POWER cluster – Needs of education and suggestions of programmes and courses for offshore wind

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Summary

To realise the extensive plans for more wind power in the North Sea a large scale industrial transformation has to take place. As with all such transformation processes the formation of qualification opportunities is a key dimension. Without specialised qualification offers provided in adequate quantities and in a timely fashion, we simply can't expect a transformation to unfold. This is especially valid for all kind of personnel, from service technicians to master/PhD-level. In several of the countries around the North Sea there are very few or no courses that deal with specifically offshore wind power. In the previous POWER Interreg III project a summer school curriculum was established. One objective of the POWER cluster project is to evaluate this curriculum and other available courses for offshore wind energy within the partner countries in the project, and to develop new courses and curricula where needs are identified. To establish what is needed there will be expert interviews with companies within the wind energy sector, focusing on engineering, construction and maintenance, but also involving internal qualification managers and human resource managers.

This paper will present the work that is carried out within POWER cluster, an EU-project within the INTERREG IVB North Sea Programme. It will propose programmes and courses for offshore wind energy and focusing in three main areas: further education; layout of modules for BSc and/or MSc programmes; and raising the awareness among school teachers and students.

1. Realising the potential of offshore wind power – implications for the formation of capabilities in firms and in the higher educational sector

Environmental threats are fundamentally changing the context of all industrial endeavors. There is today a broad consensus that if we are to avoid the most extreme effects on climate change, we need to halt the escalating emission of green house gases and then reduce it to a fraction of current levels. This requires a transformation of the energy sector on a scale never witnessed before. New systems centered on carbon neutral technologies have to emerge, grow and subsequently replace fossil fuels within a time span of a few decades.

Wind power is, in this context, a key technology. Over the past three decades, a supply capacity has been built up. This would appear, at first glance, to be a major achievement. However, in the context of the very considerable challenge that lies ahead of us, it is only a beginning. The supply capacity needs to be greatly increased over the next decades if wind power is to substantially contribute to the transformation of the energy sector. In GWEC's Advanced Scenario, the current supply capacity is increased by a factor of 8 by 2030, allowing wind power to capture about 20 per cent of the world electricity market. In the European case, offshore wind power, mainly in the North Sea, has the potential to contribute significantly to this very large scale industrial transformation process, providing nearly 600 TWh out of a total supply of 1100 TWhs.

The need for transformations of this nature constitutes a formidable challenge, but also opportunities for decision makers at both government and firm levels. For the capital goods industry the growth potential is phenomenal. However, as with all such transformation and growth processes (e.g. the recent three decades of development and diffusion of electronics) the formation of capabilities is a key dimension. Without specialized capabilities provided in adequate quantities and in a timely fashion, we simply can't expect a transformation and growth process to unfold, nor can we expect to maintain a vibrant wind turbine industry in Europe.

The objective of this sub-project is to assess the volume and content of the required capabilities and to compare those with the current capacity of the higher educational sector to deliver these. The study will include interviews with firms in the whole value chain for wind power in the North Sea countries as well as with a selected number of higher educational organizations. Implications will be drawn for both the higher educational sector and for the business community.

2. Further Education

The creation and development of training modules and activities that will both help to inspire candidates and encourage mature candidates to retrain in a career for the offshore wind energy market are important tasks for further education.

The ultimate aim is to direct and train those candidates wishing either to embark on or transfer to a career in the offshore wind industry. This will be achieved through a series of robust industrial standardised modules, flexible in both delivery and learning style, which will enable the candidate to mix and match modules so as to allow them to progress along the academic path to first degree level. Generally speaking the knowledge transfer has to be tailored to suit the needs of the candidate, which means the wording has to be as clear as possible, examples have to be vivid and it has to be available in time. The modules and activities will have been tailored to suit the needs of the industry through target group questioning will allow

diversification from similar engineering disciplines, thus improving the employability of the existing workforce and allow movement throughout the EU.
However the pilot programmes are supposed to be the basis for the transnational transfer, therefore careful attention must be given to the different national educational standards and the competences and professional experiences of the learners.

Activities for further education include:

- Development of new concepts for short courses targeted at up-skilling for the offshore wind industry. This would be based on experiences of Master Classes/ Summer Schools conducted under POWER and may include new innovative elements.

- Combining e-learning modules with project work and activity based learning methods.

- Bringing together different competences and learning approaches from vocational training institutes and academic institutions so as to integrate target groups to specific qualification concepts. An essential need is to overcome institutional teaching techniques and national border limitations.

As an example of equipment for training to work at height is the training tower at Northumberland College, UK, see figure 1. The provision of the new training tower is allowing development of new modules relating to working at height: rescue from lifts, torquing of bolts at height, maintenance & inspection of climbing and access equipment including lifts.

The content of the "Level 3 technician course" at Northumberland college is the following:

- Passport to Safety
- Health and Safety (Turbine Specific)
- Sea Survival & Transfer
- Working and Rescue from Height
- First Aid at Work
- Team Building
- Supply Chain Management
- Environmental Awareness
- Mechanical Engineering
- Electrical Engineering
- Data Transfer and Control Techniques
- Blade Technology and Repair
- Lifting Hooking and Strapping Techniques

Figure 1: The training tower at Northumberland College,UK.

In figure 2 the work with the generator is shown.

Figure 2: Training of technicians at Northumberland College, UK.

3. Raise the awareness of offshore wind energy among school teachers and students

Offshore wind energy (OWE) has a high relevance for the North Sea Regions with respect to their economic development, the supply of energy, and the preservation of nature. Given the growing importance of this topic, students have to be motivated taking an active role in ecological decision making as reflective and responsible individuals.

Due to the increasing need of the industry for high qualified employees it is important to awaken their interest for renewable energies and to inspire the youth for the professions of responsible engineers, technicians and mechanics in the field of offshore wind energy.

Dealing with offshore wind skills development, this activity of the POWER cluster project develops tests, optimises and disseminates teaching materials. These materials (such as worksheets with tasks, guidelines for experiments, job descriptions in the OWE industry, e-learning elements) provide a basis for increasing the scientific knowledge of students and stimulating their increased awareness of renewable energies The innovative character consists in the survey and the integration of different expertise: Students, science teachers and experts from the field of OWE. To achieve this goal the working group developed a flyer to contact science teachers at schools.

Furthermore the inspiration of the youth to a profession in the field of offshore wind energy is being achieved by developing methods and programmes such as open days, information events, excursions, practical courses for students and children at different levels and ages. Pilot schemes have to take place internationally in order to generate products, like target group orientated programmes with guest speakers from wind energy industry, visiting programmes and interactive learning programmes, presentations with experiments all suited for inspiring the youth. The aim is to promote collaboration between schools (teachers and their classes), universities, further education centers and companies from the OWE industry.

The creation and development of training modules and activities that will both help to inspire candidates and encourage mature candidates to retrain in a career for the offshore wind energy market. See figure 3 where the pupils work with testing of their wind turbines.

Figure 3: Pupils are designing and constructing anemometers and wind turbines during the wind energy course of fk-wind at a junior academy and the scientific festival at Chalmers University.

4. Layout of modules for BSc and/or MSc programmes

In the last few years the wind energy branch in general has been experiencing rapid growth and is now suffering from a lack of highly skilled experts. This situation is aggravated by the absence of structured and specialized academic training programmes, such as what is the norm in the automobile and aircraft industry, and the future development of offshore wind energy will create an even bigger demand. Because of the highly interdisciplinary and international nature of offshore wind energy the challenges on experts will be new and different, especially in the fields of planning, construction, operation and maintenance.

The increasing demand for experts requires increasing qualification possibilities. Therefore the development of recommendations for modules of courses/programmes at bachelor/master level specializing in wind power is an important task. The focuses should be on design, engineering and construction of wind power plants, as well as maintenance of the offshore wind farms. This can be done in collaboration with several educational departments due to the facts that wind power covers several engineering disciplines and especially the marine subjects. OWE is by nature international thereby the feasibility of an international programme is studied and negotiated. Apart from the content especially organisational and legal issues have to be tackled (e.g. possibilities for co-operations between universities in different countries, financial issues, exam regulations). Also, ways to integrate practical contents, expertise and know-how through the cooperation with companies are studied.

In the tables below some examples of programmes for Bsc/MSc/Phd are shown. It can be seen that there are quite some master programmes available but only a few bachelor programmes.

Table 1: Examples of programmes for Bsc/MSc/Phd.

University	Institute / Dept.	Programme	Bsc / MSc / PhD
ForWind / Univ. of Oldenburg (DE)	Physics	Physics, Engineering Physics	y / y / y
dto.		Postgraduate Programme Renewable Energies	n / y / n
dto.		EUREC Master Renewable Energy	n / y / n
ForWind / Univ. of Hannover (DE)	Mechanical / Electrical / Structural Engineering	Wind Engineering (starting 2010)	n / y / y
Univ. of Applied Science Bremerhaven (DE)	Technology	Maritime Technology and Wind Energy	y / y / n

University	Institute / Dept.	Programme	Bsc / MSc / PhD
CEwind (DE) (Univ. of Kiel, Univ. of Flensburg, Universities of Applied Sciences of Kiel, Flensburg and West Coast, Nordakademie)	Various engineering depts.	Wind Engineering	n / y / ?
DTU - Technical University of Denmark (DK)	Electrical / Mechanical Engineering	Wind Energy	n / y / y
Aalborg University (DK)	Energy Technology	Wind Power Systems	n / y / n
TU Delft (NL)	Aerospace Engineering	Wind Energy	y / y / y

Example of Bachelor study course at the University of Applied Sciences Bremerhaven:

Bachelor study course “Maritime Technology” with specialisation in wind energy and offshore technology contents of a 3-year full-time programme with a high level of practical content. The first three terms concentrate on the teaching of the basic natural science and engineering subjects and the following terms includes the development, design and operation of on- and offshore wind power plants.

Example of Master study course at the University of Applied Sciences Bremerhaven:

Master study course “Wind Energy Technology” includes full-time study with four terms duration. Course modules designed to follow on from each other based on the core competences structures and simulation as well as measurement and control of wind power plants. The Master course has a strong practical emphasis with practice-related laboratory work, exercises and internships in enterprises and research institutions.

5. A proposal for how to overcome countrywide regulations and legal restrictions for service technicians OWE working transnational

The project POWER cluster aims at convergent trainings that are given in different EU countries for OWE technicians. One task among others is to provide uniform training that can be given in different countries around the EU. For short trainings to educate service technicians different approaches can be used. Both theoretical modules and practical training are necessary elements. However one issue arises: How can the different country- and company demands within areas like safety, environmental, legal restrictions and company management principles be fulfilled?

To become a service technician for OWE

To become a service technician you can either start from scratch (background for example from high school) or further education from other technical service profession (for example shore based industry/wind energy or offshore/merchant navy). In either case the students need both theoretical studies and practical training within the fields of structure, mechanical-, electrical- and instrumentation topics. The level is of course related to the students` background. There will also be a demand to be familiar with the environmental and very special physical layout and placement of an offshore wind turbine. Only going out there is related to high degree of risk (either by chopper or by boat). This means that there must be a high degree of safety thinking and how to use safety equipment. This trainings and certificates differ from country to country and from company to company. They should be developed into a standard training module that can be used transnationally.

Proposal

Why not use already existing trainings and certificates and adjust them to fit OWE services? The International Maritime Organization IMO (which is a section within UN) has set up rules and principles which are used throughout the maritime world. Every known country has accepted a Maritime Agreement and follows these principles. The rules and principles are related in the area of seafarers to set a minimum competence for safety standard and working area setup and equipment. There are also agreements to secure the maritime world from pollution. This means that all seafarers have some kind of training related to their position aboard a ship. A certificate is issued after completed studies and trainings in a specific area. This certificate can be used all over the maritime world. It doesn't matter if the ship has a Swedish, Dutch, British or German flag. There are training elements that can be used in the common areas of shipping and OWE service work.

An example: Basic Safety Certificate

An example is for instance Basic Safety. This training aim to fulfill the qualifications needed to work on any ship. Some of the elements are:

- Different types of firefighting equipments
- Use of firefighting equipment and practical firefighting.
- Escape and survival technique
- Training in water with survival suit.
- Emergency plans
- Communication and information during critical situations
- Company routines and standards

6. Promoting qualification as key factor for successful business

What is the influence of qualification as a factor in the decision making on setting-up businesses in the offshore wind industry? This question is analysed and answered using "best-practice" examples from different European regions.

The POWER cluster project will develop a guide with recommendations for decision makers in industry and administrations about the importance of qualification strategies to the potential labour supply for the economic development of the region/location. The documentation has three important effects: 1. The guide will make clear the importance of qualification. 2. The guide is helpful for other regions in Europe as an example for innovative establishment decisions of companies of the wind industry but also other different companies. The product is also helpful for science, the administration for the labour market policy and institutions of education. The guide shows the importance of qualification strategies for the potential labour supply. 3. The guide will create a dialog between companies of the wind industry/supplier industry and the institutions of education and science to get more interaction.

bfw Bremen has already analysed the situation in Northern Germany and is preparing right now an overview of existing qualification possibilities. In this overview the reader can find out the main emphasis of the different qualification courses. The guide documents the development of the qualification programmes as well. In parallel interviews are planed with experts of industry. The experts are invited to describe their experiences of the regional situation and specially the development of skills and qualification.

7. Conclusion

It can be clearly seen that number of educations regarding wind power and also off shore wind power are increasing. The educations are covering the whole spectra from pupils in the school up to PhD-courses.