

Wind Energy – The New Horizon

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Ladies and Gentlemen, good morning.

Maya Angelou the American poet once wrote “The **horizon** leans forward, offering you space to place new steps of change.”

Wind Energy is a major portion of the Renewables business, the fastest growing part of the energy sector and is in my view just about to undergo fundamental change. With its ability to deliver Gigawatt-scale capacity, over the coming years its continued growth will be a key part of de-carbonizing and supporting the world’s electricity production.

The three areas I want to talk about today are:

- Key issues affecting the wind industry globally, and why it is appropriate for the wind industry to head for a new horizon
- In this context, the challenges and opportunities for the offshore wind sector
- And what we are doing at E.ON to overcome the issues faced by the industry.

The wind industry has made tremendous progress in the last 20 years. It has gone from a niche for the enthusiastic entrepreneurs to a multibillion dollar concern. After all, why do we need to affect transformation in this industry which is growing so successfully? **(Slide 2)**

Today there is roughly 100GW of wind generation worldwide. If we are to reach the targets set by the international community and, as of late, for instance, firmly articulated by the EU, there will be 900GW of wind generation by 2020. Nine times the capacity we have today.

From 2007 the annual volume of the world market for renewable energies has doubled from €30bn per year to €60bn. It is expected to grow to 400bn € in 2020. This will mean investing over a trillion Euros in the industry worldwide and erecting over 300,000 wind turbines till 2020.

To put that into context one wind turbine must be erected every 25 minutes between now and 2020. (It’s about 35 minutes past now so since the beginning of the session one turbine should have gone up and probably the foundations should be in for another.)

To achieve such an extraordinary level of growth requires a completely different approach to the industry which still is only 25 years old, so in industrial terms and despite terrific technical improvements, it is still in infant days.

Step changes need to be made at every stage of the value chain: in development, construction, and operation with improvements in the technologies, equipment and processes used, and a broadening of the skills base for the people working in the industry.

If project pipelines are to be realized and actually "the MW are got on the ground", the wind industry has to move from the **boutique** sector to truly **industrial** levels of output. This is a theme that we at E.ON have made our strategic imperative.

Let me highlight some of the challenges that need to be overcome, to affect this change.

(Slide 3)

Developing wind farms is a long process requiring experts with many different skills. Meteorologists, planners, regulatory and environmental experts to name but a few.

However the planning and consenting process is often too slow and unpredictable. It takes many years from the start of the development process to the first electricity feeding into the grid. Timelines are clearly not matching the pace of execution required.

Let me be clear, I am **not** saying that developers should be able to dismiss local concerns or ignore potential impacts on the environment and wildlife. Proper Environmental impact assessments and local consultation must be part of the process.

In Central Europe on average, for every five projects that get to the latter stages of development, only one will actually get built. The development costs for all five projects still have to be recovered for the assets that do come on line and generate revenue.

So what is needed is consistency and transparency in the regulatory process. If wind projects are caught up in planning or refused consent at the last minute, many years of effort and resources can be wasted. Given the size of the challenge ahead this is a waste the industry can ill afford.

The obstacles to our agenda are not all external within the planning processes only. Our **construction processes** are not short of many imperfections either.

In 2008 there was 20GW of new wind capacity installed worldwide. It was a record, the best ever year for the wind industry.

The challenge now is to increase the annual additional capacity 4 or 5 fold by 2020 to 90GW of new wind capacity, per year. That is roughly the same as the UK's entire installed electrical generation capacity (100GW) to give you the scale of the step change needed.

To achieve this level of additional capacity year on year, construction methods must become easily replicable to create significant economies of scale.

Imagine 100MW in ten wind farms each having a maintenance crew and spare parts. Now imagine these ten parks just having one maintenance crew, one set of spare parts and enough know-how to install systems which do monitor the condition of a turbine in the portfolio at any time.

We also have to push harder for the benefits of scale. Fewer, larger wind farms will reduce infrastructure costs like building access roads, along with minimizing the number of grid and water connections that need to be made.

At E.ON we are looking towards the new horizon as later this year we will open the final phases of the world's largest wind farm at Roscoe, a 780MW onshore project in West Texas in the US.

While the long term cost of wind power has reduced around 75% over the last 20 years, recently the supply chain has suffered from bottlenecks with costs going up quite a lot and delivery in tight schedules made more difficult. To mitigate the latter in particular it will require a very different level of alignment and interaction between the contributing parties so that turbines and equipment needed for large scale projects can be delivered and installed on time and to budget.

As a wind farm operator we want our assets to be generating for as much of the time as possible because once they are created, the "fuel" comes for free and availability translates directly to the bottom line. Furthermore, Operations & Maintenance accounts for around 20% of the costs of a wind farm.

In the past, maintenance procedures have often been on a reactive, almost ad hoc basis, causing lengthy and unnecessary delays. Going forward, we require a more proactive system of preventive and predictive maintenance and an efficient stock management of critical components, and what those are we are just about to find out. In short driving down the life cycle costs of wind turbines making sure they are reliable is vital for the long term competitiveness of wind power.

An important part of reliable operation obviously is the matter of necessary grid infrastructure, but in the interest of time I will skip this topic, it is important though. Growing the industry at pace and with favorable locations becoming scarce in some parts of the world requires building wind farms in more challenging locations.

(Slide 4)

The offshore sector, as part of the industry most obviously is on the verge of a new horizon in development. If offshore is pursued correctly it will create the dramatic growth and will change the face of the industry.

Offshore is being seen by many countries as ideally suited to get around issues such as space, planning constraints and local opposition to onshore wind farms. The UK's entire renewable strategy is, quite rightly, largely dependent on offshore success. The same is true for Germany.

Offshore wind has many well known advantages. The strength and consistency of the wind is better offshore. To take Germany again as an example, the average load factor for an onshore wind farm is about 22%. For offshore, the load factor doubles to around 41%.

The potential size and scale of offshore wind farms in almost GW-scale mean they will be able to generate as much power as a conventional power station.

However we must be realistic about the speed and pace of progress. This is a fledgling industry with many technological hurdles to overcome.

Whilst there was nearly 100GW of onshore wind at the end of 2008 there is only around 1.5 GW of offshore wind globally. By 2020, if Europe is supposed to reach its renewable energy targets, recently set at 20% by the European Union, we are looking at potentially 43GW of installed capacity offshore required.

And building offshore wind farms is not simply a case of putting an onshore wind farm, into water. Both in terms of construction and of maintenance, offshore developments are markedly more complex. The vast majority of industry experience is in what we at E.ON call the near-shore 20/20 envelope. That means wind farms built 20km from shore and in water 20 meters deep.

Far shore, deep water projects do bring far more additional complexity. For example, larger wind turbines, (5-6 MW instead of 3 MW), larger foundations, so-called tripods, which in turn requires larger vessels that can lift themselves 50 meters above the surface of the ground, and in particular larger cranes to the lift those foundations.

To put a turbine into near shore waters, a monopile is "hammered" into the ground. The weight is around 350 tons. Far shore needs a tripod weighing 800 tons. This is nailed to the ground with 3 nails each weighing 100 tons. A very difficult challenge to manage.

It is also worth noting that each of those tripods foundations is 45 meters tall, which is the height of a 15 storey building. Transporting and securing them to the sea bed requires a great deal of skill and expertise. It can be done, but it needs the right methods, the right equipment, in particular the right vessels.

Currently there is a lack of bespoke vessels to construct offshore windfarms. Much of the equipment used today has been adapted from use in the offshore oil and gas industry and is not ideally suited for offshore wind construction. Specifically designed vessels to construct offshore wind farms will not be in service until 2011 /2012 at best, another challenge to recognize.

Regular maintenance is logistically more challenging at sea and the further you move offshore the harder this becomes.

Foundations and turbines blades need to be able to withstand harsh stormy conditions, and delicate components in turbines must be protected from the corrosive salty air. This is done by pressurizing the turbine from the inside to prevent salty air to get inside.

A malfunction during a winter storm for instance poses a serious problem: it could take days before a weather window opens up and you can get a vessel to the wind farm with the necessary spare parts.

Operators do have range of choices

- A. Service the wind farm from the nearest port with a fleet of fast shuttle boats.
- B. Erect some living quarters on a maintenance platform next to the wind farm.
- C. Anchor a vessel out near the wind farm as a floating operations and maintenance depot.
- D. Carry out maintenance via helicopter by lowering a man on to the nacelle but this has health and safety issues and limits the size and amount of spare parts he can carry (to basically what he can get in his pockets).

None of these challenges are insurmountable but as a developer and operator, it makes engineering sense to build wind farms close to shore in shallow water first. We can then build on this experience in developing far shore, deep water farms.

So what is E.ON doing to move the industry forward? Broadly this falls into two categories: 1) driving hard technical excellence and superior supply chain management and 2) doing this by developing strategic partnerships.

E.ON is the world's largest investor-owned power and gas company. Worldwide, we employ nearly 100,000 people and have 61GW of generation capacity through conventional sources and renewables. As a vertically integrated power company we have decades of experience across the electricity value chain. We can rely on the expertise of over 4000 engineers, more than the entire German wind industry.

The knowledge we have gained in the conventional energy sector is helping us to overcome the challenges faced by the wind industry. E.ON is investing €6 billion to 2010 in our renewable business worldwide. Over the past 18 months we have increased our operating wind capacity from 400MW to 2200MW and literally erected one wind turbine every ten hours in 2007.

To manage our portfolio we are developing a sophisticated Supervisory Control and Data Acquisition systems (SCADA) to monitor and control our wind farms worldwide. This will enable us to optimize their efficiency.

We have advanced condition monitoring systems that enable us to predict if a component is likely to fail and so our engineers can undertake preventive maintenance.

As an example, condition monitoring allows us to predict the failure of a bearing, a small but essential part in the gear box. By changing the bearing before it breaks takes about 2 days whereas repairing the gearbox after the bearing is broken, which leads to further damage, might take up to 5 months.

We are introducing spare part pooling and looking to harmonizing the types of wind turbines we use and thus limit the number different components we need to store.

Through these steps and many others we aim to reduce our Operations & Maintenance costs by 10% by 2011 and increase the technical availability of our wind farms to 98%.

As a leading offshore wind developer, we are building on our experience of having built three wind farms with a total of 100MW and two more are under construction of over 400MW as we speak. There are very

few companies out there that have the skills and expertise to build and operate an offshore wind farm. E.ON is one of them.

We have built up experience of various foundation types - monopiles, gravity foundation and jackets - and are working in deep water and in areas with strong tidal currents.

With partners EWE and Vattenfall we are constructing Alpha Ventus which will be the world's first wind farm in true far shore conditions. It is a pioneering project 60km off the north German coast and in water 30 meters deep. This takes wind into a truly new environment and offers tremendous new potential and will give us key learnings for building the large projects averaging 400MW in deep water that will become the norm. **(Slide 5 and 6)**

Strategic partnership is another critical part of E.ON's ambition to move the renewables sector forward. We are working with partners that share our passion for renewables and have the technical competence to deliver.

I will give you two examples.

(Slide 7)

We are working with Siemens on the turbine supply side. As you may have seen in the media last autumn E.ON entered into an agreement on collaboration with Siemens that should bring significant benefits to both of our companies. We intend to work closely together to drive the performance of reliable and environmentally friendly wind power projects around the globe.

(Slide 8)

I am particularly proud of E.ON's global partnership that we have announced recently with MASDAR. Initially we are working together on the world's largest offshore windfarm, the London Array a 1000MW project in the Thames Estuary, when built it will be able to power a quarter of London's homes.

We have secured in MASDAR a strong partner to work with us on the London Array scheme and on future renewable energy projects which will help push the industry to its next stage. We will extend our relationship further and intend to work together across a range of potential projects that will complement our existing renewable energy strategies. As the partnership develops, we expect to be able to announce a series of exciting projects across the broad spectrum of renewable energy.

Summary

(Slide 9)

Let me conclude: The wind industry is on the verge of a new horizon.

The large increases in wind capacity planned between now and 2020 require an industrialized approach to the sector. It is a long term goal, which needs long term planning and commitment.

No one manufacturer or developer will have all the answers or be able to solve all the issues by themselves. The market will drive innovation in our sector as long as the policy frameworks are in place to continue encouraging growth.



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It is right that EU and others have ambitious targets for renewables. It is right that the public expect the renewables industry to deliver low carbon electricity at a price they can afford. And it is right that the industry steps up to these challenges and makes the fundamental changes needed to deliver that low carbon electricity the world so desperately needs.

I am optimistic that, together we will meet the challenges ahead. I know E.ON will play our part and we hope that we are joined by others.

You have been generously listening for which "Thank you very much".