Policies for Airborne Wind Energy

Preparing the grounds for AWE-specific incentive schemes – Scoping Study

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Executive Summary

The Airborne Wind Energy (AWE) sector is poised to grow with several companies planning to commercialize their systems in the next years. Several challenges still need to be overcome, the **entrance into the highly competitive and regulated European electricity markets** being one of them. To become a player in these markets, a good understanding of the broader policy and industrial context and strategies on the European as well as on Member State level is crucial.

In the context of this scoping study a number of **interviews** were conducted with AWE companies, policy makers on EU and national level as well as other stakeholders. It became clear that policy matters for AWE has not received much attention but there was wide consensus that AWE policies need to get into the focus if the sector wants to be successful.

This study discusses the policy related lessons learned from other renewable energy technology like wind, PV and ocean energy, showing that also the **AWE technology will require specific policy support** to reach its full potential. A number of European push policies, i.e. support schemes and programmes that provide R&D or investment support, are briefly presented; some of them have already been used by AWE companies, others may provide opportunities for the future. At the moment AWE-specific pull-policies, i.e. revenue support through FiT or tenders, are not yet of the agenda of policy makers, but it may be helpful to start the preparatory discussions. The (high-level) analysis of the EU State Aid Guidelines for energy projects shows that member states could justify AWE-specific support schemes.

The **years 2018-20 offer a unique opportunity** for the AWE sector to not only become more visible to policy makers, investors and other stakeholders, but to potentially influence the (re-)design of some of the funding programmes to better respond to the needs of the AWE sector.

To do so, the **sector needs to collaborate much more closely**. The sooner joint activities, projects and processes can be established, the faster the sector will be able to reach its potential. The creation of the European association **Airborne Wind Europe** can help bringing the AWE companies closer together and raising the sector's profile and visibility by initiating a number of joint activities. These activities may include:

- Defining a "sector wish-list" towards policy makers (as input to EC study)
- Developing a European AWE policy road map up to 2025 incl. funding needs
- Developing a consistent storyline for communication
- Getting visible towards EC, Member States and Funding Programmes
- Reaching out to WindEurope, ETIP Wind and other networks
- Advocating for AWE-specific, common test and demonstration sites
- Joint activities on safety, airspace regulation, standards, etc.

The next years will be crucial for the future of the AWE sector. By getting prepared in the field of policies and support schemes, the chances of successfully reaching the commercialization phase will significantly increase. Airborne Wind Europe is committed to provide the support required to define and achieve the sector's goals.

1 Introduction

1.1 Background

Several AWE systems are at the brink of commercialization. European companies like Ampyx Power, Enerkite, Kitemill, Kitepower, Kite Power Solutions, Twingtec, or the US company Makani develop systems that not only target specific niche markets, e.g. off-grid applications or re-powering of first-generation offshore wind farms, but that eventually are supposed be able to compete at the wholesale power markets. However, the technology has not been demonstrated on a larger scale for extended periods of time and actual costs of electricity have not yet been proven. The technologies are not yet mature enough to be able to participate in competitive tenders with conventional wind power and most niche markets are limited in size. Further challenges exist regarding airspace regulation, safety and standards.

So far, individual AWE companies have received R&D and Innovation funding. But to reach market readiness, the so-called "valley of death" needs to be crossed where much higher amounts of capital are required. How can this funding be secured? As for other innovative or renewable energy (RE) technologies, it can be assumed that **support policies** are needed. Without targeted policy support, the promising AWE technologies may fail to reach large scale deployment.

So far, the AWE sector has not yet dealt systematically with policies – the focus has been mainly on technological, regulatory and certification issues. Therefore the recently established sector association Airborne Wind Europe has commissioned **this Scoping Study to investigate the role of financial support policies for the development of AWE technologies**.

1.2 Objective of the Scoping Study

This Scoping Exercise aims to provide decision makers of AWE companies with an overview of policy related issues by examining companies' and policy makers' views on AWE policies and reviewing relevant renewable energy support schemes. It will discuss the following questions:

- Why does the AWE sector need policy support?
- What kind of policy support would help AWE?
- What does the sector needs to do?

1.3 Methodology

The methodology to find answers to the above questions consisted of four parts: Interviews, desk research, synthesis and the presentation at the AWEC 2017.

Interviews were carried out with stakeholders from three main groups:

- **Interviews with AWE companies (developers):** The questions to seven AWE companies (see annex) covered their prior work on policy related issues, their strategy or position on what to expect from policy makers, expectations and kind of support they need from Airborne Wind Europe regarding policies. These interviews helped to understand how well the sector stakeholders are prepared to deal with and shape policies.
- **Interviews with policy makers:** There were interviews conducted with policy makers from the European Commission and three national governments (DE, UK, NL). These interviews were meant to get a first impression about policy makers' current position about AWE support schemes. Questions included: Have you dealt with AWE? Do you think that AWE needs specific support for deployment? What kind of support do you think is politically possible? What does the sector have to deliver to take action on this matter?
- **Interviews with other experts and stakeholders:** Additional interviews were carried out to get further input and advice from other experts or stakeholders in the field of RE. This included among others: EUREF, EUREC, EIB, wind associations, consultancies, investors, etc.

Findings from previous interviews and the desk research were verified or discussed in subsequent interviews. It should be noted that most of the interviews were rather short. For the calls with the

companies it was not the intention to receive concrete data in a standardized format. This would need to be done in a new round once the activities of Airborne Wind Europe have been defined and agreed on.

Desk Research and Synthesis: As part of the desk research, current and planned European and national support schemes and policies potentially applicable for AWE were reviewed as well as lessons learned from other sectors.

Synthesis: The findings from the interviews and the desk research were analysed and discussed with Airborne Wind Europe colleagues. The results were synthesized into the presentation for the AWEC 2017 and this report at hand.

Presentation / Workshop: At the AWEC 2017 the preliminary results were presented and discussed in a dedicated session. The importance of the topic was underlined by the fact that the final plenary discussion dealt to a large extent with policy issues.

Structure of the report:

1. Why policy support?
    a) Perceived and real risks
    b) Market environment
    c) "Valley of death"
    d) Lessons Learned from other RE technologies
2. What kind of support?
    a) Push Policies
    b) Pull Policies
3. What needs to be done?
    a) Window of opportunity
    b) Political and industrial context
    c) Consistent outreach

2 Why policy support?

2.1 Risks – real and perceived ones

Airborne Wind Energy is a promising technology. It can harness steadier and stronger wind energy in higher altitudes with significant material and potentially cost savings, it can be flexible and scalable and may thus be able to make an important contribution to the energy transition.

However, the interviews, conversations and research carried out for this study revealed that there is still lot of scepticism on AWE technologies. The following quotes from DTU, ForWind, Fraunhofer IWES, Ocean Energy Europe, BMWi illustrate this finding:

- *"… , the challenges facing the AWES industry are of such magnitude that it cannot be stated with certainty that this industry will be commercially viable."*
- *"I doubt that we will see AWE making a dent in the energy universe any time soon or even midterm. Would I invest in such technology? Probably not …"*
- *"AWE still needs ten years, and this is what I have already said five years ago."*
- *"The sector seems to be too optimistic. Wave & tidal were also too optimistic, then they could not deliver and interest got lost."*
- *"So far I have not seen a convincing project proposal."*
- Jason Deign, GreenTech Media: "*The likelihood of airborne wind energy becoming a commercial proposition any time before 2025 is remote.*"[1]

[1] https://www.greentechmedia.com/articles/read/a-beginners-guide-to-the-airborne-wind-turbine-market , September 5, 2017

It became clear that many technological and non-technological issues still need to be solved. The sector's general statement that most of the AWE components already exist in one way or another is only valid on a high level; once a more detailed look is taken, there are still many open questions for every component or aspect: wings, controls, tethers, drums, generators, wind farm design, environmental issues, safety, airspace use, airworthiness, certification, zoning, grid access, etc. The fact that the dominant design has not emerged yet also shows that the sector is still in a quite early phase.

However, experiences and technological advancements in related sectors will help: For instance, the new developments on drone technology and the general awareness that this sector needs regulation will also help paving the way for AWE system regulation.

Against this backdrop it cannot be expected that the AWE sector is able to overcome all challenges and barriers without political support.

2.2 Challenging market environment

AWE companies deal in a market environment which is not only very competitive but also highly regulated and subject to political influence of various stakeholders. All of these stakeholders have their own agenda which needs to be taken into consideration:

- The **European Commission** consists of various Directorates General (DGs), each of them with specific objectives for their respective policy area, which may even compete with each other. DG ENER (Energy) aims to achieve the Energy Union, DG COMP (Competition) aims to foster competition and avoid member state subsidies, DG CLIMA (Climate Action) aims to accomplish the climate targets and DG RTD (Research and Innovation) aims to foster innovation, also with regards to new RE technologies. Other DGs can be relevant as well, e.g. DG ENV (Environment), DG MARE (Maritime Affairs and Fisheries), or the Executive Agency for Small and Medium-sized Enterprises (EASME).
- The **EU Member States** follow the general strategy of their governments which again consists of many ministries each with own policy objectives. The emphasis that Member States put on RE innovation and deployment can vary widely.
- A specific complication for technology providers in the field of electricity is the fact that the electricity market is highly regulated. Those **regulators** exist in each member state but also on the European level (e.g. through the Agency for the Cooperation of Energy Regulators, ACER). Therefore it is not possible to "just enter" this market without complying with a number of regulatory and technical requirements. For AWE additional regulation regarding the use of airspace with all its related safety regulation needs to be taken into account.
- Finally there are the **clients and investors,** for instance utilities or power generation companies which sell electricity, or RE project developers, or – in the case of remote or off-grid applications – end customers like mining companies, emergency response services, etc. For some the Return on Investment has the highest priority, for others long term viability, for other reliability.

The figure below depicts this market environment. The multiple boxes by stakeholder group intend to visualize the various entities per stakeholder group.

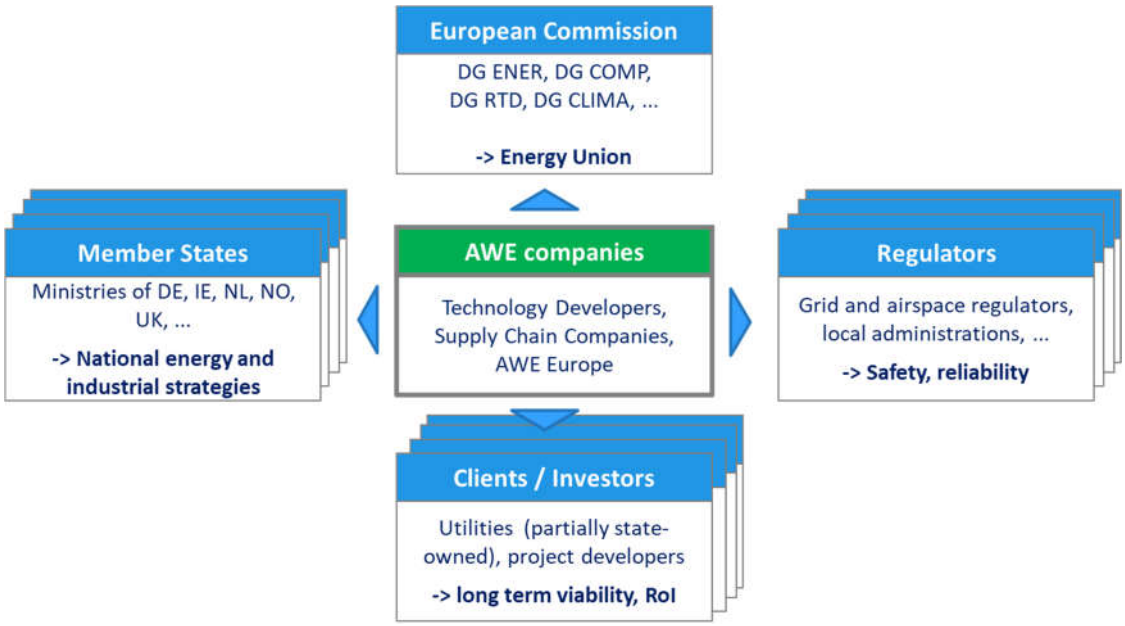

Figure 1: Market environment. Players with different objectives. Source: Own elaboration.

What is not shown in this figure are the **competitors**: In the electricity market there are various established technologies used by powerful companies that may not be interested in facing additional competition by an emerging technology like AWE. The introduction of competitive tenders – and thus the introduction of caps on capacity additions for RE technologies – led to fierce competition for the renewable capacities that can be added.[2] Technology-neutral tenders are further aggravating this issue.

Hence, trying to gain a foothold in heavily regulated and competitive electricity markets without strong support of several of the above mentioned stakeholders is not realistic. In fact, there are no electricity generation technologies that have been introduced without political intervention.

2.3 Commercialization challenge: AWE facing "Valley of Death"

Some of the companies (like Ampyx Power) are about to move from pilot to part-scale demonstration projects. For these companies the so-called "valley of death" is coming into sight – maybe not in the next 1-2 years but potentially soon thereafter. This means that a high amount of capital for upscaling is required while at the same time the real and the perceived risks are still high (as described above) which makes it difficult to attract investors and financial institutions.

[2] This is an example where the policy objectives of DG COMP (high competition, suppression of state aid, reduction of costs) has basically prevailed over the objectives of DG CLIMA which advocates a quick deployment of RE to reach mitigate climate change.

Especially public funding is needed at this stage to successfully reach the phase of commercial viability and deployment. This is illustrated in the figure below:

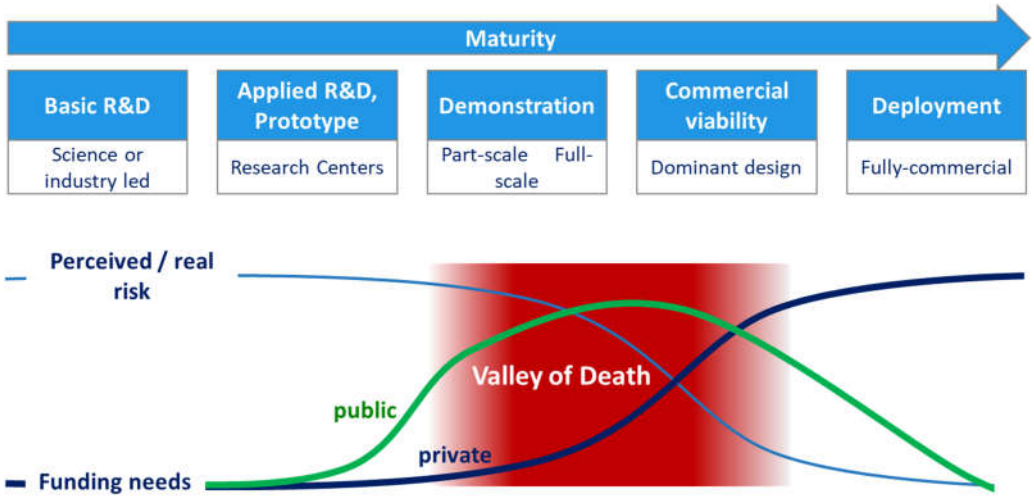

Figure 2: Valley of death

Even though several companies have ambitious development plans, it seems that all companies interviewed still require many hours of testing. While some companies take the approach to scale up quickly (Ampyx Power), others propose to rather install many smaller systems of less than 100 kW in order to reach a high number of operational hours (Thomas Hårklau, Kitemill: "*You need a track record. You cannot trick statistics.*").

2.4 Lessons Learned: All RE technologies needed policy support

When it comes to support policies, other innovative RE technology sectors can provide some lessons learned for the AWE sector.

2.4.1 Photovoltaics

Solar Photovoltaics (PV) started its development in the early 1970s but only began to gain significant market share some 30 years later when revenue support schemes were put in place. To put the level of deployment at that time into perspective: In the year 2000 about 1.2 GW of PV were installed world-wide[3]; this was the year when the German Feed-In-Tariff Law (EEG) was introduced, the key legislation which kick-started the large-scale deployment of PV on a global level and which led to the significant cost reductions, especially after the removal of the program cap in 2004.[4]

The figure below shows the key policy measures since 1990. The strong increase in capacity installations between 2004 and 2012 was followed by an abrupt decrease due to the reduction of Feed-in-Tariffs and the introduction of tenders for larger plants as well as the introduction of a deployment cap.

[3] Source: Wikipedia, https://en.wikipedia.org/wiki/Growth_of_photovoltaics

[4] Before that law, the 1,000-roof-program provided capital grants of up to 70% of capital costs, and then later soft loans were issued through the 100,000-roofs-program

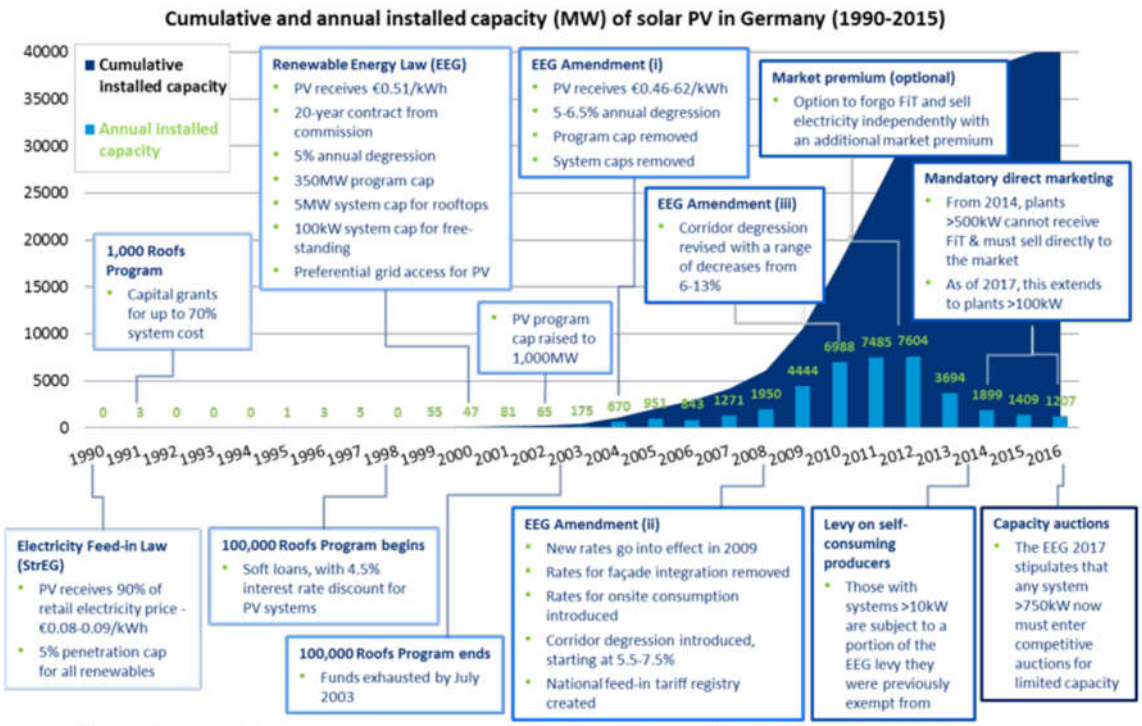

Figure 3-5: Key policy measures to support solar PV installed capacity (MW) of solar PV in Germany (1990-2015) (Sources: Carbon Trust analysis; IRENA RESource)

Figure 3: Key policy measures to support solar PV in Germany. Sources: Carbon Trust, IRENA RESource.

The experience of PV boom years funded by public or rate payer's money with in part excess remuneration and disproportionate benefits for PV companies has left policy makers with a "trauma", now trying to avoid any kind of incentive schemes for RE that may lead to similar situations.[5] For the AWE sector this means that it cannot expect similarly generous support schemes.

2.4.2 Offshore wind energy

In the year 2000, onshore wind had already some 17 GW installed world-wide, hence an order of magnitude that is not comparable to the AWE sector. A more useful comparison may be the offshore wind sector which built on the experiences of the onshore wind industry but required a large amount of new knowledge and expertise to overcome many additional challenges.

The policy measures to support offshore wind in the UK are shown in the figure below. In the UK offshore wind is leased in "licensing rounds" coordinated by the Crown Estate (CE) which is the landlord and owner of the seabed. This approach allows knowing where future offshore developments will take place.[6] The Renewable Obligation Certificates (ROCs) are considered to be the key reason for the success of offshore wind in the UK. "Their ability to guarantee a stable source of revenue over a long period of time combined with an increase in the level of the obligation made it an attractive financial proposition for developers and investors alike."[7]

[5] There were also other reasons why PV lost political support, e.g. the influence of utilities and lobbying groups.

[6] http://www.renewableuk.com/page/OffshoreWind

[7] IEA RETD TCP (2017), Commercial Readiness Index Assessment – Using the method as a tool in renewable energy policy design (RE-CRI)

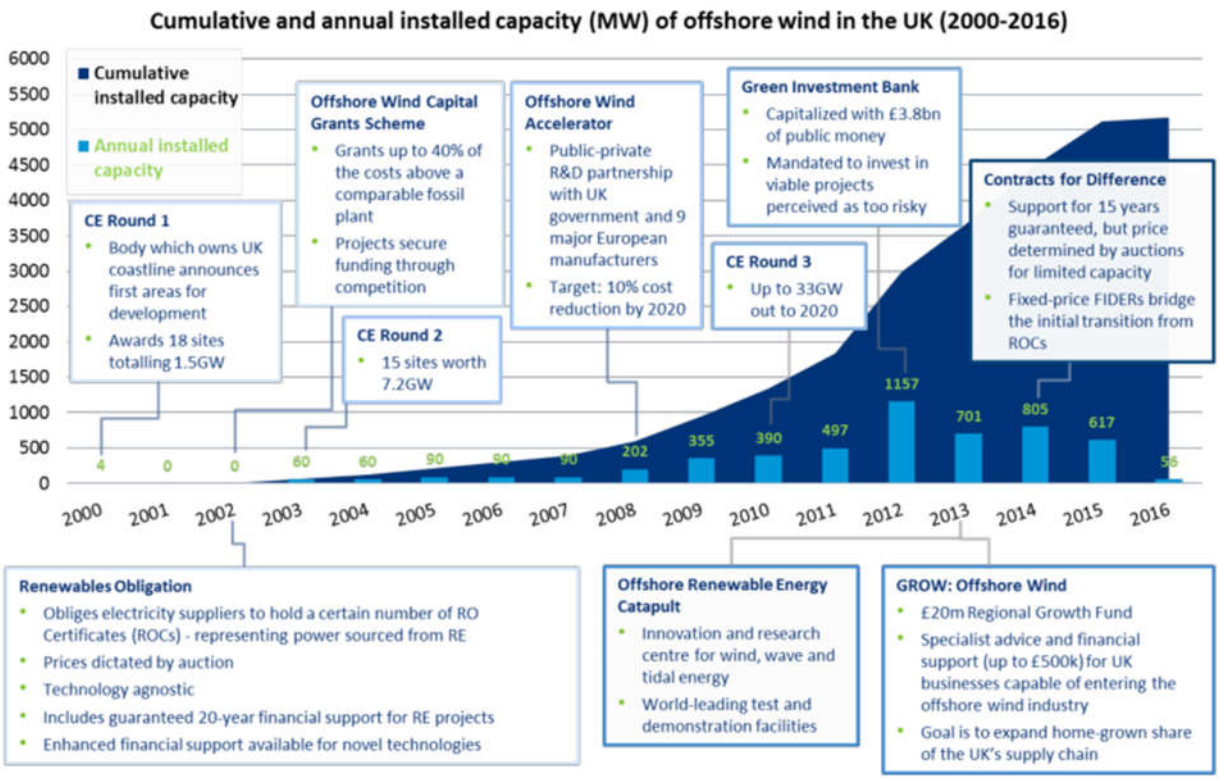

Figure 4: Policy measures to supported offshore wind in the UK. Sources: Carbon Trust, IRENA Resource. Note: CE = Crown Estate.

As can be seen, it took almost a decade from the first licencing rounds until a significant amount of MW were installed. This means that AWE sector may need to start thinking about securing sites early on or make arrangements with licence owners to use parts of the development areas for AWE systems.

2.4.3 Ocean energy

A sector which is in a comparable situation as AWE is the ocean energy sector. In 2013, ocean energy stood at 10 MW and had attracted €600 million of private sector investments in seven years.[8] By mid-2016, 17 MW of tidal stream and 12 MW of wave energy were deployed.

Individual projects were quite successful in assuring funding, for instance the Irish WestWave project received a €23m funding allocation from the second round of the European Commission's NER300 funding competition (this scheme will be further discussed in section 3.2.2.2). This equates to a feed-in tariff of 535 €/MWh.[9] The project had already received €19.8 million of funding under phase one of the NER300 in 2013.[10] Another recipient of NER300 funding, with an award of almost €18.4 million, was the 8 MW project Sea Generation (Kyle Rhea) Ltd.

These examples show that it is possible to get early support from policy makers and investors for innovative projects that show a convincing case.

Even though there were **FiT schemes** in place in a few countries like Portugal or Ireland, they have not led to a consistent uptake yet. In the UK discussions about an ocean-energy-specific revenue-based support scheme are being discussed but so far no decision has been taken. One interviewee said that the ocean energy sector has started discussing this kind of specific revenue support quite late, and that the **AWE sector may intend to trigger talks earlier in the process.**

[8] https://setis.ec.europa.eu/setis-reports/setis-magazine/ocean-energy/editorial-dr-sian-george-ceo-european-ocean-energy

[9] http://renews.biz/69985/westwave-scoops-e23m/

[10] https://setis.ec.europa.eu/setis-reports/setis-magazine/ocean-energy/ocean-energy-receives-funding-under-ner300

2.4.4 Small wind

Support schemes for small wind energy technology may be interesting to investigate in more detail, especially for the AWE demonstration systems. Size limits and Feed-in Tariffs vary widely from country-to-country as can be seen in the table below. In general systems below 20, 40 or 100 kW are considered small wind. FiTs range from less than € 10 cents to over € 40 cents/kWh.

Table 1: Small wind Feed-in Tariff Pricing worldwide. Souce: WWEA 2017[11]

Table. Small Wind Feed-in Tariff Pricing Worldwide

Country/ Region	Size Limit	EUR/kWh	Country/ Region	Size Limit	EUR/kWh
Canada			Japan	< 20kW	0,464
Nova Scotia	< 50kW	0,340		≥ 20kW	0,185
	> 50kW	0,089	Luxemburg		0,091
China		0,134-0,201	Portugal	< 3,68kW	0,432
Chinese Taipei	1-20kW	0,237	Serbia		0,092
	> 20kW	0,078	Slovenia	< 1 MW	0,095
Czech Republic		0,071	Switzerland	< 10MW	0,179
Denmark	< 10kW	0,330	Switzerland	< 10MW	0,179
	10-25kW	0,200	UK	< 50kW	0,097
Greece	< 50kW	0,250		<100kW	0,0635
Italy	< 1MW	0,300	USA		
Israel	< 15kW	0,250	Hawaii	< 100kW	0,110
	15-50kW	0,320	Vermont	< 15kW	0,200

2.4.5 Challenging competition of RE technologies

It is obvious that AWE can neither wait for 30 years nor until deployment levels in the gigawatt range are reached to receive meaningful support. In the interviews the representatives of the AWE companies actually emphasized that they are confident that they can be cost-competitive within a comparably short timeframe of maybe 5-10 years.

However, the **energy context has significantly changed** in the last years, making it very challenging for new RETs to enter into the electricity market: Until recently all RETs were expensive, so policy makers saw the need to bring down costs. By now, PV, onshore and even offshore wind have become in many regions more cost-efficient than fossil fuels, so the need for **developing new RET may not be seen as urgent as it used to be**[12]. This context needs to be considered when discussing AWE-specific support schemes with policy makers as it requires to make a very convincing case for the future deployment potential (not only with regards to costs but also energy system integration, capturing additional renewable resource potential, and other aspects like job creation potential).

It is also important to note that the large cost reductions of PV and wind were only possible through **large scale deployment of *grid-connected* systems**. Off-grid applications for PV and wind have existed for a long time but the real boom occurred only once feed-in tariffs guaranteed a constant flow of revenues based on the sales of electricity. The off-taker is obliged to buy the electricity. This made projects **bankable**, i.e. attractive for banks to finance.

By contrast, an off-grid system usually does not sell electricity, it "only" saves diesel costs. So the technology provider needs to generate income from the sale of the system itself. As the client has usually no obligation to buy an RE system, the business model is riskier and thus less interesting for

[11] http://www.wwindea.org/wp-content/uploads/filebase/small_wind_/SWWR2017-SUMMARY.pdf ; Note on Switzerland: The 2nd line is supposed to say "> 10 MW", the FiT is the same for small and large wind turbines: 0.215 CHF/kWh, see http://www.res-legal.eu/search-by-country/switzerland/single/s/res-e/t/promotion/aid/feed-in-tariff-1/lastp/396/

[12] Notwithstanding that there is still the widespread argument that RET receive too many subsidies – an argument that ignores the fact that there is still no level playing field on the energy markets with fossil and nuclear energy receiving several times higher subsidies and not internalizing their external cost.

banks to finance. Several AWE companies (like Enerkite or Twingtec) develop their systems targeting off-grid markets; but they do so less because they find those markets particularly attractive but because they see that – assuming that there will be only limited help from support schemes – AWE systems can become faster competitive in these niches than in wholesale markets.

But the lesson learned from PV and wind is that this strategy will most likely keep AWE systems in these niches for a long time. So even if a few companies may sell a decent number of systems, it is unlikely that the sector as a whole makes will bring costs down to a level that is competitive with PV, conventional wind or fossil fuels.

Hence, **the sector cannot rely on niches to develop a fully competitive technology**. In the last decades there has been no new power technology – neither fossil, nor nuclear, nor renewable – that made it "by itself" into the electricity system, all of them required public support in one way or another.[13] The AWE sector can therefore demand policy support with a reasonable amount of self-confidence – at least as long as it can deliver on its promises.

3 What kind of support?

3.1 Overview

Although in the previous section a number of support schemes were already mentioned, this section will give a more systematic overview on the range of policies that can be used to support innovative technologies like AWE. The following table shows the various types of policy support schemes that exist for the renewable energy sector:

Table 2: Policy support schemes. Source: IEA-RETD 2014

focus type	Push-Policies – supply side	Pull-Policies – demand side	Input / Complementary
Financial	• Investment grants • Interest subsidies • Tax credits	• FIT • TGC • Tax credits • Investment subsidies	• R&D grants • Financial programs for schools, universities • Research awards
Regulatory	• Standards (TÜV, …), • Labels • IPR • R&D spending obligation • Land use rules • Intellectual property	• Product norms/ standards (ISO) • Quotas • Product information standards or requirements • Financing	• Mandatory education/training • Educational standards (curriculum) • Reporting standards • Legal framework/rights • Banking rules • Recycling rules
Educational, research, learning	• Scientific, management, … training on the job • Building of capacities and skills	• Information activities (platforms, discussion rounds, presentations, talks, speeches, …) to increase awareness of selected issues	• R&D networking • Education programs • Establishment of platforms, WS
Infrastructural	• Infrastructure road, rail, ship, IT, power, water,….	• Finance	• Education

[13] This does not only include financial support (or tax exemptions) for investments or R&D but also political support in the form of allowing externalization of costs (through pollution, greenhouse gas or nuclear emissions) or concessions for infrastructure (seabed or land rights, pipelines, ports, etc.). Subsidies to fossil and nuclear energy are still higher than for fossil fuels, see e.g. IEA "World Energy Outlook 2014", Ecofys (2014) "Subsidies and Costs of EU Energy", EC,: https://ec.europa.eu/energy/sites/ener/files/documents/ECOFYS%202014%20Subsidies%20and%20costs%20of%20EU%20energy_11_Nov.pdf

The main focus of this scoping study lies on the financial support schemes. Financial incentive mechanisms are not static but evolve with technology and market maturity. Governments take on higher risk in immature stages and then intend, at least in theory, to gradually scale down their support to avoid market distortions[14].

The so-called push-policies provide investment or innovation support (like grants, public equity, low-interest loans, or tax credits) in the early phases of the product life cycle. Once the technology has been successfully demonstrated, (market-) pull policies provide revenue support through e.g. Feed-in Tariffs or Premiums, Contracts for Difference or technology-specific auctions.

The combination of the two policy types (together with complementary and non-financial policies as shown in the table above) have successfully taken PV, onshore and offshore wind across the valley of death, allowing their commercialization and large scale deployment (see depiction below).

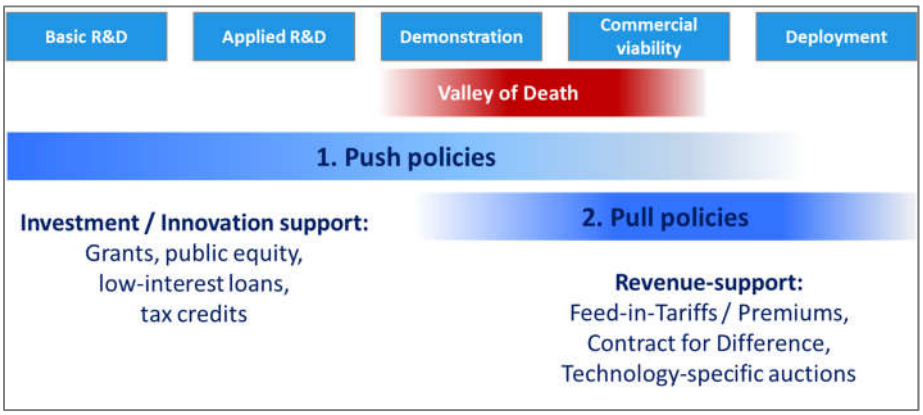

Figure 5: Combination of push and pull policies.

As outlined above, there is no guarantee that policy makers will apply this approach for new RE technologies. But as long as there is no other mechanism available, the existing schemes have proven to be – to different degrees and depending on their design and implementation – effective and efficient.

Within the field of support policies, there are two questions that this study intends to address:

- Regarding push policies: Are all available funding schemes known, especially on EU level? And how can the AWE sector be better considered in future or revised support schemes?
- Regarding pull policies: Is the sector prepared to discuss with policy makers in member states?

The following sections will have a closer look into these issues.

[14] An example of a technology that receives policy support for a very long time (in fact for more than half a century) is nuclear energy.

3.2 Push Policies

The interviews have confirmed that investment support is the most important type of incentive which the AWE sector currently requires. Grants and loans are in general available and used both on European as well as on national level.

3.2.1 Funds raised by AWE sector in recent years

AWE companies raised under the European funding programmes FP7 and its successor Horizon 2020 about 16 M€, see table below:

Table 3: European funding for AWE companies

EU financing			
Project name	**Grant Scheme**	**Financial contribu-tion [m€]**	**Website**
KitVes	FP7	2.90	http://www.kitves.com; http://cordis.europa.eu/result/rcn/92928_en.html
HAWE	FP7	1.90	http://www.omnidea.net/hawe/index.html; http://cordis.europa.eu/project/rcn/96067_en.html
HighWind	ERC	1.50	http://homes.esat.kuleuven.be/~highwind/?p=14; http://cordis.europa.eu/project/rcn/98087_en.html
AWESCO	H2020-MSCA-ITN-2014	3.00	http://www.awesco.eu; http://cordis.europa.eu/project/rcn/193938_en.html
NEXTWIND	H2020 SME-1	0.05	www.kitemill.no; http://cordis.europa.eu/project/rcn/210686_en.html
EK200-AWESOME	H2020 SME-1	0.05	www.enerkite.com; http://cordis.europa.eu/project/rcn/205145_en.html
AMPYXAP3	H2020 SME-2	2.50	https://www.ampyxpower.com; http://cordis.europa.eu/project/rcn/197306_en.html
REACH	H2020 FTI	2.67	http://kitepower.nl; http://cordis.europa.eu/project/rcn/199241_en.html
TwingPower	H2020 Eurostars	1.50	http://twingtec.ch/;https://www.eurostars-eureka.eu/project/id/11105
Total [m€]		**16.07**	

In addition, some 15 m€ were raised through national /regional funds (note that this includes US funds for Makani Power), see Table 4:

Table 4: Funding by national /regional programme funds. Source: HWN500[15]

National/regional financing			
Applicant	**Grant Scheme**	**Financial contribu-tion [m€]**	**Website**
Ampyx Power	Kansen voor West 1 (EFRD)	0.80	http://www.kansenvoorwest.nl/index.php?option=com_projectdetails&view=projectdetails&Itemid=42&projectId=732&lang=en
Ampyx Power	Kansen voor West 2 (ERDF)	2.50	https://www.ampyxpower.com/2017/11/kansen-voor-west-ii-subsidy-granted
Ampyx Power	WBSO subsidy 2009-2014	0.90	http://www.rvo.nl/subsidies-regelingen/wbso
Ampyx Power	WBSO 2015-2016	1.30	http://www.rvo.nl/subsidies-regelingen/wbso

[15] Exchange rates used: EUR/CHF: 0.87, EUR/GBP: 1.12, EUR/USD: 0.84

National/regional financing			
Applicant	**Grant Scheme**	**Financial contribu-tion [m€]**	**Website**
Ampyx Power	KvW2 NLR consortium	0.60	http://wp.nlr.nl/2016/03/24/ruim-23-miljoen-europese-subsidie-voor-smart-industry-field-lab-van-nlr-in-flevoland/
Ampyx Power	R&D projects TKI "Wind op Zee"	0.44	https://www.rvo.nl/subsidies-regelingen/projecten/exploratory-research-and-lcoe-airborne-offshore-wind-farm (English)
e-kite	Subsidy for a feasibility study, MITOost2015.007	0.05	https://www.rvo.nl/subsidies-regelingen/projecten/autonoom-kite-power-systeem; http://www.e-kite.com/blog/
e-kite	Subsidy for a feasibility study, MIT2016.Oost.048	0.05	https://www.rvo.nl/subsidies-regelingen/projecten/commerciële-haalbaarheid-kite-power-technologie
TU Delft	European Regional Development Fund (EFRO)	0.05	http://unmannedvalley.com/
TU Delft	Rotterdam Climate Initiative; Project: Laddermill Ship	1.00	https://repository.tudelft.nl/islandora/object/uuid:4faee228-f21b-4f3e-841b-d7d849d90280?collection=research
TU Delft	Fryslan Fernijt II	0.14	Kite Control Unit
Kitepower	European Regional Development Fund (EFRO)	0.05	http://unmannedvalley.com/
KPS	DECC UK / BEIS Energy Entrepreneurs Fund	0.56	http://www.kitepowersolutions.com
KPS	Innovate UK's Energy Catalyst competition	1.12	https://www.gov.uk/government/collections/energy-entrepeneurs-fund
Kite Energy Scheme	Research Technology Programme	0.11	http://gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=EP/P510312/1
HWN500	ZIM Germany Zentrales Innovationsprogramm Mittelstand		http://hwn500.de
SwissKitePower	CCEM Competence Center; Energy and Mobility, BFE, Alstom	0.44	http://www.swisskitepower.ch/
Autonomous AWE	SNSF Swiss National Science Foundation	1.13	No project homepage
TwingTec RnD projects	CTI Commission for Technology and Innovation Switzerland	0.87	No project homepage
OnKites	Fraunhofer IWES		No project homepage
OnKites II	Fraunhofer IWES	0.80	No project homepage
Beyond the Sea	ADEME French Environment and Energy Management Agency	4.40	http://www.ademe.fr/en/beyond-the-sea
A2WE			http://a2we.ch/
Total [m€]		**14.80**	

In the US, AWE technology is also supported through publicly funded programmes, notably through the Small Business Innovation Research (SBR), the National Science Foundation (SCF) and the Advanced Research Projects Agency – Energy (ARPA-E).

Table 5: Public US funding for AWE

US financing			
Project name	**Grant Scheme**	**Public financial contribution [m$]**	**Website**
eWind Solutions	SBIR (Small Business Innovation Research) program 2015-17	0.80	https://www.sbir.gov/sbirsearch/detail/403258
Windlift	SBIR 2011-16	1.15	https://www.sbir.gov/node/382133
Windlift	SBIR Defense	n/a	http://www.e-kite.com/blog/
Altaeros Energies	SBIR 2011-14	1.44	https://www.sbir.gov/sbc/altaeros-energies-inc
Altaeros Energies:	NSF (National Science Foundation) 2014-18	1.20	https://www.nsf.gov/awardsearch/showAward?AWD_ID=1430989
Makani Power:	SBIR 2012	0.10	https://www.sbir.gov/sbirsearch/detail/395451
Makani Power	ARPA-E/US Dept. of Energy 2010-13	6.00	http://arpa-e.energy.gov/?q=slick-sheet-project/airborne-wind-turbine
AirLoom (former: KiteFarms)	SBIR	0.97	https://www.sbir.gov/sbirsearch/detail/690883
AirLoom	NSF 2016-17	0.23	https://www.nsf.gov/awardsearch/showAward?AWD_ID=1622031
Total m$		**11.89**	

In total **at least 31 m€ of European public funding** have gone into or have been earmarked for the AWE sector and another **12 m$ in the US**.

It is important to note that the above **tables do not show financial contributions of the private sector funding** which is in many cases is also a condition to receive public funding. A recent report estimates that the sector has attracted investment of about **$200 million** from Google, e.on, Shell, Schlumberger, Tata, Softbank and others.[16]

The tables also **do not include loans**, i.e. credits with favourable conditions like the Innovation credit received by e-kite[17] or the Swiss ESA BIC seed funding which supports Skypull[18].

3.2.2 Potentially useful European schemes

The following support schemes have been identified as the main ones which are available at the European level to support innovative technologies:

- Horizon 2020
- NER300 and ETS Innovation Fund
- InnovFin

[16] https://www.prnewswire.com/news-releases/global-airborne-wind-energy-awe-market-report-2018-2028---200-million-investment-from-giants-google-eon-shell-schlumberger-tata-softbank-300541959.html

[17] InnKred2014.22, €353.459, 2014, https://www.rvo.nl/subsidies-regelingen/projecten/innovatiekrediet-94

[18] ESA BIC Switzerland, CHF 500'000, https://www.startupticker.ch/en/news/september-2017/skypull-completes-full-system-test ; http://esabic.ch/

- European Fund for Strategic Investments (EFSI)

It seems that apart from Horizon 2020 the other schemes have not been used yet by AWE companies.

3.2.2.1 Horizon 2020

As shown in Table 3 above, several companies and consortia have made use of this programme. As it will run out by 2020/21, the question will be how the successor programme will look like.

Fast Track to Innovation (FTI): FTI provides funding for for close-to-market innovation activities. Proposals must be submitted by consortia comprising between three and five legal entities established in at least three different EU Member States. The FTI budget is €300 million for the period 2018-2020).[19]

SME Instrument: The SME instrument supports close-to-market activities providing SMEs with 1.6 billion in funding over the period 2018-2020. It offers among others business innovation grants for innovation development & demonstration purposes in the range of EUR 500,000 and 2.5 million (70% of total cost of the project as a general rule).[20]

3.2.2.2 New Entrants Reserve (NER) 300 and ETS Innovation Fund

The NER300 is a programme to finance innovative renewables, industries and Carbon Capture and Storage (CCS)[21]. It is not available for new projects anymore but will be substituted by the ETS Innovation Fund which is currently being defined[22]. NER 300 had a budget of 2.1 bn EUR.

According to an interview conducted, the ETS-Innovation Fund will most likely be – as the NER300 – output-based*: "Final disbursement is based on operational performance of projects and awards are dependent on the verified avoidance of CO_2 emissions".* This means that the full grants will only paid out if (at least some 75% of) the predicted electricity generation will be reached. Projects will require complete financing, i.e. own contributions or loans must be ensured. The conditions are not yet fully clear, e.g. if it be a grant or a mix of grant and loans.

While this tool can be very interesting for AWE projects in the future, it seems that several AWE companies were not aware of this potential future opportunity. The EC department within DG Climate Action dealing with this fund confirmed that it would be helpful to better understand the current status of the AWE sector and which pipeline of projects can be expected. The EC plans to conduct a public consultation by end of 2017 or beginning of 2018 where the AWE sector can submit its comments and any specific needs. Airborne Wind Europe will intend to coordinate a sector response.

3.2.2.3 InnovFin (EIB)

The InnovFin financing tools are managed by the European Investment Bank (EIB). They can be used by AWE. The main focus is on loans: *"InnovFin financing tools cover a wide range of loans, guarantees and equity-type funding, which can be tailored to innovators' needs. Financing is either provided directly or via a financial intermediary, most usually a bank or a fund. InnovFin is available across all eligible sectors in EU Member States and Associated Countries, under the EU Research and Innovation programme Horizon 2020."*[23]

For the period 2014-2020, InnovFin financial products make available some EUR 24bn which finance up to 50% of investment costs, thus InnovFin supports final R&I investments of about EUR 48bn.[24]

[19] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/fast-track-innovation-pilot

[20] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/sme-instrument/

[21] https://ec.europa.eu/clima/funding/ner300-1_en

[22] Non-official website: http://ner400.com/

[23] http://www.eib.org/products/blending/innovfin/index.htm

The **Energy Demo Projects Pilot (EDP)** facility is one of the products that may also be suited for AWE companies: *"InnovFin's EDP facility is focused on first-of-a-kind projects using technologies not yet proven at scale (i.e. TRLs 7 & 8) which can be replicated in the EU and globally. The facility is a strong outcome of the EU's Strategic Energy Technology (SET) Plan. The objective is to support innovative companies and project promoters to overcome the "Valley of Death" between the demonstration and commercialisation phase. The EDP is able to provide direct lending of between €7.5m and €75m. EIB can provide up to 50% with the expectation of around 25% equity and 25% of funding from other sources. Collateral requirements, which project sponsors must fulfil to receive funds, will be set by EIB on a case-by-case basis."*[25]

Another product of interest may be **InnovFin Equity** which does not invest directly into enterprises but works with fund managers. This means that an AWE company has to contact a fund manager first and raise its interest. Among the current funds investing[26] there seems to be only one company (SET Ventures) that also invests in renewable energy / cleantech.

InnovFin Advisory is a tool that provides financial advisory support to companies, a service that may also be useful for AWE companies.

3.2.2.4 European Fund for Strategic Investments (EFSI)

The EFSI is linked to the "Juncker Plan" and is managed by the EIB.[27] It does not trade independently but is combined with instruments like e.g. InnovFin.

"*EIB loans made under the Investment Plan for Europe's EFSI are backed by a guarantee from the EU budget and some of the Bank's own resources. This allows the EIB to accept a greater number of higher risk transactions. These deals are "additional," meaning that they address a market failure and would – in principle – not have been financed in the same way or perhaps to the same extent by the EIB without the Plan's support. Of the deals signed so far, there are ten times as many with new counterparts as there are with existing EIB clients."*[28]

Under this instrument so-called **Investment Platforms** are set up which aim to raising the profile of a particular sector; this could be potentially interesting for AWE.

3.2.2.5 Other financial instruments

Other European financial instruments may be also of interest for AWE[29]:

COSME: The programme for the competitiveness of enterprises and small and medium-sized enterprises[30] runs from 2014 to 2020, with a budget of €2.3billion. COSME support SMEs among others by facilitating access to finance through a Loan Guarantee Facility and the Equity Facility for Growth, a programme which provides risk capital to equity funds investing in SMEs in the expansion and growth-stage phases.

ERA-NET: *"ERA-NET Cofund actions support coordination and collaboration between Member States and their research and innovation programmes. Consequently participation in these actions is limited to entities that can fully participate in joint calls and other actions between national and regional programmes. In this regard programme owners are typically national/regional ministries/authorities responsible for defining, financing or managing research programmes carried out at national or regional*

[24] http://www.eib.org/attachments/documents/innovfin_faq_en.pdf

[25] http://ec.europa.eu/research/energy/pdf/innovative_financial_instruments_for_FOAK_in_the_field_of_Energy.pdf

[26] http://www.eif.org/what_we_do/equity/single_eu_equity_instrument/innovfin-equity/innovfin-equity-signed-deals.pdf

[27] http://www.eib.org/efsi/index.htm; http://www.eib.org/projects/sectors/energy/index.htm

[28] http://www.eib.org/attachments/thematic/investment_plan_for_europe_en.pdf

[29] https://ec.europa.eu/info/business-economy-euro/growth-and-investment/financing-investment/innovative-financial-instruments_en

[30] http://ec.europa.eu/growth/smes/cosme_en

level. Programme 'managers' are typically research councils or funding agencies or other national or regional organisations that implement research programmes under the supervision of the programme owners."[31]

Although ERA-NET would be a useful instrument to promote AWE, it is at the moment not realistic to be applied as long as there are not several governments convinced that AWE should be promoted further in a joint effort. However, it is worthwhile to keep this instrument in mind once progressive Member States can be identified that may want to collaborate.

3.2.2.6 Study on financial instruments First-of-a-kind (FOAK) projects

The study on *"Innovative financial instruments for First-of-a-kind, commercial-scale demonstration projects in the field of energy"*[32] commissioned by DG Research & Innovation has put together the following table which shows the ranges of costs and capacities of projects supported by EU funding schemes:

Table 6: Market overview of sectors based on FOAK project findings[33]

Table 4.2 Market overview of sectors based on FOAK project findings from project developers[81], market participants and overall study findings

Criteria	AEN	BIO	CCS	CSP	Geo	LES	Ocean	SPV	Wind
Total project size range [1]	53-70 MW	Diverse*	250-300 MW	41-111 MW	12-93 MW	6 – 250 MW	4 – 320 MW	Diverse*	2 – 400 MW
Total project cost range [1]	€30m – €41m	€8m – €600m	€500m – €1400m	€185m – €330m	€75m – €117m	€16m – €350m	€20m – €1000m**	€38m – €250m	€54m – €2000m
NER 300 award range [2]	€8m – €85m €11m (median)	€4 – €204m €31m (median)	€300m	€40m – €60m €45m (median)	€16m – €39m €17m (median)	-	€9m – €72m €21m (median)	€8m	€11m – €113m €33m (median)
Range in Cost per MW [1]	€0.57m per MW – €0.58m per MW	Diverse*	€2m per MW – €4.24m per MW	€3.0m per MW – €4.9m per MW	€2.2m per MW – €9.8m per MW	€1.3m per MW – €2.8m per MW	€3.1m per MW – €10m per MW	Diverse*	€1.4m per MW – €10m per MW
Interesting EU markets for FOAK/SET [4]	DE, FR, UK	BG, CZ, DE, FR, IT, PO	NL	IT	DE, FR, NL	DE, ES, UK	FR, UK	DE, NL, RO	DE, DK, FR, NL, UK
Key FOAK risks identified by sponsors [1]	Org risk Tech risk Market/policy risk	Tech risk Market/ policy risk	Market/policy risk, Env. reg. risk, Tech risk	Market/ policy risk, Org risk Tech risk	Tech risk, Operations risk	Tech risk, Market/policy risk	Tech risk C&C*** risk Ops risk	Org risk Tech risk Market/ policy risk	Tech risk C&C*** risk
Key technical issues for FOAK projects from perspective of project developer [1]	Applicability of Technology			"High probability" that project may fail its goals	Implementing new reservoir technology in EGS project Uncertainty over resource prior to drilling		"Unfavourable comparison with other technologies" "Difficulty in getting investors to believe the technology is viable" "Reliability and warranties still need to be improved"	"The problem is the demonstration of the feasibility and potential of the project."	"No reference projects available - No vendor warranty given" "Obtaining market competitive performance guarantees from suppliers, specifically the turbine manufacturer"
Key market issues [1]	Impact of AEN infrastructure on	"Lack of long-term goals &	"Main obstacles are not	"Market Uncertainty"	Secondary issue is social	"No business case…revenue			"Lack of certainty for legal

The table gives the AWE sector an idea where other technologies are positioned. Ocean energy may be the benchmark closest to the AWE sector.

The study found that "*two EU financial instruments have been identified as being needed: equity provision and specialist loans. Loans are already being offered by the pilot InnovFin Energy Demo Projects (EDP) facility. Both equity and loans provision need to be increased to a scale of around €250 million and ideally €500 million until 2020.*"

It further recommends: "*Although the equity fund option scored slightly higher than the InnovFin EDP facility, both are deemed to be of strategic importance and should be developed in parallel, as complementary interventions. Additionally, a clear need has been identified for an Advisory Service to*

[31] http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-ga_en.pdf, p. 7 Footnote

[32] https://setis.ec.europa.eu/system/files/innovative_financial_instruments_for_foak.pdf

[33] AEN: Advanced electricity networks; BIO: Biomass conversion technologies, 2nd generation only, for bioenergy and biofuels; CCS: Carbon Capture & Storage, CSP: Concentrating Solar Power; Geo: Geothermal energy; LES: Large-scale energy storage solutions, including pumped-storage hydropower; SPV: Solar photovoltaics.;

help project sponsors navigate public support and plan better the critical steps in achieving financial close."[34]

It can be therefore expected that the EU will continue to improve its financial instruments over the next years for innovative projects.

3.2.3 Potentially useful national schemes

Apart from EU schemes there are various national support programmes that AWE companies may tap into or which have been used already in the past. Examples are:

- Energy Technology Development and Demonstration Programme (EUDP), Denmark
- Market Development Fund (Markedsmodnings-fonden), Denmark
- Programme Investissements d'Avenir (PIA) (tr: "Investments for the Future"), France
- BMUB Environment Innovation Programme (EIP)(operated by KfW), Germany
- Energy transition financing initiative, KfW, Germany
- Industrifonden, Sweden
- Green Investment Bank (GIB), UK
- Scottish Enterprise, Scotland/UK
- Support for the introduction of new technology – Enova, Norway

More information can be found in the annex of the above mentioned report on FOAK financing.

3.3 Pull policies / revenue support

3.3.1 Possible schemes

While it became clear during the research that the sector still needs mainly push-policies on the supply side like grants and loans, those will not be sufficient in the mid-term. Loans have to be paid back which means that the companies have to generate income. Even if a technology supplier can sell AWE systems, the buyer (e.g. an utility) will have to eventually sell the electricity. Current power market prices in Europe do not provide sufficient revenue and off-grid applications may not lead to sufficient scale as discussed above.

Revenue support schemes increase the bankability and long-term visibility of projects and thus create investor confidence which is crucial for market upscale. Possible performance based incentive schemes are:

Feed-in-Tariffs: Feed-in tariffs (FiT) guarantee the producer of renewable energy a certain price per unit of energy during a determined period of time. FiT were key contributors to the deployment and cost levels that wind and PV demonstrate today.

Feed-in-Premiums: A feed-in premium (FiP) is an additional price per unit of energy that is paid to a producer that sells the renewable energy on the market. That way a certain market price risk is passed through to the producer.

Contracts for Difference: CfDs are similar to FiPs and are used in the UK. A renewable generator is paid "the difference between the 'strike price' – a price for electricity reflecting the cost of investing in a particular low carbon technology – and the 'reference price'– a measure of the average market price for electricity in the GB market."[35] CfDs are determined in auction rounds.

Technology-specific tender schemes: In recent years tenders or reverse auction schemes (the bidder with the lowest price per kWh wins) have been increasingly implemented by countries. These schemes aim to create a more competitive environment. Nevertheless, there are disadvantages like the high upfront costs for tenderers (making it un-attractive for small entities) and the risk of no delivery (when

[34] https://setis.ec.europa.eu/newsroom/news/study-innovative-financial-instruments-support-innovative-projects-finalised-dg, https://setis.ec.europa.eu/system/files/innovative_financial_instruments_for_foak.pdf

[35] https://www.gov.uk/government/publications/contracts-for-difference/contract-for-difference

tenderers bid too low and do not install the capacity they tendered for, even if they have to pay penalties). Even if AWE were already cost-competitive with conventional onshore and offshore wind and PV, AWE would not be eligible under current tender rounds because regulation (safety, standards, noise emissions, environmental impact, etc.) are not yet defined and tender documents are clearly designed for conventional turbines.

In any case, it is clear that AWE technology is not yet mature enough to be able to participate in competitive tenders with conventional renewable power. On the other hand, AWE companies have expressed their general willingness to compete as soon as possible. Therefore it would be crucial to define AWE-specific tender schemes where AWE companies could submit bids under fair conditions with tariffs that are adequate to the technology.

Innovative or mixed policy schemes: For promising technologies like AWE a mix of policy schemes or innovative support may also be considered. For instance, at the AWEC 2017 Henrik Stiesdal proposed a competition initiated by the EC where companies are invited to demonstrate their ability to generate a defined amount of electricity over a defined period of time under certain conditions. The companies would receive investment support during this competition. The winner(s) of the competition would then be awarded a performance based revenue support during e.g. 15-20 years.

Member States may set up support schemes that should be technology and market specific, i.e. incentives may differ by AWES classification like power class, legal classification (e.g. aircraft vs. obstacle), or by market and application (permanently grid-connected utility scale vs. micro-grid vs. temporary disaster response).

3.3.2 Approval process of schemes

Unlike push policies – that can be introduced by the European Commission – pull policies need to be initiated by the Member States. If they consider revenue support as needed to promote a certain technology, they can propose it but need to get approval by the EC which will investigate if the scheme can potentially create market distortions.

The bar for introducing revenue support schemes in EU member states has been raised by the European Commission over the last years as they are considered to not be in line with a competitive market environment. Especially FiTs, which are not linked to energy market prices, are nowadays seen as not appropriate anymore.[36]

The key legislation in place that needs to be adhered to and whose proper application is thoroughly checked by EC DG COMP are the **"Guidelines on state aid for environmental protection and energy 2014-2020" (EEAG)**[37], notably the articles 107 – 130.

In the annex a brief review of these articles has been carried out. The general conclusion is that overall it should be possible for Member States to justify revenue support for AWE: The AWE technology is innovative, can create European jobs, helps to fight climate change, reduces costs, increases the technical potential of renewables and could be potentially exported to non-European countries; to which extent it will be more cost-efficient than conventional (non-)renewable technologies and deployed on a large scale is still to be proven. The AWE sector will have to provide data, information and evidence that the technology has a long-term, cost-efficient potential.

All interviewees from AWE companies confirmed the ambition to quickly come down with the cost and to become competitive. No one expects or demands to ask for support for a long time (rather in the range of 5 years, not of 10 years). But it was confirmed by one of the large utilities at the AWEC 2017

[36] It can certainly be debated if considering FiTs as a "distorting" policy is correct because their aim was in fact to *overcome* market distortions resulting from unfair market conditions for renewables (no appropriate price on carbon, no internalization of external costs, fossil fuel subsidies, etc.). The way it was implemented in many countries was not well thought through, for instance with regards to a consistent tariff level adjustment or the non-consideration of experiences and mistakes made by other countries. But in any case, the AWE sector will have to deal with the current policy environment and cannot hope to change it by itself.

[37] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014XC0628%2801%29

that revenue support would definitely help investors to take pro-AWE investment decisions. Therefore the sector should start soon discussions with policy makers about which criteria need to be fulfilled to implement revenue support schemes.

3.4 Policy support is not only required for funding

Apart from the financial support schemes, policy makers can support AWE through a multitude of other policy measures, e.g.

- **Identifying or reserving spaces that are suitable for AWE**, either as demonstration sites or for deployment with grid access: This type of in-kind support would allow companies to be able to fully concentrate on their technologies. It would also allow the comparison between different technologies under the same conditions.
- **Support from local governments**: Policy makers of local and regional governments can also help with identifying spaces, getting buy-in from local citizen initiatives, environmentalists, and other stakeholders. They can provide lean administrative procedures (e.g. "one-stop-shops").
- **Support regarding airspace and safety regulation**: Policy makers can potentially help to facilitate or accelerate decision making processes on all aspects regarding use of airspace, safety, etc. Especially the importance of safety standards was mentioned several times at the AWEC 2017.

4 What needs to be done

4.1 Policy context – Window of Opportunity

It is important to note that the next months and years (2018 – 2020) offer a unique opportunity for the AWE sector to influence decisions on future renewable energy funding schemes. There are a number of developments currently going on that will determine the availability of funding for AWE companies:

1. **EC Study:** In summer 2017 the EC has commissioned a study on the AWE sector; it will be carried out by Ecorys. Results will have an impact on how the sector will be seen by the EC. The better the sector can present own ideas and requirements for future development, the higher are the chances to be perceived as an important future player. The consultants will not have to develop recommendations only by themselves but can build on the sector's proposals. The study also provides the opportunity to get critical feedback from the consultants and the EC on the ideas and plans brought forward by the sector.
2. **General European RE Policy Framework:** These months (end of 2017) the general EU energy strategy laid out in the so-called "Winter Package" (published in Nov 2016) including the Recast of the Renewable Energy (RED2)[38] are being negotiated. The outcome will potentially affect the way how innovative technologies like AWE shall be promoted and under which conditions.
3. **National Legislation:** Based on the decisions on EU level, the subsequent redefinition of national RE legislation will take place. The National Energy and Climate Plans (NECPs) that will have to be developed will be underpinned by potentially new national RE support schemes. The AWE sector should make sure that it becomes visible in these schemes.
4. **The ETS Innovation Fund ("NER 400")** is currently being defined as mentioned above. The public consultation planned by the EC for October or November 2017 is a great opportunity to submit the AWE sector's view and any specific needs. The sector will have to discuss on how to best answer this request (who is in charge, who should be involved).
5. **Horizon 2020**: This funding program will come to an end one the current Work Program 2018-20 is implemented. The discussions on the successor program, which will likely last until 2030, have started. It may look similar but specific aspects and focus areas may change. For instance, if it was decided that funding for innovative, new RE technologies would scaled down and focus should be put on improvement of conventional wind and PV, it would be a major issue for AWE.

[38] https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf

6. **InnovFin:** As the InnovFin tools are comparatively new, it can be expected that they will be further developed in the future. Showing the needs and specificities of the AWE sector will help the EIB to define services that are specifically useful for AWE companies.
7. **Multiannual Financial Framework for 2021-2027** (including a renewable-focused financial instrument): The preparation of this framework has begun, so it may be investigated which potential impacts it may have for the AWE sector.

The figure below summarizes the developments in the energy context.

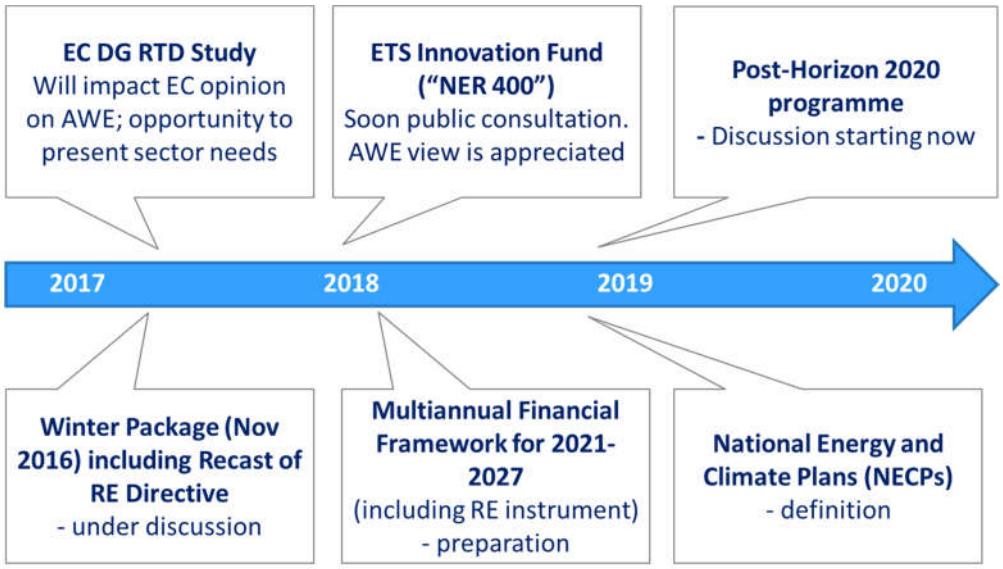

Figure 6: Developments in the context of RE policies

Being aware and getting informed about these activities on RE support schemes is important for each AWE company as well as for the sector as a whole. The scoping exercise revealed that most of the AWE companies are either not aware or not actively involved in these developments. This is understandable because companies usually do not have the resources and time available to deal with these issues. Airborne Wind Europe may be able to overcome this deficiency by ensuring AWE representation and keeping the AWE companies informed.

In order to leverage its impact on current negotiations, the AWE sector should get aligned. It is crucial to demonstrate the sectors' ambition and that the sector is willing to work together on common issues.

4.2 Industrial context

4.2.1 Raising the sector's profile

It is not only important that the AWE sector needs to be fully aware of the policy context, it is also important that policy makers are aware of the AWE sector. The interviews with a few policy makers on EU and national level showed that the knowledge about the technology, its current status and its potential is limited. Only one (US) policy maker participated at the AWEC. In order to demonstrate how the sector can be embedded in the European and national strategic frameworks, **the sector has to become more visible** and provide more information and data on its achievements as well as potential development and deployment scenarios. That way, policy makers can take the sector into consideration when designing new funding programmes or defining energy strategies.

The same holds true for potential investors like utilities and the industrial sector. At the AWEC there were only a few representatives of large European utilities and AWE related industries. The sector needs to raise its profile towards these companies in order attract interest.

4.2.2 Sector-wide data and information

Currently individual companies have drafted plans how they envision their product to be rolled-out. Some companies have plans up to 2030. However, there is no aggregated, sector-wide scenario

available yet because so far there has been no initiative to gather the companies' business plans in a systematic way. Such an exercise should analyse at least the following **data by year up to approximately 2025**:

- **Planned capacity [MW] installed and number of systems.** Not all companies plan their systems to be deployed in large wind parks. Therefore different categories of systems and applications need to be defined. For instance, while one company plans to build one single 100 kW system in 2018, and then to scale-up to 5, 15, etc. systems in the following years, others plan to scale up more quickly in size and number of systems.
- **Planned installation costs [EUR/kW].** During the interviews a wide range of costs was given: between 1500 and 5000 EUR/kW. This demonstrates that on the one hand AWE technologies are quite different (e.g. soft kites are generally cheaper than rigid kites but they need to be exchanged more often), and on the other hand that the development status of some companies may be further advanced than others.[39]
- **Levelized Costs of Energy (LCOE)**. The LCOE is widely used to compare energy technologies. One company claimed to be able to produce in the next 1-2 years for 15 ct/kWh; most companies did not want to speculate on costs yet.
  One important input factor to the LCOE is the cost of capital. One interviewee said that it took 20 years for the wind and PV sectors to lower the interest WACC (Weighted Cost of Capital) from 10% to 5% (only recently for offshore wind). A large kite over 250 kW may be able to compete with the LCOE of conventional wind, but only if the same interest rate could be applied. It is therefore crucial to demonstrate AWE system reliability very fast in order to lower risk perception of investors.
- **Planned generation by system [MWh and full load hours].** One of the key promises of the sector is to be able to generate electricity during more hours over a year than conventional wind turbines. At the AWEC 2017 Henrik Stiesdal reminded the sector that this claim needs to be substantiated urgently in order to attract policy makers' and investors' interest. One company expected a 45% capacity factor very soon, so needs to be seen if this can indeed be realized. It should be noted that certain systems will not target a high amount of full load hours as they will be mainly used for emergency response cases.
- **Staff development.** An important driver for the justification of policy support is the creation of jobs in Europe. Companies should show the plans for their own staff but potentially also try to estimate the job creation potential along the entire value-chain. The more of the production can take place in Europe, the more favourable policy makers will view the technology.
- **Target markets.** The export potential of an innovative technology is another reason to provide public financial support. Analysing the companies' target markets will allow drawing conclusions on the potential revenues generated through exports.
- **Funding needs**. The aggregation of funding needs over all companies would show which amounts the sector actually requires for its growth. This would also provide justification for AWE-specific incentives. For instance, the ocean energy sector claims that it needs an Investment Support Fund of €250m and an Insurance and Guarantee Fund of €50m-€70m.[40]

The aggregation and comparison of these data may also be used as a **benchmark exercise** which could reveal that certain companies may already be behind. Naturally, not every company would be interested in an open comparison because it can affect their funding possibilities. Therefore it is important to plan this analysis carefully, conduct it potentially anonymously and ensure that confidential data are not published or widely shared.

Another important aspect is that the data gathered as well as the results need to be critically reviewed and challenged. **If this sector does not deliver what is promised it will lose credibility**. This was one of

[39] This finding is consistent with a survey carried out by HWN500 in 2014: "*For AWE in particular, the survey has revealed that expectations on required capital to develop a commercially viable utility-scale AWE device (500kW to 1 MW or larger) vary considerably between EUR 5-10m at the lower and over EUR 100m at the higher end".* (Zillmann, 2014)

[40] Ocean Energy Forum 2016, Roadmap

the issues of the ocean energy sector where expectations were raised that could not be satisfied, leading eventually to investors and policy makers turning away.

A future funding strategy for the sector requires that investors are made aware of the high probability that **not all companies and concepts will survive once the dominant design(s) emerge.** But this does not necessarily mean that the invested money did not have a lasting effect: the knowledge and insights gained by the employees and throughout the evolutionary process will be assimilated by the companies that survive. It can be assumed that there will be new opportunities for the ones who may have lost their jobs.

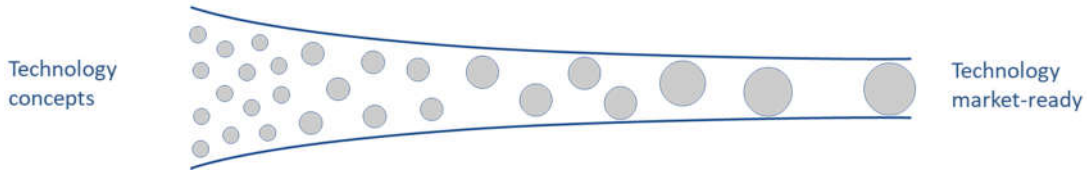

Figure 7: Technology development towards a dominant design

Companies should therefore constantly follow the sector developments and be potentially prepared to change their technological concept or strategy. To find the right balance between fierce competition on concepts and funding versus collaboration to develop the sector will be a challenge for all companies.

4.3 Outreach and positioning of AWE

A stronger collaboration among the AWE companies also means that communication and outreach activities need to be aligned to convey consistent messages. Currently most companies promote their technology by comparing them with conventional wind energy, basically **claiming that "AWE is better than conventional wind"** due to the long term cost saving potential. AWE is even called a "disruptive" technology that could make the entire conventional wind industry obsolete.

However, while it is important to show the potential advantages of AWE to attract interest, it is questionable if it is the best strategy to view conventional wind as the main competitor. The AWE sector has already many challenges and barriers to overcome, facing strong opposition from the established wind industry which regards AWE as a threat will not help to make life easier for AWE companies.

Figure 8: Positioning of AWE sector

There is no doubt that there are areas where AWE would be the best and most suited RE technology, e.g. in areas with currently low wind resources, deep water offshore, in isolated off-grid applications or in hurricane-stricken regions where it would be too risky to put up conventional turbines. But it is unlikely that AWE can substitute in all locations – and definitely not any time soon given the sheer number and capacity of conventional turbines already deployed. The cost levels already achieved will continue to decrease, so it becomes more and more challenging for AWE to compete with new turbines.

An alternative approach is to position the **AWE sector as a complementary part of a wide mix of RE technologies, including conventional wind**. Eventually a suite of RE technologies in combination with energy efficiency and savings, storage, sector coupling and demand side management is required for a swift transition towards a 100% renewable energy system. The combination of RE technologies can be regarded as disruptive, but not one single technology. In other words: The different RE technologies need to complement each other, like the instruments in an orchestra. Asserting that AWE could

substitute conventional wind is not only highly speculative but even presumptuous given that this young industry does not have a convincing track record yet.

Apart from that, for any RE technology it will become more and more important to support the energy system by providing services and energy when most needed. New provisions in the design of auction and other schemes are already happening,[41] AWE needs to – and is potentially able to – respond to these requirements in the future.

To become successful, the AWE sector will need the support and acceptance not only of the public and policy makers but also of the entire RE community, and specifically of the wind energy sector. Therefore AWE should not try to compete against other RE technologies, but should focus on proving how it can best contribute to the renewable energy transition and to the phase out of fossil and nuclear energy. Policy makers' and investors' interest and funds need to be drawn away from those technologies, not from other renewables.

4.4 Airborne Wind Europe – potential activities

Airborne Wind Europe has been launched at the AWEC 2017 as Europe-wide AWE industry association aiming to support individual companies[42] and the sector as a whole. Potential activities to support the AWE sector may include:

1. Define "sector wish-list" towards policy makers (as input to EC study)
2. Develop a European AWE policy road map up to 2025 incl. funding needs;
3. Develop a consistent storyline for communication
4. Get visible towards EC, Member States and Funding Programmes
5. Outreach to WindEurope, ETIP Wind and other networks
6. Advocate for AWE-specific, common test and demonstration sites
7. Joint activities on safety, airspace regulation, standards, etc.

In the following the proposed sector-wide activities are briefly outlined.

4.4.1 Define "sector wish-list" towards policy makers

The sector study commissioned by DG RTD will be finalized by mid-2018. It would be useful to present common ideas and recommendations or requests for policy makers as a sector, not only as individual companies. However, interviews with companies have probably already started and there may not be enough time anymore to coordinate the AWE companies. But Airborne Wind Europe could prepare such a "wish-list" and try to get comments and approval from the companies. Key-points could be:

- Required investment and revenue support on EU and MS level
- Common test sites
- Timely advancement of European airspace regulation
- …

Tasks: Prepare first draft of wish list, circulate among network partners, gather feedback, organize telephone conference(s), get approval on final version, discuss with EC consultants, etc.

4.4.2 Develop a European AWE Roadmap up to 2025

To raise the profile of the AWE sector as described under 4.2, a European AWE Roadmap should be developed which would cover the key sector-specific data and plans. It could be used as main reference for stakeholders.

The roadmap could be set up in similar ways as the one from the Ocean Energy sector (*quotes in italic;* short comment underneath)[43]:

[41] Jansen, M. (2017) „Innovation Balancing"

[42] Activities to support individual companies are not the primary focus of this study. They may include: Identification of funding opportunities, support with funding applications, advice on policy or regulatory issues where companies may not have the resources, support on business and marketing plans, etc.

- *Action 1 – Industry and Member States to establish a European phase-gate scheme to validate sub-systems and early prototypes in the less mature ocean energy technologies.*

  It should be investigated if this approach can be applied to the AWE sector. At first glance it seems to be useful; at least it can provide some ideas.

- *Action 2 – EU and National Authorities should set up a €250m Investment Support Fund providing flexible capital and enabling further private capital to be leveraged.*

  The order of magnitude may be similar for the AWE sector. In any case, the funding needs need to be calculated for different uptake scenarios.

- *Action 3 – EU and National authorities should set up a €50m-€70m Insurance and Guarantee Fund for ocean energy demonstration and pre-commercial projects, covering risks that are currently not covered by either insurance products or manufacturers guarantees.*

  As for Action 2, the AWE sector may need a similar fund since risk coverage is also required.

- *Action 4 – Relevant planning and consenting authorities to de-risk environmental consenting through an integrated programme of measures that will develop guidance on planning, consenting, research, socio-economics and demonstration. This guidance will ensure that best practice and experience in consenting ocean energy projects is shared and used to improve and streamline processes.*

  Such guidance will also be required for AWE. It would need to be extended and focused on airspace.

These are certainly only suggestions; to develop a European AWE Roadmap the companies would need to define it in a joint approach.

Tasks: Structure and manage roadmap definition process, provide capacity building to AWE stakeholders on policy issues, define advantages and disadvantages of AWE / conduct SWOT analysis, define sector goals and targets, organize workshop(s), systematically collect business plans, calculate funding needs, draft roadmap, organize review process, etc.

4.4.3 Get visible towards EC, Member States and Funding Programmes

As discussed above, the AWE sector needs to become more visible for policy makers and funding programmes such as NER400, Horizon"2030", InnovFin, etc. Even though funding is in most cases provided for individual companies, it is important to show the potential of the entire sector. On the European level the current window of opportunity should be used to try to "earmark" a part of the R&D and innovation funding for AWE. At the national level of Member States, the association can start discussions with policy makers about AWE-specific support schemes.

Tasks: Prepare sector presentation, meet with responsible programme managers and present AWE sector (ideally including funding needs and sector uptake scenarios), explain opportunities and programme details to network members, etc.

4.4.4 Become visible in various networks

The sector should start reaching out and/or become member of the following networks:

- WindEurope
- European Technology and Innovation Platform on Wind Energy (ETIP Wind)[44]
- National wind associations

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[43] https://webgate.ec.europa.eu/maritimeforum/sites/maritimeforum/files/OceanEnergyForum_Roadmap_Online_Version_08Nov2016.pdf

[44] https://etipwind.eu/?ref=tpwind

- IRENA
- IEA and IEA Wind Technology Collaboration Programme
- REN21
- EUREC
- Etc.

This will help to increase the sector's visibility in discussions, conferences, fairs, reports, studies, websites and other forms of communication, and to be considered for future energy strategies and policies. The contacts will also help in case specific questions arise where insight knowledge is required, and the sector may get informed about certain (political) developments that may affect the sector.

The positioning within the RE community as discussed under 4.3 should be taken into consideration.

Potential activities include: Make presentations, participate in workshops, conferences and meetings, provide information upon request, participate in studies or common projects (like certain tasks in the IEA Wind Technology Collaboration Programme), voice special requirements for AWE sector when it comes to policy recommendations, etc.

4.4.5 Advocate for AWE-specific, common test and demonstration sites

Ideally there would be several sites across Europe. All AWE companies that apply (and maybe have a certain level of TRL) can test their systems in the sites. Certain data would be shared. Companies would get a secured grid access; a battery system could be built up for systems that are not grid compatible yet.

One could then think of a common support scheme, e.g. all electricity produced gets a certain FiT. This FiT could be paid either by the country where the park is located or by the countries that participate in the test field programme. The FiT could be either the same for all companies in the test site or it may be tendered. Such an approach could be marketed as a common Energy-Union approach. As projects need to apply for the site access, there will be also competition between companies and concepts which will justify support towards DG COMP.

The Dutch Ministry of Economic Affairs mentioned that a new test site is planned in the North of the Netherlands which could potentially host also AWE systems. AWE companies should follow-up on this information.

4.4.6 Joint activities on health and safety standards, airspace regulation, data sharing, etc.

There are many areas where the AWE sector needs to speak ideally with only one voice in order to pave the way for the individual companies. This concerns for instance:

Health & safety standards: At the AWEC 2017 several companies highlighted the importance to define industry wide health and safety standards to avoid accidents and damages. Those could have a very negative impact on the entire sector. Pictures of detached blades, broken wind turbines and burning PV plants have always led to discussions in the media and social networks, negatively impacting the image of the affected technology but also of the renewable energy sector as a whole. Therefore the AWE sector must have safety standards defined before any accident has happened. As those probably cannot be prevented at hundred percent, the sector should at least be able to prove that utmost precautions were taken.

Airspace use and regulation: Joint activities of AWE companies with EASA and other regulatory bodies have already taken place in the past. They should be further intensified to solve these issues for the entire sector and all technologies.

Data sharing: The data gathered during flight tests (power, generation, wind speeds, etc.) should be shared among AWE companies to allow for quicker learning, more efficient testing, benchmarking, etc. The type of data and the way they should be gathered and shared need to be defined.

5 Conclusions

The AWE sector is poised to grow with several companies planning to commercialize their systems in the next years. Several challenges still need to be overcome, the **entrance into the highly competitive and regulated European electricity markets** being one of them. To become a player in these markets, a good understanding of the broader policy and industrial context and strategies on the European as well as on Member State level is crucial.

As any other (renewable) energy technology, the **AWE technology will require specific policy support** to reach its full potential. While a number of support schemes exist, they will need to be further extended or adjusted to the needs of the AWE sector. The years 2018-20 offer a unique opportunity for the sector to become more visible and to potentially influence the design of some of the funding programmes.

To do so, the **sector needs to collaborate much more closely**. The sooner joint activities, projects and processes can be established, the faster the sector will be able to reach its potential. The creation of the European association Airborne Wind Europe can help bringing the AWE companies closer together and raising the sector's profile and visibility by initiating a number of joint activities, e.g. regarding the definition of sector roadmap, outreach to policy makers and other stakeholders, definition of health & safety standards, etc.

The next years will crucial for the future of the AWE sector. By getting prepared in the field of policies and support schemes, the chances of successfully reaching the commercialization phase will significantly increase.

6 Annex

6.1 Review of the EEAG – Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01)

In the following the key articles of the EEAG are briefly commented on in order to give a first idea of potential justification of AWE-specific support schemes proposed by Member States. For better visibility, comments are highlighted in blue.

Introduction

The introduction of this key policy describes how DG COMP understands effects, efficiency, etc. and what is allowed, reasonable, not disturbing the market. Important is to always show that State Aid supports the 2020 and 2030 targets, that the least market-disturbing form is chosen and that there is a strategy to phase them out.

[…]

5) The headline targets mentioned in recital (3) are particularly important for these Guidelines. In order to support achieving those targets, the Europe 2020 strategy put forward the 'Resource efficient Europe' as one of the seven flagship initiatives (4). That flagship initiative aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy which helps to:

(a) boost economic performance while reducing use of resources;

AWE's promise is exactly that.

(b) identify and create new opportunities for economic growth and greater innovation and boost the Union's competitiveness;

AWE can create a new industry.

(c) ensure security of supply of essential resources;

Using wind resources in high altitudes, in low-wind areas, in deep-offshore waters, etc.

(d) fight against climate change and limit the environmental impacts of the use resources.

Key promise of AWE.

(15) These Guidelines do not apply to: […]

(d) State aid for research, development and innovation [(16)] which is subject to the rules set out in the Community framework for State aid for research and development and innovation [(17)]; [(16)] The Guidelines provide for a bonus for eco-innovation projects, which are highly environmentally friendly and highly innovative investments. [(17)] OJ C 323, 30.12.2006, p. 1.

The new Renewable Energy Directive – which is currently being discussed – would be formally above the guidelines but after longer controversies with DG COMP it seems that EEAG is the one to be applied.

There may be other research and other innovation guidelines and funds (to be checked, e.g. with EUREC)

AWE relevant sections of the EEAG: Section 3.3, §§107-130

3.3. Aid to energy from renewable sources

3.3.1. General conditions for investment and operating aid to energy from renewable sources

(109) Market instruments, such as auctioning or competitive bidding process ***open to all generators*** *producing electricity from renewable energy sources competing on equal footing at EEA level, should normally ensure that subsidies are reduced to a minimum in view of their complete phasing out.*

Technology-neutral auctioning or competitive bidding are seen as the "normal way". Although this can be questioned, it will be too difficult for the AWE sector to fight this general assumption.

(110) However, given the different stage of technological development of renewable energy technologies, these Guidelines allow technology specific tenders to be carried out by Member States, on the basis of the longer-term potential of a given new and innovative technology, the need to achieve diversification; network constraints and grid stability and system (integration) costs. [see also §126, 2nd paragraph a)-d)]

In general EEAG says in § 110 that market introduction has to be done with tenders but it can be technology specific. But that certain exceptions are allowed (§111).

(115) In particular while the EU ETS and CO2 taxes internalise the costs of greenhouse gas ('GHG') emissions, they may not, yet, fully internalise those costs. State aid can therefore contribute to the achievement of the related, but distinct, Union objectives for renewable energy. Unless it has evidence on the contrary, the Commission therefore presumes that a residual market failure remains, which can be addressed through aid for renewable energy.

(116) In order to allow Member States to achieve their targets in line with the EU 2020 objectives, the Commission presumes the appropriateness of aid and the limited distortive effects of the aid provided all other conditions are met.

So AWE can expect that state aid is ok, the question is only in which form.

(119) Aid to energy from renewable sources can be granted as investment or operating aid. For investment aid schemes and individually notified investment aid, the conditions set out in Section 3.2 apply.

The conditions under Section 3.2 should pose no general issue to AWE.

(120) For operating aid schemes, the general provision of Section 3.2 will be applied as modified by the specific provisions as set in this Section. For individually notified operating aid, the conditions set out in Section 3.2 apply, where relevant taking into account the modifications made by this Section for operating aid schemes.

The conditions under Section 3.2 should pose no general issue to AWE.

(121) The Commission will authorise aid schemes for a maximum period of 10 years. If maintained, such measure should be re-notified after such period.

It should be checked again if this is about the scheme or also about the incentive as such (can operating aid be given for 20 years?)

(122) The Union set an overall Union target for the share of renewable energy sources in final energy consumption and translated this target into mandatory national targets. The Renewable Energy Directive includes cooperation mechanisms (63) to facilitate cross border support for achieving national targets. Operating aid schemes should in principle be open to other EEA countries and Contracting Parties of the Energy Community to limit the overall distortive effects. It minimises costs for Member States whose sole aim is to achieve the national renewables target laid down in Union legislation. Member States however may want to have a cooperation mechanism in place before allowing cross border support as otherwise, production from installations in other countries will not count towards their national target under the RED (64). The Commission will consider positively schemes that are open to other EEA or Energy Community countries.

If AWE can achieve a cross-border scheme this will be probably a positive point.

(123) Aid to electricity from renewable energy sources should in principle contribute to integrating renewable electricity in the market. However, for certain small types of installations, this may not be feasible or appropriate.

May be only applicable for first systems, but in general not an issue for AWE. Small types that cannot be integrated into the market could be discussed if applicable, at least for the beginning.

3.3.2. Operating aid granted to energy from renewable sources

This section describes that Operating Aid Schemes are possible including Feed-in-Premiums (FiP) under certain conditions.

3.3.2.1. Aid for electricity from renewable energy sources

(124) In order to incentivise the market integration of electricity from renewable sources, it is important that beneficiaries sell their electricity directly in the market and are subject to market obligations. The following cumulative conditions apply from 1 January 2016 to all new aid schemes and measures:

> *(a) aid is granted as a premium in addition to the market price (premium) whereby the generators sell its electricity directly in the market;*
>
> Pure FiT will not be possible anymore
>
> *(b) beneficiaries (65) are subject to standard balancing responsibilities, unless no liquid intra-day markets exist; and*
>
> It's clear that this needs to be done by AWE systems, too.
>
> *(c) measures are put in place to ensure that generators have no incentive to generate electricity under negative prices.*
>
> This can be easily fulfilled.

(125) The conditions established in paragraph (124) do not apply to installations with an installed electricity capacity of less than 500 kW or demonstration projects, except for electricity from wind energy where an installed electricity capacity of 3 MW or 3 generation units applies.

Maybe the first project can run under this paragraph but it is not possible anymore for wind parks.

(126) In a transitional phase covering the years 2015 and 2016, aid for at least 5 % of the planned new electricity capacity from renewable energy sources should be granted in a competitive bidding process on the basis of clear, transparent and non-discriminatory criteria.

From 1 January 2017, the following requirements apply: Aid is granted in a competitive bidding process on the basis of clear, transparent and non-discriminatory criteria (66), ***unless****:*

The following paragraphs may be key to justify FiT or FiP for AWE:

> *(a) Member States demonstrate that only one or a very limited number of projects or sites could be eligible; or*
>
> AWE specific schemes with limited size would most likely fall under this exemption.
>
> *(b) Member States demonstrate that a competitive bidding process would lead to higher support levels (for example to avoid strategic bidding); or*
>
> This may be less likely for AWE as it is probably too early / too risky to already engage in strategic bids.
>
> *(c) Member States demonstrate that a competitive bidding process would result in low project realisation rates (avoid underbidding).*
>
> This exemption would only apply if in a general technology open support scheme there were not enough participants of ***any*** technology. This is rather unlikely to happen.

The bidding process can be limited to specific technologies where a process open to all generators would lead to a suboptimal result which cannot be addressed in the process design in view of, in particular:

The following paragraphs are important to justify an AWE-specific tender scheme:

> *(a) the longer-term potential of a given new and innovative technology; or*
>
> This is a key argument for AWE because the longer-term potential can be very high for offshore as well as for onshore locations.

(b) the need to achieve diversification; or

AWE will help to use wind resources in areas where resource potential of conventional wind turbines is not sufficient (due to lower heights)

(c) network constraints and grid stability; or

This argument can used if AWE can show that it produces when other wind turbines do not produce. Higher full-load hours and thus a generation that is closer to baseload power are advantageous for the grid stability.

(d) system (integration) costs; or […]

This will need to be further analysed.

(127) Aid may be granted without a competitive bidding process as described in paragraph (126) to installations with an installed electricity capacity of less than 1 MW, or demonstration projects, except for electricity from wind energy, for installations with an installed electricity capacity of up to 6 MW or 6 generation units.

This is a general exception of §126. Probably only for a maximum of 10 years if State Aid Clearance accepts this timeframe. DG COMP also sees 10 years as upper limit for guaranteed remuneration.

(128) In the absence of a competitive bidding process, the conditions of paragraphs (124) and (125) […] are applicable.

This is ok and should be possible to be ensured by working with

(129) The aid is only granted until the plant has been fully depreciated according to normal accounting rules and any investment aid previously received must be deducted from the operating aid.

So it may not be possible to first receive investment aid and then operating aid; this has to be checked.

(130) These conditions are without prejudice to the possibility for Member States to take account of spatial planning considerations, for example by requiring building permissions prior to the participation in the bidding process or requiring investment decisions within a certain period.

Important for AWE will be to have permission for use of airspace.

6.2 Extract of Recast of Renewable Energy Directive (RED) on support schemes

A few paragraphs are cited below which explain how the RED defines support schemes and how they are supposed to be implemented. This is just for information purposes for readers that are less familiar with this directive.

https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf

In the electricity sector, Member States will be able to promote renewable electricity by implementing cost-effective national support schemes subject to State aid rules and the framework conditions defined at EU level, including rules for cross-border participation.

To this end, the Forum encouraged the Commission to develop common rules on support schemes as a part of the revision of the Renewable Energy Directive that facilitate a market based and more regionalised approach to renewables.

[…]

(i) Options to increase renewable energy in the electricity sector (RES-E) a) A common European framework for support schemes: (1) sole use of market mechanisms; (2) European framework for market-based and cost-effective support; (3) mandatory move towards investments aid. ***The Renewable Energy Directive allows the possibility for support schemes, but leaves the choice of support schemes to Member States. This has led to the sub-optimal situation where Member States*** *have introduced support schemes which were subsequently, in many cases,* ***changed or revoked retroactively****. This has in turn negatively impacted investor confidence. Clearer rules are therefore needed in the recast Renewable Energy Directive to increase investor confidence. Against this background, Option 2 entails*

the introduction of principles for support schemes that Member States can put in place and are currently still needed for attracting sufficient investments to reach the Union 2030 target. This option includes design principles for Member States to use for support schemes and the protection for investors against retroactive changes. Such principles are without prejudice to State aid rules.

[…]

c) A renewable-focused financial instrument: (1) an EU-level financial instrument with wide eligibility criteria; (2) an EU-level financial instrument in support of higher-risk RES projects. The goal under this area is to enhance the use of funds under existing or new financial instruments to support the high ambition of Member States in deploying renewables. The details of such enabling framework should be set out in the context of the preparation of the Multiannual Financial Framework for 2021-2027.

[…]

For this purpose it is necessary to define in the present regulatory framework the relation between, on the one hand, the right for Member States to choose their own energy mix and to develop the renewable technologies that they have chosen, e.g. for diversification reasons, and the objective to ensure a level of competition between technologies on the other.

RED recast, Article 2 definitions:

***'Support scheme'** means any instrument, scheme or mechanism applied by a Member State or a group of Member States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments;*

Article 4 Financial support for electricity from renewable sources.

Subject to State aid rules, in order to reach the Union target set in Article 3(1), Member States may apply support schemes. Support schemes for electricity from renewable sources shall be designed so as to avoid unnecessary distortions of electricity markets and ensure that producers take into account the supply and demand of electricity as well as possible grid constraints. 2. Support for electricity from renewable sources shall be designed so as to integrate electricity from renewable sources in the electricity market and ensure that renewable energy producers are responding to market price signals and maximise their market revenues. 3. Member States shall ensure that support for renewable electricity is granted in an open, transparent, competitive, non-discriminatory and cost-effective manner. 4. Member States shall assess the effectiveness of their support for electricity from renewable sources at least every four years. Decisions on the continuation or prolongation of support and design of new support shall be based on the results of the assessments.

6.3 Interviews & consultations

AWE companies:

- Ampyx Power
- Enerkite
- Kite Power
- Kite Power Systems
- Kitemill
- Skysails
- Twingtec

Policy makers:

- BEIS Energy Innovation team, UK
- BMWi Germany

- DG CLIMA
- DG COMP
- Ministry of Economic Affairs, Netherlands

Others:

- DTU
- E.on
- Ecorys
- EIB
- EUREC
- Fraunhofer IWES
- HWN500
- IEA RED
- TU Delft

6.4 References

EC, ICF (2016), Innovative financial instruments for First-of-a-kind, commercial-scale demonstration projects in the field of energy

EC (2014), EEAG Guidelines on state aid for environmental protection and energy 2014-20

EC (2016), RE Directive RECAST_1_en_act_part1_v7_1

IEA-RETD TCP (2014), Accelerating the commercialisation of emerging renewable energy technologies (REInnovationChain), IEA Renewable Energy Technology Deployment Technology Collaboration Programme (IEA RETD TCP), Utrecht, 2014

IEA-RETD TCP (2017), Commercial Readiness Index Assessment – Using the method as a tool in renewable energy policy design (RE-CRI), IEA RETD TCP, Utrecht, 2017

Jansen, M. (2017), Innovation Balancing – Proposal regarding §39j/§88d EEG „Innovation Tenders / Innovationsausschreibungen“ (InnoA). E4tech. Short study commissioned by BEE e.V. and Hannover Messe, London / Berlin / Hannover Ocean Energy Forum (2016), Roadmap, Online, Version, 08 Nov 2016

Zillmann, Hach (2014), Financing Strategies for Airborne Wind Energy