Diminishing Russian Carbon Reliance: Funding the Household Renewable Energy Transition in Europe

Russia's invasion of Ukraine and the commodity prices fallout have once again highlighted Europe's dependence on Russian energy supplies and the general topic of energy security. A major uncertainty from this conflict is its implications for global carbon transition plans. The crisis has the potential to slow the transition in some areas, with decelerating climate financing and international investment if countries ramp up internal fossil fuel production or transition reliance to other oil and gas producers. Conversely, the conflict could also speed up energy transition efforts as countries look to diversify their energy supply away from fossil fuels due to fuel price spikes while decreasing dependency on Russia through strengthening green infrastructure. One necessary area of focus is the opportunity for households and small businesses to participate in the transition. In this report, KBRA UK Limited (KBRA) examines the opportunities—and financing obstacles—presented by solar compared to other renewable technologies. The European Green Deal includes a European Union (EU) directive that stipulates all member countries make community energy not only possible but also profitable.

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Key Takeaways

- The energy transition among households and small businesses is key to reducing reliance on carbon-based fuel suppliers.
- The US is ahead of Europe in terms of funding availability for individuals and small businesses to enable the transition.
- Project finance offers commercial scale capital market funding, and securitisation offers the ability to scale residential funding for capital markets.

Challenges to the Transition

- Choice of alternatives
- Funding choices
- Regulations, power volatility, and grid adjustments

European Transition Choices for Residential and Small Businesses

As part of the European Green Deal, the European Commission has set out many ambitious targets to achieving carbon neutrality by 2050. A key pillar of the Green Deal is to improve energy efficiency among new and existing buildings as part of a renovation wave across the continent. Approximately three-quarters of the EU's existing building stock is energy-inefficient, according to the European Commission. Residential homes and commercial workplaces represent a large portion of these inefficient buildings and are the largest consumers of energy, responsible for 40% of primary energy consumption and 36% of CO_2 emissions.[1]

Renewable energy generation options include:

- Onshore and offshore wind
- Solar photovoltaic (PV)
- Solar thermal and concentrated solar power (CSP)
- Geothermal, bioenergy (biofuels and biomass)
- Hydropower
- Marine

After solar PV, the available options for residential households and businesses to migrate towards a carbon neutral future are more focused on generation of heat and its conservation once generated. Home and business renovations can include improvements to insulation as well as migration to carbon-friendly heat generation. These include heaters such as ground source and air-source heat pumps, biomass boilers and heaters, or can include solar thermal panels, where solar energy is used to heat water.

[1] Home improvements for the planet | Research and Innovation (europa.eu)

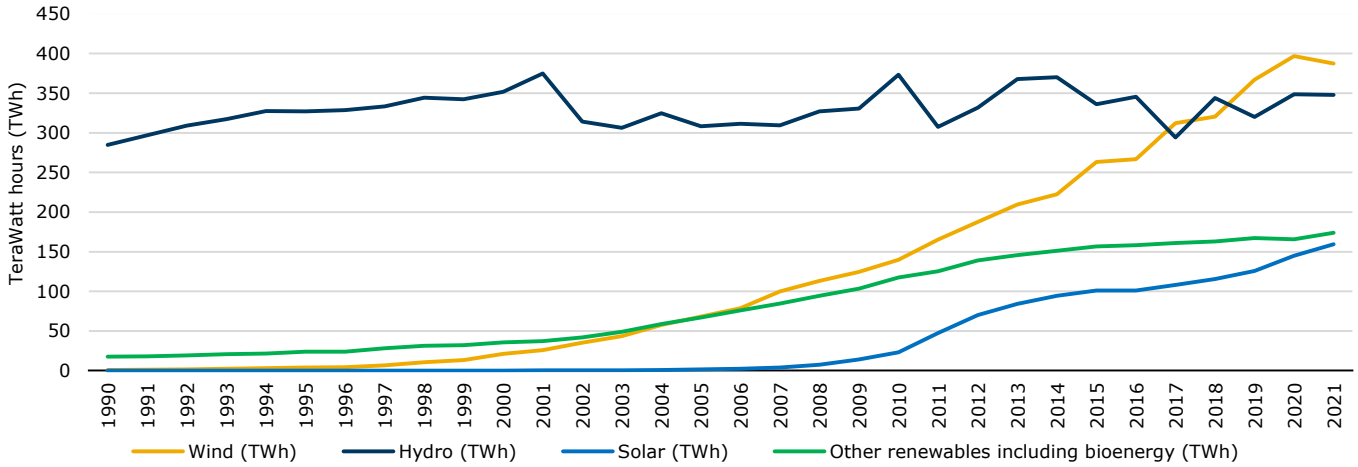
While there are ambitious plans to offer alternatives, the economic decision as it relates to switching the type of energy supply in the home or small business comes down to a choice between consuming gas, electricity, or biomass. The consumer then needs to select from among the available efficiency alternatives to generate heat and electricity on site. Currently, solar PV is the only real on-site choice to solely generate energy, as the other options require energy consumption (gas or electric) to become more efficient at powering or heating the premises.

In addition, solar stands out as the easiest renewable energy technology to implement. Solar has developed at differing rates in various EU countries, depending on the availability of subsidies and financing. In terms of large-scale projects, wind (both onshore and offshore) and hydropower have seen the highest uptake, although solar projects are making some headway.

In the EU, solar PV energy generation increased from less than 25TWh in installed capacity in 2010 to around 160TWh in 2021. Growth rates for solar PV capacity had trended above 25% since 2001 before declining from 2014, where it stood at around 0%-9% between 2015 and 2019. Solar growth rates reversed again in 2020, when it reached 15%, followed by 10% in 2021.

While solar remains the main viable small-scale option and is trending upwards, it still has a way to go before reaching the levels demanded by customers. Hydropower, for example, continued to see relatively steady growth with 300TWh to 375TWh produced between 1990 and 2021. Meanwhile, wind was the largest growth segment, with generation up from virtually nothing in 2000 to reach 367TWh in 2019 and 397TWh in 2020. It also outpaced hydropower generation (320TWh) as of 2019 (see Figure 1).

Figure 1: Renewable Energy Generation, 1990-2021



Source: Our World in Data based on BP Statistical Review of World Energy and Ember

Europe's Available Energy Transition Funding

Affordable funding is needed to increase adoption of residential and commercial renewable development. In Europe, most countries implemented an incentive model to increase development and expand renewables, particularly for solar PV panels and their components. This expansion helped to broaden the adoption of solar PV which in turn brought down equipment costs. The funding incentives as well as solar PV deployment varied from country to country. However, since the initial incentives in 2010-2013, various country government support has declined and the market has adapted to survive on its own commercially.

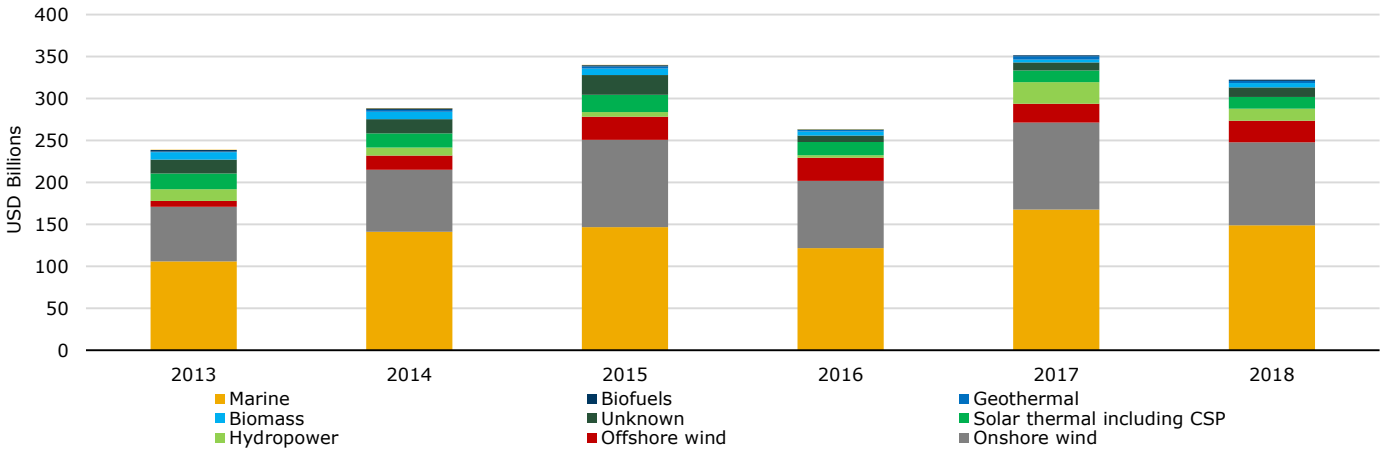
In 2020, the International Renewable Energy Agency (IRENA) and the Climate Policy Initiative (CPI) published a report outlining the renewable energy finance market.[2] Investment in renewable energy steadily increased from USD239 billion in 2013 to reach its peak level of USD351 billion in 2017, before falling slightly to USD322 billion the following year. This drop in investment partly masks the fact that reduced technology costs still allowed for greater installed generation capacity per dollar invested. As discussed earlier, installed renewable generation capacity increased in 2018. Installed solar PV and wind (onshore and offshore) increased 6% in 2017, following an additional 149 gigawatts (GW) capacity. Further, separate data from IHS Markit suggests that capacity has grown at a double-digit rate in both 2020 and 2021, and is expected to rise again in 2022.[3]

Over the report study period, solar PV and onshore wind represented the biggest investment focus among all renewable generation sources globally. In 2018, solar PV capacity attracted investment of USD149 billion compared to USD99 billion for onshore wind (see Figure 2). Western Europe remains one of the largest areas of investment for renewable energy. In 2017-18, it represented 15% of total global investment in the sector, at an annual average of USD51 billion over the period.

[2] Global Landscape of Renewable Energy Finance 2020 (irena.org)

[3] Global solar PV installations to grow 20% in 2022, despite rising costs: IHS Markit | IHS Markit

Figure 2: Funding by Renewables Type, 2013-2018 (USD Billions)



Source: International Renewable Energy Agency

The advent of newer technologies such as battery storage (which to date have been typically financed as part of larger solar or wind transactions) has begun to attract utility-scale and project finance interest. Battery storage also presents an opportunity to de-risk some of the resource risks associated with solar in European countries that struggle with a predictable and regular source of irradiation. Advancements in technology associated with battery storage and a greater availability of funding for storage can help with the transition brought about by solar technologies (on both a small and utility scale).

After a period of incentives to help develop the homeowner and small business renewables markets, there is now a greater importance on community-based energy and a greater focus by EU governments to support the funding opportunities similar to the experience in the US.

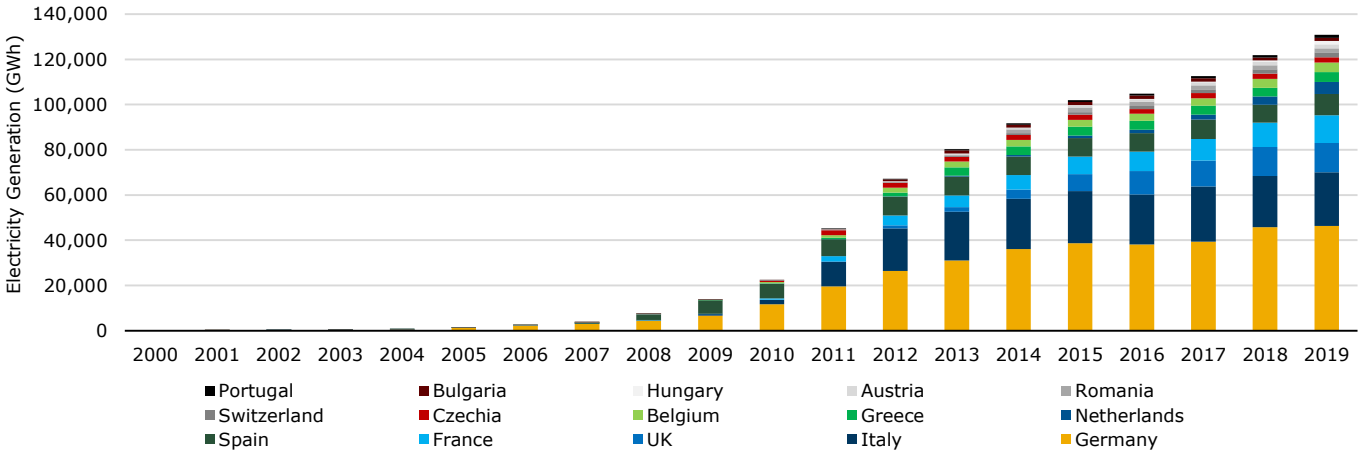
For example, Ireland's Micro-generation Support Scheme (MSS) allows homes, businesses, farms, and communities to receive a payment for any renewable energy they export to the grid. The scheme, which was implemented in February 2022, hopes to generate 380MW of installed micro-generation capacity and contribute to the country's solar renewables target of 2.5GW under the Climate Action Plan. The latter equates to more than 1 million solar PV panels on approximately 70,000 buildings.

In Spain, the EuroPACE project, akin to the US's property assessed clean energy version, has been trialled in a public-private partnership (PPP) in Olot, Spain. A consortium of seven companies, energy agencies, cities, and nonprofits digitalised the entire renovation process. The EUR1.87 million financing was mobilised for smart homes, better accessibility, energy-efficient windows and doors, insulation, heating and cooling, including renewable energy solutions. The process worked in three parts: (1) a digitalisation of the home renovation process, providing an online tool to provide technical advice, support, training, verification and financing services; (2) a process to pair local homeowners with selected contractors, and have the works verified and certified; and (3) financing the renovations with the backing of local and state governments, given that energy retrofits are a public good, and which justified the use of a tax system to support the collection of loan repayments. However, the various tax regimes across Europe present many challenges to this type of funding at the EU level.

The Solar PV Market in Europe

Through 2019, 79% of European installed solar PV capacity is generated in just six countries: Germany (35%), Italy (15%), the UK (10%), France (8%), Spain (6%), and the Netherlands (5%). These countries are expected to continue their dominance given their energy demands and relative sizes. There are 15 European countries with over 1,000GWh of solar PV generation as of 2019. This compares favourably to the three countries (Germany, Italy, and Spain) that were above 1,000GWh in 2010. There are plans to increase capacity in a number of European countries, but as of now the larger capacity country contributions to solar electricity generation are outlined in Figure 3.

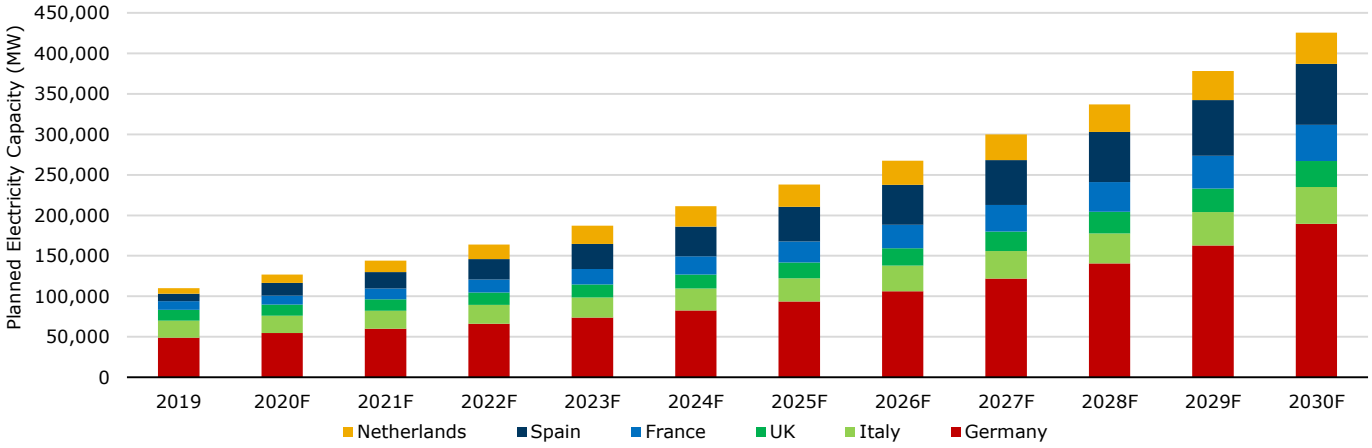
Figure 3: Solar PV Capacity Across Europe, 2000 to 2019



Source: International Renewable Energy Agency

In total, the planned expansion of European solar PV capacity is currently expected to generate around 570,000MW by 2030. While many of the smaller countries are expected to grow rapidly, capacity from the largest six producers is expected to jump to 425,000MW. Spain is expected to increase solar capacity by 735% between 2019 and 2030, followed by the Netherlands (+435%), and France (+315%). The remaining countries are expected to more than double their capacity from 2019 to 2030 (see Figure 4).

Figure 4: Solar Photovoltaic Forecast Capacity Growth Across Europe, 2019 to 2030F



Source: International Renewable Energy Agency

Regardless of the type of renewable energy, an economic forecast is needed for the "payback" period of the upfront investment. For example, the cost of rooftop solar panel installation can reach around EUR10,000. Most consumers may not have the money readily available, and if they do, they will need to be convinced that the cost of installing the panels will pay them back through lower energy bills over time. For many of the alternatives, these payback periods can be quite long, ranging from five years to over 20 years, depending on various factors such as government support, prevailing energy prices, and the cost of the project and financing alternatives. Recent increases in energy prices should help to reduce payback time frames, but as panel prices have recently increased due to commodity price inflation and shipping costs, this could offset the gains from higher energy prices.

Solar PV Funding Options Across Europe

The European Commission had sponsored a study on the various funding models for solar PV between 2015 and 2017, as part of the EU's research and innovation funding programme, Horizon 2020.[4] The study found some best practices for solar PV funding across the different countries. There were various methods of funding, including debt and equity-based schemes. On the equity side, financing was provided by private equity, leasing, crowdfunding (crowdfunding was found to be used for both debt and equity), and energy cooperatives. In regards to the debt schemes, these focused on project finance, loans, and bonds.

[4] Project Structure | PV FINANCING (pv-financing.eu)

Self-Funded
Individuals with a positive environmental attitude are more likely to willingly self-fund the installation of solar PV. This may be due to the support offered by feed-in-tariffs or due to the desire of the homeowner, business owner, or landlord to lower their energy bills regardless of the payback timing.

Crowdfunding
Crowdfunding was used for projects searching for broad public acceptance or local participation in the commercial or utility segment. Crowdfunding is 5apitaliz through online platforms or banks as well as directly by the company wanting to install the system. Crowdfunding schemes can be based on equity or debt. This funding has been widely used in France and Germany as local multifamily housing, public sector, and some commercial projects 5apitalize on local interest to generate the funding needed for their energy transition. It has also been used in Italy and the UK.

Private Equity
While private equity is mainly used for small installations in residential and commercial projects, it is also a contributor to large installations as well. This type of funding is typically used because of the relatively low investment costs of smaller installations as well as the avoidance of financing costs.

Leasing
Leasing is mainly found in the residential and small commercial segment. Leasing provides a service package that includes all investment and operation expenses, which appeals to those not willing to own the panels or be responsible for maintenance. The consumer pays a fixed monthly rate or is billed according to consumption. Leasing is more common in larger schemes and public projects. It has been used in most countries but has proven especially popular in Germany and Austria. In Turkey, it has also been used for larger industrial installations.

Energy Co-operative Schemes
Energy co-operative schemes can be found in several countries, including in the EU, but is so far most active in Turkey. The European Commission estimates that citizen-run energy cooperatives could own 21% of installed solar capacity by 2030. The scheme is typically used for larger installations with multiple stakeholders looking to support a project. The co-operative structure and the opportunity provided to the investor or sponsor are very case-dependent.

An example of such an energy co-operative exists in Heilbronn, southwestern Germany. Heilbronn has installed 126,000 solar panels on the roofs of homes, kindergartens, municipal buildings, and factory halls. The Heilbronn initiative is part of a nationwide network of roughly 900 community energy co-ops that sell renewable energy to German households and businesses. Across northwestern Europe, experts estimate that more than 10,000 community energy associations now exist, mostly in Germany, Denmark, Belgium, the Netherlands, and the UK. The co-operatives operate with solar generation, wind power, small hydroelectric plants, bioenergy, and even combined heat and power plants.

Project Finance
Project finance is mainly used for large utility-sized installations, and in some cases in commercial systems. Given the scale of these projects, there is typically a great deal more effort involved due to the local regulatory approval process. These schemes focus on the economics provided by stable positive cash flows and have typically been used in markets with feed-in-tariff schemes or other forms of regulatory support where cash flows can be predicted and are economically viable. Under the project finance model, power purchase agreements (PPA) can also be entered into but their reliability will depend on the credit standing of the counterparties and contract terms. Contracts for differences (CfD) for funding of solar farms on a smaller scale (10MW to 20MW) has been important in providing stability to the revenue profile of smaller solar projects, making them more attractive to lenders from a credit quality standpoint. Given the withdrawal of direct government support to renewable projects, utility-scale solar project finance transactions are increasingly being exposed to merchant risk (see Demand for Environmentally Friendly European Power Assets Risks Weakening Credit Profiles).

Loan
Loan schemes are mainly found in the commercial and utility segment, but some countries' residential investors and homeowners are making use of loans. The challenge is the availability of residential lending for solar PV installations within the various countries. The relative costs for residential users are higher than for commercial and industrial as typically the financing must be guaranteed by other assets, such as adding the funding to a mortgage. Loans are used to varying degrees in most countries across Europe. Given the demand on banks and other finance companies to invest into greener technologies and adjust their books to be more environmentally friendly, dedicated green lending is showing signs of adoption. A number of nonbank finance providers have begun to look at methods such as securitisation to expand their lending further.

Bonds
PV bonds have been used in several European countries for medium and large plants. They are backed by the issuer's balance sheet. The bonds are usually used for a portfolio of projects which might include other renewable installations.

Securitisation: The US Solar and PACE Markets

Project finance schemes in the bank and capital markets have been used in Europe to fund utility-scale solar transactions since the early 2000s. In contrast, securitisation financing opportunities only emerged in the US about a decade ago following the advent of solar rooftop technologies. This involved a portfolio of smaller sized assets and the securitisation of the future cash flow streams from customer agreements. An example of the early role of capital market securitisation as a means of funding solar transactions was the 2014 SolarCity LMC Series II, LLC loan, which included a mix of residential, commercial, and government entities in California.

In Europe, the use of securitisation for the purposes of funding green projects and initiatives has been slow to develop. While government efforts in Europe are dedicated to developing funding for renewables, the use of securitisation has not lived up to its potential, which partly reflects the nature of the funding available. In the US, about 70%-80% of solar PV comes with some form of financing, either through a loan, lease, or PPA. In Europe, there have been several dedicated transactions in the form of green mortgage lending. However, in order for the market to capitalise on the advantages of securitization, support is needed for other types of products to develop. In the US, securitisation has played a vital role in supporting the development of funding in the solar market as well as property assessed clean energy (PACE) loans, both areas where KBRA is active. US solar funding comes in two variations, namely, residential solar loans, as well as residential solar lease and PPA.

To gauge the full potential of certain funding tools such as securitisation of cooperative/community funding, it will be important to observe to what extent the EU generates a level playing field for residents and community energy co-ops to the same incentives, financial supports, and advanced technologies as the larger integrated utilities.

Residential solar loans are offered to customers through an indirect sales model, where installers sell solar energy systems to homeowners. As the cost of these systems can be relatively high, installers offer financing options to cover purchasing and installation costs. These financing options are supported by solar finance companies that maintain relationships with approved installers and purchase the loans from the installers. The loans are generally purchased at a discount based on the loan term, credit quality of the borrower, annual percentage rate, and installer agreements. The financing company/installer relationship is mutually beneficial for both parties. The installer benefits by having a financing option available to make the system affordable for customers and creating a monthly payment that may be in line with their current utility payment (depending on the tenor selected), while the solar finance company benefits from purchasing the loan (typically at a discount) and earning interest income or a gain-on-sale when it is sold to a whole loan buyer.

Lease contracts and PPAs operate on a third-party ownership model, since under these agreements the lessor (who is also the lender) retains ownership of the physical solar PV system and the customer purchases the energy produced. As a result, operations and maintenance of the panels are obligations of the lender, not of the property owner.

Similar to many European countries, an incentive model is in place to support the adoption of solar PV installations. In the US, this is done through tax credits rather than generation tariff support. These tax credits are beginning to roll off, similar to the decreasing tariff support across Europe.

In the US, the tax system also uses PACE programs, which typically enable local governments to finance renewable energy and energy efficiency projects on privately-owned residential, commercial, agricultural, or industrial properties. The general purpose of a PACE program is to promote energy efficiency, water conservation and renewable energy improvements, support green job creation and stimulate economic activity. The programs are financed through the tax authorities, and the borrower repays the loan through their property tax bill. This places them in seniority to a homeowners mortgage payment priority, thereby supporting their recovery and making them attractive for securitisation investors.

KBRA is very active in rating solar loan ABS, solar lease and PPA ABS, residential PACE, and commercial PACE securitisations. In total, KBRA has rated 81 solar ABS transactions and 31 residential PACE transactions since 2014.

Development of a European Solar Securitisation

There are several reasons why the European market has not adopted the use of securitisation to support funding of the energy transition. But these dynamics are changing rapidly as the cost of energy increases, as best illustrated in the immediate aftermath of Russia's invasion of Ukraine on 24 February and the broader call for Russian energy supply independence on the continent.

There is currently a lack of widely available financing options for individuals to support the energy transition. While some European countries have support in place, funding can be difficult to achieve or is targeted at specific areas such as insulation. We have found selective government-sponsored initiatives, such as energy efficiency improvement loans in Germany that are underwritten by KfW, or an additional EUR26,300 available to Dutch mortgage borrowers on their NHG guarantee for energy efficiency improvements on their homes. However, these do not necessarily go far enough.

In addition, some governments have decided to support projects on the energy side to make the product more appealing for development, rather than supporting the funding of the development. For example, the use of feed-in-tariffs increases the value of the energy produced but does not help the borrower fund the upfront cost. This is changing as government tariffs roll off and new grants emerge. For example, the UK's latest scheme for supporting the adoption of air-source heat pumps includes a grant to lower installation costs, while on the continent, EuroPACE (a public-private funding initiative), helps to lower the financing costs of home improvement projects.

Challenges to the Transition

In addition to homeowners' competing choices for a more carbon neutral energy supply, challenges remain in the development and use of solar PV. Regulations are evolving and incentives could be changed, making the choice for consumers even more difficult. Further, there are challenges associated with infrastructure, as the grid adapts to fluctuating energy levels and changing demand dynamics related to renewables' increasing share of the power generation mix.

Regulations

Feed-in-tariffs have historically supported the adoption of utility-scale renewable financing as well as homeowner installation. Tax incentives, grants, and renewable support schemes targeted at smaller size businesses and households, as well as community initiatives, are also associated with smaller scale solar transactions. The removal of such support measures will require the market to develop on its own, exposing it to pricing risk. If regulators decide to adjust the current system by increasing or decreasing incentives, this could create confusion and a lack of certainty with regards to navigating the payback for installation.

Regulatory approval for the installation of solar panels is typically required as part of the property renovation process. The approval process can be cumbersome and time-consuming for many consumers, but installers have historically helped them navigate the paperwork. Any changes to this process, such as greater incentives to different technologies, can increase challenges to consumers looking to renovate their homes to be more energy efficient.

Further, there is a need to ensure regulation that supports large-scale utility initiatives does not come at the expense of small-scale schemes. When European countries (including Germany in 2017) began holding auctions for the development of large renewable energy projects, larger vertically integrated solar and wind projects led by the integrated utilities were favoured. These producers could afford to bid a lower price than the smaller cooperative initiatives.

Pricing

Recent challenges associated with supply channels and the relative cost of materials needed to manufacture solar panels has increased the cost of solar PVs. This can change the demand from utilities and consumers as the cost of the project increases, thereby lengthening the payback time frame. The cost of solar PV panels has dramatically reduced over the last 10 years as panels became more efficient and the manufacturing costs declined with economies of scale gained from higher demand. In 1990, solar PVs reached USD8.81/Watt compared to USD2.04/W in 2010 and a low of USD0.20/W in 2020. However, post-COVID increases in shipping and raw materials has since increased the cost of solar PVs to USD0.31/W. Prices are unlikely to decline given the current supply chain issues and overall constraints on commodity supplies and increased pricing.

Individuals need to assess the payback periods for their investment. Recent movement in pricing has shifted the economics. As the cost of electricity increases, the appeal of renewable energy such as solar PV is improved. Consumers' net energy consumption from the grid is decreased, therefore increasing the ongoing savings in energy bills. However, as the cost of the solar panels rises, this increases the upfront cost to the installation. As a result, the time to recover the upfront costs through energy savings may be extended, despite the decrease from higher ongoing grid energy costs. The ongoing squeeze on consumers pockets as inflation increases costs and decreases available savings makes it challenging to invest into the installation of renewables. This is where low-cost funding would be helpful to support the initial outlay by consumers and lower their net energy consumption levels.

Grid Impact

The migration to renewable energy is an overall positive, but there remain challenges to its implementation at an infrastructure level. Existing grid networks are set up to distribute power to homes and businesses at a steady rate and pace. Power demand can generally be forecast with some daily fluctuations expected. This demand can typically be met by traditional non-renewable generation sources, allowing suppliers to increase or decrease supply according to demand. However, with renewable energy, the variability of supply is increased. It can be difficult to predict irradiance and wind strength on a daily basis, for example. Further complicating demand is the democritisation of power generation, where consumers effectively become their own suppliers.

What Happens Next?

Government policy is likely to rapidly change in the wake of the invasion of Ukraine as countries look to increase their energy security. This will likely lead to an acceleration in renewable energy projects. Government support could take many forms, including greater incentives or funding. But the challenge for energy transition lies in the upfront cost. One aspect that made solar and PACE securitisation a success in the US was the availability of funding to support upfront development costs. In Europe, both private and public finance is needed to provide specific support among household and business sector driven investment into renewables and to minimise European reliance on large-scale integrated utilities that are only providing utility-scale projects. Previous examples of government guarantees, such as those employed by the European Investment Bank, could be an effective tool to support low-cost source of funding to help consumers transition their energy consumption.

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