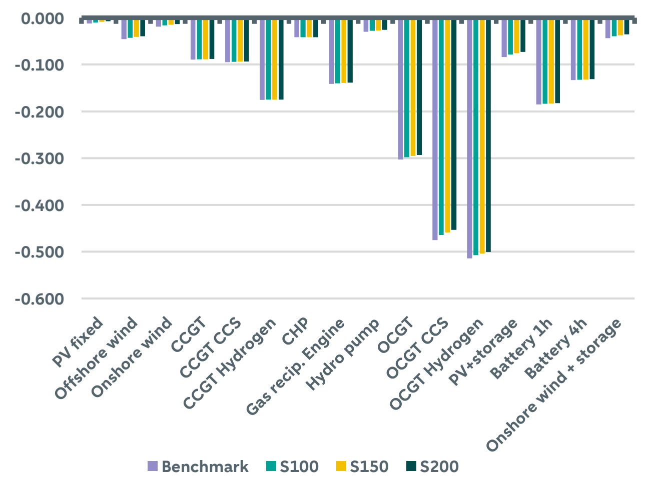
Technologies in Germany

Our aim in this section is to present the differences in the financial gap between different technologies for Germany. This comparison would reflect the current position of different transition technologies in the power sector and the potential GLTRO impact.

As we focus on the same country, the electricity price is assumed to be the same and thus, the financial gap reflects only differences in LCOE across technologies which is similar to those explained in the LCOE section above. The chart below (left) illustrates that the nonviability of the business of all technologies with negative value for the financial gap for all technologies. While favourable green interest rates improve the business case, the financial gaps in all cases would remain negative.

Financial gap (Germany)

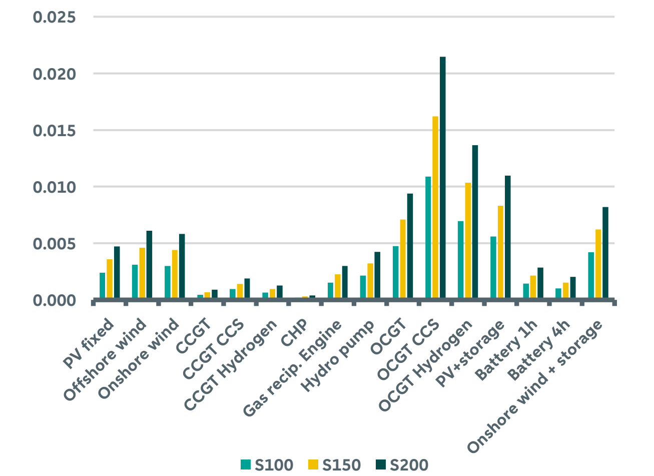
EUR/KWh



Source: Bloomberg, Oxford Economics (2024), own calculations, ABN AMRO Group Economics

Policy impacts from Benchmark (Germany)

EUR/KWh



Source: Bloomberg, own calculations, ABN AMRO Group Economics

The chart on the right above shows wide differences in policy impacts between technologies, with the highest impact being on Open Cycle Gas Turbines with Carbon Capture and Storage (OCGT CCS) and the lowest (very close to zero) for Combined Heat and Power (CHP). These technologies differ in multiple aspects that explain the differences in policy impacts. First, and most important, is the CAPEX and OPEX costs which differ widely across technologies with higher costs for technologies in early stage of technical development such as OCGT technologies (CHP has lowest CAPEX costs). Additionally, the financing structure (debt to equity ratio) and the associated costs of debt and equity are different among technologies, and thus, the WACC is less responsive to a decrease in interest rates in technologies which rely more on equity financing, such as utility scale batteries, which rely heavily on equity financing. Furthermore, the capacity factor and project lifespan could also explain some of the differences.

GLTRO impacts on transition costs

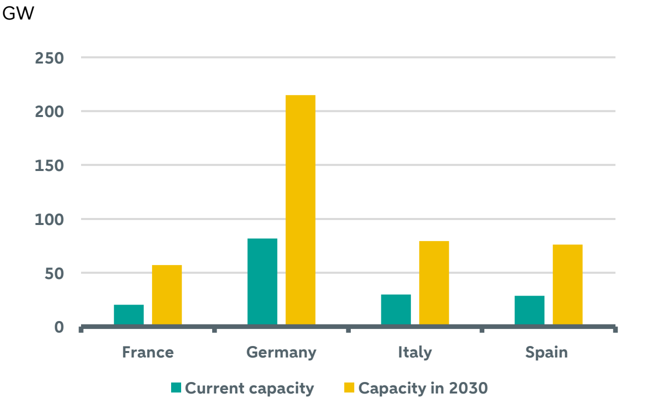
After quantifying the viability of investments and the impact of the ECB's intervention to improve the business case for the three selected technologies, we are interested in calculating the change in transition costs associated with achieving the 2030 capacity targets for the various countries. We can attain this by multiplying the financial gap by the volume of generated power from newly added capacity. More explicitly, this volume is attained by multiplying the country-specific additional capacity that would need to be installed between 2024 and 2030 by the capacity factor in each country and the number of years in operations in which the policy is applied. Since we are mainly interested in quantifying the change in transition costs following a preferential interest rate by central banks through GLTRO, we calculate the impact over the whole life time of the new investments.

As mentioned above, whenever the financial gap is negative, new investments are not viable and GLTRO would help reduce transition costs. On the other hand, in countries with a positive financial gap, GLTRO would further strengthen the business case for targeted technologies making them even more attractive to invest in. In our analysis for transition costs, we assume the implementation of GLTRO by the ECB is the same across all union members. That is the policy is not country specific and will benefit all countries whether they have positive or negative value for the financial gap.

Solar PV (fixed axis)

As illustrated in the chart on the left below, Germany has the highest planned additional capacity in 2030 with almost additional 133GW, followed by Italy (50GW), Spain (48GW), and France with almost 37GW of additional solar PV capacity.

Current and target capacity for Solar PV (fixed axis)



Source: IRENA (2024), Integrated Climate and Energy Plans (see Table 1 in the Annex), ABN AMRO Group Economics

Saved transition costs for solar PV (fixed axis)

Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

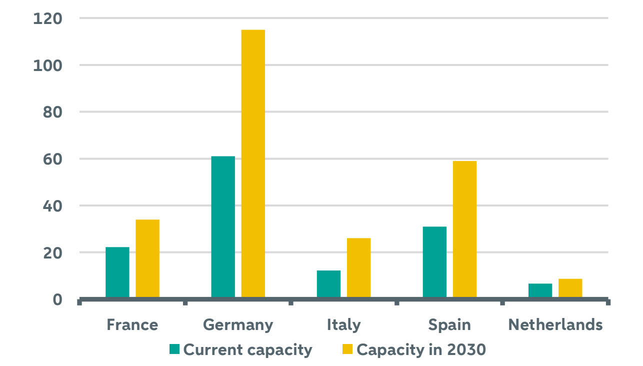
The right-hand side chart above summarizes the reduction in transition costs from the Benchmark (no GLTRO) scenario across countries (the difference between the potential support value under the scenarios with lower interest rates and that value under the Benchmark scenario). We note that as the power price is assumed to be constant across scenarios, its impact on transition costs cancels out, and thus, the chart reflects only differences in LCOE and the power generated through additional capacity to meet the 2030 goals

Accordingly, the chart shows that GLTRO targeting solar PV would be, based on national energy plans, most beneficial for Germany, and could save up to 606 million euros for the country under the S200 scenario reaching its 2030 capacity targets. The savings for France could range between 85 and 167 million euros under S100 and S200, respectively. The overall cost reductions for the four countries would amount to 1.11 billion euros under the S200 scenario.

Onshore wind

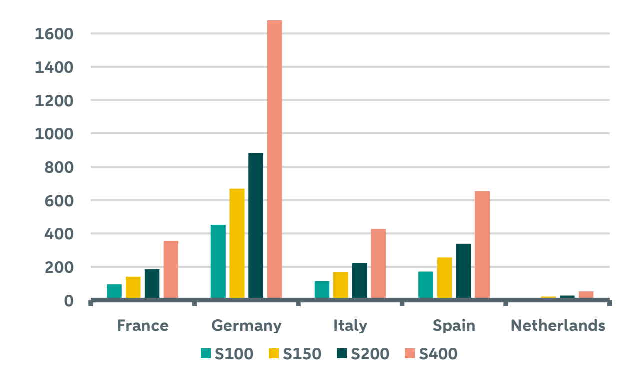
For onshore wind, Germany is also the country with the highest capacity targets in 2030 with almost an additional 54GW, followed by Spain (28GW), Italy (14GW), France (12GW), and The Netherlands with only 2GW of additional capacity as illustrated in the left-hand chart below.

Current and target capacity for onshore wind



Source: IRENA (2024), Integrated Climate and Energy Plans (see Table 1 in the Annex), ABN AMRO Group Economics

Saved transition costs for onshore wind



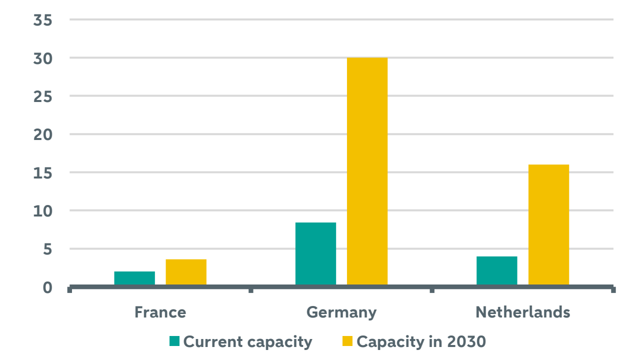
Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

Accordingly, similar to the case of solar PV above, a decrease in debt costs for onshore wind through GLTRO would save between 451 and 881 million euros for Germany in S100 and S200 scenarios, respectively, representing the highest potential quantitative impact across the countries. The least impact is for the Netherlands with up to 27 million euros in the S200 scenario. The total potential savings in transition costs for all selected countries would range from 845 million euros and 1.65 billion euros under S100 and S200, respectively.

Offshore wind

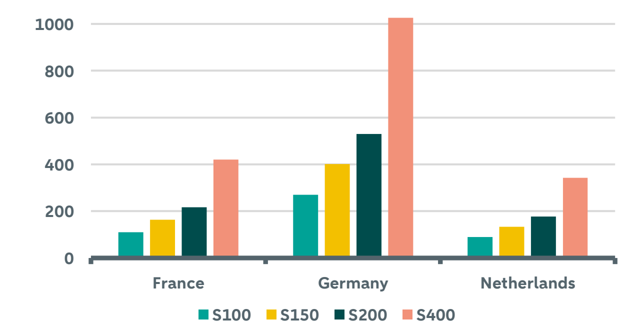
Similar to solar PV and onshore wind, Germany has the highest capacity targets for offshore wind in 2030 with around 22GW of additional capacity followed by The Netherlands (12GW), and France (3.6GW) as shown in the left-hand figure below.

Current and target capacity for offshore wind



Source: IRENA (2024), Integrated Climate and Energy Plans (see Table 1 in the Annex), ABN AMRO Group Economics

Saved transition costs for offshore wind



Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

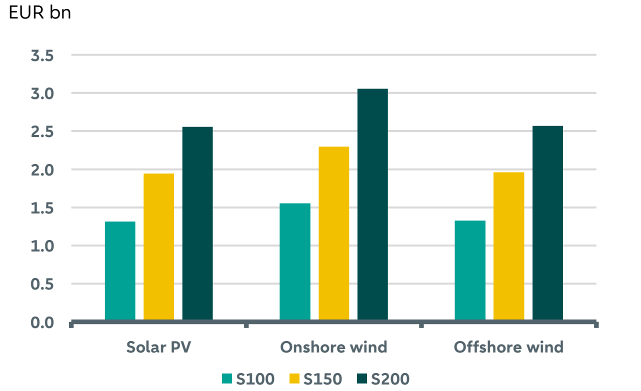
Savings in transition costs triggered by the introduction GLTRO in this sector would save the most in Germany (see right-hand figure above). More precisely, these saving could range between 270 and 530 million Euros in the S100 and S200 scenarios, respectively. For France, even though the country has a relatively low planned additional capacity for offshore wind, GLTRO would save up between 110 and 215 million euros in the S100 and S200 scenarios, respectively. The reason for this is the relatively very high CAPEX (mainly construction) costs for France in comparison to other countries. The least impact is for The Netherlands mainly because the country has the lowest construction and development costs. Accordingly, the total potential savings in offshore wind transition costs for all studied countries would amount to 665 and 989 million euros under S100 and S150, and up to 1.3 billion euros under S200.

To summarize, the results show that GLTRO is effective in reducing transition costs for all technologies and boosting the transition going forward. Policy impact differ across technologies and countries. Results show that the policy would benefit Germany the most with saving amounting to 1, 1.5, and 2 billion euros under S100, S150, and S200 scenarios, respectively, while total potential savings across all three technologies and studied countries would amount to 1.9, 2.8, and 3.7 billion euros under S100, S150, and S200 scenarios.

Cost of equity move in tandem with the cost of debt

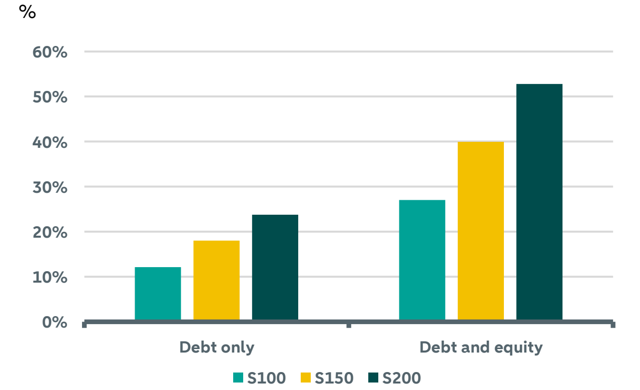
All results above assume that the cost of equity remains constant after a change in interest rates by the ECB, however, in reality, the cost of equity would also change. That is, the results presented above could be considered as a lower bound effect for the change in GLTRO under the assumption of 100% pass-through rate. In order to also consider other potential impacts that take into account the change in the cost of equity, we have redone our analysis under the assumption that the cost of equity would move in tandem with the cost of debt, assuming a pass-through rate of a 100% for the change in policy. That is, under S100, we assume the cost of debt and that of equity to decrease by 100 basis points. Similarly, for S150 and S200.

Reduction in transition costs



Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

Transition costs share reduction per scenario



Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

Results between scenarios under this case (tandem change in cost of debt and equity) are summarized, in term of the reduction in transition costs, in the left-hand chart above across the three technologies. The chart shows that savings following the change in interest rates were amplified compared to our findings in the previous section. More precisely, results show that the policy would still benefit Germany the most with savings amounting to 2.1, 3.1, and 4.1 billion euros under S100, S150, and S200 scenarios, respectively, while total potential savings across all three technologies and studied countries would amount to 4.2, 6.2, and 8.2 billion Euros under S100, S150, and S200 scenarios, respectively.

The total relative change in transition costs versus the benchmark value (for all countries whether they have a negative or positive value for the financial gap), are summarized in the right-hand chart above for the cases when only cost of debt changes with a change in interest rates, and the case when both debt and equity change. Under the S200 scenario, GLTRO could reduce transition costs, associated to existing financial gaps, by 23.7% under the debt only case, and by 52.7% under the assumption that both debt and equity move in tandem with a change in GLTRO.

The ECB deposit rate is back to more 'normal' levels

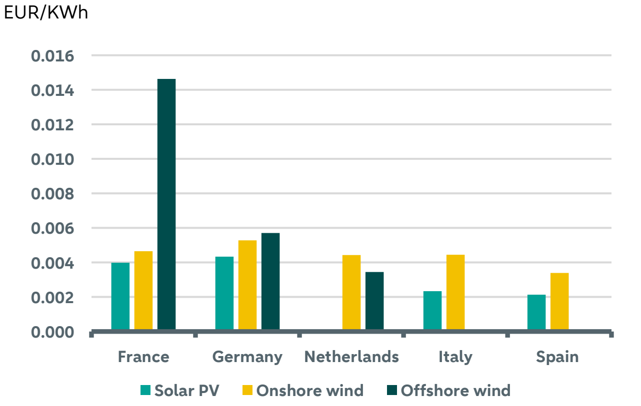
The benchmark used in our analysis above reflects the ECB deposit rate as of the second half of 2023. However, from a historical perspective, this rate is exceptionally high and may not reflect the average level of interest rates we are likely to see over the coming years. Therefore, our aim in this subsection is to highlight the potential impact of GLTRO in a situation where the ECB deposit facility rate is around more average levels. Although there is uncertainty about what such a level of interest rates would be, the midpoint of various studies points to a level of around 2%. To do so, in this subsection we adopt the S200 scenario as our benchmark and assume the ECB implements a 200 basis points GLTRO rate, which reflects the S400 scenario.

Results for solar PV show that such a policy is more than enough to close the negative financial gap for France turning it to the positive territory, while that for Germany remains negative. For Italy and Spain, the policy would strengthen the business case of solar PV even more.

With regard to onshore wind, the financial gap turns positive for France and for the Netherlands following the implementation of the GLTRO. For Germany, this is not the case, while for Italy and Spain investing in onshore wind becomes more attractive.

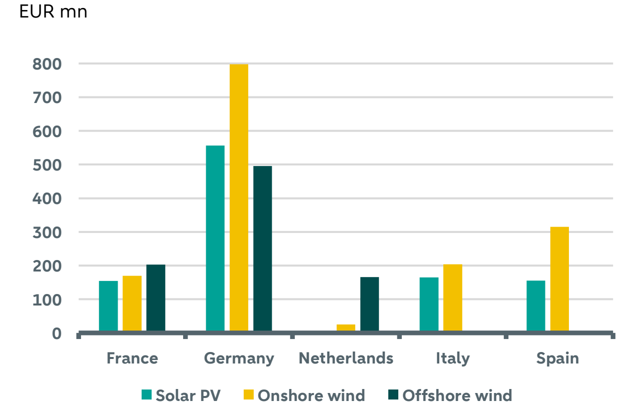
For offshore wind, the GLTRO is not able to close the gap for any country and the financial gap remains negative. However as illustrated in the left hand figure below which summarizes the change in the financial gap across technologies and countries between S400 and S200, the policy impacts for France offshore wind is the largest. The reasoning behind this is the same as discussed above.

Change in financial gap between S400 and S200



Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

Saved transition costs between S400 and S200



Source: Bloomberg, EC, own calculations, ABN AMRO Group Economics

The right hand chart above summarizes saved transition costs under this case (S400 deviating from S200 as a benchmark). The chart shows that Germany would save the most across countries for all technologies mainly because of its relatively higher capacity targets for all three technologies.

Comparing policy effects under this case with the S200 scenario discussed above, we find that the reduction in transition costs (associated to existing financial gaps), following the GLTRO, is higher by 1.4% under the debt only case. That is, a 200 bps GLTRO could reduce transition costs, associated to existing financial gaps, by 25.2%. The reason behind this is that a lower benchmark would increase the relative change in the WACC, and thus a higher relative policy impact.

Discussion, conclusion and further research

Discussion

This report shows that for selected countries, for solar as well as for onshore and offshore wind, the total cost difference of a 200 bps green rate would be 3.7 billion euro until 2030. This will be partly an increase in profitability (as with solar and onshore wind in Italy and Spain), but mostly (2.8 billion) will be lower losses, or a lower (negative) financial gap. If the cost of equity fell equally to the cost of debt, the cost difference will be substantially larger and increase to 8.2 billion euro, of which 6.1 billion will be lower losses.

As the covered countries cover only around 73% of the EU's current solar capacity, 62-79% of its onshore wind capacity, and 59% of its offshore wind capacity, the numbers for the EU as a whole would be higher.

Given that, according to the model used, the total additional transition costs associated to existing financial gaps for selected technologies and countries is 15.5 bn, a green rate of 200bps would reduce this number by 23.7% if only the cost of debt would be reduced by 200bps and by 52.7% if the cost of equity would be also reduced by 200 bps.

Moreover, if the policy is implemented when the ECB deposit rate would be back to 2%, the additional costs associated with financial gaps become 13.5 bn and the GLTRO would reduce this number by 25.2% if only the cost of debt would be reduced by 200bps.

The uncertainty of future power prices could be a serious impediment for the development of renewable energy. In such a case, an intervention is necessary. Such intervention could take the form of Contracts for Difference (CfD) which would guarantee project profitability if electricity price went below a certain threshold. Our results for the financial gap are based on the assumed average electricity price. More precisely, a negative gap would decrease, or turn positive, with higher prices, and vice versa. All other results regarding the policy impacts are independent from the electricity price since these results are calculated between scenarios in which the electricity price does not vary and thus its impact cancels out.

Our results are based on the market data as of the second half of 2023. Accordingly, our results may change following any change in this data. For example, a change in the cost or financing structures would induce changes in the LCOE and changes in the policy impact. Probably one of the largest uncertainties here is in the cost development of the different technologies. Both wind and solar have shown spectacular reductions in production costs over the last decades. These could continue but could also stall or even (temporarily) reverse due to supply chain bottlenecks or scarcity of raw materials.

Also there is uncertainty about the outlook for interest rates. The first reduction already took place in June and more are expected to follow. Hence, the reduction in rates of 200bps may well materialize through reductions of the general interest rate. Nevertheless, as illustrated in our analysis for S400 scenario, also then financial gaps remain while GLTRO impacts on transition costs became relatively lower.

Our results also highlight that a GLTRO on the European level would benefit some countries more than others. The ECB should take these effects into account when forming such policy.

Conclusion

This report investigated the potential impacts of GLTRO on the energy transition within Europe. Our analysis is based on comparing changes in LCOE for three main renewable technologies in main European economies. Under this framework, we track changes in financial gaps and transition costs under three policy scenarios. Our results show that for most countries the green TLTRO is effective in reducing transition costs. However, in some countries and for some technologies there is already a viable business case with the current interest rate. In contrast, GLTRO would still leave the financial gap negative for offshore wind and for Germany for all technologies. This means GLTRO would not be a silver bullet and would need to complimented by other interventions.

Still, our results show that the ECB could make a significant difference. More explicitly, a green rate of 200bps would reduce these costs by 23.7% in the case of a 200 bps reduction in the cost of debt, and assuming policy rates are cut to more neutral levels, the GLTRO impact would be even bigger. In the case of similar additional reduction, the cost of equity the relative impact rises to 52.7%. Furthermore, our analysis provides comparison of the policy impacts for wide range of power transition technologies for Germany. Finally, our results show that the impacts differ across technologies and between countries with Germany as largest beneficiary.

Further research

In order to better understand what the impact of differences in interest rates are on the cost of the energy transition, we see the following areas for further research.

First, more technologies and more countries require better modelling of costs as we have been able to do for Germany and was done by Bianchi et al. (2023) for The Netherlands. This is especially important if the time horizon extends beyond 2030 where such technologies may play a larger role.

Second, using updated data our results are based on data from the second half of 2023. This data contains many factors that continuously change. For example, CAPEX and OPEX costs across technologies and countries are changing over time. Future research on GLTRO should take this into account by frequently using the most up-to-date data for the analysis.

Third, extending the time horizon to cover 2050 capacity targets per country. Whereas we could calculate the financial gap, we could not translate this into absolute costs for 2050. This is because for some of the selected technologies there are no capacity targets defined per country until 2050.

Fourth, the effect on the total cost of capital of interest rate changes depends on the transmission into the cost of debt and equity. In our analysis, we assumed a passthrough rate of 100%. That is if interest rate changes by 1%, the cost of debt and equity would change by 1%. We acknowledge that in reality this is may not be the case. Accordingly, quantifying these transmission channels would help in quantifying the overall impact of GLTRO more accurately.

Acknowledgements

The authors would like to thank Nick Kounis, Sandra Phlippen, and Brenda Kramer for their valuable feedback on initial drafts of this report. The authors are also grateful to Aleksander Simic, Mark Sanders and Friedemann Polzin for fruitful discussions during the process. Finally, special thanks to Pauline Simon for her help in data collection.