CLIMATE POLICY INITIATIVE

Policy and investment in German renewable energy

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A CPI Report

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Descriptors

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About CPI

Climate Policy Initiative works to improve the most important energy and land use policies around the world, with a particular focus on finance. An independent organization supported in part by a grant from the Open Society Foundations, CPI works in places that provide the most potential for policy impact including Brazil, China, Europe, India, Indonesia, and the United States.

Our work helps nations grow while addressing increasingly scarce resources and climate risk. This is a complex challenge in which policy plays a crucial role.

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Executive summary

The relationship between finance and policy stands at the centre of Germany's twin objectives of reaching renewable energy deployment targets and doing so cost effectively. With the renewable energy industry maturing, and calls growing for improving the cost competitiveness of renewable energy policy, German policymakers and investors must continue to improve their understanding of how policy can influence the potential investment pool, and how policy can drive a robust and low-cost mix of investors and investment to underpin the continued development of a cost-effective low-carbon energy system. Climate Policy Initiative examined the availability of capital for renewable energy, the cost-effectiveness of different mixes of capital and investors used in meeting Germany's medium and long-term deployment goals, and the potential impact of policies on this mix of investment.

Our analysis indicates that, provided an appropriate policy framework is in place, there is more than sufficient capital available to meet German renewable energy targets, but that a mix of investors is needed to meet Germany's objectives at lowest cost. To meet deployment goals most cost-effectively in the medium term, Germany must meet the challenge of creating electricity system flexibility to facilitate integration of renewable energy without imposing unmanageable risks on renewable energy investors.

More generally, for investors we find that the most relevant near-to-medium-term policy decisions regard incentive auction design, end user participation, support design and long-term targets. However, for the medium-to-long-term development of investment, issues including curtailment policy and energy market design will become increasingly important and merit immediate attention.

Table 1: Overview of policy issues

POLICY ISSUE	RECOMMENDATIONS OR FINDINGS	QUANTITATIVE FINDINGS
INCENTIVE AUCTION DESIGN	• Frequent, predictable bid rounds reduce risks and costs • Small investors fear complex and costly bid processes • Exemptions for smaller projects or simplified bidding processes are needed to preserve Germany's diverse investor base	• A gap between auction rounds causing a 12-month delay in an offshore development can increase bid prices by 21% or more if delay expectations are reflected in bids
SUPPORT DESIGN	• Stable and reliable support schemes over longer periods allow higher leverage and reduce average energy costs • Indexing support to inflation could attract some institutional investors and reduce expected lifetime costs	• Shortening revenue support from 20 years to 15 years could increase energy costs 15-18% depending on the technology • Linking revenue support to inflation could decrease energy costs by 18-20% in real terms, depending on institutional investor appetite and how actual inflation evolves
END USER PARTICIPATION	• Auction design and exemptions, end user consumption options and support design should be tailored to continue encouraging investment from all investor groups	• Over 25% of 2015 equity investment and half of 2020 potential equity investment comes from end users
LONG TERM TARGETS	• Reliable long-term targets incentivise investments in project development and business processes that increase competitiveness and reduce costs in the long term	• Halving offshore wind targets would limit learning, potentially increasing the cost of energy by 6% by 2020 • Business process improvements drive cost reductions: From 2006-2014, non-module costs for PV systems fell 11.5% p.a. for large scale projects and 7.7% p.a. for rooftop solar.
ENERGY MARKET DESIGN	• Current energy market design does not reflect the reality of a renewable energy dominated system	• Current design could lead to zero or negative electricity prices for more than 1000 hours per year by 2030
CURTAILMENT	• Policymakers should consider alternatives to curtailment at times of negative prices including take-or-pay arrangements or proportional curtailment • Significant investment in system flexibility is required	• Current proposals for curtailment of production during negative price hours could increase onshore wind bid prices by 17% in 2020, if no other flexibility measures are taken
DEVELOPMENT COSTS	• Higher development costs could amplify any cost increases resulting from incentive auction design and a lack of long-term targets; policy should seek to reduce development costs (i.e. pre-auction costs or costs of bids that fail)	• Development costs for large projects like offshore wind can run to 50 million Euros or higher

1. Overview of investment and policy issues

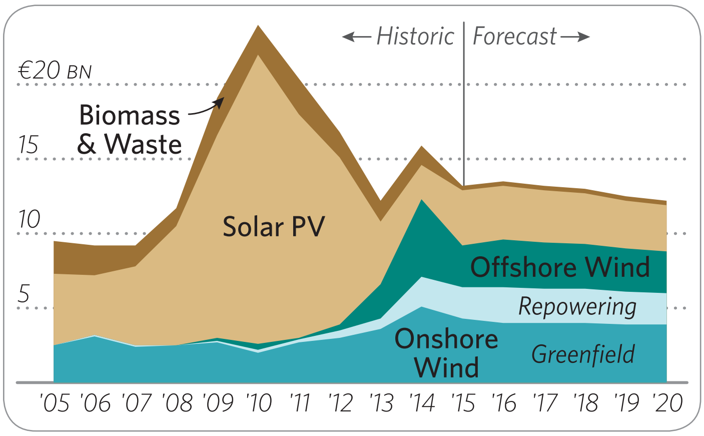
Between 2005 and 2015, investors poured over €150 billion into renewable energy in Germany (Figure 1). Energy companies and utilities, households, farmers, energy co-operatives, municipalities, banks, and institutional investors all provided capital to renewable energy projects, relying upon policy that provided reliable revenues, attractive returns and certainty. Since the cost of renewable energy was often higher than energy from more conventional energy sources, policy was needed to plug the gap between renewable energy costs and the prevailing market price for electricity.

Today, the cost of many forms of renewable energy has fallen to the point where the cost gap has virtually disappeared. Yet policy is still needed, not so much because there is a cost gap, but because the financial, operating and ownership characteristics of most renewable energy investments are different from historical, conventional electricity investments, and these different characteristics need to be integrated with the existing industry and market structures.

Policy and the cost and availability of investment are inextricably linked in balancing the German goals of meeting low carbon renewable energy deployment targets and keeping costs low. With the renewable energy industry maturing, and calls growing for improving the cost competitiveness of renewable energy policy, now is the time to evaluate the potential investment pool, and identify the investor and policy mix that can underpin the continued development of a cost effective low carbon energy system.

Climate Policy Initiative has developed the fact base upon which this evaluation can be based. In this evaluation we have addressed three main questions:

Figure 1: German investment in renewable energy 2005-2020



Source: BMWi

1. **What pools of capital are potentially available to invest in renewable energy in Germany and are these pools large enough to meet German policy objectives?**
2. **What mix of capital and investors is likely to be both low-cost and efficient and most likely to meet German renewable energy deployment targets?**
3. **How can policy enable both the right mix of investment and ensure that this mix of investment is achieved at a low cost for each individual investment source?**

In this first chapter, we summarise our assessment of capital availability and the impact of investor mix and policy.

One key difference between renewable energy and conventional power plants is the much wider range of investors that could potentially develop and invest in renewable energy projects. In Chapter 2, we identify these sets of investors and set out the motivations and constraints that drive investment in renewable energy, based on our interviews and analysis for each investor group. In Chapter 3, we offer a more detailed, quantitative analysis of the investment potential available for renewable energy in Germany for each of these investor groups.

With a more diverse set of objectives, resources and capabilities, renewable energy investors as a group will have more diverse and differentiated responses to policy than electricity industries have traditionally faced. Thus, an electricity system with a large component of renewable energy may need to think much more broadly about how policy will affect investment and the cost of energy supply. In Chapter 4, we highlight the short, medium and long-term policy concerns facing investors and assess their impact on the attractiveness and cost investment by different investor classes.

In Chapter 5, we conclude by approaching the policy analysis from four different perspectives to see how priorities could change if policy were focused on:

- Specific renewable energy technologies
- Developing a particular segment of investors
- Building renewable energy businesses as opposed to focussing on projects
- The long term of renewable energy investment versus shorter term cost effectiveness

CPI/ECF German Policy and Investors Study

Main input sources and activities:

1. Interviews with companies, financial institutions, investors and their advisors across the full spectrum of potential investors into German renewable energy;
2. Tests of opinions and responses to potential policy measures, including some of the most current relevant policy questions in play today;
3. Modelling of investment behaviour of all investor classes using financial models simulating real assets and investment decisions that these investors could face;
4. Convening of an advisory panel representing investors across the spectrum of size and industry to refine and validate the hypotheses and syntheses drawn from the interviews, analysis and modelling; and,
5. Synthesis of responses to policy and investment decisions to explore how these various pieces and investors fit together.

1.1 The availability of investment capital to meet German renewable energy targets

Provided that the right policy framework is in place, our analysis suggests that there is more than sufficient capital potentially available. Depending on the technology mix and trend in technology costs, our analysis suggests that there is potentially €25 - €35 billion of annual investment potential, 60-170% more than required to finance the German government's targeted deployment of around 7.4GW of new solar photovoltaic (PV), onshore wind and offshore wind capacity per annum in the years to 2020 (Table 2). Within technologies, there is more than double the required investment available for solar and offshore wind if attractive policy is in place for the right investors. For onshore wind there is slightly less spare investment capacity, although the greater maturity and competition in onshore wind – and the lower returns that have developed as a result - may be a contributing factor to the relatively smaller cushion available.

Table 2: Investment needs and potential

TECHNOLOGY	ANNUAL CAPACITY TARGET (MW)	INVESTMENT REQUIRED (€ BILLION)	INVESTMENT POTENTIAL (€ BILLION)	POTENTIAL/ REQUIREMENT
SOLAR PV	2.5	3.5 - 4.5	8.0 - 12.0	178%-343%
ONSHORE WIND	2.5 (net) 4.1 (gross)	6.0 - 7.0	8.0 - 12.0	114%-200%
OFFSHORE WIND	0.8	3.0 - 4.0	9.0 - 10.0	225%-333%
TOTAL		13.0 - 15.5	25.0 - 35.0	161%-269%

Source: CPI Analysis ; See Chapter 3 for more detail

Investment capital is not homogeneous. To achieve effective, low cost finance, projects or companies need at least three types of finance:

- **Short-term finance** covers the early stage, higher risk, and often higher return, segments of a project lifecycle including project development, construction and project commissioning. This capital is provided by project developers, utility companies, and banks.
- **Long-term debt** can bring in lower cost capital, generally supplied by banks or other financial institutions through project finance, or through loans or bonds to utilities, developers, companies, households or other long term equity investors.
- **Long-term-equity** is provided by the long term owners of the projects that may include utilities, developers, financial institutions, landowners, or energy consumers among others.

As in Figure 2, our analysis shows that in Germany there is sufficient capital available across all types of capital for each of the three major renewable energy technologies. The potential for long-term equity investment in solar PV is particularly large, owing to the diverse set of investors – ranging from households, commercial and industrial companies, cooperatives and financial

Figure 2: German renewable energy investment potential versus targets

	SOLAR PV	ONSHORE WIND	OFFSHORE WIND
SHORT TERM CAPITAL	156%		179%
LONG TERM DEBT	136%		291%
LONG TERM EQUITY	390%	235%	157%

Source: CPI Analysis; See Chapter 3 for more detail

investors - that are willing and able to invest in the sector.

The potential for long-term debt in offshore wind is also high, as the large project size and the professional and well capitalised position of the equity investors makes offshore wind attractive to institutional investors and banks. Since solar PV and some onshore wind projects in Germany are smaller in scale, lending directly to these projects is less attractive for lenders, as the cost of project evaluation is larger compared to the investment opportunity. Thus, lenders more often lend to the equity investor based on their credit risk, rather than to the project itself.

As we will see later, financial structuring and decision making processes have an important impact on the relationship between policy and investment. Thus, understanding where this potential lies and why these investors might invest in renewable energy may be more consequential for policymaking. There is a diverse range of motivations among different investor groups. For some it may be part of the core service of delivering energy to their customers. Others may regard renewable energy projects as a purely financial investment; some as a means to meet their own energy needs; while others are driven by a more moral imperative to contribute to the prevention of climate change, even if the financial returns on offer remain low.

1.2 Comparing the cost of renewable energy owned by different investors

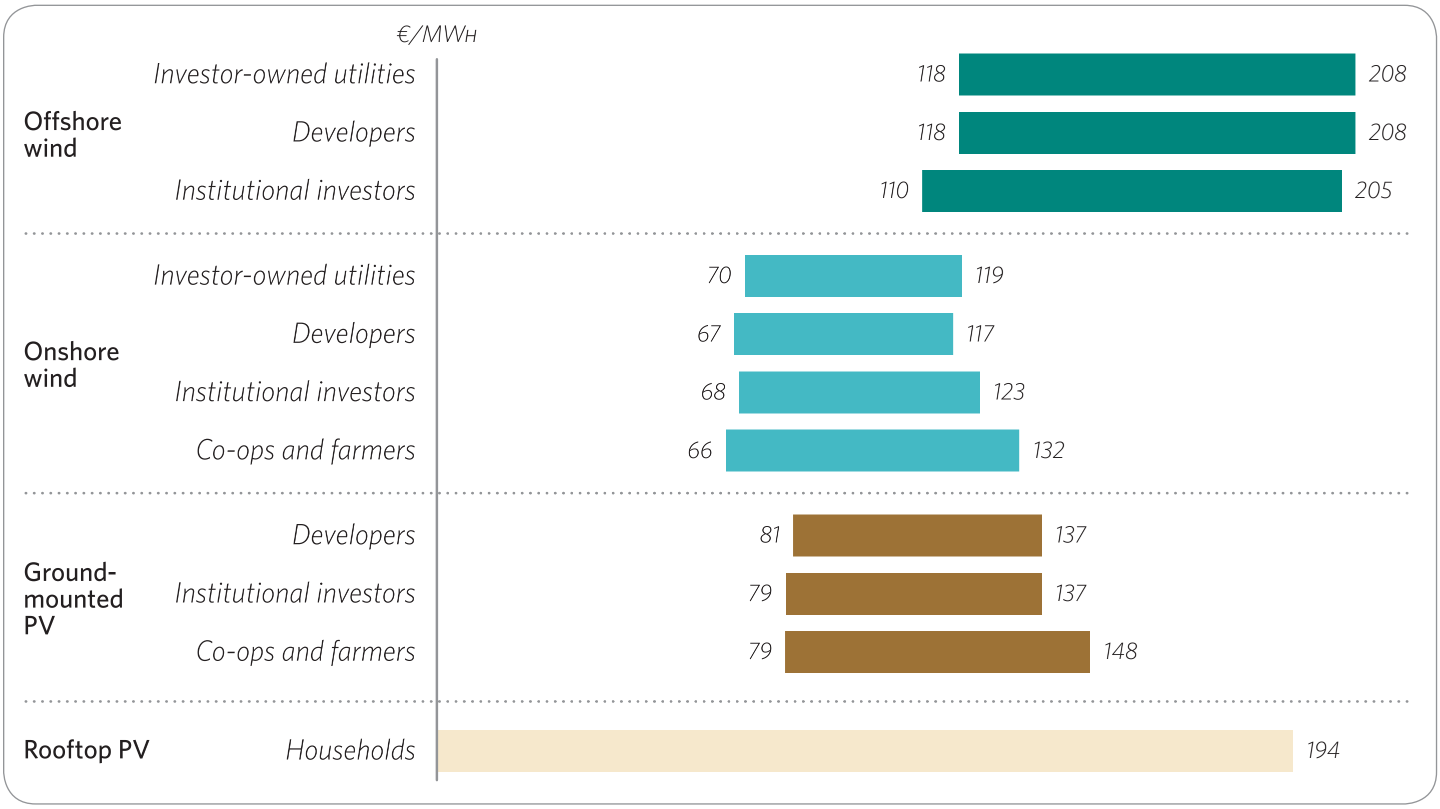
The average cost of electricity produced from a power plant over its life time – often referred to as the levelised cost of electricity - is a function of many factors including the initial capital cost, the return on that capital required by investors, expected output, fuel costs, operating costs and the lifetime of the power plant. For many new conventional powerplants this calculation is difficult because the cost of fuel and future maintenance costs can be very uncertain.

Renewable energy has no fuel costs and maintenance costs are generally much lower compared to fossil fuel power plants. However, renewable energy has wide range of potential investors which leads to large differences in the required return on capital. Since projects are site specific, initial capital costs and expected output are also very different. Furthermore, investors may make very different assumptions about costs, for instance, how much a household charges for the use of its roof, if anything.

Based on interviews with potential renewable energy investors across the investment and technology spectra, we analysed the range of lifetime prices for energy that would meet investor hurdles given their investment criteria (including the cost and availability of debt finance). For those able and willing to enter an auction process, the prices would represent the minimum price that these investors would be willing to submit or accept. Figure 3 shows the large range of potential bid prices within a technology, but also for specific investor types, often as a function of the quality of the site in question. Other investors, like some households, have completely different reasons for investing: some want hedges against future energy price rises, some want the pride of owning their own generation, while others wish to make their energy consumption more green. Many do not even think about the concept of return on investment in their decision making.

The diverse set of potential investors makes planning and optimum policy, very different for renewable energy than for conventional generation. Not only must policy ensure that the right mix of technologies get built to minimise future energy costs, but also that the right mix of investors emerge, to ensure that the low cost investor mix gets access to the market. Arguably, the optimum mix should aim to include the low cost portion of each technology.

Figure 3: Levelized cost of electricity (potential auction prices) by investor type and technology



Source: CPI Analysis

Further, these ranges will change as a function of technology development, investment in business processes, policy, experience and fashion. Fostering a range of investment now could ensure that low cost investment continues to be available in the future. Of course, this argument could apply equally to developing offshore wind as it would to ensuring that rooftop solar for households has a continued place in the policy scheme.

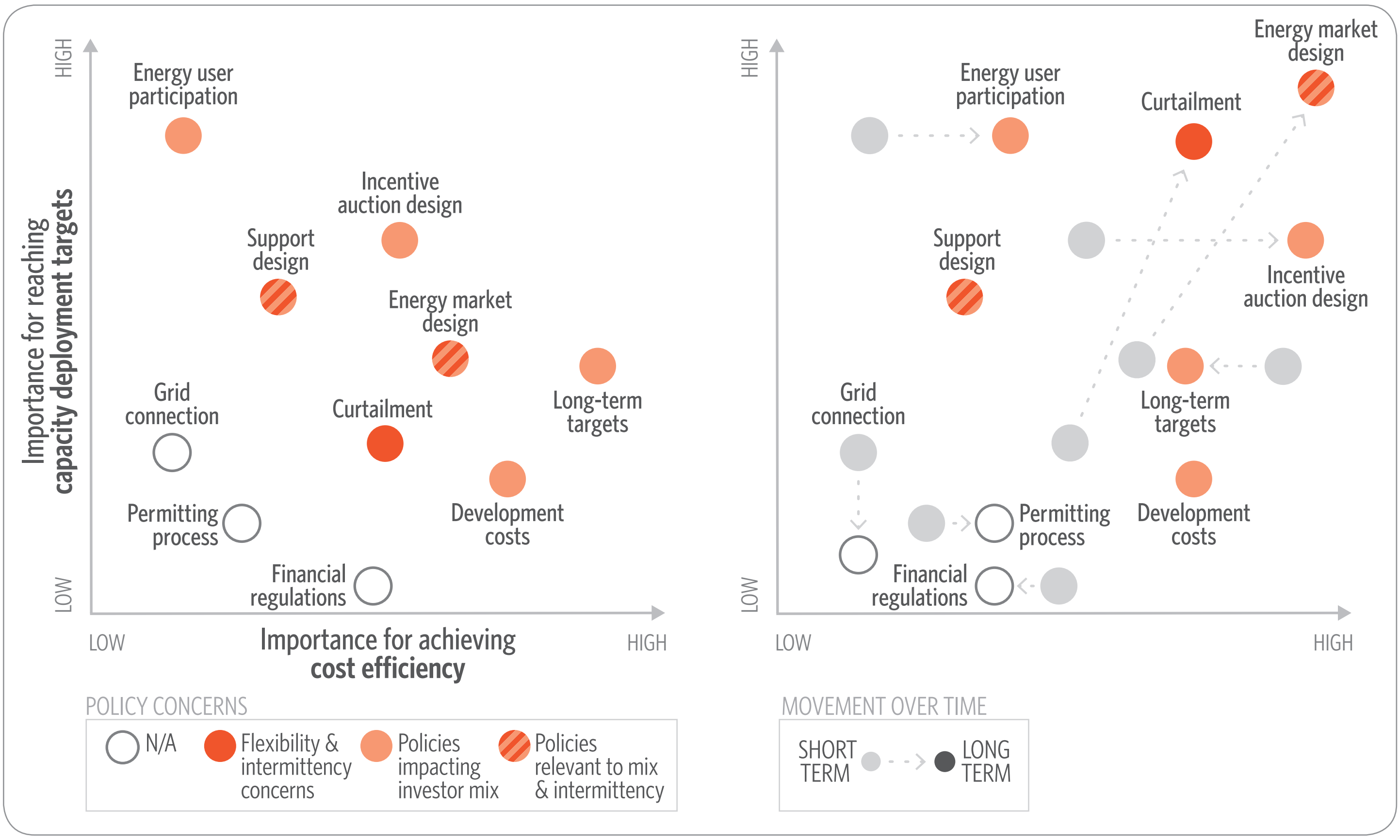
1.3 Policy elements influencing the mix and cost of investors in renewable energy

The interview process raised ten key policy areas that are of most concern to the various investor groups. While Germany has many objectives for renewable energy policy and development, we have identified the two most relevant to investor mix, investment and policy as being:

- Reaching renewable energy targets, which for investors translates into willingness to invest, and,
- The cost effectiveness of reaching those targets, which translates to the cost of investment for investors.

In Figure 4, we set each of the ten highlighted policy issues against these two objectives, showing how, given the level and nature of concern amongst the various investor groups, each of these issues could affect either the ability to meet deployment targets, or the cost of providing more renewable energy. The left-hand figure shows the more immediate concern of investors, while the right-hand chart shows how we think that concern could develop over time, given forecasts for market change and investor preferences. For example, with **energy use options,** small investors expressed concern that they were not directly able to use energy from their own rooftop PV or small scale wind turbines. As a result, they were less inclined to invest since there was a weaker link between investment and their desire to be green and self-sufficient and investment provided only a very weak hedge against rising future energy prices. In the near term, this issue has a strong impact on willingness to invest amongst "prosumers", that is, investors who would both produce and consume their electricity generation, but since there is much more than enough investment to meet targets, it has little impact on overall cost efficiency. In the future, if these excluded investors are lower cost than other renewable energy supply sources, it could have an impact on cost effectiveness as well (see right-hand figure). Each of these issues are laid out in more detail in Chapter 4

Figure 4: Key policy impacts on investment



Source: CPI analysis based on interviews

of this paper, including qualitative and quantitative analysis based on an investor type by investor type evaluation of the impact of different policies.

At a more aggregate level, the various policy issues identified reflect two general concerns facing investors:

1. How will the market design and its regulation deal with the changes needed to integrate renewable energy? More specifically, how will markets and prices adapt to the intermittency of renewable energy and the flexibility required to integrate intermittent energy into the system?
    a. Policy concerns include: the design of the energy market, renewable energy support and curtailment rules. All of these could determine how the cost of supplying more flexibility to the market will be included in energy prices, how renewable energy would be paid, and how the cost of flexibility could affect the revenues to renewable energy investments.
2. Will renewable energy policy favour one set of investors over another, potentially in the interest of cost efficiency or manageability of the industry?
    a. Policy concerns include: Energy use options (as discussed above), incentive auction design or development requirements that could be complex or costly and thus exclude small, unsophisticated players; or unreliable long-term targets that could make it difficult for large players to invest in their business and thus weaken their competitive position.

As in the right hand side of Figure 4, most of the concerns regarding either mix or flexibility are likely to grow stronger over time. The controversies around economic **curtailment** and **incentive auction design** represent the costs and trade-offs that need to be considered in the flexibility and investor mix policy arenas, respectively.

1.4 Intermittency of renewable energy and economic curtailment

Unless consumers are seamlessly able to adapt their energy usage to follow energy supply or new technologies emerge such as inexpensive energy storage, large quantities of intermittent renewable energy generation will lead to an energy system that in some hours has too much energy supply, while in others expensive plant may be needed to meet demand.

A key question for all involved in the energy system is who will pay to shift supply or demand so that they are balanced across every minute of every day. A corollary should be: what incentives are needed to create new, low cost, flexibility options on both the supply side and the demand side to reduce the future costs of balancing the market and thereby enable more investment, deployment and integration of renewable energy generation?

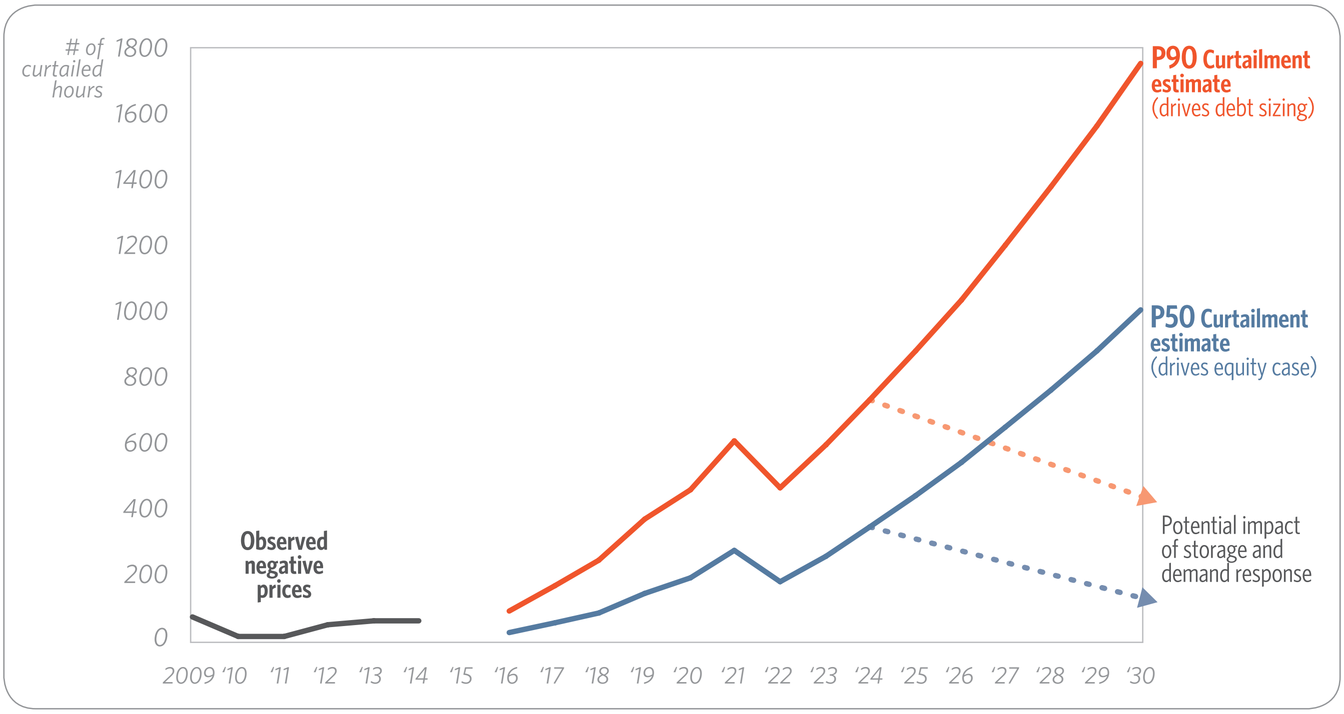
Current electricity market designs lead to negative electricity prices when there is an excess of supply on the system, effectively charging electricity generators for the cost of removing excess supply (and encouraging consumers to shift their demand to hours with excess prices). Over the last five years, prices on the German electricity system have turned negative on average less than a hundred hours a year.

With less than a hundred hours a year of negative prices, our interviews (Figure 5), unsurprisingly showed that most investors are relatively unconcerned. However, those that expressed concern often regarded negative prices as the single biggest issue facing renewable energy investment. To understand the importance of flexibility, we modelled the number of hours of negative prices – that is excess supply – Germany would face if flexibility remained at today's levels. Debt investors look at protecting their loans from default, and so look at downside probabilities as reflected in the P90 estimates above, while equity investors are more likely to look at average probabilities (P50). In either case, our analysis shows that in the absence of improved flexibility, negative prices will rise strongly in the coming years.

Renewable generation in Germany is usually paid a fixed price tariff for each unit produced and so is relatively unaffected by price fluctuations. With a guaranteed price, both debt and equity investors see renewable energy as low risk, lending more to the project and requiring lower returns, leading to a lower levelised cost of electricity (LCOE). Since renewable energy providers have close to zero variable costs and cannot control when the wind blows or sun shines, even if renewable energy generators were subject to fluctuating, but positive, energy prices they would not be able to respond, so the lower risk and cost from fixed prices leaves everyone better off.

However, as the price goes negative, the theory is that renewable energy producers could curtail their output, providing the flexibility by shutting off production to help balance the system. Unfortunately, our analysis shows that the cost of curtailing renewable energy is very high due to the revenue risk and uncertainty that it imposes on investors and the higher returns (and lower levels of debt) that would be required to compensate investors for that risk.

Figure 5: Estimated hours of negative prices in Germany – 50th and 90th percentile cases



Source: CPI Analysis; historic load data compiled by Paul Frederick Bach

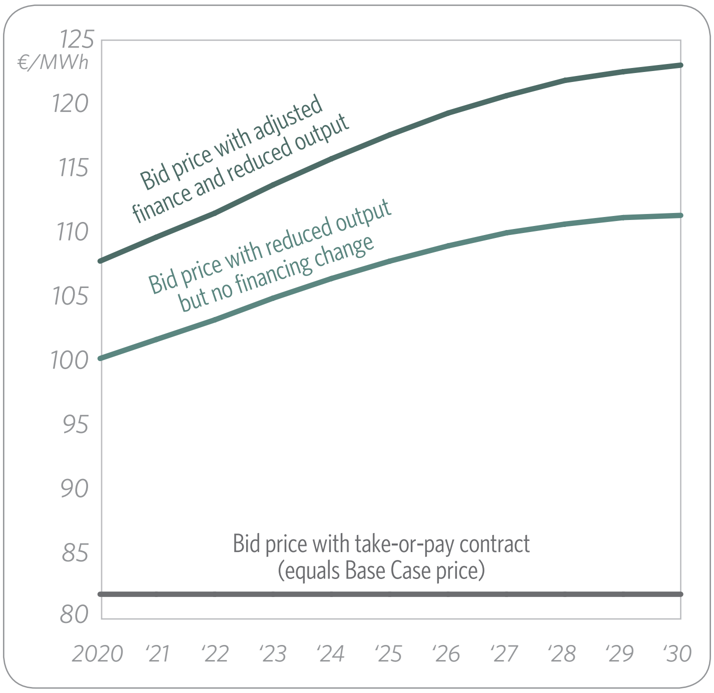
Figure 6 shows how investors would respond to the threat of reduced output and greater uncertainty in output if forecast curtailment levels reached those set out in Figure 5. By 2020, seeing curtailment levels approaching 500 hours by 2025 and then rising, investors would need prices over 30% higher to achieve their financial objectives than if they were paid for all of their output at the fixed price. About one third of this increase is because debt investors will lend less to the project because of the increased risk, while two thirds comes from the reduced output. In other jurisdictions, some investors have told us that an uncapped economic curtailment risk would make the market uninvestible.

The question, then, is whether there are less expensive ways of achieving this flexibility, and also whether the policy of economic curtailment of fixed price renewable energy tariffs makes sense. On the first point, clearly more research is needed and policy makers should redouble efforts to increase the number and quality of flexibility options available to the energy system. On the second point, we evaluated several different policy measures that have been proposed to address the economic curtailment issue (Table 3).

- **Take-or-pay:** One option would be to curtail production from renewable energy, providing flexibility for the grid, but continue to pay generators for the lost output. This option provides the lowest cost and risk while still offering the flexibility, but under current interpretations could run afoul of EU state aid regulations, by incentivising production when it was not needed.
- **Curtailment after six hours:** A modification that the EU deems consistent with state aid regulations restricts payment of a fixed tariff only during periods with 6 consecutive hours of negative electricity prices. This option decreases the cost of curtailment from over 30% to under 20%. In particular, this option significantly reduces the risk of particularly high levels of negative price hours and therefore increases the amount that debt investors would lend.
- **Proportional curtailment:** Negative prices generally occur when wind or solar generation is high. Our analysis shows that on average a reduction of only 15% of wind output during negative price hours would move prices into positive territory. Thus, a system that could curtail only the excess generation and allocate the cost of this curtailment amongst all fixed tariff generators would better reflect system economics. It also reduces the cost of curtailment to only 5%.
- **Add to the end:** under this option any hours that are curtailed during the 20-year support period – after incorporating the 6 hour rule - can be accrued and power generation beyond this support period can claim additional support until such time as the accrued hours are used up. However, high discounting of cash flows 20 years from now, as well as the fact that such a policy does not extend the operating life of the generation assets (and therefore would add no value if future energy prices are at or higher than the fixed tariff prices), means that this policy would add almost no value to investors.
- **Cap:** under this option we assume that in addition to the 6 hour cut-off there is a limit to the number of hours that can be economically curtailed each year. The impact varies as a function of the cap level.

From a renewable energy investor's perspective, the take-or-pay option, supported by intensive efforts to increase system flexibility is a clear low cost winner. As a next best option, caps on hours of curtailment and proportional curtailment limit the risk to investors

Figure 6: Impact of curtailment on energy prices or bid prices



Source: CPI analysis

Table 3: Different policy options for addressing negative prices for renewable energy

	AUCTION PRICE IN 2020 (€/MWH)		PRICE INCREASE COMPARED TO TAKE-OR-PAY		10-YEAR P50 AVERAGE PRODUCTION P.A. (GWH) 2020 GOING FORWARD		CHANGE IN PRODUCTION COMPARED TO TAKE-OR-PAY	
TAKE-OR-PAY	81.7		n/a		8,985		n/a	
HOURLY CURTAILMENT	107.7		31.8%		7,864		-12.5%	
CURTAILMENT AFTER 6 HOURS	95.9		17.4%		8,233		-8.4%	
PROPORTIONAL CURTAILMENT	85.9		5.1%		8,793		-2.1%	
ADD TO THE END	95.5		16.9%		8,233		-8.4%	
CAP LEVEL AT	0 HRS	50 HRS	100 HRS	200 HRS	300 HRS	400 HRS	500 HRS	600 HRS
AUCTION PRICE (€/MWH)	81.7	83.5	85.1	88	90.7	93.2	95.1	95.9

Source: CPI analysis

and the increase in cost. Beyond these near term policy fixes, policy makers need to consider carefully how the current market design leads to negative prices and how adjustments to the energy market itself could increase the incentives provided to consumers and technology developers to invest in increasing their contribution to system flexibility.

1.5 Incentive auction design and investor mix

As renewable energy has matured, calls have grown to expose the industry to more competition to create pressure to reduce costs and to ensure that prices reflect costs. Utilities and large scale developers work assiduously to develop cost-effective projects, and to reduce the risk of those projects. Their experience engenders cost-reducing system improvements and their size allows them to access large pools of capital. Thus it is logical to think that in a more competitive world they should be the natural winners.

However, they may not have access to some of the best resources or sites, such as the south facing rooftops of warehouses, and the very cost of their professionalism and project management systems could make them more expensive than competitors. In fact, investor-owned utilities (IOUs) in Germany focus less on onshore wind and more on offshore wind because only the scale and complexity of latter offers a competitive advantage to the capabilities that the IOUs have at hand. Furthermore, the shareholding structure of the utilities demands that they seek returns commensurate with other opportunities they may have, including projects in other countries. Thus their financing costs may be higher than competitors with different objectives or fewer opportunities.

As discussed in Chapter 1.2 above, the objective should be to select the lowest cost mix of investor/developers from across the spectrum. Incentive auctions, where renewable energy project developers are awarded fixed price energy supply contracts if they submit bids with winning (low) incentives or prices, is one tool that Germany is rolling out to create a competitive market and select investors. The competitive pressure of such auctions should encourage developers to find the best projects, develop and finish them as inexpensively as possible, while identifying the lowest cost financing. Furthermore, regular and predictable auction rounds will encourage developers to invest in business processes that will continuously reduce costs, in order to maintain or improve their competitiveness, with the result that costs for the industry should decline over time.

The downside is that incentive auctions impose costs, complexity and uncertainty that, at best, will be included in bid prices, increasing energy costs. At worst, cost and complexity could discourage whole sets of investors, limiting the pool of competitive investors. More significantly, higher costs and uncertainty fall much more heavily on smaller, less sophisticated investors and developers of first- or one-of-a-kind projects.

Figure 7 shows how investors respond to the key threats of incentive auctions: high transaction costs, complexity and the threat of gaming; a competitive environment; uncertain outcomes; and the impact of possible set asides for different technologies. Larger investors like utilities and large scale developers are very comfortable with auctions, believing that they will impose a discipline on the market that will keep the industry attractive for the long term. Their largest fear, that auctions could cause them to sink millions of Euros into development only for the project to fail at the auction, could be alleviated by frequent and predictable auctions and policies that keep pre-auction development and bidding costs relatively low.

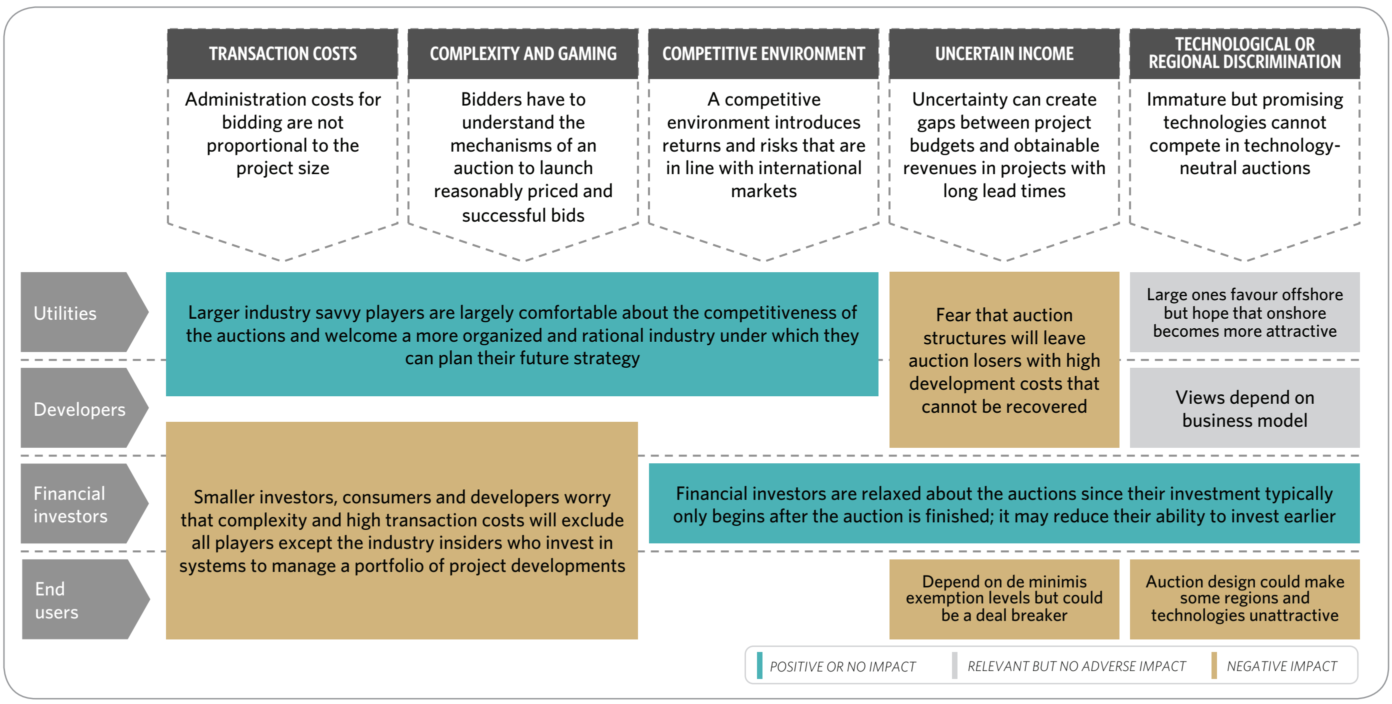
Smaller investors, including end users, are threatened by the complexity and costs of entering an auction. With no learning from participating in multiple auctions, their bid costs and risk of losing would be high, while smaller projects will have proportionally higher bid costs than larger projects that can amortise fixed costs over a larger investment (and multiple projects). Many smaller developers would choose not to bid.

The reduced competition could eventually lead to higher prices. In Germany, this effect may take some time to develop as developers and utilities told us that they have many projects in development that they can submit to early rounds. Competition amongst these projects will keep bids low. However, if development costs get too high, or the results too uncertain, decisions to stop developing new projects as a result will affect future rounds.

The absence of smaller investors could require more projects from the larger players, enabling more expensive and marginal projects to win bids. In the long-term, shutting down the small investor market could exclude many projects from development and could hamper the development of a whole range of sites, technologies and business processes that with more favourable policy could have become the most cost effective options.

Germany and the European Commission have set out de minimis exemptions, where projects below a certain size do not need to participate in auctions. Although these exemptions provide a route for the smallest of projects, auctions, along with limited end use options are providing pressure on a segment of investment that provided over a quarter of German renewable energy equity investment in 2015 and offers as much as half of the potential equity investment in 2020.

Figure 7: Issues around incentive auction design



Source: Interviews