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RESEARCH ARTICLE

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Bridging the valley of death in the EU renewable energy sector: Toward a new energy policy

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Abstract

The European Union (EU) has committed to becoming a global leader in renewable energy. Reaching this target implies fostering innovation activity to maximize the competitiveness of the European renewable industry. By relying on a case study approach based on a small number of in-depth interviews with selected stakeholders, this paper illustrates one of the main factors hindering technological development in the renewable energy sector in Europe. More specifically, the paper focuses on the so-called "valley of death," which traps promising technologies in a "limbo." While ready to be deployed from a technical standpoint, these technologies are not cost competitive and, paradoxically, only their widespread commercialization would allow to drive their cost down. The paper also identifies a mix of policy solutions that can effectively support the competitiveness of the EU renewable energy industry. While more public funding to deploy promising renewable energy technologies is certainly needed, EU policymaker should also improve synergies between EU funding programs at all stages of the research and innovation process. In addition, introducing an EU risk insurance and guarantee fund would ultimately allow to reduce deployment costs and boost commercialization of new technologies.

KEYWORDS

energy policy, innovation policy, renewable energy industry, technology development, valley of death

1 | INTRODUCTION

Countries around the world are facing the challenges posed by climate change, which make even more important to achieve the goals of the Paris Agreement without further ado. Against this background, the problematic and complex nature of the green energy transition is becoming more prominent. While the need to cut anthropogenic greenhouse gas (GHG) emissions is more apparent than ever, promoting the use of renewables and improving energy efficiency are increasingly driven by inter-linked environmental, economic, and

Abbreviations: CAPEX, Capital Expenditure; CoC, Cost Of Capital; CSP, Concentrated Solar Power; EC, European Commission; ERDF, European Regional Development Fund; ESIF, European Structural and Investment Funds; EU, European Union; FOAK, First-Of-A-Kind; GHG, Greenhouse Gas; GVA, Gross Value Added; IRR, Internal Rate Of Return; PV, Photovoltaic; R&I, Research and Innovation; R&D, Research and Development; RE, Renewable Energy; RES, Renewable Energy Sources; TRL, Technology Readiness Level; VoD, Valley of Death.

social-development policy goals (Taylor, 2020), which have been made even more urgent by the recent natural resource prices increase.[1] In this context, innovation activities and fast technological development deserve more attention to accelerate the energy transition.

With its brand-new European Climate Law,[2] the European Union (EU) wants to become the first climate-neutral continent. More specifically, the EU aims to reduce by 2030 GHG emissions by at least 55% compared with levels in 1990 and achieve climate neutrality by 2050. These very ambitious targets require fundamental changes in energy systems, fostering electrification in many economic sectors, including energy-intensive industries and transports, and a major increase in renewable energy (RE) generation. Overall, environmental policy and performance will become a key aspect in economic systems (Albertini, 2017). In this context, to increase the share of renewable energy sources (RES) in the European electricity generation mix and diversify it, all EU Member States have already supported RE generators and manufacturers of equipment with various public funding schemes over the past decades. In fact, energy markets alone would not have ensured the needed development due to an insufficient market maturity of RES and evident cases of market failure (EC, 2020a). However, more needs to be done, as achieving climate neutrality will require European countries to continue supporting the RE industry and ensure that new and promising technologies make it to the market and are deployed fast and on a large scale (IRENA, 2017).

Few scholars have recently argued that the so-called "valley of death" (VoD) could represent the possible causes of delay in the diffusion of RE technologies in Europe (Grubb et al., 2021; Hartley & Medlock, 2017; Nemet, Zipperer, & Kraus, 2018). The VoD could hamper the effectiveness of public or private funding to research and development (R&D) activities, as new technologies developed in labs are unable to compete, before being deployed at a scale, with technologies that are already used and diffused in the economic system, for instance, because they are still too expensive or they do not perform yet as efficiently as more mature technology (Frank et al., 1996; Markham et al., 2010). Against this rationale, in this paper, we investigate the funding gap between the R&D and commercialization phases of RE technologies. More specifically, we aim to provide qualitative evidence about whether and to what extent the VoD is hampering the innovation potential of the RE industry in the EU, identify its main drivers, and propose a mix of policy solutions that can help bridge the funding gap, thus effectively supporting the competitiveness of the EU RE industry.

This paper builds, inter alia, on the results of a recent study carried out for the EU (COWI, Prognos, & CEPS, 2021), which aimed to analyze the global RE supply chain and present policy options to support the international competitiveness of the EU RE industry. To achieve these objectives, the study relied on different methodologies, including consultation with stakeholders via workshops and interviews, literature review, development of intervention logic, and impact assessment of policy options. The authors of this paper were part of the research team carrying out the study for the EU and were, therefore, able to conduct in-depth interviews with primary groups of informants in public authorities, industry associations, private companies, and associations representing research organizations. When relevant, secondary data including funding figures and industry statistics were used to complement data and information collected via interviews.

This paper is structured as follows. In Section 2, we describe from a theoretical standpoint the VoD paradox in the innovation policy literature, and we show how this problem is affecting the EU RE industry and curtailing its innovation potential. In Section 3, we describe the methodology applied and present the main findings of the case study approach, including the key drivers underlying the VoD problem and possible policy solutions. In Section 4, we provide concluding remarks.

2 | THEORETICAL BACKGROUND

2.1 | Definition of the VoD

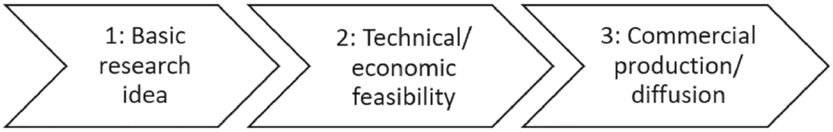
Technological change plays a crucial role in the transition toward more sustainable economic systems. The European Commission (EC) put research and innovation (R&I) policy at the core of its long-term development agenda (European Commission, 2015) and initiatives such as Horizon 2020, the largest competitive R&I program in the world, and its previous editions, funded a significant volume of scientific discoveries at the forefront of the research and technological development. Yet, while the literature on the economics of science tells us that research funding is in general good for innovation, the R&I evaluation community is constantly challenged in trying to measure and explain the ultimate effects of public funding programs, which may materialize only in the long run or may not materialize at all (Arnold, 2012).

In this respect, a relevant challenge for innovation policy and business R&D management alike, that is, receiving growing attention, is the VoD paradox. This concept refers to the situation in which a technology fails to move from the demonstration to the commercialization phase (Auerswald & Branscomb, 2003; Ford et al., 2007; Frank et al., 1996; Markham et al., 2010). Innovative firms can struggle with transitioning technologies from the discovery stage to product development, and this gap has been referred to as VoD (Gbadegeshin et al., 2022).

The VoD occurs in intermediate stages of the innovation sequence after the technologies are proved to be technically and economically feasible and before the market uptake (i.e., between step 2 and step 3 of the innovation sequence in Figure 1). According to Markham et al. (2010), in this situation, adequate resources for new technology development are available during the basic research phase, but their availability suddenly drops after the basic research activities are completed, leaving potential innovations stuck in a valley. However, if technologies can somehow make it through this VoD, resources will be once again available to bring ideas to market.

[1]See, for instance, "War and sanctions have caused commodities chaos," The Economist, 12th March 2022, available at https://www.economist.com/leaders/2022/03/12/war-and-sanctions-have-caused-commodities-chaos

[2]Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243, 9.7.2021, p. 1–17, available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119



Source: Ford et al. (2008:10)

FIGURE 1 Simplified illustration of the innovation sequence.

Conceptually, the VoD is underspecified. To put it differently, in terms of technology management, the VoD comes when technology push support runs out, but there is no market pull. Then, the technology "gets stuck," as it is not further developed, and the related industry can struggle or even disappear. In this case, there is a case of "market failure," with innovations that could improve the quality of life that does not leave the company without the intervention of external support or the exogenous introduction of induced innovations in the development process that increase the chances of marketability of these products. Evidence concerning the extent of the VoD is mixed. The conceptualization of the VoD in published research refers predominantly to the gap between early research stages conducted by research institutions and later stages such as product experimental development conducted by firms (Dean et al., 2022). In this respect, there is some evidence concerning the funding gap associated with the VoD, while the investigation of firm-specific factors concerning the extent and the determinants of this phenomenon is still scarce.

However, the solution to the VoD is not only to provide funding for "innovation" but also to set up market pull policies, creating a niche for the new technology, in which it can develop, and its industry gather strength although this technology would not survive in the "regular market" (Grubb et al., 2021). In some cases, public support to the commercialization phase has been complemented by initiatives such as consortia, business accelerators, and incubators, aimed at bridging the research phase to the market (Barron & Amorós, 2020; Zhou & Wang, 2020). These initiatives support entrepreneurs with the necessary knowledge, mentorship, and feedback (Gamo et al., 2017) to reduce the gap.

Different factors might hinder the commercialization of technologies, including regulatory barriers (e.g., complex permitting process and lack of product standards), market barriers (e.g., market uncertainty), and financing barriers (i.e., inadequate funding to bring the technologies from demonstration to market uptake and mitigate risk) (Cooper, 2013). However, the financial gap represents the biggest driver to the VoD, while regulatory and other barriers may just worsen the problem (Frank et al., 1996, pp. 62–63). In fact, in modern economic systems, public funding flows more to basic/early-stage research (the "peak"), without sufficient attention to continued funding for the intermediate stages (the "valley") of the innovation process. This is because government R&D support is often driven by social welfare criteria and much less by private welfare gains (profit) (Ford et al., 2007, p. 7). After funding early-stage research, the government considers the technology too "commercial/applied" to continue funding, while the private sector is not yet willing to invest enough capital in the technology to allow for commercialization (Frank et al., 1996, p. 61).

Failure to cross the VoD entails several consequences. Its direct implication is that the technology owners are left without support to (i) seek funding to upscale the innovation, (ii) transform the technologies into commercial products, and (iii) reach out to potential users and secure contracts to sell the products on their own. However, it has been observed that technology owners often have limited resources to perform these activities (Frank et al., 1996, p. 62). Consequently, the technology is trapped into the VoD, with its performance not fully improved and its costs not driven down due to the lack of economies of scale and economies of learning. Therefore, innovative projects are not deployed because they lack the necessary funding to become commercially viable (Heller & Peterson, 2016). Besides, companies bear the risk of losing the first mover advantages, that is, advantages only available for companies that enter the market first (IEA-RETD et al., 2012, p. 65). In addition, the VoD diminishes the return on public R&D investment in the earlier phases (Ford et al., 2007, p. 4). Finally, society will lose the social welfare that would otherwise be generated if such technologies were translated into useful and innovative products (Ford et al., 2007, p. 35).

2.2 | The extant evidence on the VoD in the RE sector

Theoretical and empirical support to the relevance of the VoD in the RE industry is relatively scarce. While a recent WIPO study (Cornell University et al., 2018) highlights the necessity to address this problem to relaunch investments in this sector, Elkerbourt et al. (2021) identified the funding gap affecting the deployment and commercialization of innovative RE technologies as one of the main obstacles to the installation of new RE generation capacity in the EU.

Young et al. (2020) addressed the phenomenon for clean energy businesses and the need for new intermediaries and collaborative platforms to tackle financing issues. According to the authors, traditional forms of financial intermediation are not addressing properly clean energy financing needs, failing to connect investors with companies. In this respect, current investment support instruments aiming at de-risking clean energy investment fail to inform investors about the unique risks involved in each phase of the development cycle of technologies. There are relevant information asymmetries between industry stakeholders and funding institutions and needs for intermediaries reducing transaction costs between parties. In this respect, the VoD materializes in the RE sector for two reasons.

First of all, the economic viability of investments is limited because projects in this area require large-scale capital and a long-term commitment before commercialization. The investment is

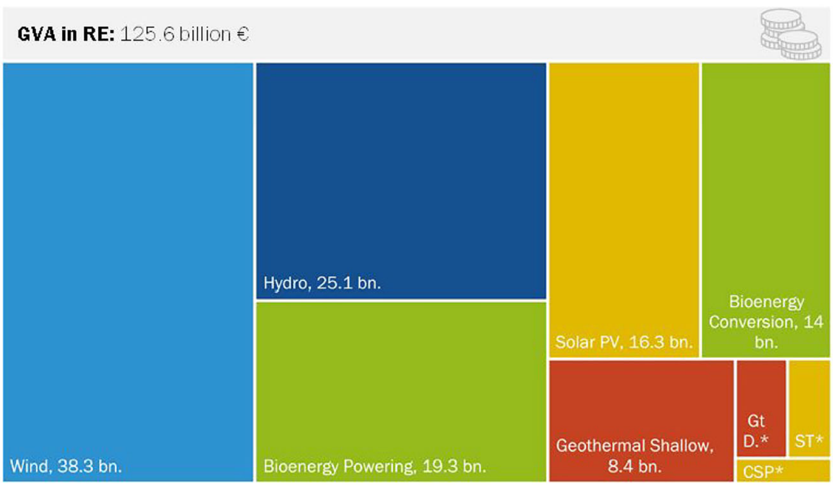
Business Strategy and the Environment WILEY

requested upfront, before the technology becomes commercially proven. Moreover, their application is in highly regulated and conservative industries such as in power utilities (Young et al., 2020). In this respect, traditional financial products are not suited in terms of size, duration, and exit strategies (Gaddy et al., 2016). The RE industry also fails to attract late-stage investors, which further reduces the exit opportunities of early-stage investors. Current policies have a limited impact in making the RE sector attractive. First, there is concern among investors about the longevity of projects once the public support is lifted. According to Nemet (2009), this is particularly evident for radical innovations where there is a higher degree of uncertainty around the longevity of public policies. Second, strong demand-pull measures can have a technology lock-in effect on firm innovativeness, as firms may lean toward making investments on safer technologies that have already met burdensome policy requirements instead of pursuing ground-breaking projects. According to Hoppmann et al. (2013), firms investing in less mature, more innovative technologies can have a hard time in bridging the VoD because their marketability might depend on strong policy intervention in creating favorable conditions for innovation diffusion (e.g., in the ocean energy sector).

Second, the gap in the investment process at various stages of technology development can be due to the lack of effective intermediation and collaboration in the clean energy investing ecosystem (Islam, 2017). According to Norberg-Bohm (2000), the negative connotation of this concept in application to energy technologies is reflected in the unfortunately common experience of companies operating in the RE industry, where many new technologies that get stuck in the valley "die" before being successfully commercialized. While this does not necessarily imply inefficient allocation of public funding (Beard et al., 2009; Hartley & Medlock, 2017), it leaves ample room for intervention for innovation policy. There is an untapped investor pool, with too many information asymmetries and competition among investors rather than collaboration. In this respect, the widening of this gap in the RE industry should not indicate that business energy projects are unattractive for investment portfolios but rather as proof that traditional investment instruments have limited capacity in setting long-term industrial development patterns and in attracting large-scale capital.

2.3 | The VoD in the EU RE industry

The RE sector is very important for the EU economy. In 2018, it accounted for over 1.4 million jobs in the EU28. Yet, the intensity of employment differs significantly among the main RE value chains, and each sector shows specific characteristics in terms of firm clustering and value chain configuration (Glowik et al., 2022). The bioenergy conversion and empowering value chain is the most labor intensive, as it entails agricultural activities. It provides employment for over 700,000 people, about 50% of the total employment in the RE industry. More than 80% of them contribute to the sourcing of resources for bioenergy. Wind energy is responsible for almost 230,000 jobs or 16% of total RE employment. This value chain includes both construction and operation activities (62% of the jobs) and the manufacturing segment (22%). The shallow geothermal value chain ranks third (141,000 persons employed), followed by solar photovoltaic (PV) (139,000). Like in wind power, most of the jobs in these value chains are related to construction and operation (74% and 59%). In hydropower, even 94% of the 129,000 persons are employed in this segment. The relevance of different value chains changes when considering the economic output in terms of the gross value added (GVA)



*Gt D.=Geothermal Deep, 1.9 bn.; ST= Solar Thermal, 1.6 bn.; CSP 0.9 bn. Euro.

Source: COWI, Prognos & CEPS, 2021
Note: The ocean energy is not included in the graph due to their current marginal market, activities in this value chain cannot be reasonably identified within the statistical data.

FIGURE 2 Gross value added (GVA) in renewable energy value chain in the EU, 2018.

(Figure 2). By this metric, wind energy is the most important and accounts for more than 38 billion euros. This represents 31% of the 125 billion euros total GVA generated by the RE industry in the EU—twice the share wind energy holds with regard to employment. Hydropower ranks second, with a value added of 25 billion euros. Likewise, the share of hydropower is twice as much as in employment. Bioenergy conversion, in contrast, has a much lower share in GVA than in persons employed.

The EU is trying hard to turn the current health and economic crisis related to the COVID-19 pandemic, into an opportunity to promote and accelerate the green transition. Similarly, the current war in Ukraine is forcing European countries to reassess completely their energy policies and the sources of supply, especially for fossil fuels. The European Green Deal's investment plan aims to mobilize at least 1 trillion Euros in investments over the course of 10 years, turning the EU into the first climate-neutral continent by 2050 (D'Alfonso, 2020). This will require significant investment from both the public and the private sectors. Clearly, innovation activities in key European industries such as the RE sector, which is one of the most technology-intensive industries in the EU, will play a key part in supporting the achievement of the EU's climate neutrality target.

The innovation potential in the European RE sector is extremely high. Technological advancements in some manufacturing industries such as solar PV are already improving our quality of life, bringing down the cost of energy and helping EU Member States meet the ambitious goals energy and climate targets of the EU. Yet, the full potential of the RE sector is very far from being achieved, and while Europe is the world leader in several RE manufacturing industries (e.g., hydropower) (see ETIPWind, 2020; Hewicker, 2015), it is challenged by other countries that are rapidly catching up in terms of technological development.

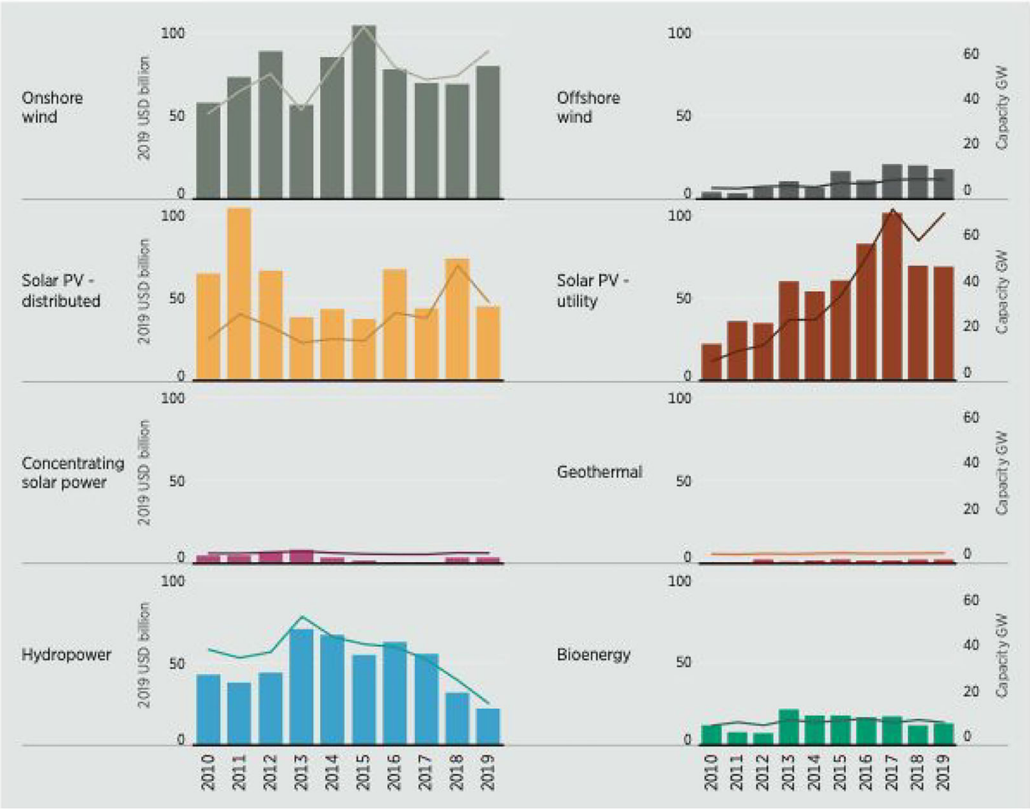
While the EU RE industry develops first-class equipment to exploit many different sources such as ocean energy, wind, and geothermal, a lot of innovative RE technologies fail to reach the market or take long time to be deployed due to very high costs for demonstration and early-stage commercialization. Innovation in the RE industry often experiences a major gap in financing before commercialization (Fernández et al., 2019; Young et al., 2020, Elkerbourt et al., 2021). This is the case, for example, of sustainable energy technology first-of-a-kind (FOAK) projects, which face tremendous challenges in raising sufficient funding to achieve financial close, complete construction, become fully operational, and thereby prove to the market the efficient operational performance of the innovation (European Commission, 2019). The scale of finance required for such projects has hitherto failed to be fully recognized by policymakers. The VoD in the innovation process cripples research efforts and negatively affects the EU economy and the green transition.

Yet, as observed in more mature sectors such as solar PV, effective diffusion of technologies can have several positive effects, rapidly promoting incremental innovation activity and bringing down the cost of equipment and ultimately the energy cost for citizens. Most importantly, the diffusion of RE technologies can have remarkable effects in several value chains, ensuring economic development and high-skilled jobs.

Some proxies, as presented below, can help spot the magnitude of the VoD in RE sector. Following Beard et al. (2009), to better understand the VoD, we must evaluate investments as a multistage process. Therefore, the first proxy could be the amounts invested across different RE technologies and their trends over time. Growing investments may reflect the maturity of RE technologies as well as cost reductions linked to economies of scale, production and technology improvements, and increasingly sophisticated procurement mechanism such as auctions (IRENA, 2020a). They can also hint at the VoD paradox. In the RE sector, investment trends vary considerably among different RE technologies (Grubb et al., 2021). IRENA (2020b) found that solar PV and wind power, which are relatively mature technologies, absorbed most of the total renewable investment. The added capacity of utility-scale and distributed solar PV represented 42% of the total RE investments in 2010 and 45% in 2019. In 2019, utility-scale solar PV dominated deployment capacity and accounted for 60% of total solar PV investment, while investments in distributed solar PV remained relatively stable. As for wind energy, new capacity figures went up from 2010 to 2019, with a 39% total RE investment in this sector. Offshore wind observed a remarkable growth, with newly commissioned capacity installed and investment growing more than fourfold over the same period. By contrast, investments in concentrated solar power (CSP) and bioenergy reached their peak in 2013 and then decreased. The geothermal sector only saw modest new capacity addition over the period 2011–2019. Overall, relatively mature technologies absorbed the largest share of investments, leaving the potential of other sectors such as CSP, bioenergy, and geothermal untapped.

Looking at new capacity yielded per investment unit can help corroborate the arguments in support of the existence of a VoD. This indicator was much higher across technologies such as solar PV or onshore wind energy than innovative technologies such as CSP or geothermal. For instance, USD 1 million invested in utility-scale solar PV yielded a fourfold increase in capacity (Figure 3). In the same period, distributed solar PV observed a three-time increase in the added capacity and similar impact was recorded for onshore wind. Meanwhile, such increase in capacity installed per million USD investment was not observed for some RE technologies such as CSP and geothermal, indicating that the costs of those technologies have not been brought down to the optimal level, possibly due to the lack of economies of scale and economies of learning. As an example, upscaling geothermal technologies is quite challenging due to high capital requirements, geological risks, and limited insurance policies to cover such risks (ETIP-DG, 2019, p. 13; European Commission, 2019, pp. 145–146). Similar challenges are faced by ocean energy, with tidal technologies considered as being at the pre-commercial stage, and most wave energy technologies are still at the R&D. Another noteworthy argument is the lack of (affordable) risk insurance and guarantee services for renewable projects relying on new technologies (JRC, 2019, p. 39; Ocean Energy Forum, 2016, p. 47).

Finally, the level of public subsidies for RE technologies could also indicate the level of public support to scale up those technologies. Taylor (2020) estimated that, in 2017, the EU had by far the largest world share of RE subsidies (USD 78 billion), accounting for 62% of total renewable power generation subsidies on a global scale. In the



Source: IRENA Renewable Cost Dabatase and IRENA, 2020a.
Note: Investment value is represented by bars and new capacity additions by lines.

FIGURE 3 Investment value and new capacity added by renewable power technology, 2010–2019.

EU, 40% of total subsidies were allocated to solar PV, 23% to onshore wind, 22% to bioenergy power generation, 7% to offshore wind, and only 3% to CSP and 5% to hydropower, geothermal, and other RE sources.[3] This subsidy allocation shows the dominance of solar PV and onshore wind in recent deployment (IRENA, 2018). These differences may translate in more limited opportunities for commercialization of technologies such as geothermal and CSP, which also means that they will have less chances to benefit from economies of scale and become competitive in terms of generation costs.

Finally, financial indicators can provide further support to the hypothesis of the VoD in the RE sector. The ocean energy sector can be considered a good example of how the VoD is hampering innovation. It is estimated that the minimum internal rate of return (IRR) required by private investors to fund tidal energy projects is around 10%–12%, compared with 2%–3% for commercial large-scale hydroelectric projects, 5%–6% for onshore wind, and 7%–8% for solar PV (Figure 4) (Ocean Energy Europe, 2017). The cost of capital (CoC) can be the main cost component for the ocean energy project, making this type of project not sustainable from a financial standpoint without proper public support.

3 | METHODOLOGY AND RESEARCH DESIGN

3.1 | Methodology

In order to investigate possible solutions to bridge the VoD in the RE sector, we followed a case study approach and relied on face-to-face interviews with experts and a validation workshop. Theory building from case studies involves using cases to create theoretical constructs or propositions from case-based, empirical evidence (Eisenhardt, 1989).

In the context of the broader study in which an earlier version of this paper was prepared (COWI, Prognos, & CEPS, 2021), sixty-five suitable organizations were identified and contacted. This selection included reputable EU-level stakeholders with experience to cover the five research areas investigated in the original study,[4] including officials from several Directorates of the EC (e.g., DG CLIMA, DG DEVCO, DG ENERGY, DG ENVIRONMENT, DG FISMA, DG NEAR, DG RTD, and DG TRADE) and the European Investment Bank (EIB), stakeholder associations representing the EU RE sectors (e.g., Solar

[3]Major differences were recorded; however, among different technologies. Globally, solar PV received the largest share (48%) of renewable power generation support (USD 60.8 billion), followed by onshore wind (USD 31.6 billion, 25%), biomass (USD 21.9 billion, 17%), and offshore wind (USD 6.6 billion, 5%).

[4]Improved access to finance for commercially ready RE projects, reducing administrative burdens of project permits, bridging the funding gap between R&D and commercialisation, supporting the export of RE technologies and services, fostering global demand for renewable (heating and cooling) technologies.

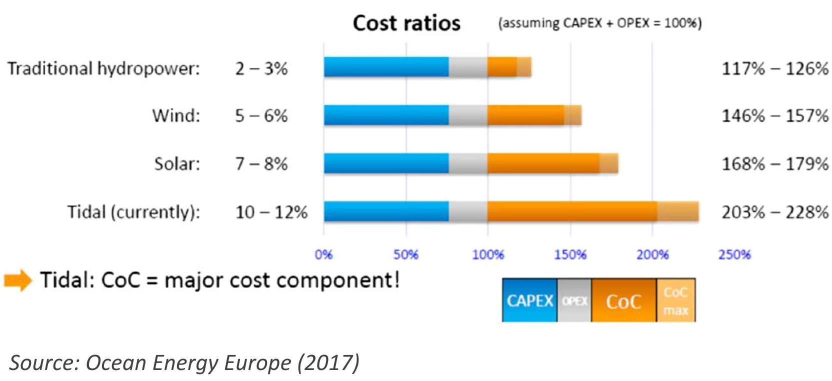


FIGURE 4 Comparison of project internal rate of returns and respective costs of capital.

Power Europe, European Solar Thermal Industry Federation, the European Geothermal Energy Council, Ocean Energy Europe, Wind Europe, European Renewable Energy Research Centers, and International Hydropower Association), standardization organizations (e.g., European Standardization Organizations and CEN-CELEC), independent experts from leading consulting firms (e.g., EY and COWI), and large manufacturers of RE technologies or project developers operating in multiple EU countries (e.g., Nordex, Hitachi Energy and GE Renewable Energy, BayWa r.e., Vattenfall and Abo Wind, Andritz, Valmet, Natan, and Fortum). Forty-three stakeholders accepted to be interviewed to investigate the most relevant issues hampering the competitiveness of the EU RE industry. Eight organizations specifically dealt with the challenges posed by the VoD and accepted, therefore, to be interviewed on this topic.

The eight interviews were viewed as distinct cases, following multiple case study approaches and logic (Yin, 1994). Each stakeholder has presented the very same structure of interview: questions focused on the main obstacles to be addressed by a possible EU policy intervention, the underlying drivers of these obstacles, the general and specific objectives of such a policy intervention, the different policy solutions that could be considered, and a succinct assessment of their expected impacts, including impacts on the competitiveness of the EU RE industry. The interview guidelines are included in Annex I.[5] In line with the confidentiality statement included in the interview guidelines, the information provided by respondents is used in this paper in anonymous form so that it cannot be directly attributed to any specific respondent.

All data and information collected during the interviews were used to prepare five draft policy briefs, one for each topic covered by the main study (COWI, Prognos, & CEPS, 2021). The draft findings were then presented in a virtual validation workshop where all interviewed stakeholders were invited to participate and provide their feedback. Participants were also allowed to submit comments in written form, after the workshops. All comments and feedback received were carefully examined and used to validate or revise the findings presented in the main study and in this paper.

We applied the "Eisenhardt Method" (Eisenhardt, 2021) in the case study analysis. This method focuses on theory building and is based on Yin (1994). We focus our attention on the VoD and enquire participants about the following main issues:

1. The obstacles that are hampering the competitiveness of the EU RE industry (i.e., the VoD)
2. The underlying drivers increasing the selected obstacles
3. The stakeholders' agreement with proposed policy solutions to overcome the obstacles under observation

With the Eisenhardt Method, the choice of cases focuses on organizations where the focal phenomenon is likely to occur and where similarities or differences across responses are likely to improve theory building. This involves the application of an analytic process of comparison among cases which attempts to find a common pattern across focal cases. In this respect, the eight organizations interviewed represented relevant European stakeholders including public authorities, industry associations and companies operating in the RE sector, and associations representing research organizations. They specialize in some of the RE technologies that are believed to be most affected by the VoD problem (offshore wind, ocean energy, and geothermal energy). More specifically, in-depth interviews were conducted with two representatives of the EC, two associations representing the geothermal energy industry, one association representing the ocean energy industry, one association representing the wind power industry, one association representing research centers in RE, and one hydropower and offshore energy project developer.

The Eisenhardt Method emphasizes explicit *theoretical arguments* supporting the reasons *why* particular phenomena happen. These arguments represent the heart of inductive theory building as they address the validity and logical coherence of the arguments supporting the emerging theory. The inductive case research exercise partially depends on the nature of the research question (Eisenhardt & Graebner, 2007). In this case, we pose theory-driven research questions validating and extending existing theory (Lee et al., 1999). The research questions are scoped within the context of the VoD existing theory, and the justification for the exercise is linked to the paucity of data on the VoD in the RE sector and on the possibility that qualitative data will offer insight into complex phenomena that quantitative data

[5]In line with the privacy statement included in the interview guidelines, the information provided by each of the eight interviewees will remain confidential and cannot be disclosed to any third party. The results presented in this study cannot be attributable to any specific respondent.

would not easily reveal. Following Yin (1994), our exercise could be considered multiple holistic case study research design. We aim to identify the circumstances and conditions framing the VoD, which according to existing theory, should be a recurrent phenomenon.

3.2 | Findings: The obstacle of the VoD in the EU RE industry

According to all the interviewees, innovation diffusion and commercialization of new technologies in the RE sector are seriously hampered by the VoD.

The ocean energy sector is a good example of how the VoD is hampering innovation in the RE industry. The ocean energy sector is still at an early stage of development and has yet to cross the VoD (Corsatea, 2014). This is reflected in the relatively low technology readiness level (TRL) of important ocean energy technologies (e.g., tidal and wave energy), which are often not even captured in official statistics (as shown in the paragraphs above). The EU stakeholders in the energy field typically use the EU Horizon 2020 TRL scale.[6] However, according to EC et al. (2017), the concept of TRL still lacks a clear definition, in particular in the field of RE technologies and this scale has some disadvantages that are relevant for the creation of a VoD, such as not considering neither the economic (cost) aspects of different stages nor manufacturing aspects. In tidal energy, most devices are still at pre-commercial phase. Most device classes reached only TRL 5–7, except for horizontal axis turbine reaching TRL 8. Similarly, the highest TRL that wave energy devices reached is mostly TRL 7, with some technologies such as overtopping devices even stuck at TRL 5 since recent years (Magagna, 2019). Three main reasons explain the slow development and very limited market uptake of ocean energy. First, by the nature of the technology, the *investment needs for demonstration projects* are considerably high and can be higher than EUR 50 million (Ocean Energy Europe, 2020). Second, *public support* for pilot and pre-commercial farms is not sufficient to obtain the needed economies of scale and decreases the costs of energy generation. So far, public support funds (e.g., Horizon 2020, European Regional Development Fund [ERDF], and national funds) have been mostly concentrated on the R&D phase for wave technologies, and a limited amount of funding were directed to demonstration of tidal energy projects (Magagna, 2019). Last, while bearing significant technological risks, ocean energy technologies cannot access commercial *risk insurance products* in many EU Member States, because these products do not exist, or they are available but at an unaffordable premium (Ocean Energy Europe, 2020). The private funding required to reach higher TRL for ocean energy technologies has not been available. This shows a lack of investor confidence and explains the relatively high IRR required by financing institutions. Trust is a key factor for investors in helping businesses cross the VoD (Lefebvre et al., 2022), and this confidence needs to be inspired by better, more precise knowledge about the future benefits of RE technologies (Polemis & Spais, 2020). The sector has observed a significant reduction in venture and corporate funding compared with peaks in 2005–2010 (JRC, 2018). In addition, because of the low rates of deployment, the energy generation cost of ocean energy is still prohibitively high.[7]

The geothermal energy sector is another good example of the significance of the VoD. This sector has not reached the level of market maturity needed due to its capital-intensive nature and significant risk component. Geothermal projects require large upfront investments, particularly during the drilling phase to explore geothermal resources. Exploration and drilling activities can take 3–6 years before such projects are fully operational. The project viability is largely unknown until the size and quality of the geothermal resources are confirmed (i.e., when the wells are drilled) (Laenen et al., 2019). Therefore, there is a risk of failure and financial loss until the well field is developed (EC, 2019). As a matter of fact, project developers have to rely upon insurance products to cover these risks. However, relevant insurance providers are only available in a few EU MS (e.g., France, the Netherlands, and Germany), while an EU risk management scheme is still missing (EGEC, 2020). The high capital requirements combined with geological risks and long project preparation time translate into relatively higher costs for geothermal projects (COWI, Prognos, & CEPS, 2021; Laenen et al., 2019).

There are many other examples of innovative RE that are bogging down in the VoD. For instance, the first utility-scale floating solar plant was created in Germany just in 2019 (CleanTechnica, 2019). The floating solar industry is calling for comprehensive support from proof of concept to market deployment, particularly for the development of prototype installations (SolarPower Europe, 2019). There is also a critical shortage of funding for second-generation biofuels due to uncertainty in biomass policies, high capital costs of FOAK projects, and relatively low oil prices (EC, 2019). In the biomass sector, the contribution of the public sector to demonstration projects has historically been lower than for other sectors, delaying the go-to-market phase (Nemet, Callaghan, et al., 2018). In other sectors, such as offshore wind, continuous R&I funding will still be critical for the development of next-generation technologies (e.g., offshore grid design, substructure design, research and testing of floating offshore wind structures and mooring, and cable technologies; Wind Europe, 2019). Incidentally, in the offshore floating wind sector, investment needs in FOAK projects are believed to be most unmet by the market while the associated risks are very high (EC, 2019).

[6]The TRL scale used by Horizon 2020 for the eligibility assessment of projects is organised in nine levels: TRL 1 Basic principles observed; TRL 2 Technology concept formulated; TRL 3 Experimental proof of concept; TRL 4 Technology validated in lab; TRL 5 Technology validated in relevant environment; TRL 6 Technology demonstrated in relevant environment; TRL 7 System prototype demonstration in operational environment; TRL 8 System complete and qualified; TRL 9 Actual system proven in operational environment.

[7]The levelized cost of energy (LCOE) was around 560 EUR/MWh in 2018 for wave energy and 400 EUR/MWh for tidal energy, compared wind 31–42 USD/MWh for utility-scale solar PV and 26–54 USD/MWh for onshore wind (Lazard, 2020; Magagna, 2019).

3.3 | Findings: The underlying drivers of the VoD in the EU RE industry

The underlying drivers of the VoD issue vary across RE technologies, but they share some common features. Overall, two main drivers are contributing to hindering new RE technologies from reaching commercialization or the market deployment needed to achieve the necessary economies of scale. First, there is a lack of funding to deploy and commercialize new RE technologies (Driver 1). Second, deploying new RE solutions is a risky endeavor, and risk insurance and guarantee services for new RE technologies are not available or charge very high premia to investors (Driver 2).

3.3.1 | Driver 1: The funding gap

The first driver of the VoD concerns the funding gap. In the EU RE sector, innovative RE concepts face a funding gap when trying to go from R&D to market commercialization. This gap can be explained by both (i) the lack of funding for development at high TRLs (i.e., technologies that are close to commercialization) and (ii) difficulties in sequencing different funding opportunities to go from low to high TRLs.

While there is a legitimate concern that public R&D support might "crowd out" corporate investments, evidence shows that the productivity of corporate research is increasingly dependent on ideas arising from publicly funded R&D (IEA, 2020). Therefore, public R&D funding in the energy sector may "crowd in" private sector spending along the whole technology development process, not the contrary (e.g., the solar PV sector and Li-On batteries). According to one of the interviewees in the ocean energy sector,

> *Overall, the support that the EU provides [with Horizon 2020] to R&D is quite good in the early stages. R&D funding in floating solar and ocean energy technologies is not a problem but developing prototypes can be more important than R&D itself. For instance, in floating solar technology, the technologies of separate components (the solar panels, the anchors) already exist, but putting all technologies together (e.g., connecting the panel with anchor) can be challenging.*

This statement is consistent with the findings provided by Fernández et al. (2019), who found that private innovation financing levels in the stages following the activities sponsored by Horizon 2020 are still a matter of concern in overcoming the VoD and in scaling up business activities.

Along the same lines, some of the respondents noted that the low diffusion rate of innovative RE technologies does not allow to achieve economies of scale, keeping the average cost of equipment (and energy generation) high. This is particularly concerning as in relatively more mature RE sectors such as solar PV, there is evidence that the cost per watt has been plummeting thanks to record learning rates.[8] Therefore, difficulties in achieving economies of scale should be mitigated with public intervention in order to accelerate the diffusion of alternative RE technologies. Quoting another stakeholder interviewed for this paper:

> *The lack of economies of scale is an issue. For new technologies, even when the technology development is done and the prototype works, economies of scale cannot be compared to mature technologies. This will lead to lower rate of return, making investments in such technologies less attractive. The unachieved economies of scale will prevent new technologies from getting money from the bank or private funding. Ironically, the dropping installation costs of onshore wind and solar PV prevents the development of new RE technologies.*

The limited public support to bridge the VoD undermines the impact of the large amount of public investments in the previous research stages (with low TRLs) such as basic research, where typically the involvement of public research organizations is larger and most public funding for R&D is invested. In this respect, it must be noted that despite EU leadership in RE innovation, public R&I expenditure in the energy sector in the EU is stagnating (EC et al., 2020) and other countries such as China, Japan, and the United States are catching up in terms of innovation rates and moving ahead in terms of public R&I expenditure (EC, 2020b). Moreover, when it comes to the number of patent filings, the EU has been surpassed by China and Korea in recent years.[9]

Second, while increasing R&D funding is seen by many stakeholders as a necessary step to promote innovation in the RE sector, some call for a more efficient and effective generation of synergies between different sources of public funding such as Horizon 2020 (and, more generally, the EU Framework Programs for Research and Innovation) and the European Structural and Investment Funds (ESIF) (JIIP, 2017), even if the networking promoted by Horizon has been found to be beneficial also at later stages of technology development (Vantoch-Wood & Connor, 2013). More should be done to create concrete linkages between funding programs to ensure real coherence and complementarity, going from basic research to market deployment of innovative technologies (European Parliament, 2019). According to one stakeholder,

> *We need to have an eco-system of available EU and national funding. The real challenge to leverage industry potential is to combine these existing elements more easily.*

[8]See, for instance, http://www.rapidshift.net/solar-pv-shows-a-record-learning-rate-28-5-reduction-in-cost-per-watt-for-every-doubling-of-cumulative-capacity/

[9]In particular, China has shown a remarkable increase in innovative activities. In 2008, China and the EU each represented about one fifth (20%–26%) of the global number of patent family filings. In 2016, two thirds (66%) of the filings came from Chinese applicants, while the EU's shares went down from 20% to 8% between 2008 and 2016 (COWI, Prognos, & CEPS, 2021).

3.3.2 | Driver 2: The risk protection gap

A number of major risks can threaten investment in RE projects, thus preventing rapid uptake of desirable technologies, such as the exploration risk in the geothermal industry or prototypical/technology risks in tidal and wave technologies. Unlike mature RE technologies, for example, solar PV and onshore wind (Egli, 2020; Angelopoulos et al., 2017), risk insurance and guarantee services for RE projects relying on new technologies are not available or charge very high premia to investors, especially in Member States with unstable and unpredictable regulatory environments. Typically, these services allow investors to transfer part of the risk (e.g., natural hazards or technical failure) to a third party that is in a better position to bear it.

Due to the lack of risk insurance and guarantee services for the most innovative RE projects, private investors have limited incentives to invest in these projects—investments are attracted by less risky sectors, with more predictable returns. The most innovative RE projects are often not considered by commercial financiers because of less favorable risk/return ratios. For instance, in the offshore wind energy sector, delays or damage during fabrication, transport, installation, testing, and commissioning can affect the revenue profile of a project; consequently, the construction stage of a wind farm is the key area of concern for investors (UNEP, 2004). As explained by one of the interviewees,

> *While some public sources of funding are already available for demonstration projects (e.g., with the EU Innovation Fund), what would really help goes beyond a dedicated call/grant for ocean energy projects and is the availability of cheap loans. So far, even the EIB has been risk-averse and refused to fund risky projects. There are no commercial insurance and guarantee products for ocean technology. Insurances can help reducing the risk and make projects more attractive for private investors*.

Most of the stakeholders involved in the in-depth interviews expressed concern regarding the fact that, due to high risks, innovative RE technologies currently face challenges in accessing cheap loan for large demonstration projects. So far, the EIB has been reluctant to fund risky projects. Commercial banks, in turn, charged very high interest rates (more than 10%) for projects involving less mature (and, therefore, riskier) RE technologies. Supporting this, several interviewees also argued that the EU is missing a clear vision and commitment on future development for specific RE sectors (e.g., targets for specific RE technologies in the coming 10–20 years). In addition, the rate of private investment is also low: Only a small share of business revenue is currently being spent on R&I in those low-carbon technologies that most need large-scale adoption to become commercially viable. A competitive RE industry can only exist if it attracts private capital as well as public financing (SolarPower Europe, 2019). This is essential for both technological breakthroughs and incremental innovation. In summary, according to one stakeholder interviewed for this paper,

> *For innovative technologies, the real problem is capital. Many projects are in the pipeline and waiting for funding support to getting to the water. Commercial banks, charge high interest rates. The financing cost can be up to half of total project cost. What the sector needs is getting funding for large demonstration projects*.

3.4 | Findings: Policy options

Against this background, the stakeholders interviewed for this study converged on three policy solutions to bridge the gap between R&D and deployment of innovative RE technologies.

3.4.1 | Policy solution 1: Public grants

The deployment of RE technologies should be supported by public grants covering CAPEX. These grants should specifically target the most innovative segments of the RE industry and those technologies that have already benefited from some form of public support at the EU or national level (thus maximizing the benefits of public support to R&D). Public support should be provided upfront to expedite investment and should aim at crowding-in private investors, for instance, by relying on implementing partnerships with the EIB and other National Promotional Institutions (as successfully done in the context of the InvestEU Program). European funding programs and instruments, such as the Innovation Fund[10] or the Connecting Europe Facility,[11] should be promoted for RE technologies at demonstration phase, in cooperation with EU Member States.

The Innovation Fund is one of the world's largest funding programs for the demonstration of innovative low-carbon technologies. The high capital intensity of some energy projects requires investment support schemes to include a strong component of upfront finance, to help projects leverage private finance and reach financial close. This fund should provide flexible grants via technology-specific calls to suit the diverse profiles of projects while requesting a strong due diligence, reducing risks for the fund itself, and providing a “seal of excellence” helping to access further private finance at a reduced cost. Frontloading funding would also help especially in the case of demonstration projects, which would benefit more from immediate financial support funding than at a later stage (e.g., closer to the 2030 target). This would support the findings of an investigation on senior managers (Burer & Wustenhagen, 2009), confirming that government R&D funding and especially grants for demonstration plants are the most favored “push” policies.

> *Policy solution 1 could be the most effective one. CAPEX support can help reduce the project cost. Unlike Horizon projects, the Innovation Fund should focus on*

[10]For more information see https://ec.europa.eu/clima/policies/innovation-fund_en
[11]For more information see https://ec.europa.eu/inea/en/connecting-europe-facility

projects whose prototype already works [e.g., FOAK] to make sure that innovative RE technologies make it to market. The Innovation Fund should support installation costs.

3.4.2 | Policy solution 2: Risk insurance and guarantees

An EU risk insurance and guarantee fund could be established to hedge risks associated with innovative pilot and pre-commercial RE projects. Governments could, therefore, play more a central and wide-ranging role in RE innovation, which goes far beyond the provision of public funds for R&D. While the commercial insurance market is cautious in backing the development of complex technological innovations, the support of the public sector could be usefully extended to cover the risks associated with product testing, pilot projects, or major demonstration projects. For instance, an insurance and guarantee fund could cover some part of the risks (e.g., installation, breakdown, and energy production) and mutualize them over an EU-wide portfolio of projects. The implementation of such an instrument could also promote the design of some private insurance and guarantee products specifically designed for RE technologies and provide relevant signaling effects to investors. In fact, if commercial insurance products are available for some RE-specific technologies to reduce the operational risks, the private sector would have better incentives to invest in such technologies. Therefore, as noted a few years ago by the United Nations (UNEP, 2004), there still is a gap between the developers, their advisors, and institutional investors, and there is a useful role for the public sector to act as a "mezzanine player" between innovators, financial institutions, and consulting firms. In this respect, there are concerns about the effective capacity of financial institutions to identify and valorize RE businesses that have embarked virtuous processes of emissions reduction (Morrone et al., 2022). According to one interviewee,

We need more insurance to cover the technological risks of demonstration projects. Manufacturers don't want to guarantee new equipment because they never put the machine in the water before. So, an EU intervention to cover that risk is helpful.

Moreover,

The EU is more risk-averse than other regions. Elsewhere it's easier to bring innovations to the market. China and the US are more open to innovation in commercial projects. The wind industry is CAPEX intensive, with high upfront costs. Risk mitigation funds should address this problem, especially for big projects (e.g., offshore wind, floating wind). Access to a risk and guarantee fund would send a strong signal to the whole community that the project is bankable.

3.4.3 | Policy solution 3: Sequencing, blending, and public procurement

For the entire R&I process (from research to commercialization), the sequencing and blending of different public funding opportunities (both at the EU and national level) need to be improved to support the deployment of RE technologies. One possible approach is to better sequence and blend EU funding sources, adopting a strategy similar to the one included in the EU Energy-intensive Industries Masterplan: Horizon Europe for R&D activities, Innovation Fund for demonstration, and Connecting Europe Facility/Modernisation Fund/Cohesion Fund (or national RE capacity tendering systems) for roll-out and deployment of the technologies. The evaluations of Horizon Europe projects should consider (and promote) the potential for further funding (e.g., TRL 7–9), for example, under the Innovation Fund, to create an EU sustainable technology development pipeline.

Another compatible approach would be to use public procurement schemes, especially in clustered RE industries (i.e., encompassing an array of linked industries) such as ocean energy. As suggested by the Organisation for Economic Co-operation and Development (OECD, 2016), beyond bringing existing low-carbon solutions to market today, public procurement can create "lead" markets, for instance, where government demand is significant (e.g., transport and construction). Procurement could spur innovation without engaging new spending. In this respect, as stressed in recent research (Yin et al., 2022), while government subsidies can be effective in crossing the VoD in low innovative industrial clusters, factors such as business network density can play a key role in innovation diffusion when close upstream and downstream cooperation between businesses are already in place.

As suggested by the EC, the complexity of the causes behind barriers to the development of RE technologies calls for an integrated approach involving both public and private actors, such as the one implemented by Horizon 2020 and Horizon Europe. It is essential that industry and market conditions are fulfilled and aligned with public support conditions. The formation of technology development consortia should be promoted. At the outset of technology development, collaboration between R&D organizations is quite common. However, collaboration in testing and deployment (e.g., work on subsystems, components, and field installations) is less frequent. Some best practices are encouraged by the ERDF via the INTERREG Europe (e.g., the FORESEA project[12]), which helps regional and local governments across Europe improve knowledge transfer in the last stages of the development of ocean energy technologies. International evidence shows that institutional support can be effective in bridging the VoD (Alecke et al., 2021; An & Zhang, 2021). In this respect, the ERDF could play an important role in supporting the diffusion of technologies, helping regions acquire equipment, and creating infrastructures (e.g., modernizing ports for the offshore wind sector). EU Member States should seize this opportunity during the implementation of national and regional programs. According to one of the stakeholders,

[12]FORESEA (Funding Ocean Renewable Energy through Strategic European Action) is an EUR11 million Interreg Northwest Europe project. https://www.nweurope.eu/projects/project-search/funding-ocean-renewable-energy-through-strategic-european-action/

Sequencing funding sources is important. We need to have an eco-system of EU and national schemes. Funding measures such as the Innovation Fund and support from the European Investment Bank are already there. The challenge for the RE industry is to combine these existing elements more easily.

4 | CONCLUSIONS

The RE sector has benefitted and is still benefiting from EU R&D funding, and the transition to renewable sources is at the core of the European Green Deal. Yet, the deployment of the most innovative RE technologies (e.g., geothermal, ocean energy, offshore wind, floating solar PV, and third- and fourth-generation biofuels) is still slow and hampered by the VoD problem. This implies that relevant technologies cannot reach the final market because the last stages of their development and commercialization process are expensive and not adequately backed by public or private investors. Therefore, the RE sector is strangled by a market failure in which governments, consumers, and companies alike long for the deployment of cutting-edge technologies, but market mechanisms do not work, keeping the diffusion of such technologies limited. In the context of the global challenges posed by climate change and the energy crisis stemming from the Russian invasion of Ukraine, this is especially regrettable as Europe has already valid technologies that, if properly supported, could rapidly replicate the successes of the solar PV and onshore wind sector in terms of learning rates and reduction in generation costs of RE. The RE industry structure is extremely articulated due to the very different nature of the various sources. Downstream, the different value chains are growing in complexity in phases such as plant operation, distribution, servicing, and maintenance. This growing industry is vital for the future energy autonomy of Europe and its economic prosperity. Yet, the VoD can hamper company growth and survival. Businesses, especially startups, will be challenged by evolving business phases and models. This will require a careful assessment of the challenges that are specific to the stages of development of technologies and secure an alignment between stakeholders (Ritter & Pedersen, 2022).

Against this background, the case study presented in this paper helped put forward three main policy solutions. First, the deployment of RE technologies should be supported by public grants covering CAPEX. These grants should specifically target the most innovative segments of the RE industry (where the VoD problem is most acute) and those technologies that have been developed in Europe (thus fostering the EU technological sovereignty) and have already relied on some form of public support at the EU or national level (thus maximizing the benefits of public support to R&D). Public support should be provided upfront to expedite investment and should aim at crowding-in private investors, for instance, by relying on implementing partnerships with the EIB and other National Promotional Institutions. Second, risk mitigation instruments such as insurance schemes and public guarantees should be provided at the EU level for the most innovative RE projects. An EU risk insurance and guarantee fund could mutualize the risk stemming from innovative pilot and pre-commercial projects over a large portfolio of installations across all EU countries. By hedging the risk stemming from innovative RE projects, this fund would increase the bankability of such projects and attract private investors. Finally, the EU and national government could further support the deployment of RE technologies by (i) increasing consistency between funding programs and instruments, thus improving the opportunities for sequencing and blending available public and private funding to cover the entire innovation cycle, from basis research to demonstration and market deployment, and (ii) relying on public procurement to create or boost demand for new technologies. The stakeholders interviewed for this paper argue that the impact of the proposed measures would be major, not just promoting innovations and lowering costs but also sustaining the competitiveness of the whole industry and promoting jobs.

Therefore, the EU should timely intervene to introduce these measures in cooperation with all Member States. Improving the functioning of the EU Innovation Fund along the lines presented above would be a low-hanging fruit to start crossing the VoD. Devising and introducing new public support schemes as well as risk mitigation instrument would require a consultation process involving all relevant parties, including industry associations and the financial sector. In this respect, the Investors Dialogue on Energy launched in September 2022[13] could be the right platform to operationalize the proposed policy solutions. Finally, ensuring synergies between EU funding programs would require cooperation between DG Energy of the European Commission, other commission services, Member States, and other public and private investors to better integrate research funds with other funding opportunities supporting the demonstration and deployment of RE technologies. This should become a priority not just for environmental targets but also to secure EU's energy sovereignty and ensure sustainable growth of the EU economy.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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[13]The Investors Dialogue on Energy is a multi-stakeholder platform launched by the European Commission to bring together experts from energy and finance sectors in all EU countries. The IDE aims to accelerate the investments needed to complete the energy transition and allow the EU achieving climate neutrality by 2050. For further information please see https://energy.ec.europa.eu/topics/funding-and-financing/investors-dialogue-energy_en

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ANNEX A: INTERVIEW GUIDELINES

A.1 | Introduction

The European Union has committed to becoming a global leader in renewable energy. An ambitious and binding renewable energy target of 32% by 2030 was introduced as a cornerstone of the EU energy policy. While reaching this target, the EU aims also at maximizing the competitiveness of the European renewable industry, thus contributing to job creation and generating economic growth.

Against this background, this interview aims to find out more about policy solutions that can effectively support the global competitiveness of the EU renewable energy industry. The interview results will be used to draft policy briefs discussing the expected impacts of the proposed solutions and providing policy recommendations for EU and national policymakers.

The information provided in this interview will remain strictly confidential and will not be disclosed to any third party. The results published will not be attributable to any specific respondent. You can find here more details on the processing of personal data when consulting citizens and stakeholders in the policy and law-making process.

If you would like to receive information regarding this study, please feel free to contact:

- *[Information redacted]*

To prepare the interview, please carefully review Annex A that provides the required background information by summarizing:

- The obstacles to be addressed and underlying drivers.
- The objective of a possible policy intervention.
- The proposed policy solutions.

1. General information

1) Organization. What is the name of your organization?

2) Type of organization. Your organization is a:

- Private company
- Industry association
- Public authority
- NGO or association representing the civil society
- Other (please specify)

3) Sector. In which sector (*or policy field*) does your organization (*or the members of your organization*) mainly operate?

4) Country. In which EU Member States does your organization (*or the members of your organization*) mainly operate? Does your organization (*or the members of your organization*) operate outside the EU?

2. Validating information provided in Annex A

5) Obstacles. Can you confirm that the obstacles under investigation are impinging on the competitiveness of the EU renewable energy industry?

6) Underlying drivers. Are the identified drivers increasing the selected obstacles? Are we overlooking any factor forming these obstacles?

7) Sectors and technologies. Do the obstacles under investigation have significant effects on specific renewable sectors and/or technologies? Are we overlooking any renewable sectors and/or technologies that are particularly affected by the obstacles under investigation?

8) Baseline. Do you believe that we have captured the most likely, future implications of the selected obstacles on the competitiveness of the EU renewable energy industry? Are we overlooking any important elements that may affect the evolution of the problem in the absence of an EU policy intervention?

9) Objectives. Do you agree with the proposed objective of a possible EU policy intervention to overcome the obstacles under observation?

10) Policy solutions. Do you agree with the proposed solutions? Are there any additional policy interventions to consider in order to overcome the obstacles under investigation? Can some of the proposed solutions be combined with each other to overcome the obstacles?

3. Impacts

11) Lowering costs. Does the solution affect access to finance? Does it affect the cost of capital, for example, price and availability of financing? If yes, could you estimate the expected percentage change in such costs?

12) Lowering costs. Does the solution affect capital expenditures, for example, investment costs? If yes, could you estimate the expected percentage change in such costs?

13) Lowering costs. Does the solution affect operating expenditures, for example, cost of essential inputs, services, or labor costs? If yes, could you estimate the expected percentage change in such costs?

14) Lowering costs. Does the solution affect information obligations imposed on EU companies (*your company*)? Does it affect costs of compliance with regulations? If yes, could you estimate the expected percentage change in such costs and the share of compliance costs out of total capital expenditures?

15) Improved technologies. Does the solution stimulate or hinder R&D&I? Does it increase the ability of EU companies (*your company*) to perform R&D&I? If yes, could you please estimate the expected percentage change in R&D&I expenditures in the period 2021–2030?

16) Improved technologies. Does the solution increase the capacity of EU companies (*your company*) to innovate and bring to the market new products (goods/services/technologies) or improve the features of the current ones?

17) Improved trade conditions. What is the likely impact of the proposed solution on the competitive position (competitive advantage) of EU companies (*and your company*) vis-à-vis non-EU competitors?

18) Improved trade conditions. What is the likely impact of the proposed solutions on extra-EU trade and trade barriers in your sector? (*What is the likely impact of the proposed solutions on your company exports and internationalization strategy*)? Could you please estimate the expected percentage variation in extra-EU exports and/or imports of goods and services, and in international investment flows in the period 2021–2030?

19) Increased global markets Does the solution affect consumer's choice and/or prices via, for example, more availability of goods and services, better quality of goods and services, more information to consumers? If yes, could you estimate the expected percentage change in the global market value in the period 2021–2030?

20) Increased global markets. What impact does the policy solution have on a market shares and comparative advantages in an international context (e.g., imports, exports, investment flows, trade barriers, and regulatory convergence)? Could you estimate the expected percentage change in market shares in the period 2021–2030?

21) Other. Could you please indicate any other expected impacts on the global competitiveness of the EU renewable energy industry? Is the proposed policy solution likely to generate significant social (e.g., on jobs) or environmental (e.g., on greenhouse gas emissions) impacts? If yes, please specify the type and magnitude of such impacts.

22) *(Other. Do you envisage any special impacts on the competitiveness of EU SMEs?)*

4. Preferred solution

23) Which of the proposed policy solutions is in your view:

- The most effective to achieve the policy objective(s) proposed in Annex A? Please rank the solutions from the most to the least effective.
- The most effective in boosting the industrial competitiveness of the European renewable energy industry, and its added value to the EU economy and society? Please rank the solutions from the most to the least effective.
- The most effective in achieving it at the minimum cost for the EU renewable energy sector and the society as a whole? Please rank the solutions from the least to the most costly in terms of resources needed for its implementation.

24) Do you believe that the proposed solutions are consistent with the overall EU framework in the field of renewable energy and with EU policies in other domains such as trade, research, and innovation?

25) Do you believe that the proposed solutions are politically feasible, that is, will be accepted and supported by policymakers and the general public? Please rank the solutions from the most to the least politically feasible.

Annex A – [Add topic of the policy brief]