



**C&F European Offshore Wind Summit
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Keynote Address

by

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“Creating a Pan-European Grid”

Ladies and Gentlemen,

I have great pleasure in welcoming you to this inaugural European Offshore Wind Summit. The agenda for the next two days is formidable and weighty. The task of this Summit is to respond to the greatest challenge of the next half century.

It can be simply expressed. “How do we reduce Greenhouse Gas emissions by 80% over the next forty years by switching from fossil fuels to renewable energy and, at the same time, allow the economy to grow and society to flourish?”

The answer cannot be so simply formulated. But it is our responsibility at this Summit to lay the foundations for a technically feasible and economically viable solution. That is why the papers to be delivered over the next two days reflect a pragmatic and practical approach to meeting the low carbon challenge. Their primary concern is dealing with “how” to do things rather than debating “why” they should be done.

The debate has moved on beyond the “why”. The analysis has been completed. Now comes the practical bit.

We have to think creatively about how to do things that were never done before. We have to innovate. We have to be prepared to take risks, to act adventurously, to give leadership, to be prepared to make mistakes and, when we do, to have the courage to start over.

For my part, I have elected to tackle “Creating a Pan-European Supergrid” as the theme of my key note address.

The Supergrid is a concept I first launched eight years ago. It has now evolved to the point where it is a project.

Consequently, the focus is on thinking out the pathways to the Supergrid. That's why I intend this morning to offer some new solutions to problems we have been grappling with for quite a while.

My point of departure may appear self evident but it is one which we need to repeat over and over again. Offshore wind power generation is a completely different technology from onshore. The offshore wind industry is not the onshore wind industry with wet feet.

Furthermore, it is an infant industry. In contrast, onshore wind generation has entered the mature phase.

Offshore, the environment is different – that’s obvious. The risks are greater – that’s clear. The technical solutions will be quite distinct – that’s understood.

We have to be pioneers.

Offshore wind is the new industrial frontier.

I relish the task ahead.

When approaching a project, such as the Supergrid, I begin by placing it in context. To do that, I try to vision the future and work out the scale of what has to be done and the time frame within which it has to be accomplished.

Here is my thinking about the future of Offshore Wind Power in Europe in order to put the Supergrid in its proper context.

The European economy will continue to grow over the decades ahead, despite the current economic depression. Demand for electricity will increase progressively, not just as a consequence of economic growth but, more fundamentally, because of a transformation within the economy itself. We are heading into an era of what can be called the “electric economy”.

Electricity is set to become the dominant source of energy. By 2050, for example, all surface transport will be powered by electricity, with the possible exception of some heavy commercial vehicles.

There will, of course, be major advances in energy efficiency but even when these are taken into account the anticipated growth in electricity demand will be between two to three per cent per annum.

At an average growth rate of two per cent, demand will double by 2050. At a three per cent growth rate, it will more than treble.

If we are to slash carbon emissions by 80% then all of this increased demand will have to be met by renewable energy. And existing coal, oil and gas generation will be phased out by then. After 2030 there will be no more fossil fuel plant built. Fossil fuel production will have disappeared by 2050. It will be replaced by renewables and nuclear.

Consequently, I envisage that by 2050 the generation mix will be:

50% wind
30% solar
10% other renewables, such as ocean energy, and
10% nuclear.

Growth rates of two and three per cent in electricity demand allow us to put lower and upper limits on the new generation capacity needed by 2050.

A simple extrapolation of current generation capacity at these rates and an average capacity factor of 35% indicate that we will need to install between 1.2m and 1.8m Megawatts of wind by 2050.

But even the most optimistic forecasts for on-shore wind are limited to approximately 200,000 Megawatts by 2050.

Planning and political obstacles are intensifying. Besides, we are running out of suitable sites.

This means that somewhere between 1.0m and 1.6 Megawatts of offshore wind will have to be installed over the next forty years.

At an average cost of £3m per Megawatt the total investment will be between £3 trillion and £4.8 trillion. This is a gigantic investment.

It will be the biggest ever spend in the EU.

It will also be the biggest construction project ever undertaken in the EU.

These orders of magnitude give some idea of the task ahead.

At this point it is important to be clear about what we mean by the term "Supergrid".

I have defined a Supergrid as

“An electricity transmission system, mainly based on direct current, designed to facilitate large scale sustainable power generation in remote areas for transmission to centres of consumption, one of whose fundamental attributes will be the enhancement of the market in electricity”.

In this instance, the “remote areas” are the waters off the North Eastern and North Western shores of Europe. The centres of consumption are the maritime countries; the UK, Germany, the Netherlands and the Baltic States.

So, Ladies and Gentlemen, not only are we tasked with building a new form of grid of enormous proportions but we are required to build it offshore. These are separate undertakings which have never been attempted before but, to add to the complexity, we have to do both simultaneously.

Unlike the US or China, which also have to build Supergrids, but on land, we Europeans have to build at sea. Hence we are entering unknown territory.

But, I approach this challenge fortified by the engineers’ motto that “The difficult we do immediately, the impossible takes a little longer”. And, I might add, inspired by the project engineer’s approach to large scale construction: break it down into manageable chunks.

On that basis, let me divide the task of creating a Pan-European Supergrid into seven discrete segments:

1. Ports
2. Logistics
3. Construction
4. Generation
5. Transmission
6. Governance
7. Finance.

Let’s start with port facilities. This may seem a strange place to start but we are dealing with the task of building at sea. While the turbines may be manufactured on land they have to be transported by sea to the point of installation. Here we have an immediate problem. Because of the size of the individual turbines and also because of the sheer numbers that have to be assembled and loaded onto ships, I can see no alternative but to develop two completely new ports, one on either coast of the UK.

There will be a massive requirement for marshalling and assembling space and this is simply not available at existing ports. In addition, wharfs and piers capable of handling huge ships the size of ocean liners will be essential. While I welcome the recent DECC Report on UK port capacity, its recommendations are for incremental – not transformational - change. I cannot see existing ports being modified to meet such exacting requirements.

These new ports should be more than transport nodes. They should be the focal point of regional development, stimulating economic revival in their immediate hinterland. If this approach is followed they can be turned into centres of excellence for R & D into all the marine sciences and maritime technologies, training centres for the thousands of technologists and technicians that will be required and enterprise zones housing the manufacturing and service companies supplying the industry with all its requirements.

They could emerge as new manufacturing centres in their own right, specializing in the production of blades, towers, cables and components. In addition they could specialize in IT for new grid design, as that the Supergrid will be amongst the most advanced of the smart grids.

Without the proper port facilities, serviced by new infrastructure, we will never reach the critical mass necessary to develop the industry, either on the scale, or at the pace required. Proper port facilities are indispensable for success.

Next in sequence comes logistics, which in this case means shipping. Here we have an equally complex challenge of creating a new form of infrastructure. When, for example, we installed turbines offshore at Arklow Banks the weather window was only four months during the summer. At present, the ships erecting the turbines can operate annually for about 200 days at sea. That's quite an improvement, and it is expected that the next generation of ships, due in a few years, will stretch availability to 290 days a year. They will cost £250m per unit.

In addition, we will have to design and build a flotilla of new special purpose vessels for tasks such as servicing the mother ship or ferrying men and material for maintenance. I even envisage submarines which will allow all weather access to the towers by using airtight all weather underwater docking mechanisms.

There is huge potential here for innovation in designing, building and equipping a complete range of ships from the heavy duty craft to fast speed shuttles.

How can the huge capex involved be financed?

It is inevitable that the banks, as ever, will insist on predictable cash flow, in this case arising from the employment of each ship. Given that we are at the very infancy of the offshore industry, the cash flow will have to be underpinned by EU support mechanisms and complemented by dedicated investment regimes operated by the EIB.

Make no mistake about it. Ships will be the bottleneck slowing down the rolling out of the Supergrid. Unless this problem is tackled with urgency, then the 2050 targets will never be reached. I would recommend that the EU should supply 80% of senior debt through the EIB, along with a price support mechanism, so that financing can be secured from the banks to fund design and construction.

It we accept that it will take another decade to get started because of the lead time in constructing the ports and building the ships, that leaves us with only thirty years to meet the 2050 targets. A rough calculation suggests we will need to install 40,000 MW per annum, which works out at about seventeen 10 MW turbines per day for a working year of 250 days.

If the constructor ships could install two turbines each on a daily basis then we are looking at a fleet requirement of ten, so as to provide for down time in dry dock due for repair and maintenance.

These great ships will cost around £250m each. On that basis, we can anticipate that the overall investment required in creating the fleet of constructor and support ships will exceed £5,000m.

The financial world is not yet alive to the scale of this investment and doesn't really understand the urgency of the task. Without a decisive intervention by the EU authorities nothing will happen. That is why I make the following proposal.

A business plan is urgently needed to ensure that the constructor ships and support craft are built within a decade. This is mobilization on a grand scale.

I invite the European Commission and the EIB to initiate work on the plan without delay in consultation with the ship building industry and to publish it as official EU policy so as to give reassurance and certainty to the banks.

The third segment of the project is construction. Here I have previously advocated that we create a standard 500 MW wind fired power station which can be replicated in modular fashion. This would have the merit of using standard construction technologies, uniform components and a common approach to the layout of the turbines.

It would also permit important innovations in respect of generation. This would lower costs, enhance building efficiencies and simplify the construction and design of the power stations.

Two key innovations are required in the design of the grid and they relate to the turbine itself and to the transmission of the electricity generated.

In order to reduce the need for repairs and maintenance, and thereby increase reliability while lowering operating costs, the sophisticated onshore turbine will have to be replaced offshore with a simpler more basic machine.

Think of the turbine as a voltage source and it follows that it can be stripped of many components, including the gear box, and that its basic functionality can be reduced to feeding raw power into a transformer.

For a grid stretching across tens of thousands of square kilometres of ocean we will have to introduce what we in Mainstream Renewable Power call the Supernode. While the underpinning science has to be developed we are quite clear about the concept.

A super node is a junction on the supergrid which we use as a collector and/or distributor of large scale electrical energy. In our context it is based on both AC and DC technologies, using the individual strengths of each to our advantage.

We use the AC to collect the energy from large off-shore wind power stations and the DC to transmit this energy to distant load centres. We then convert back to AC for connection to existing transmission and distribution systems. We propose to do this using many supernodes connected in a DC supergrid to allow multidirectional power flows depending on supply and demand.

In addition to financing such a venture, there are both technical and organisational challenges.

On the technical side, our proposed supernode design can be refined and enhanced by development of an HVDC circuit breaker (we will leave this to the main manufacturers) and a multi-node control system for the DC grid. It is our intention to pursue the development of the control system with partner academic organisations.

On the organisational side the Supergrid will require an Offshore Transmission System Operator (OTSO) – the organisation and rules for such an entity have are being defined by Mainstream, a point to which I will return later.

Transmission from the offshore power stations to the land will be by the HVDC cable technology which is an already proven technology and which is being used at present in the North Sea and onshore in China, where it covers distances of up to 2000 km.

One of the engineering tasks ahead is to create an interface between the offshore Supergrid and the established grids on land. This means that there must be systematic interaction between the OTSO and the onshore TSO's. It also means the EU should have a common regulatory system across Europe.

One of the benefits of the Supergrid, and one that was referenced in the definition offered earlier, is that it will enhance the market for electricity. Power can be routed from jurisdiction to jurisdiction using the Supergrid as a common resource, thereby providing a most elegant solution to the market fragmentation that bedevils Europe, penalizes the consumer by imposing monopoly prices and weakens business competitiveness by increasing the cost base.

This leads logically to the question of an appropriate governance system for this common piece of infrastructure.

The long held objective of a single market for electricity can be created by the Supergrid in which the customer is king and where risks are shouldered by investors, not by the unfortunate consumer as at present.

Two innovations are required. The most basic is an Offshore Transmission System Operator which regulates the Supergrid in the common interest of the participating investors and which shares out its benefits equitably among the states.

That, Ladies and Gentlemen, will get the show started. We need to think all this out over the next five years.

Here are some ideas from Mainstream Renewable Power to start the ball rolling.

By using the Enhanced Co-operation provisions of the Nice Treaty, the European OTSO can be based on European law and be made an integral part of the EU's system of economic governance analogous to the EIB or the ECB itself.

The OTSO could establish a regulated return for the Supergrid. If 7% is the accepted regulated return for grids on land then I believe the regulated return for the Offshore Supergrid should be 10%.

As I said at the outset, the onshore and offshore industries are not identical. The risks at sea are greater than those on land. In order to incentivise investors in the Supergrid the regulated return will have to be substantially greater than its counterpart on land.

Let me summarise by way of conclusion.

We are facing into a forty year long project of unprecedented scale and complexity; Offshore wind power will be the main means of meeting our Greenhouse Gas reductions by 2050.

Between one million and one point six million Megawatts will have to be installed at sea.

The first decade of the project will, necessarily, be given over to laying down the foundations for the greatest single construction project ever undertaken in Europe.

The four indispensable building blocks are:

- An EU business plan to finance the construction of the shipping required.
- An EU Offshore Transmission System Operator providing a regulated return for investors in the Supergrid and a single regulatory system.
- New port facilities to manage the deployment and servicing of the turbines, and
- Training schemes to provide the necessary skilled manpower.

The business plan and the governance system will have to be completed within five years. Progress on both fronts will stimulate investment in the manufacture of blades, towers and cabling even before the business plan and governance system are completed.

Work on building the shipping fleet will start immediately but will reach sufficient production levels only when the EU intervenes to help mitigate the risks associated with ramp up of the offshore wind industry.

From that point onwards, the central tasks will be to build the wind fired power stations, construct the Supergrid and link it with the grids on land.

Such a vast undertaking requires a European framework. But it will need the genius of the private sector to innovate, and take risks, and thereby provide the required technical solutions at least cost.

The greatest challenge of the next half century is to complete the once off transformation of the energy economy from fossils to sustainability.

The goal is to create a low carbon economy without dislocating society.

The prize to be won is energy independence for Europe.

The environmental prize is zero emissions from power generation.

Ladies and Gentlemen, I do not minimize the difficulties ahead in achieving these goals.

I hope I have faced up to them honestly in this overview of creating a Pan-European Supergrid.

And I fervently wish that I have conveyed the confidence I feel in ultimate success.

We are condemned, by the demands of the planet itself, to succeed.

Thank you.