# EXAMPLES OF INNOVATIVE FINANCING SCHEMES

2019

EurObserv'ER

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## *Examples of innovative financing schemes*

## CASE STUDIES

# INNOVATIVE FINANCE SCHEMES

**Under the current macro-economic trends, the so far abundant support system for renewables (mainly in the form of feed-in-tariffs and quota systems) has been drastically modified. In many EU countries, companies are trying to find alternative ways to secure financing for their renewable energy projects. Therefore, new ways of attracting private capital for the realisation of green energy goals have to replace the old schemes.**

**Some new forms of financing are coming together with the EU Cohesion Policy2014-2020 (project guarantees, packaging of small project for micro-financing schemes at the regional level, preferential loan instead of subsidies etc.). Advanced financial structures are likely to play an increasingly important role in the allocation of risk and reward among different investor classes. The finance and investment gap needs to be filled by the private sector. The challenge is to identify the appropriate policy options and financial tools to attract and scale-up private investments. There are, however, already innovative and promising business and financial models to promote the deployment of RES in the EU.**

**The aim of the EurObserv'ER case studies is to find such examples and describe them so as to put forward the best practices and the replicability of the future promising financing mechanisms. EurObserv'ER will aim at choosing only the most promising ones and try to describe them in order to promote replicability in other geographical areas. The selection criteria for the choice of case studies should ensure (i) diversity across regions and RES, (ii) diversity across finance instruments/mechanisms, (iii) success of approach and its potential to be replicated, (iv) and a wide range of the "size" of actors/ investors and the resulting RES investments (capacity).**
**The current selection also takes into account the fact that there were already some case studies published in 2014, 2015 and 2018. These are also available for download on the project website : www.eurobserv-er.org**


# GREEN POWER PURCHASE AGREEMENTS (PPAs)

## POWER PURCHASE AGREEMENTS AS EMERGING FUNDING MECHANISM

Green Power Purchase Agreements (PPAs) have become a trend topic in the renewable energy finance sector and have attracted the attention of market observers in many EU member states.

PPAs are by no means a new concept and they have been around in the energy industry for decades. A PPA - in very simple terms - is an individually negotiated supply contract between a generator of electricity and a buyer. A typical PPA will eventually run for 10-20 years and thus provides contractual security for a longer time. In the form of Green PPAs, however they gained more and more relevance over the past years. The growth of PPAs has been facilitated by the fall in the cost of renewable energy technologies, especially of solar PV modules (panels) and wind turbines. The significant surge in Green PPAs was largely driven by the demand of utilities and other corporates within the commercial, industrial and institutional sector. In countries that used guaranteed fixed feed-in tariffs to support their first renewable energy systems, e.g. over a 20-year term, like in Germany the initial support schemes for old renewable power plants are ending, rendering alternative funding mechanisms more relevant for owners of ageing plants that reach the end of the fixed feed-in support. Such plant operators must therefore find ways to ensure their continued operation economically. The use of PPAs is not necessarily limited to the sector of renewables, but this has become their main field of practical implementation. The instrument gained attractiveness for large wind energy and large PV projects as *initial* financing instrument. When these PPAs take the form of long-term purchase agreements, they represent one alternative business model for generators of electricity that can enable the raising of long-term project finance debt, provided the creditworthiness of the corporate off-taker is sufficient for the lenders. The agreement wording mainly includes provisions on the contract parties, pricing, quantities, duration, performance securities, contract adjustments and guarantee of origin.







**1**

*PPAs in Europe, end of 2018*

| MW | Wind onshore | Wind offshore | Solar PV | Total |
|---|---|---|---|---|
| Scandinavia (Sweden, Finland, Norway) | 4.095 | 600 | | 4.695 |
| Spain | | | 1.661 | 1.661 |
| UK | 333 | 860 | 367 | 1.560 |
| Italy | 693 | | | 693 |
| Netherlands | 548 | | 68 | 616 |
| Ireland | 78 | | | 78 |
| Germany | 65 | | | 65 |
| Poland | 45 | | | 45 |
| France | 41 | | | 41 |
| TOTAL | 5.898 | 1.460 | 2.096 | 9.454 |

*Source: Energy Brainpool 2019, page 5. Figures as of end 2018, in MW, for 2017+2018 based on research of public sources.*

## CORPORATE PPAs: EUROPE CATCHING UP TO THE US

From a global and historical perspective, the US has paved the way. The growth of PPAs there has largely been driven by multinational companies. Their objective is to hedge expected higher electricity prices in the future, for example due to higher $CO_2$ prices. Further drivers are regulatory requirement, or a more positive renewable reputation.

PPAs are still in their infancy in the European Union. The first agreements were signed in the UK in 2012. In the recent past, the number of deals started growing at an exponential rate and across multiple member states. PPAs mostly enable new renewable energy investments, specifically in countries where there were no state-guaranteed feed-in tariffs or tenders for renewable energy plants (Sweden) or where renewables can compete successfully with conventional power technologies. Similar to what has been happening in the US, European corporates have started to sign long-term power offtakes from renewables causing a remarkable and quick growth in Europe in 2017 and 2018. Huge PPAs have recently been concluded in the Nordic countries Norway, Sweden, and Finland. The Netherlands and the UK were focusing on wind power whereas in Spain renewable PPAs signed in 2017 and 2018 were exclu-

sively ground mounted PV projects (see table 1).

According to recent data collection from Energy Brainpool, more than 9 400 MW of wind (onshore and offshore) and photovoltaic capacity were covered by PPAs. PPAs started on a large scale in onshore wind energy still account for 85% of all corporate PPAs signed in Europe according to WindEurope. Meanwhile the first large offshore wind PPA have been implemented.

Whereas the majority of these contracts secured investment in new renewable capacity, a more recent trend is PPA in countries where support systems have expired (Finland) or will do so on a larger scale in the near future (Germany).

## VARIOUS TYPES OF PPAS

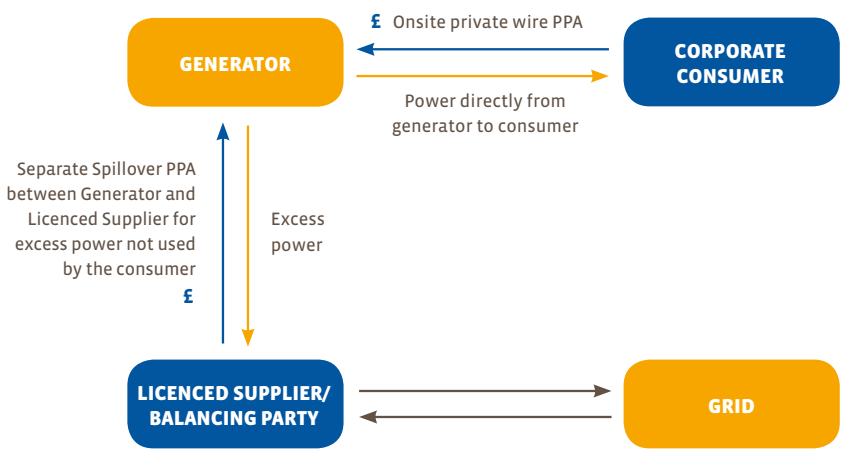
Different types of PPAs can be distinguished: ***physical PPAs*** and **virtual PPAs**. In a *physical PPA,* the power is actually physically delivered. In such a model a renewable energy plant is built especially for this purpose and produces green energy at a fixed price. Physical PPAs can be implemented as ***direct or as indirect PPAs***: in a direct PPA the buyer is supplied with green electricity directly by the generating company that produces this energy exclusively for this purpose. The power here is supplied via a direct line and the energy producer then is a full service provider and also supplies the electricity (fig.2). The indirect PPA (sometimes called sleeved PPA) differs in that the electricity generating company produces clean energy at a fixed price but delivers the power via the public grid. In this constellation, a different company acts as supplier and takes on tasks like producing load forecasts or providing balancing power (fig.3).

The second major type are the so-called ***virtual PPAs*** (also financial or synthetic PPAs). They are distinct from physical PPAs in that these are rather financial products which do not include a physical supply of electricity to a customer. The contract is rather intended for financial hedging of risks on the power exchange. Also, virtual PPAs can be designed in different ways: one way is a **price-guaranteed agreement** also called Contracts for Difference. In such CfDs a base price is agreed for a certain period. The electricity is bought in via the market as usual. Should the market price be higher than the price agreed in the contract, the electricity supplier will cover the difference. However, should the electricity price fall below the limit set in the contract, the customer will pay the difference.

A second option is a **certificate purchase agreement**. Here only the guarantees of origin are sold at a pre-set price over a long term

**2**

***Onsite private wire PPA model.*** *(Solar Trade Association/Birde⊖Bird)*




*Sources : EU-Wide Solar Business Models, Guidelines for Implementation, Solar Power Europe, November 2016*

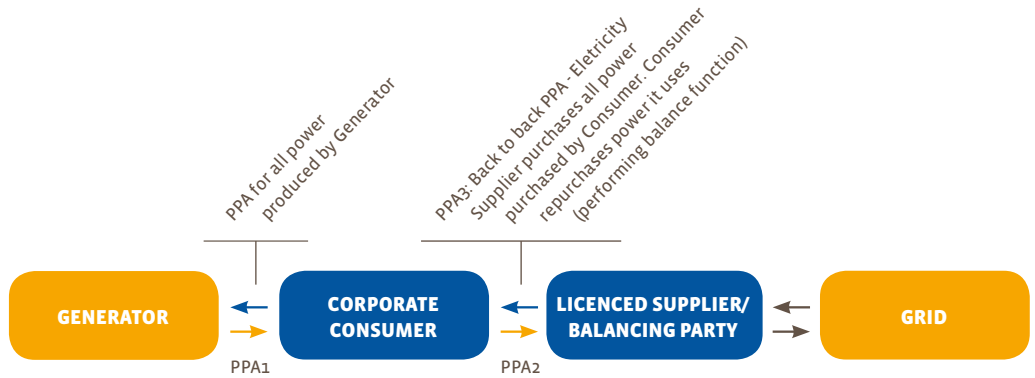






**3**

***Sleeved PPA model.*** *(Solar Trade Association/Birde⊖Bird)*




*Source : EU-Wide Solar Business Models, Guidelines for Implementation, Solar Power Europe, November 2016.*

contract. Certificates of Origin guarantee the source and method of production of a unit of energy. For every MWh of renewable electricity produced one certificate of origin is issued, which in turn can be sold in the marketplace. As such they can provide extra income for the RE generator, but - if not properly regulated - guarantees of origin also allow for green washing. The prices are not linked to the electricity price. In this way, the customers remain flexible in terms of buying in their electricity. Irrespective of the distinctions above, another terminology is used concerning on who is the buyer of PPA.

If the customer is a commercial user, we speak of a ***corporate PPA***. If it is an energy supplier or trading company it is a **utility PPA**. In principle, selling renewable electricity via PPAs is not limited to larger corporations. Public or municipal utilities with own large renewable power plant portfolios also show increasing interest in PPAs as sellers. Energy cooperatives or citizen energy projects are also not exempt from acting as sellers, but given the high transaction costs for producers and buyers, smaller organisations cannot always keep pace with the rising complexity of PPAs. PPAs are often not a suitable approach for relatively small PV roof systems or small wind farms.

## PROMISED BENEFITS AND RISKS OF POWER PURCHASE AGREEMENTS

Potentially, PPAs offer various advantages. The ultimate promise of PPAs is to create win-win situations with extensive benefits for suppliers (sellers) and customers (buyers). For **sellers**, project developers, plant operators and energy companies power purchase agreements provide financial certainty. This is often a significant roadblock to building new renewable facilities. In other words, PPAs secure a steady stream of income and thus leave scope for further investments in more renewable energy, and thus overall saving of $CO_2$ emissions. Financial certainty and security to renewable energy suppliers is thus a driver for PPAs. Besides stability, PPA are thought to reduce risks, since the customer guarantees to purchase the supply, in turn reducing capital costs and increasing the creditworthiness of a project.

For (corporate) **buyers**, the PPA in theory is also beneficial: PPAs allow corporations to reduce their exposure to price volatility in the market over the long term. The PPA can secure a source of reliable, albeit variable and affordable clean energy. The long-term planning avoids price risks, thus cutting energy costs and energy savings as a second argument. Businesses can reduce their carbon footprint and achieve carbon reduction goals cost effectively. Larger companies may communicate this and thus promote a positive public image. The company may meet and fulfil the expectations of employees and customers. Also, on the buyer side the long-term electricity supply via PPAs could also be of interest to medium-sized commercial

**4**

*Selected Green PPAs in Europe.*

| Country | PPA project | Supplier | Buyer | Technology | Size (MW) | Duration |
|---|---|---|---|---|---|---|
| Sweden | Project Nysäter | E.ON | Non-disclosed Global Energy major | Wind | 475 MW | n.a. |
| Spain | Talayuela Solar | Solarcentury | Encavis AG | PV | 300 MW | 10 years |
| Norway | Överturingen wind farm | Green Investment Group | Norsk Hydro | Wind | 235 MW | 29 years |
| Netherlands | Wieringermeer Wind Farm | Vattenfall (Nuon) | Microsoft | Wind | 180 MW | 10 years |
| Sweden | Lehtirova+ Jenasen | n.a. | Google | Wind | 179 MW | n.a. |
| France | Gard / le Var | Voltalia | SNCF | PV | 143 MW | 25 years |
| Netherlands | Bouwdokken wind farm | Dutch wind consortium | AkzoNobel, DSM, Google, and Philips | Wind | 102 MW | n.a. |
| Spain | Don Rodrigo 2 | BayWa | Statkraft | PV | 50 MW | 15 years |
| France | Prémont | Valeco | Statkraft | Wind | 40 MW | 10 years |
| Italy | PV plant Sardignia | Octopus Investments | EGO Trade | PV | 40 MW | 5 years |
| Germany | Nordsee Ost | RWE/Innogy | Deutsche Bahn | Offshore wind | 25 MW | 5 years |
| Italy | L'Oréal Building | Enersol | L'Oréal | Rooftop PV | 3 MW | n.a. |

*Sources: EON, Mercedes, Norsk Hydro, Statkraft, SolarCentury, Iberdrola, Italy, Deutsche Bahn, Facebook, Microsoft. Compiled by EurObserv'ER 2019.*

companies which do not benefit from various electricity advantages such as large-scale industry players.

PPAs, however are not without **risks,** especially when it comes to the credit quality of the buyer that is usually not as good as the creditworthiness of a state-backed feed-in tariff scheme. Although Europe is arguably well positioned to have a more homogeneous approach, different models have emerged, creating a number of regulatory and legal barriers. Another hurdle is that many corporates lack the knowledge and expertise to make PPAs happen.

## PROMISING FUTURE FOR PPA IN THE CONTEXT OF EU 2030 TARGETS

The financing of new plants and their electricity marketing via PPAs is booming throughout Europe (see table 2). The drivers for this trend are rising $CO_2$ prices and countries which already show high market prices for PV and wind energy. In the course of the next few years market observers expect substantial PPA growth in Germany, Denmark, France, Poland and the rest of Europe. The push factors in Spain were high exchange electricity prices, high solar irradiation and abundant available space. With a projected solar capacity of 36 GW by 2030, PPAs are thought to becoming an essential component of Italy's energy transition, too. Some market observers project that PPA-financed PV and wind projects might attain a market share of 50% and more until 2040 in Europe. Another promising and emerging field of PPAs are countries with a huge but ageing fleet of large-scale renewable installations. PPAs can also make sense in countries such as Germany or France where each year an increasing capacity falls out of feed-in tariff support. PPAs may ensure the continuation of depreciated plants whose feed-in tariff support is about to expire. Or PPAs could secure funding and cash flows for repowering wind projects, which are often uncertain and difficult due to increasing requirements. The large-scale use of PPAs can also be a push for the economy. A report for the European Commission found, that should EU-based industrial and commercial companies commit to source renewable electricity to meet 30% of their total demand of electricity by 2030, the EU renewable energy sector could generate more than €750 billion in gross added value and above 220,000 new jobs. □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# FINANCING RES INVESTMENTS IN THE EU – THE ROLE OF GREEN BONDS

As countries move towards a low-carbon, climate resilient future, the appetite for innovative financing solutions is also growing. Green Bonds have emerged in recent years as an answer to the urgent need of mobilising capital to support the United Nations' Sustainable Development Goals (SDGs) and the objectives of the Paris Agreement. In order to achieve these ambitious goals, the vast majority of the required investment must come from mobilising private sector capital, in particular from the institutional investors that manage the bulk of the world's private wealth.

The importance of Green Bonds as an instrument to finance investments grew substantially in the past decade and still experiences rapid growth. In 2018, Green Bonds amounting to USD 171 billion were issued.[1] According to the Climate Bonds Initiative, issuance is estimated to reach more than USD 200 billion at the end of the year. At the same time, the investor demand for dedicated green investment opportunities as Green Bonds also increases, in particular among long-term investors such as pension funds, mutual funds, insurance companies and sovereign wealth funds. One reason for the increasing investor appetite is the trend towards green and sustainability ratings and the integration of Environmental, Social and Governance (ESG) factors in investors' strategies. Therefore, Green

*1. For Green Bonds to be included, at least 95% of proceeds must be dedicated to green assets or projects aligned with the Climate Bonds Taxonomy.*

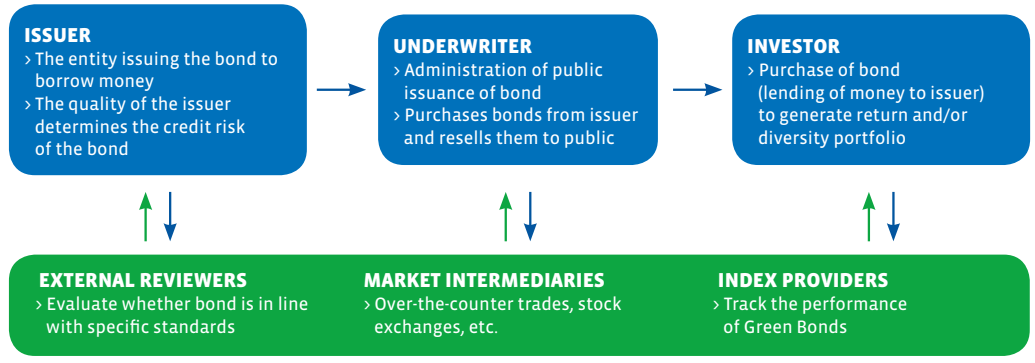






**1**

*Process of Green Bond issuance and the key stakeholders.*




*Source: European Commission, 2016.*

Bonds are a potential instrument to shift the investment appetite of investors towards climate-related investments, as RES capacity, energy efficiency, or low-carbon transport.

## WHAT IS A GREEN BOND?

Green Bonds are structured like traditional bonds with the same characteristics as standard bonds in terms of risk/ return profile, seniority, rating, execution process, and pricing. Figure 1 provides an overview of the issuing process and relevant stakeholders. A bond issuance is a main alternative to bank loans to raise debt financing. The issuer is the entity that issues the bond in order to borrow money. Like normal bonds, green bonds can be issued by various entities, such as governments, multilateral development banks, banks and financial institutions, or corporations. The issuing entity guarantees to repay the bond over a certain period of time, plus either a fixed or variable rate of return. By buying the bonds, the investors lend money to the bond issuer. Investors are mainly institutional investors, i.e. insurance companies, sovereign wealth or pension funds, etc., but also other private investors as commercial banks or even households. The public issuance and distribution of the bond is administered by so-called underwriters. They typically work closely with the bond issuer to determine the offering price of the bond. The underwriter then buys the bonds from the issuer and resells them either directly to the marketplace or to intermediary dealers.

The main difference of Green Bonds compared to other bonds is that they are themed, i.e. the proceeds of the bond issuance are to be used for a specific investment. In the case of traditional bonds, there are typically no restrictions on the proceeds. Thus, Green Bonds allow investors to invest in areas seen as politically important to their stakeholders. Therefore, although Green Bonds have the same credit risk and returns profile as standard bonds, they differ in terms of the use of proceeds. Due to the earmarking of the Green Bond's proceeds – the money raised is dedicated to green assents or projects aligned with the respective standard (e.g. Climate Bonds Standard (CBS)) – there are additional stakeholders involved in the issuance of Green Bonds. External reviewers provide an independent evaluation of the alignment of the Green Bond with the respective guidelines or standards. These reviewers can directly verify the use of the bond's proceeds or, alternatively, provide a certification that the bond is in line with specific guidelines, e.g. the CBS.

There are different types of Green Bonds that mainly differ with respect to the use of proceeds raised by the bond and the debt recourse. Recourse is a legal agreement defining what serves as collateral that the lender (investor) is allowed to collect in case of a borrower (issuer) defaults on the debt raised

**2**

*Main Green Bond Types*

| Green Bond Type | Proceeds raised by bond and debt recourse |
|---|---|
| Use of Proceeds Bonds | Proceeds are earmarked for green activities or projects of the issuer. Recourse to the issuer itself, i.e. bond is secured by issuer's assets. |
| Use of Proceeds Revenue Bonds | Proceeds are earmarked for green activities or projects of the issuer. The revenues stream generated by the green project is the collateral. |
| Project Bonds | Proceeds are earmarked for the specific green project only. Recourse only to the project's assets and balance sheet. |
| Securitisation Bonds | Proceeds are earmarked for a portfolio/pool of green projects. Secured by the assets of the portfolio. |

*Source: Climate Bond Initiative.*

by the bond. The most widely used types of Green Bonds include (I) Use of Proceeds Bonds, which are earmarked for green projects but backed by the issuer's entire bank balance, and (II) Use of Proceeds Revenue Bonds, where proceeds are assigned to eligible green projects. Bond holders have recourse to a specified revenue stream, but not to the issuer. Additional types of Green Bonds are so-called Green Project Bonds and Green Securitisation Bonds (Asset-Backed Securities (ABS)). Figure 2 provides an overview of these types of Green Bonds including the debt recourse.

## OVERVIEW OF THE EUROPEAN GREEN BOND MARKET

In the international context, the European green bond market is at the forefront. According to Moody's, global issuance has been largely dominated by issuers based in Europe, North America and Asia-Pacific, but European issuers led with 40% of global issuance in 2018, up slightly from 37% in 2017. In 2019, European issuers observed the third-largest year-on-year regional growth rate at 15%, securing their top spot as largest green bond market overall. According to the Climate Bonds Initiative, 146 entities have issued Green Bonds in Europe; one third of the global total. Issuers include 48 companies in the energy sector, 35 financial institutions, 23 property companies, 17 local governments, and 3 sovereigns. The share of green, social, and sustainability bonds, excluding government issuances, has increased constantly to approximately 10% of the total bonds issuance by entities in Europe by the end of 2018. About 70% of European Green Bond issues have a tenor of ten years or less: 28% have tenors up to 5 years and 41% between 5 and 10. Both public and private non-financial corporates tend to finance themselves with medium- to long-term debt (5-10 years to perpetual). By contrast, financial institutions have issued mostly shorter-dated bonds (up to 5 years). Sovereigns have by far the greatest appetite for long-dated bonds (15 years and above).

In addition to the size of the market, the EU is also a pioneer in the market as several Green Bond types originate from the EU. The first Green Bond was issued by the European Investment Bank (EIB) in 2007; EUR 600 million with a maturity of five years and an index-linked coupon with a minimum 5% pay-out. The EIB's programme of Climate Awareness Bonds is gradually increasing liquidity, size and scale of Green Bond issuance. As of 31 December 2018, EIB remains the largest issuer of Green Bonds with over EUR 23.5 billion raised across 11 currencies, of which the EUR equivalent of 4.0 billion was raised in 2018. In France, the region Île-de-France issued the first municipal Green Bond in 2012. Globally, the first corporate Green Bond was issued by the Swedish company Vasakronan, while the first green sovereign bond was issued by the Polish government in 2016. Subsequently, issuances also came from the Baltics and Slovenia, for example Lithuania places the first tranche of its Sovereign Green Bond programme for energy efficiency upgrades to approximately 160 apartment buildings (EUR 20 million). In 2018, Iceland also made its first issuance with a USD 200 million bond to finance renewable energy projects.

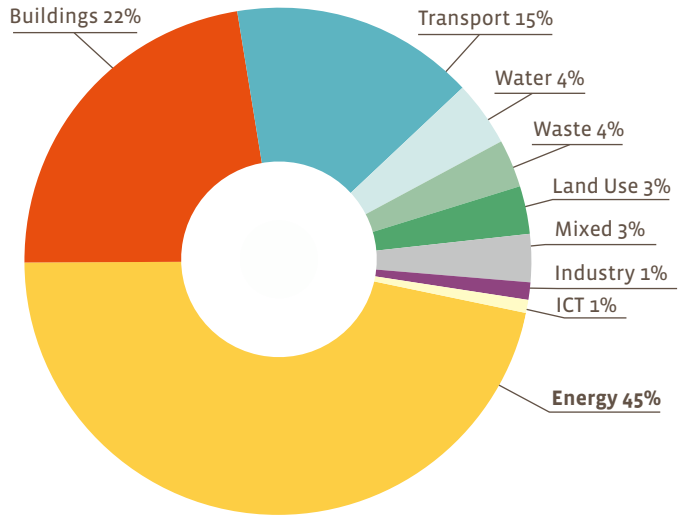
Green Bonds play also an important role in Commission action plan on financing sustainable growth. One of the main mains of the established Technical Expert Group (TEG) on sustainable finance is to assist the Commission in establishing EU Green Bond Standard. In 18 June 2019, the TEG published its proposal for an EU Green Bond Standard (EU-GBS). The proposed EU-GBS is built on four main principles: (I) the use of proceeds required to finance assets and projects with positive environmental impacts should be described, (II) the selection process of projects has to be clear, and the need for (III) describing how funds are allocated or tracked and (IV) reporting on the use of proceeds the environmental impact of the projects (if possible).

## RELEVANCE OF GREEN BONDS FOR RES INVESTMENTS

As outlined above, Green Bonds can be used to finance various climate-related assets or projects including RES. Green Bond issuers in Europe have always allocated a substantial part of Green Bonds proceeds to the energy sector. The use of proceeds of issued Green Bonds in Europe in 2018 is depicted in Figure 3. Almost half of the financing raised by Green Bonds, namely 45%, was used for projects and assets in the energy sector. The two following sectors are buildings and transport, which are also increasing in relevance. The majority of bonds in the transport sector are issued by government-backed rail companies and with ambitions plans for upgrading rail transport across Europe, the share of transport is likely to increase.

**3**

*Use of Proceeds 2018.*




*Source: CBI and FC4S (2019)*

More detailed information in the use of proceeds within the energy sector is available for 2017. In that year, new Green Bonds worth more than EUR 34 billion were issued of which almost EUR 16 billion went to the energy sector. In 2017, diversified energy companies, as EDF, Enel, Engie, or Iberdrola, dominated the issuance of bonds in the sector. These companies use the proceeds to transition from fossil fuels to RES. The second largest segments within the energy sector are grid operators that connect RES to the grid, as TenneT Holdings (Netherlands) or Fingrid (Finland), and RES generation companies. Smaller in size are utilities, e.g. Hera and Iren (Italy), or equipment manufacturers as Nordex (Germany).

## CHALLENGES, SUCCESS FACTORS, AND POTENTIAL FOR REPLICABILITY

The EU Green Bond market has developed substantially over the last decade. Green Bonds offer several advantages for both the issuers and investors. On the issuers' side, Green Bonds provide an alternative source to raise debt financing for RES assets and projects. In particular as bonds are very flexible instruments that can be used by various types of issuers. These range from countries to corporations that can issue bonds on a company level, e.g. the typical Use of Proceeds Green Bonds, or even on the project level (Green Project Bonds). In particular the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latter enable also smaller RES developers to access financing for their RES projects.

At the same time the investor's also benefit from Green Bonds due to the trend towards green and sustainability ratings and integration of ESG factors in investors' strategies. This trend will get even stronger in the future due to recent EU ambitions towards sustainable finance. Currently, the TEG is assisting the Commission in developing a so-called EU Taxonomy – a classification system to determine whether an economic activity is sustainable – and guidance for companies on how to report on their business' impact on the climate. These developments will provide further incentives for, e.g., institutional investors to include more sustainable assets into their portfolios as Green Bonds.

In addition to the possibility of raising debt, the issuance of Green Bonds is a positive signal about sustainability an issuer can send out to the market, which could also translate into monetary benefits. In a recent study, Flammer (2019) investigates firms after the issuance of Green Bonds and finds that (I) the stock market reacts positively to the issuance, which increases the firms' financial performance and (II) Green Bonds are actually effective in improving the environmental footprint of companies issuing them. These results, however, are only significant for Green Bonds that are independently certified, which hints at one core challenge in the market. Although Green Bonds are in essence a simple financial product, there is quite some confusion among investors. There is an at times overwhelming amount of different standards and disclosure and reporting guidelines that challenges both issuers and investors. Hence, the recent activity of the Commission concerning the creation of an EU Green Bond Standard is a very promising step forward to tackle this challenge. The recently published TEG proposal for an EU Green Bond Standard (EU-GBS) has the potential to standardise procedures and rules, e.g. concerning external review, and increase the transparency of the market. The importance of this work is also highlighted by the investors themselves. In a recent survey conducted by the Climate Bonds Initiative, European Green Bond investors named policies focusing on standardisation and definitions, as the work of the EU TEG, as the most effective way to scale up the Green Bond market. ▫

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# REDUCING BARRIERS FOR FINANCING OF RES INNOVATION – THE CASE OF INNOENERGY

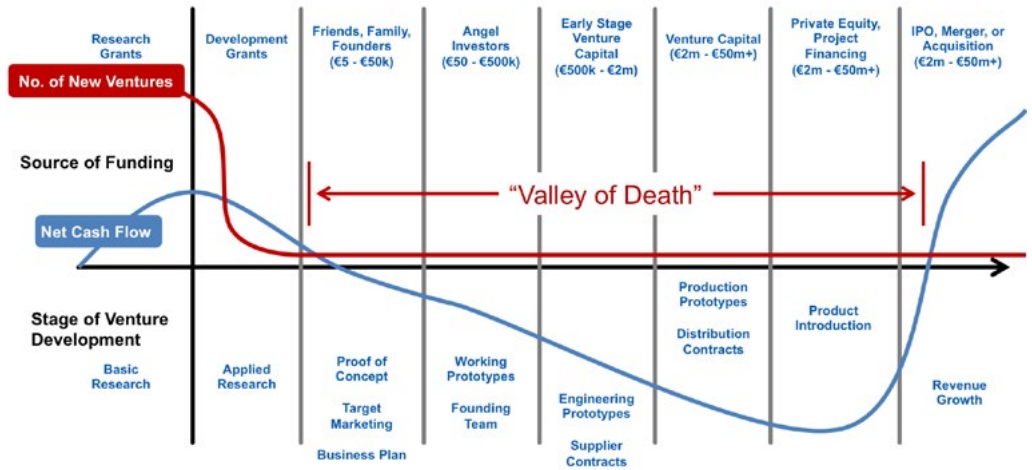
Innovation is crucial for a large-scale deployment of RES as it can lead to (i) new and efficient RES technologies and (ii) improvements of current RES technologies that make them more cost efficient. Hence, innovation plays a key role in the European energy policy, where Research, Innovation and Competitiveness is one of the five key dimensions. Next to existing firms, start-ups play a crucial role for innovation. Across sectors, however, start-ups (ventures) find it difficult to secure financing, in particular in early stages. This phenomenon seems to be particularly pronounced for innovative tech ventures. One main reason for this is the difficulty to properly value these firms. The new product or technology requires typically several years to progress from the innovation and prototype towards a possibly mature technology that can be commercialised. A core challenge is that the tech venture needs early stage financing, whereas the potential revenues only occur in the future in case of successful commercialisation of the innovation. This means that investments into early stage ventures are, in general, risky. These risks seem to be particularly high for clean tech start-ups, where failure rates are higher compared to other high tech sectors as software and medical.[1] Possible reasons are the relatively long development periods for RES innovations and comparably high capital requirements of these ventures.

1 Kerr and Nanda (2011)

1 Gaddy et al. (2017)

**1**

*Typical stages of an Innovation Process and the associated Types of Investors*




*Source: Own illustration based on UC Davis Centre for Entrepreneurship*

Innovators in the RES sector face numerous barriers to secure financing for their ventures. Some of these factors, as regulatory or commercial risks, are very specific to the sector. A lot of these barriers thus depend on RES policies and support mechanisms, as they can reduce these risks and thus increase the incentives to innovate. The commercial success of clean technology firms depends, among other factors, on the regulation and support mechanisms concerning the use of these technologies, as feed-in tariffs or other incentive schemes. Retroactive changes in the support schemes, e.g., may increase the perceived regulatory risk and increase the difficulty to secure financing for RES innovation.

There are, however, other issues for financing innovative RES ventures that cannot be addressed by such policies. RES innovators typically have a pronounced technical expertise, but might lack financial knowledge and capabilities for developing a business plan. The case is often the opposite for potential investors, who might lack of technical know-how while having a pronounced understanding of business development. In their study for the DG Energy, Trinomics (2017) find that these issues are main barriers for clean energy innovations in the EU.

## THE INNOVATION PROCESS AND INVESTOR TYPES

Before analysing potential solutions to these barriers, in particular the case of InnoEnergy, it is important to develop a basic understanding of the innovation process and the associated need for financing. The total innovation process consists of various stages ranging from basic research to the point where a RES technology is ready for full scaled deployment. Based on the position in the development process, the financing needs of the innovator differ substantially. Similarly, the types of potential investors change based on the position in the innovation process, as visualised in Figure 1.

Figure 1 shows the typical stages of innovation for any kind of product or technology. Typically, early stage research or applied research is funded by research grants. These early stages are then followed by first steps towards the commercialisation of the innovation. Starting with a business plan, the process is followed by prototypes and securing of suppliers and potential distribution partners. If all steps were successful, the invented product or technology is introduced to the market, which leads to first revenues.

In all the stages of development, there are different types of investors that are potential sources of financing for the start-up firm. In reality, of course, the paring of investor type and stage of innovation is not as clear cut, but Figure 1 depicts the investors that are characteristic for the respective step of development. The further the venture develops towards maturity, the higher are typically the investment amounts.

After the basic and applied research stages, however, there are several stages until the commercialisation of the innovation, where net cash flows are typically negative. Thus, it is essential for the innovative venture to secure financing for these stages as otherwise the innovator has to abort the project. Due to the difficulty to acquire financing, the majority of ventures end at the beginning of this phase, such that it is often referred to as the "Valley of Death". One aim of investment communities as InnoEnergy is to help clean energy innovators to overcome this Valley of Death by trying to link them with potential investors in order to reach the stage of positive net cash flow. A brief description of the respective investor types can be found in figure 2.

## OVERCOMING THE "VALLEY OF DEATH" – THE CASE OF INNOENERGY

As outlined above, one main barrier to RES innovation is the innovator's challenge to secure financing in order to reach commercialisation. One possibility to overcome this challenge is to match the respective actors, as RES innovators and possible investors, and provide support with the aim to minimise the existing knowledge gabs. A main investment community in the EU is InnoEnergy of the European Institute of Innovation and Technology (EIT). InnoEnergy is, through EIT, mainly financed by the EU and provides several services for innovators and investors. All profits generated are being re-invested into new innovation activities. InnoEnergy promotes innovation by integrating three main actors in the innovation process in the energy sector, namely industry, research, and higher education. InnoEnergy builds on a large network of relevant partners to support RES innovation. It consists of more than 400 industry partners along the RES value chain as well as research and higher education institutions. Furthermore, their network comprises 24 cleantech venture capital funds. The services can be broadly split up into services for innovation projects and services for start-ups (business creation).

**2**

*Characteristic investor types during early stages of innovation*

| Investor type | Characteristics |
|---|---|
| Friends, Family & Founders | This investor type comprises investors with a (typically) personal relationship to the innovators – and the innovators themselves – who invest their personal funds. |
| Angel Investors (or business angels) | Affluent individuals that typically both invest into the new start-up and provide the innovator with know-how and relevant business contacts. |
| Venture Capital Funds | These funds provide private equity for ventures. Venture capital is provided both at earlier stages to finance prototypes or start business development and at later stages to finance initial production. |
| Private Equity Funds | These funds invest typically in a later stage that venture capital funds in order to, e.g., scale up production at the stage of commercialisation. |

*Source: EurObserv'ER (2018) and Trinomics (2017).*

The services for innovators focus on rather early stages of the innovation process of products. The main concept is to link innovators with relevant partners in order to develop the initial ideas into commercial products within 5 years. In order to apply, the consortium of between three and seven members is required to have carried out a proof of concept (technology validated in relevant environment). InnoEnergy offers matchmaking services in order to find consortium partners, if necessary. In case of a successful application, InnoEnergy co-finances the innovation project, where the contribution consists of the financial resources of the consortium. As of March 2019, InnoEnergy investment of €222 million in this programme has led to 98 patents filed and overall 120 new products or services with forecasted sales of € 4 billion.

In the second main programme, InnoEnergy provides services for RES ventures through their business creation programme. Here it offers a programme for early start-ups, through their *Highway*® programme, and the so-called *Boostway*® programme for more mature firms in order to scale up their activities. In the former, InnoEnergy provides different services for start-ups, as an assessment of the innovativeness of the new technology as well as the market and potential competitors. A key benefit for the innovator is the expertise from the more than 400 industry partners in the InnoEnergy network. Furthermore, trainings are offered for the innovators to promote necessary skills. In particular, cleantech ventures can benefit from financial matchmaking services in order to enable them to secure external financing to overcome the aforementioned "Valley of Death". InnoEnergy links innovators with investors by organising matchmaking events, as the annual Business Booster, where only InnoEnergy start-ups have the opportunity to pitch to potential investors. In 2019, e.g., 150 cleantech start-ups were brought together with more than 1,200 participants from 44 countries. In addition to potentially investing in a venture, the VC funds provide feedback to the innovators on such events. Furthermore, InnoEnergy collects key data on their start-up portfolio and provides it to investors in their community in order to allow a better assessment of the investment opportunities. In contrast to *Highway*®, the main focus of the *Boostway*® programme is to scale-up already existing small cleantech businesses and SMEs with a proven business model and proven technology. InnoEn-

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ergy supports these businesses in finding external funding to expand their production or tap new markets. In the overall Business Creation programme, 311 start-ups were supported by this programme, which were able to raise €243 million of external financing as of September 2019.

## CHALLENGES, SUCCESS FACTORS, AND POTENTIAL FOR REPLICABILITY

Matchmaking platforms, in particular InnoEnergy, seem to be a successful way to overcome some of the key barriers preventing RES innovators from securing external funding. InnoEnergy specifically addresses these barriers by providing information on investment opportunities to potential investors, which increases their technical know-how of the sector, and by offering coaching to innovators in order to increase specific skills required to create a commercially viable business. Furthermore, InnoEnergy supports a regular exchange with additional relevant stakeholders, as industry partners, who have extensive knowledge of the market and technologies, as well as research institutes and policy makers and regulators.

Matchmaking platforms as InnoEnergy are a suitable approach to address specific challenges of financing for RES innovation, which can be seen due to numerous other similar platforms, both public and private. Replications of such a concept on a regional or national level, e.g., might be a fruitful option to promote RES innovation. Trinomics (2017) identify small regional events as a key success factor to facilitate innovation, as investors and innovators have to work intensively together. Such more regional approaches might complement large events on a European level, as offered by InnoEnergy.

In spite of the success of matchmaking platforms, it is important to bear in mind that, of course, not all RES start-ups can be successfully matched with investors. One reason might be, e.g., that innovators do not have an appropriate business model, when starting research on a new technology, which might lead to innovations that are technologically innovative, but not really marketable and thus not attractive for potential investors. Furthermore, other barriers might deter financing of RES innovation, as commercial or regulatory risk. Thus, a reliable policy that promotes innovation in the RES sectors is also vital for the continuation of RES deployment. ▫





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