20 November 2015

# Input by ETP Smart Grids on Set Plan strategy target/priorities for Off shore Wind.

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Compiled by the ETP Smartgrids Secretariat

Answers to the questions posed in the document "Set Plan Actions – Implementation process and expected outcomes" for the issue paper on Off-shore Wind, Set Plan Secretariat – 14 October 2015.

Stage 1.

**Question: Do you agree with the targets in the issue paper?**

Answer:

**Target 1:** Reduce the levelised cost of energy (LCoE) for fixed offshore wind* by improvement of the performances of the entire value chain to

- o less than 10 ct€/kWh by 2020 and to
- o less than 7ct€/kWh by 2030;.

Yes it is becoming clear from the public debate, in particular in Denmark, that there is a growing discontent with the prices paid by the public by increasingly added PSO taxes for the existing Danish offshore windfarms. The next offshore wind farm (Horns Reef 3 of 400 MW) is expected to be negotiated to a considerable lower price.

**Target 2:** Increase the reliability of offshore wind turbines to 99% and the capacity factor to 55% by 2020;

Yes. We cannot evaluate the specific numbers proposed for reliability and capacity factor for future offshore wind turbines but they need to be targeted with a high ambition. This is due to the fact that there is a growing realization within the European TSO's (ENTSO-E) of the necessity of treating an offshore wind farm as a power producing power plant in line with any other type of production (fuel type) plant. Hence requirements in terms of capabilities of supplying auxiliary services at the point of common coupling to the transmission or distribution grid will most likely be standardized in coming grid codes.

**Target 3:** Develop cost competitive integrated wind energy systems including substructures which can be used in deeper waters (>50m) at any distance from shore and for use in different climate conditions with LCoE of:

- less than 14 ct€/KWh by 2020 and to
- less than 9 ct€/KWh by 2030

For Danish TSO, for target 3 the answer is No. Shallow waters (< 50 m) and waters close to the shore (< 5 km) will be exploited firstly around the world. Hence the development of costly and risky deep water ( > 50 m) windfarm substructures should not have high priority. This is seen in the light of the decreasing public willingness to pay for high cost offshore wind energy combined with an expected low willingness to venture out into novel and high-risk deep water projects.

ENTSO-E is not against target 3.

**Better system integration**: Grid development (enhancing system security, grid integration) and reliability of the grid at very high levels of wind power penetration, up to 70% of the electricity demand, and accuracy of wind power forecasting (reduction of the day ahead forecast error of 35%-45% by 2020.

**Regarding the target of 70% of wind power penetration of the electricity demand** seems very high. According to ENTSO-E Ten Year Network Development Plan -2030 only Denmark in the most extreme vision with extreme high penetration of RES foresees this figure. In general the expected wind penetration in the electricity demand is expected to be in the range 17-25% by 2030

Regarding the increase of **accuracy of wind power forecasting for day ahead**

Day-ahead hourly load forecast errors are typically in the range of 1% to 3% . Wind forecasts typically have errors in the range of 15% to 20% mean absolute error for a single wind plant. Usually the improvements of the accuracy are estimated in the range of 15-20% . The 35%-45% reduction of the day ahead forecast error by 2020 looks again very ambitious.

However actions which will lead to improved accuracy regarding the day ahead forecast for wind will have benefits for:

- Balancing markets
- Improved operation
- Less RES curtailment

What about taking also the view of the power system and include **a target** : From LCOE to total **system costs [1]for offshore wind** in various scenarios to minimize the costs for the services .

[1] During the SET Plan Conference 2015, Agora Energiewende made an estimation of system costs for RES integration of **5-20€/MWh**: http://www.setplan2015.lu/uploads/editor/files/Christoph_Podewils1.pdf

**Question:**

**Do you think that the level of ambition is correct?**

Answer:

Generally yes, but the level of ambition should be strengthened by adding a power system perspective. In the future it will be more and more disadvantageous to continue to connect each new offshore windfarm individually to the respective national AC-grids. Instead an ambition on develop, test and start construction of offshore HVDC meshed power collection and transmission grids inclusive of national AC interconnection points should be formulated. The purpose of such an offshore HVDC grid should be to transport the wind production at all times to the most relevant market areas by the most efficient transport routes fully on market terms.

Regarding the specific target on **better system integration** on grid development and reliability of the grid at very high levels of wind power penetration (up to 70% of electricity demand) by at latest 2030 it seems ambitious and goes beyond the most extreme visions. While we could expect some countries to develop such plans we should be more realistic while still ensuring this development. Probably more suitable for longer term perspective (by 2040)

Both system integration aspects such as use of storage and interaction with other networks, use of the grid in the most efficient way as well as services from RES (ancillary services) should be developed to achieve such a target. This should be complemented by a market design common approach which should aim to achieve coherence between the development of the grid (interconnection in particular) and RES units and to balance the geographic distribution of RES

Such initial RD&D projects are already funded and set in motion by the EU i.e. the BestPaths FP7 funded project and recently the PROMOTioN H2020 funded project. The added power system perspective ambition should thus be based on the expected outcome of these ongoing projects.

The Best Path project aims already at demonstrating reduce risks of HVDC links connecting offshore wind farms (the results and lessons learned will be applied in a simulation of the East Anglia project -an area of 7.2 GW of wind capacity in the UK) at fostering the development of new suppliers and sub-suppliers of HVDC technology. It also looks at the conditions to ensure maximum interoperability for HVDC-VSC converters connected to a DC system, to technological solutions allowing the upgrade multi-terminal HVDC links as well as of integrating DC superconducting cable links within an AC meshed network with a view for different ussages.

Further in the long run this perspective will inevitable call for the development of new types of fully DC constructed wind turbines directly connected to the DC power collection grid. In this way the replacement of the AC synchronous generator and attached excitation system with a simpler DC generator and the removal of the expensive AC/DC full-bridge converter are expected to substantially reducing the cost of each wind turbine. The Best Path project is already looking into VSC (two-level, half-bridge MMC and full-bridge MMC).

**Question:**

**Are there any standing issue(s) in the way to reaching the proposed targets/priorities?**

Answer:

The priorities identified in the paper proposed by the EC including those of Grid integration (see below the EC proposal) should consider the results of the existing projects such as Best Paths and Promotion.

The services to the grid should be developed not only in terms of design but also from the point of view ancillary services (voltage, frequency, operation of non-synchronous generation) at various time frames: instantaneous, short term, long term.

More alignment between offshore wind planning activities and network planning will be beneficial.

**Question:**

**What are your specific recommendations on prioritizing R&I activities on these issues (and building where appropriate on relevant existing initiatives)?**

Answer:

**Innovative and Market-uptake Programme**

**Action 1: Grid integration – (Key issue: system integration)**

**Scope:** The successful transformation of the power system requires R&D and demonstration projects on connection technologies for offshore and onshore wind power plants to AC and DC networks (including multi-terminal HVDC grids); wind power capabilities for system support and virtual power plant (VPP) operation; and a better fit of wind energy in the power market.

To develop grid integration techniques enabling secure and cost-effective integration of high penetration levels of wind power; to develop and demonstrate optimal solutions for connecting offshore wind farms and clusters to future offshore networks; to develop and demonstrate methods for wind power management providing system support services with regard to market integration and combined operation with other power plants.

**Deliverables:**

- Demonstration of a multi-terminal offshore connection.
- he experience from existing HVDC-connected wind power plants is shared among the industry.[2]
- Better wind plant modelling within electricity system models. See the development of standard 61400-27-2
- Grid support services design including ancillary services (voltage, frequency, operation of non-synchronous generation) at various time frames: instantaneous, short term, long term and provision/VPPs
- Testing of wind power plant capabilities (methods and facilities).
- Evaluate power system costs for offshore wind in various scenarios to minimize the costs for the services

[2] See the existing projects Best Path and Promotion

- Better knowledge of impact and operation of wind power on electricity markets.
- Improved wind power forecasting techniques and utilisation.

Focus on bigger improvements for periods with the biggest forecast errors. Large forecast errors lead to most of the problems and costs with system operations

over-forecasting wind power causes more problems for system operations than under-forecasting wind power . Focus on improve wind forecasts that over-forecast errors are reduced

- Understanding of interaction between existing offshore wind farms and a future North Sea grid, including the definition of standards e.g. for connection.

In the context of new market design activities and in relation to other SET Plan priority actions the system integration actions should be prioritized. These should lead to the developments we need .

The prioritized R&I activities should be concentrated on developing offshore wind systems optimal for shallow waters (< 50 m) and waters close to the shore (< 5 km).This would achieve the shortest development path towards fulfilling the proposed target 1 of reducing the levelized cost of energy for offshore wind.

**Question:**

**Who are the best placed actors to implement the targets/priorities (industry, EU, member states, regions, group of countries/organizations/etc.)?**

Answer:

N/A

**Question:**

**Identify possible barriers (when not done already in the Integrated Roadmap) related to regulation, cooperation issues, standardization/industrialization/manufacturing, socio-economics etc.**

Answer:

To operate offshore wind systems especially if they become interconnected in future offshore DC-grids a number of regulation and cooperation issues/barriers arises above national level. The involved national regulators, power markets and TSOs need to find common firm agreements for operating such new types of international power systems.

Clearly there is a need for a complete utilization of open standards (IEC) to allow for a seamless technical build-up of offshore wind systems in terms of hardware, software and data communication systems using equipment from multiple manufactures. To facilitate this a set of new international (ENTSO-E/EU) grid codes for interconnected offshore wind systems in terms of construction, protection, operation etc. must be established and put into force.

**Question:**

**Identify possible gaps of duplication of efforts in the R&I priorities (based on the Integrated Roadmap).**

Answer:

Generally any new R&I initiative should not overlap what has already been set in motion. Hence an overview of planned, ongoing and completed related projects within the EU should be established and maintained at all times by an appropriate EU body. Examples are the above mentioned EU funded projects BestPath and PROMOTioN.

**Question:**

**Identify Priorities where there is scope for and benefit in more coordination and/or cooperation across EU, member states, regions, research institutions and/or industry.**

Answer:

To facilitate the build-up of offshore wind systems both coordination and cooperation between regulators, markets and TSOs from the member states concerned in the region in question should take place. Examples of regions could be composed of the member states surrounding the North Sea, Baltic Sea, Irish Sea, Western Mediterranean Sea and Eastern Mediterranean Sea.

To facilitate the necessary goal of achieving a set of open standards (IEC) to allow for a seamless technical build-up of offshore wind systems in terms of hardware, software and data communication systems using equipment from multiple manufactures the Industry needs to cooperate openly within the relevant standardization bodies like the IEC.

**Question:**

**Identify best practice of past or present coordination and/or cooperation that can be used as an example or as a starting point.**

Answer:

N/A