

Renewable Energy & Marine Data: The case for an Integrated Approach



Introduction

An Integrated Sea information System is needed
to accelerate the emerging € 6.4 Trillion
Offshore Wind Energy Market : *ISIS*.

To create ISIS, new policies, new standards,
greater cooperation and innovative
Information and Communication
Technologies are needed.

Open Integrated Seabed Information System

- Mainstream Renewable Power
- Offshore Wind in Europe
- Offshore Wind Developers' needs
- Supergrid's needs
- Data Management initiatives
- Integrated Sea Information System
- Next Steps

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Vision

Mainstream Renewable Power was founded by Dr. Eddie O' Connor in February 2008.

*“ Our vision
is of thriving economies and communities
liberated from the restrictions of fossil fuels,
using
renewable energy
as their
mainstream source of power. ”*

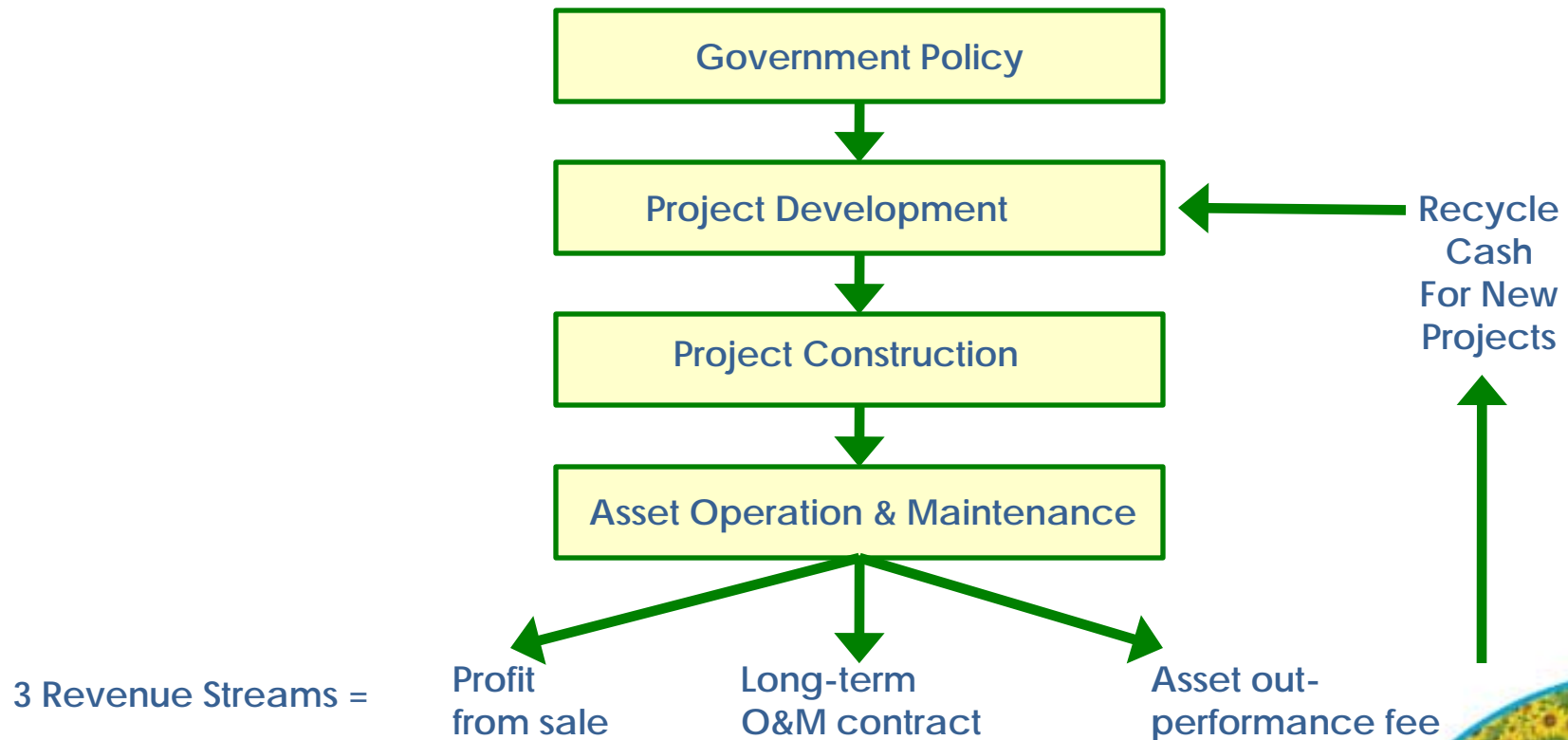
The world is experiencing a **once-off historical transition** to sustainable fuels: Each one of our 195 countries must go through it.

4 fundamental issues drive this transition ;

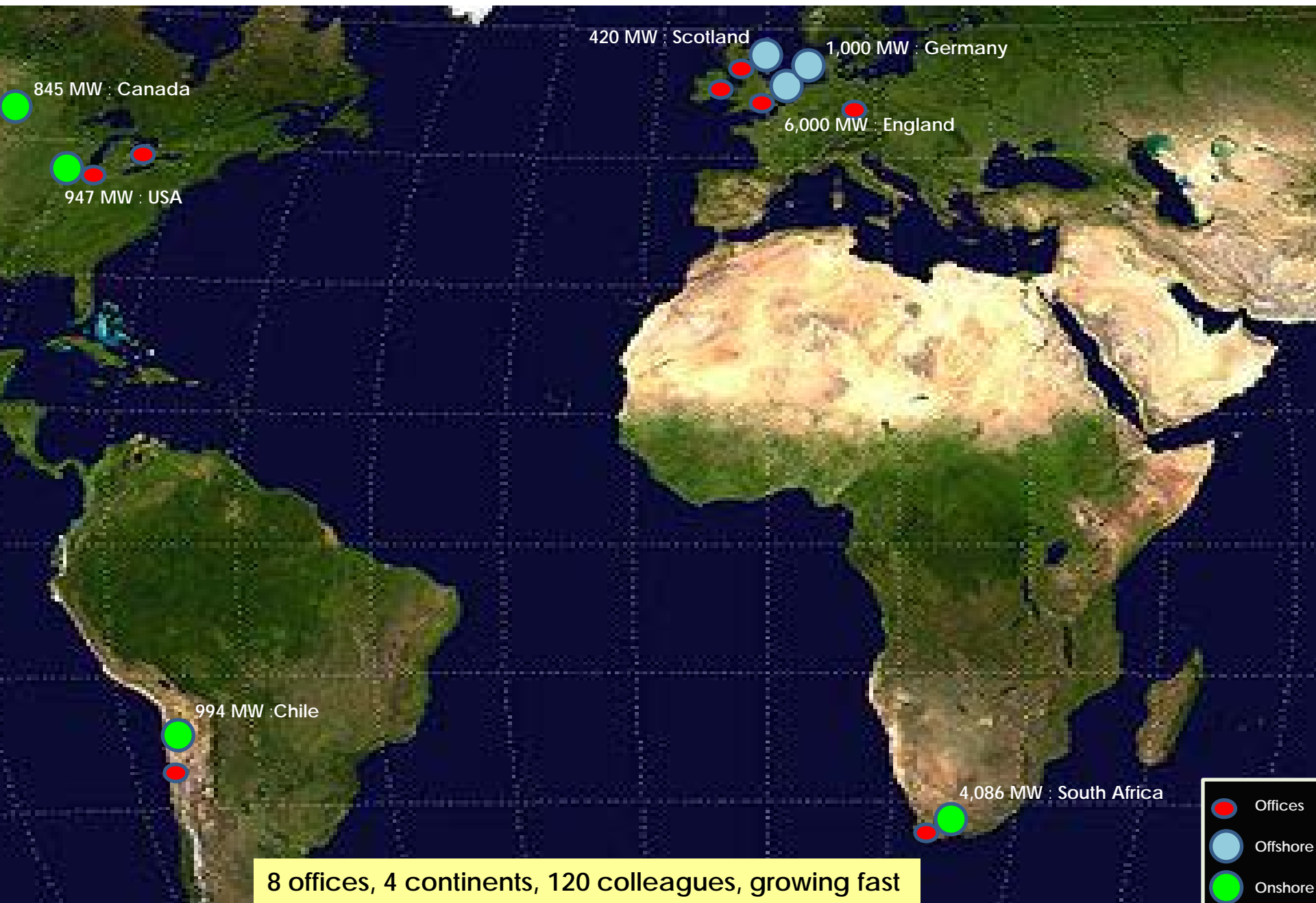
- Climate change
- Ever-increasing Demand for Energy
- Rising Fossil Fuel Prices
- Energy Security

Mainstream's Business Model

- Sustainability as a business is what we do at Mainstream : wind & solar.
- Mainstream's business model spans 4 key areas ;



Mainstream's 14,000+ MW Projects' Pipeline



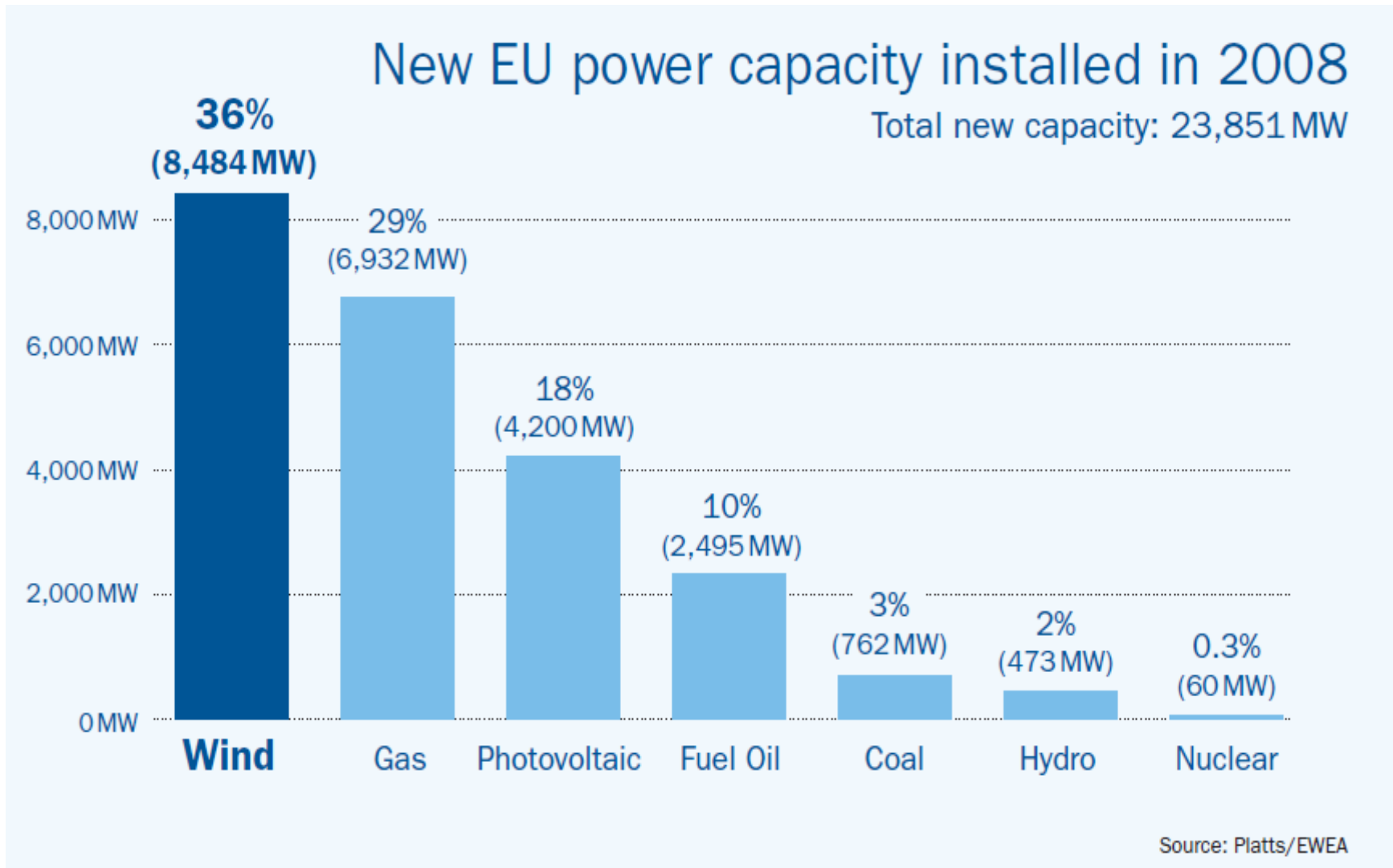
8 offices, 4 continents, 120 colleagues, growing fast

-  Offices
-  Offshore
-  Onshore

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EU Energy Perspective : Current Investment Mix



> 50 % of new Generation Capacity from Wind & PV

EU Energy Perspective : Where is the Wind Resource?

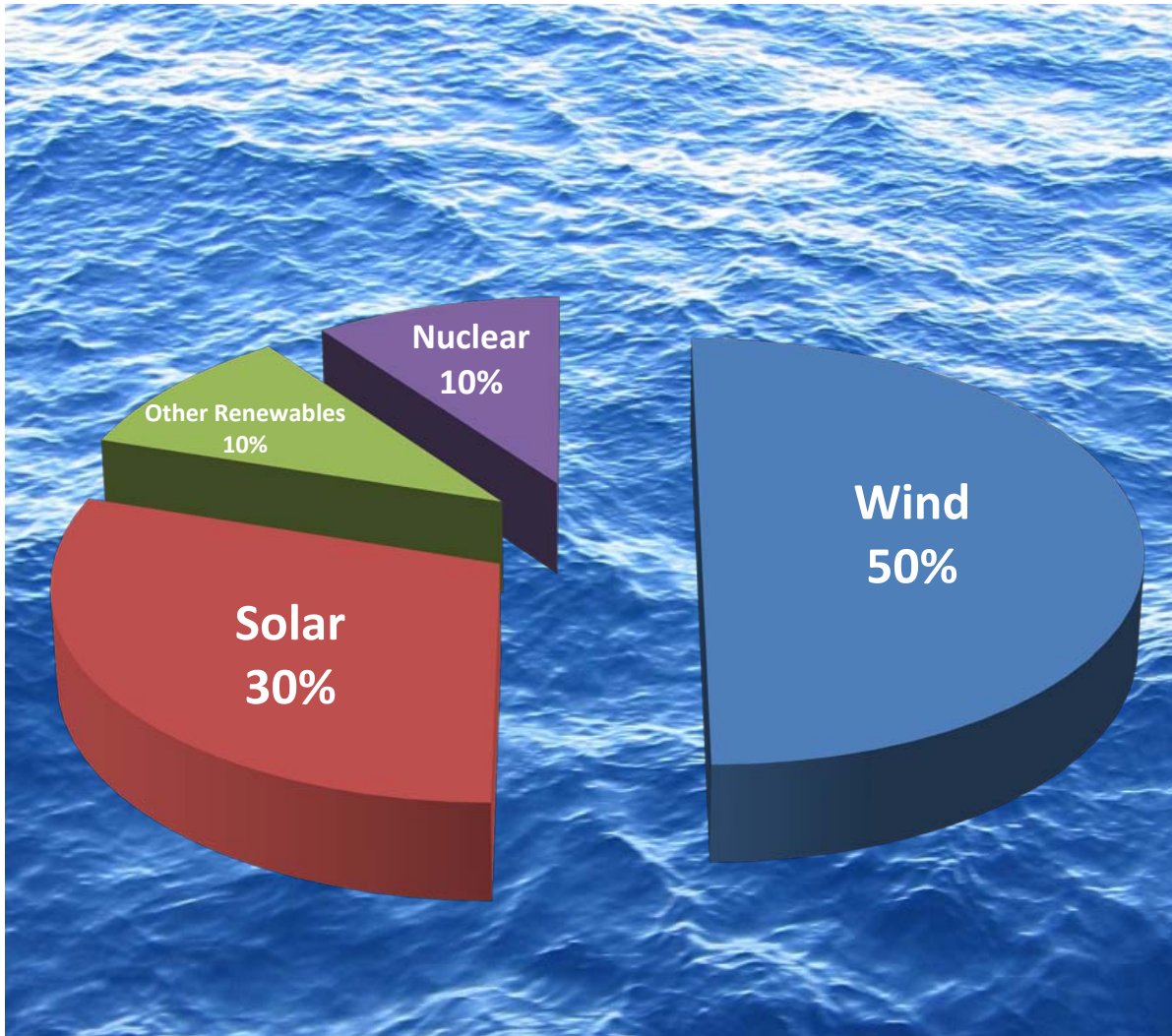
- **1,800,000 MW** of installed Wind Power needed by 2050
 - Based on projected 2050 energy requirements
- **200,000 MW** from Onshore Wind : the limit
 - The limit because Europe is the world's most crowded Continent
- **1,600,000 MW** from Offshore Wind
 - Plenty of space to grow beyond this target
 - Achievable at €3,600,000.00 per MW installed

Equates to :

- **€5.8 Trillion** investment in Offshore Wind Turbines by 2050.
- **€0.6 Trillion** investment in associated Offshore transmission and distribution .

European Offshore Wind is a €6.4 Trillion Investment opportunity

EU Energy Perspective : 2050 Mix



Energy Demand

Offshore Winds farms are needed for Europe to meet Green House Gas Targets

Interconnection across EU member states is needed to enable Offshore Wind

Interconnection, or Supergrid is vital for delivery of any 2050 scenario

2020 offshore grid connections must be Supergrid-compliant

> 80 % of Generation Capacity will be from Wind & PV

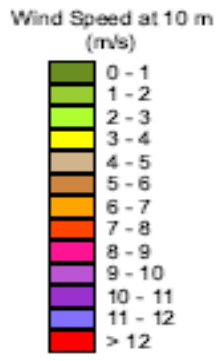
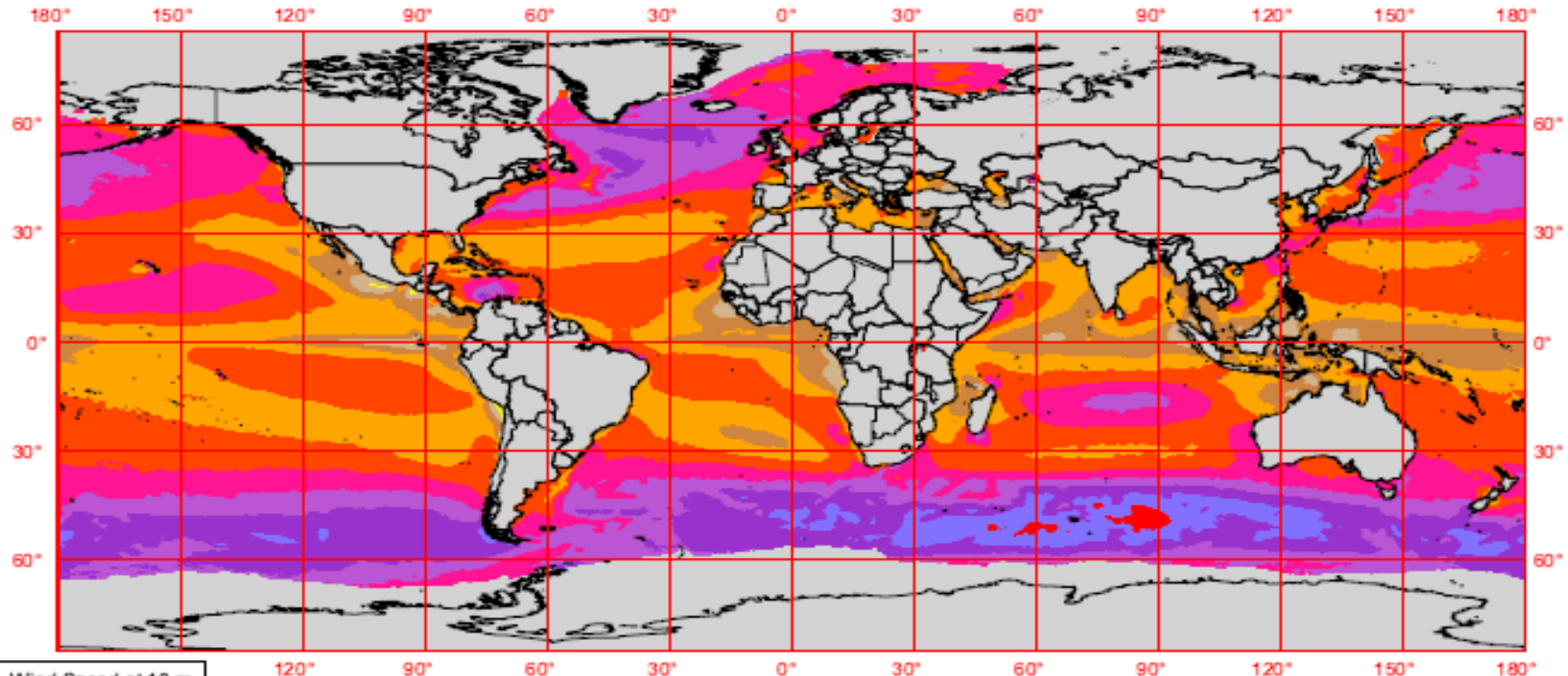
Video : 2050 Challenge



[Click Here](#)

Offshore Wind Resource

QuikSCAT - Annual Wind Speed at 10 m



Scatterometer measurements of the state of the ocean surface are used to estimate 10-m ocean winds in the QuikSCAT satellite data set. The QuikSCAT data are produced by Remote Sensing Systems and sponsored by the U.S. National Aeronautics and Space Administration Ocean Vector Winds Science Team. Data are available at www.remss.com. NREL used a 5-yr average from 2000-2004 to produce the map.

NREL has not validated the QuikSCAT satellite ocean wind estimates. NREL has observed that satellite-derived estimates of wind resource in near-shore, coastal, and island areas do not always agree with high-quality anemometer wind measurements. Therefore, satellite estimates in these areas should be compared with available wind measurements wherever possible.



Solar and Wind Energy Resource Assessment



United Nations Environment Programme



Global Environment Facility

U.S. Department of Energy
National Renewable Energy Laboratory



13-OCT-2005 1.1.00

Offshore Wind in the North Sea represents Europe's best option

Europe's Electricity Demand

Europe's Power Demand

EU27 Demand (2008): **3,200 TWh**



Offshore Wind Power Available

Area considered with 5MW/Km²

North Sea:	35,700,000 MW
Mediterranean Sea:	12,500,000 MW
Total	48,200,000 MW

Equates to: **161,000 TWh**

Conclusion :

Demand	3,200 TWh
Supply	161,000 TWh

Supply v Demand **x 50**

Mr Brian Hurley, Wind Site Evaluation Ltd.
Offshore Wind Resources in Europe
Marseilles, March 2009

Offshore Wind in the North Sea can meet Europe's need, 50 fold

Mainstream's Projects in the North Sea



Key Features

- **Excellent** wind resource
- **Convenient location** for major energy consumers
- **10 countries** are now focused & organised to developing this resource
- **Mainstream** has 3 projects in the North Sea:
 - Germany
 - Scotland
 - England
- **33,000 MW** of Offshore Wind Round 3 Development licences issued by Crown Estate in UK waters

Offshore Wind Farms in the North Sea will deliver the EU Energy Strategy

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What Offshore Wind Developers Need

- **Mainstream's fundamental belief is that marine data is a Public Good.**
 - It should be collected once and used many times.
- **Key needs ;**
 - **Accessibility and Management:**
 - **Clear policy of ownership**, licensing & access for all publicly funded data collection
 - **Single point of access** to marine data and information
 - **Discourage cost-recovery pricing** from public bodies
 - **Data Standards and Quality control:**
 - **Common standards** across jurisdictions and disciplines
 - **Ensure the above is addressed** in publicly funded data collection contracts
 - **International Coordination:**
 - **Harmonised approach** across the EU in relation to all of the above:
 - **Links** provided and maintained to EU/global databases and initiatives
- **Benefits of improved data management ;**
 - **Measurable reductions in costs** to find, access and retrieve data
 - **Wider and more reliable** data and information upon which to base assessments
 - **Mechanisms to share results** and data with stakeholders

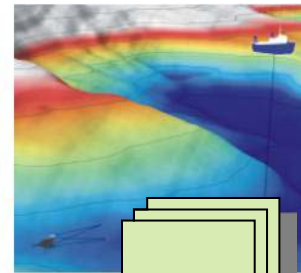
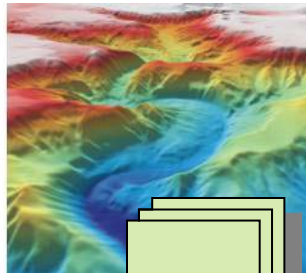
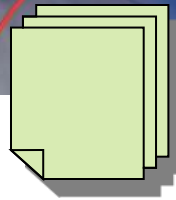
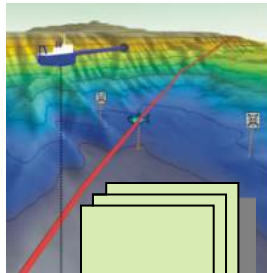
Offshore Business Process

5 % of the € 6.4 Trillion investment will be for ICT
Equates to € 320 Billion ICT investment



Business needs to...

- Identify & Mitigate Risks
- Accelerate Surveying
- Accelerate Construction
- Connect & Distribute Power



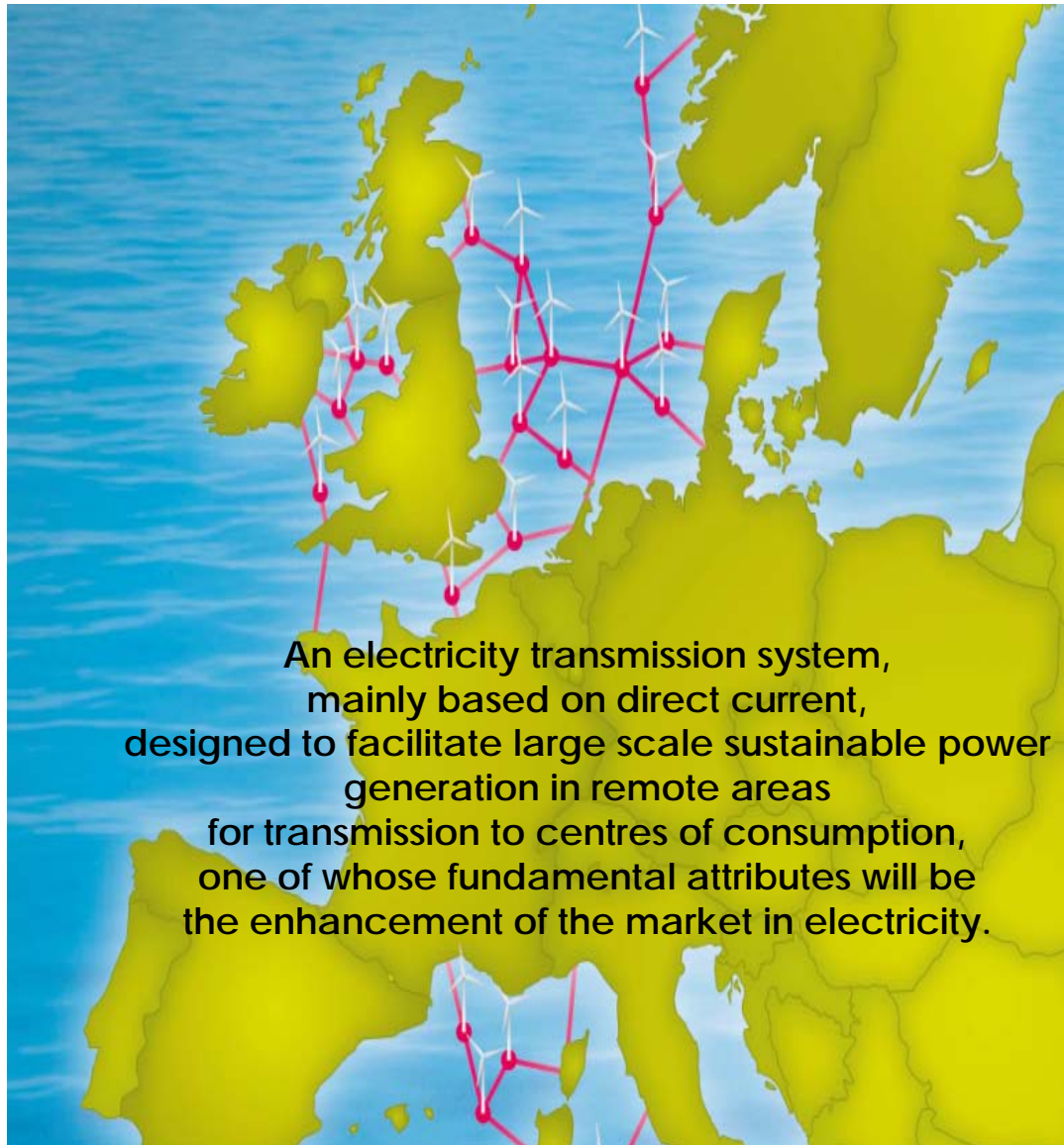
Information needed :

- Surveying
- Modelling
- Turbine Control Systems
- Wireless Communication
- Power Distribution Management
- Project & Document Management
- Risk Management

Reducing Risk is all about Data

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Key Features

- **A new transmission backbone** for Europe's decarbonised power sector
- **Enables distribution of energy** from 1,600,000 MW Offshore Wind Farms
- **A transformational approach** to electricity generation and distribution
- **Captures clean energy generation** and delivers firm renewable power across Europe
- **Goes beyond** existing point-to-point interconnectors
- **Innovative technology needed** to deliver HVDC Supernode technology
- **Requires a strategic partnership** across the Supply Chain
- **Cost to build Europe's Supergrid;**
€0.6 Trillion Offshore Supergrid
€0.6 Trillion Onshore Supergrid

The wind is always blowing somewhere; Supergrid creates portfolio effect

Supergrid Consortium



The consortium represents companies and organisations with a mutual interest in promoting the policy agenda for a European Supergrid.

CEO Ana Aguado run the Consortium which exists to accelerate the Supergrid via a 5 point strategy:

1. Develop Standards
2. Create Offshore Transmission Operator
3. Establish EU Regulations
4. Create Single Electricity Market
5. Establish legal basis for trading



Visser & Smit Marine Contracting

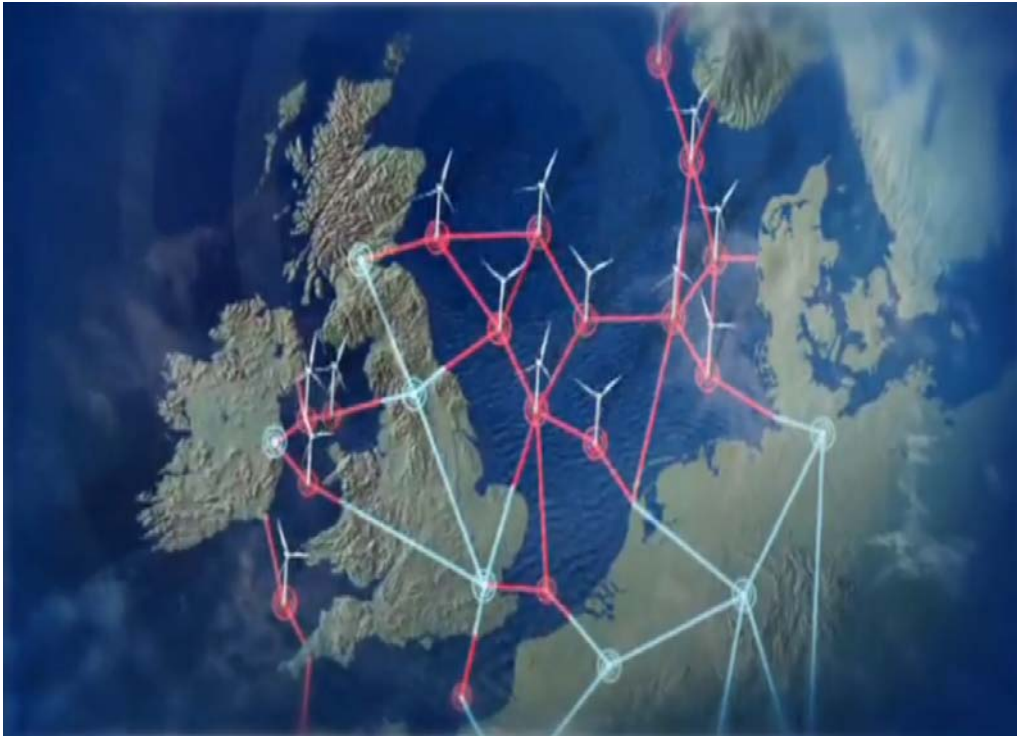


The Consortium has 20 members so far

Video : 2050 Supergrid



[Click Here](#)



7 Innovation Trajectories are needed;

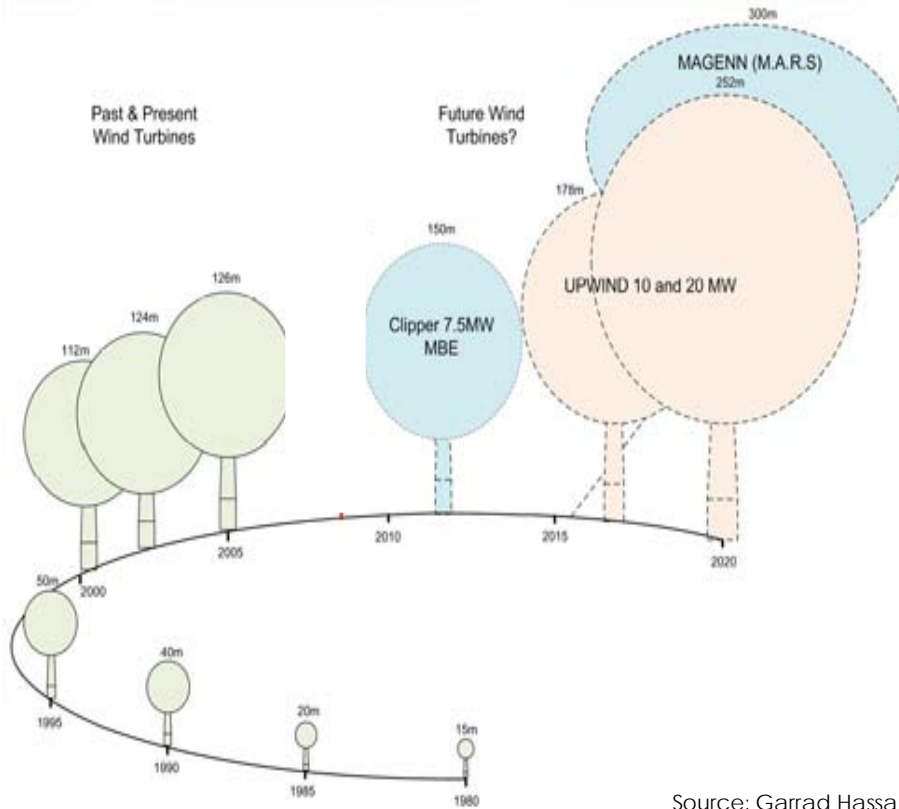
1. Bigger Wind Turbines
2. HVDC Transmission Cables
3. Supernode
4. Next-Generation Civil Engineering
5. Bigger Construction Vessels
6. Bigger Ports
7. Better ICT

Dr Eddie O'Connor, Mainstream Renewable Power
Supergrid Launch
London, March 2010

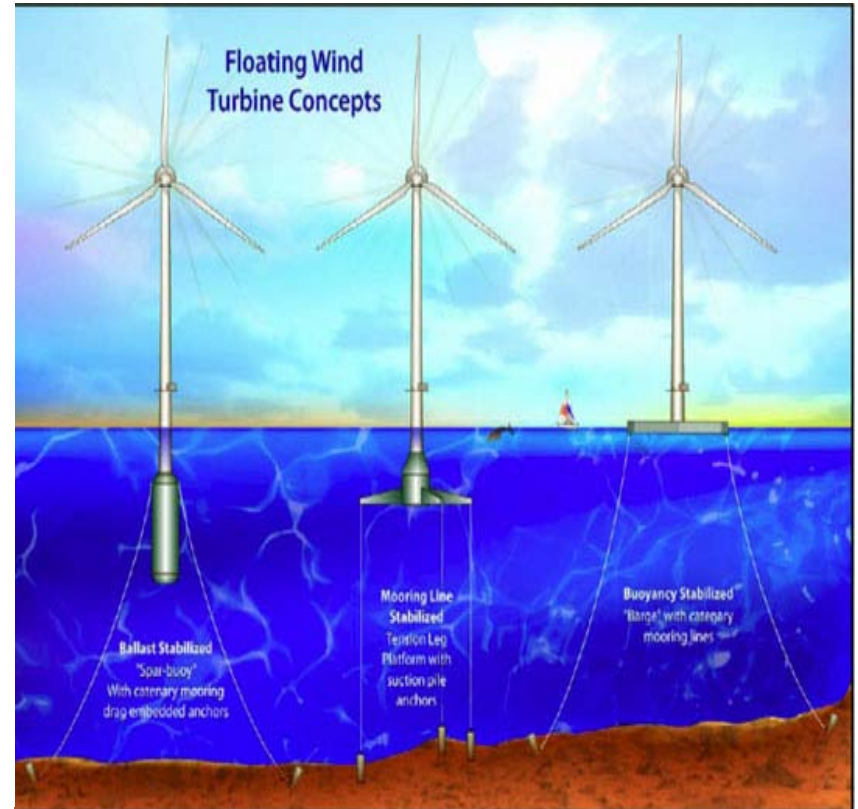
An inevitable transition to Sustainability with 7 Innovation Trajectories

Turbines will get bigger : 20 MW

Floating Turbines will be viable



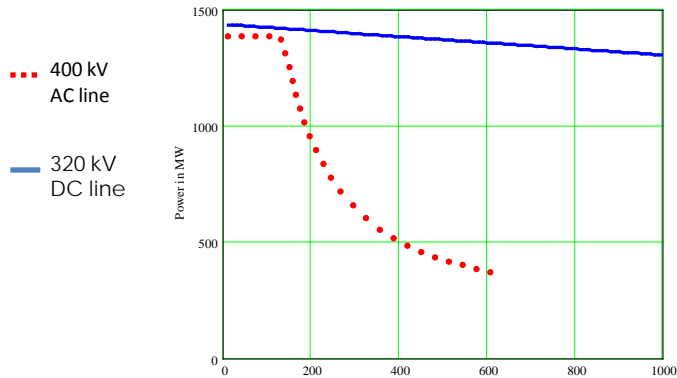
Source: Garrad Hassan



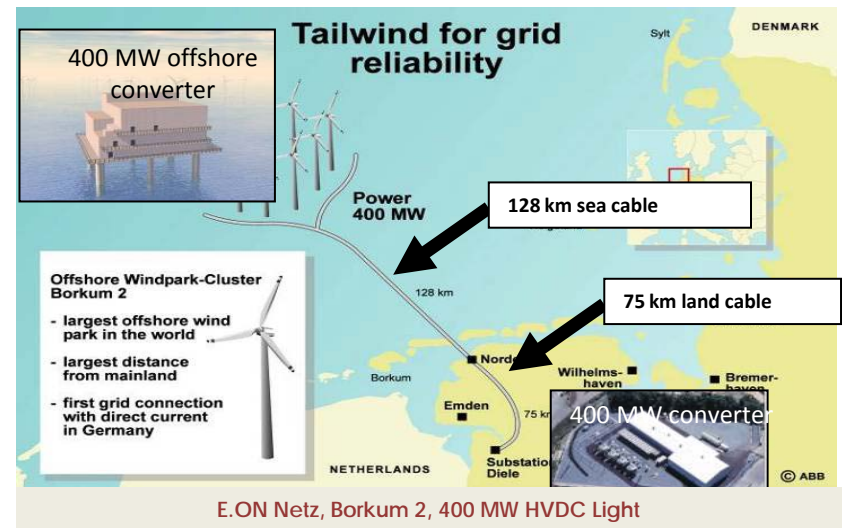
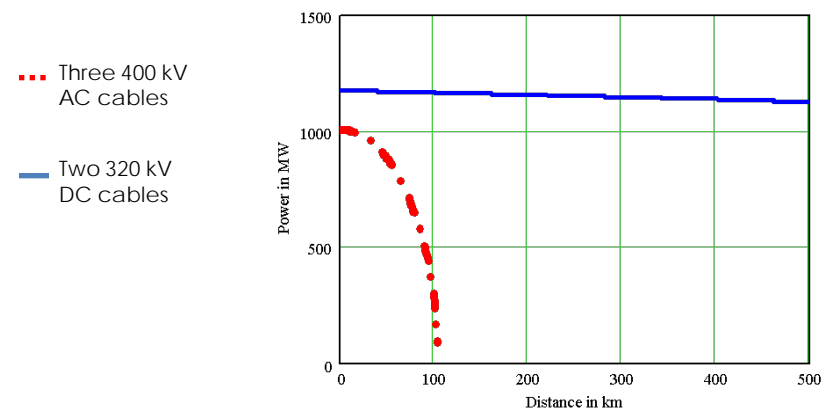
Dr Eddie O'Connor, Mainstream Renewable Power
C & F Offshore Summit
London, April 2009

Bigger, better turbines are needed

Overhead Cables

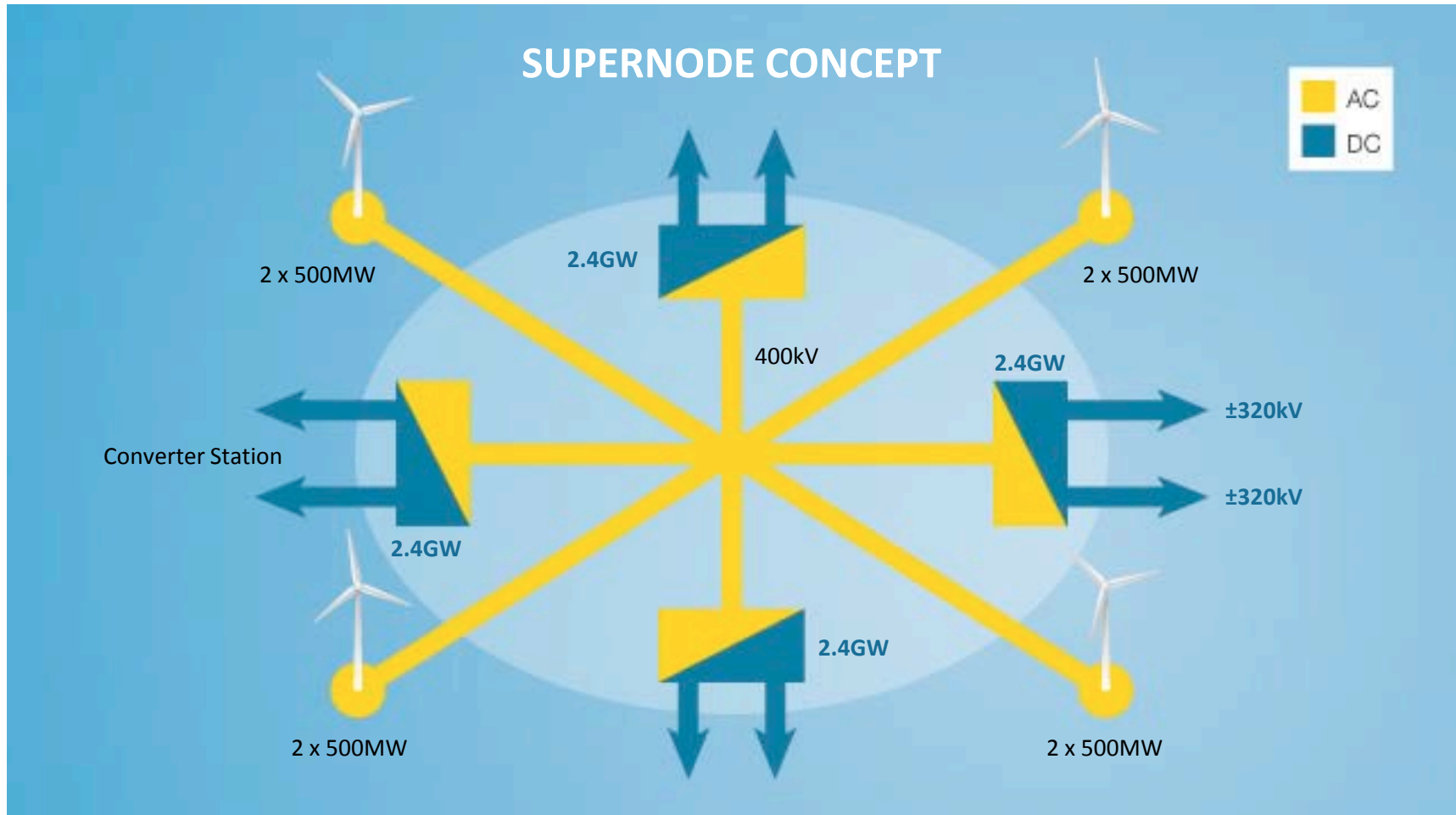


Sea Cables



Mr Gunnar Asplund, ABB
 HVDC Supergrid - Technology and Costs
 Marseilles, March 2009

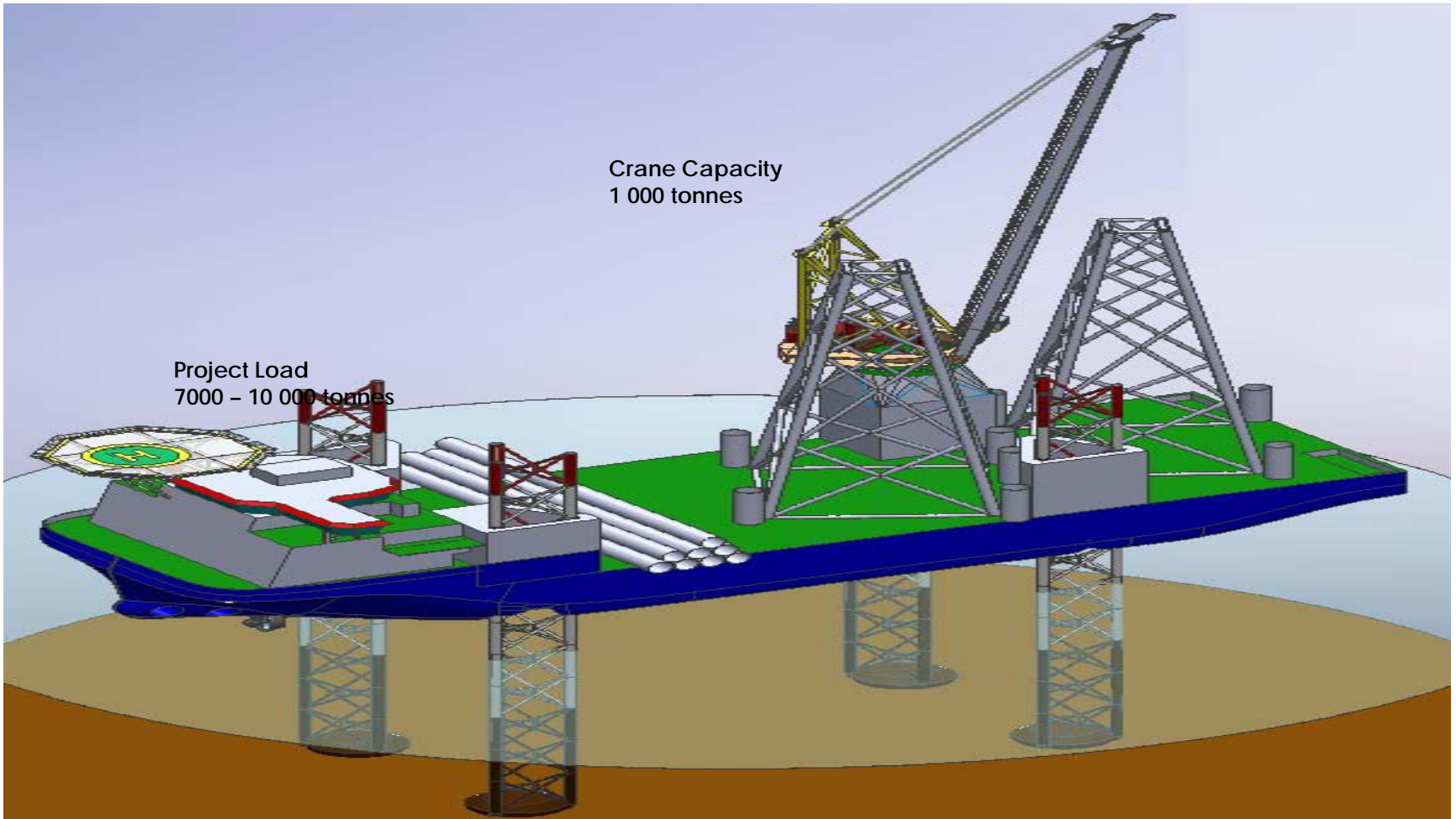
HVDC uses proven technology



Mr Joe Corbett, Mainstream
Detailed design of the Supernode
Marseilles, March 2009

Supernode is a proven concept

Offshore wind Jack-up



Mr Fenno Leeuwerke, Hochtief Construction
Building at Sea and 3rd Generation of Ships
Marseilles, March 2009

Bigger, stronger Jack-up Technology

Innovation # 5 : Bigger Construction Vessels



Mr Fenno Leeuwerke, Hochtief Construction
Building at Sea and 3rd Generation of Ships
Marseilles, March 2009

Bigger Ships for bigger loads



Requirements for UK's Offshore Plans;

- Develop two completely new ports
- One on either coast of the UK
- More than transport nodes
- Focal point for regional development
- Centres of excellence for R + D
- Training centres for technologists/technicians
- New manufacturing centres

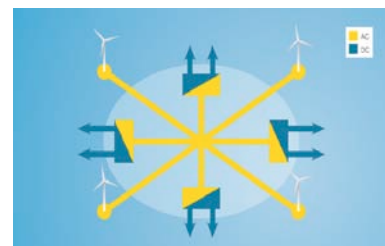
Dr Eddie O'Connor, Mainstream Renewable Power
C & F Offshore Summit
London, April 2009

An entirely new approach to Logistics is needed

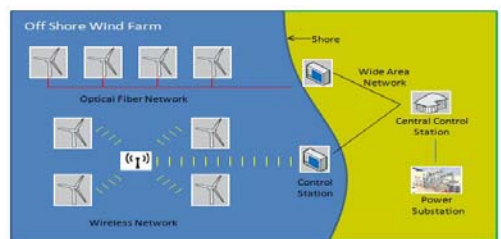
Innovation # 7 : Better Information Technology



Power Distribution Management



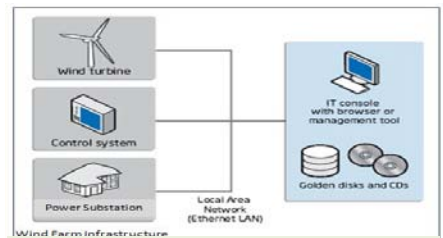
Supernode Power Controls



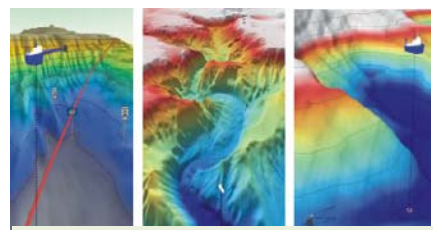
Hi-Speed Wireless Communication



Monitoring & Controlling Risk



Wind Turbine Control Systems



Surveying & Modelling the Sea

John Shaw, Mainstream Renewable Power
ICT Strategy for Offshore Wind

Better ICT will add value throughout the business process

Video : 2050 Forward

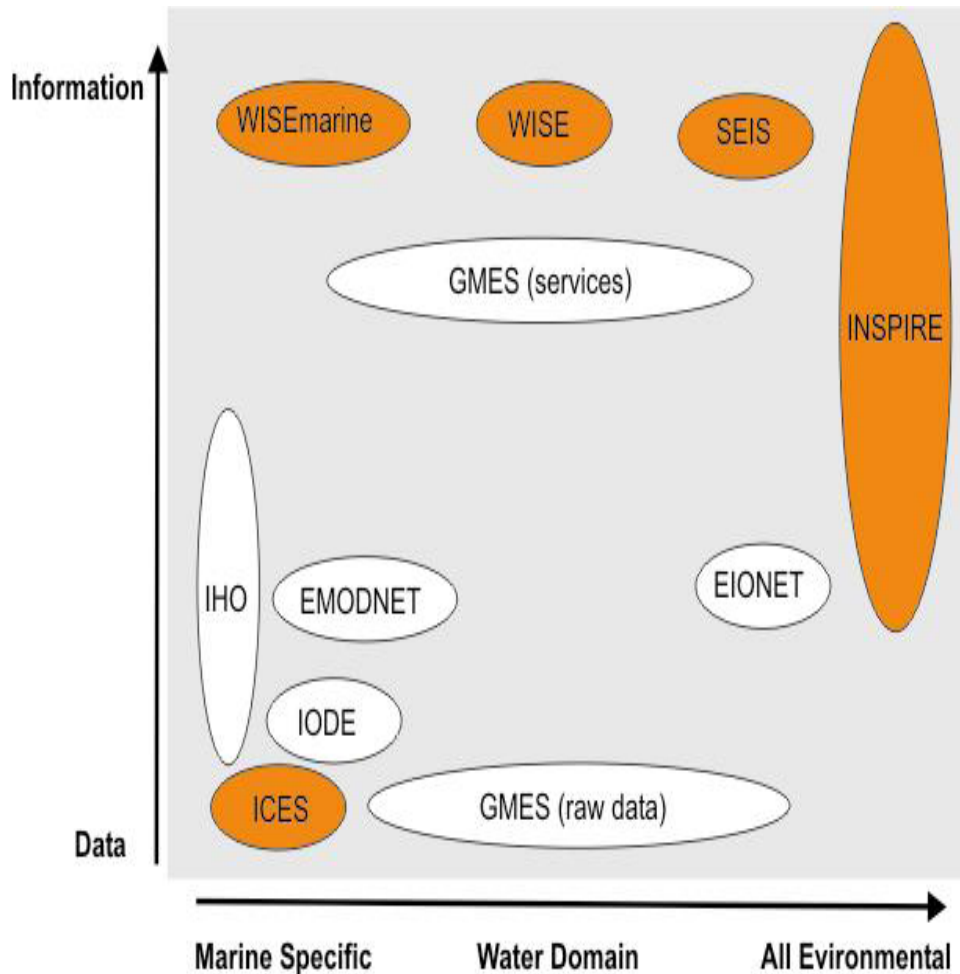


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Better ICT will add value throughout the business process

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• 4 EU Directives in particular impact industry:

- **Marine Strategy Framework Directive** – ‘establish and implement coordinated monitoring programmes for ongoing assessment of the environmental status of [member state] marine waters’
- **INSPIRE Directive** – ‘adopt measures for the sharing of data sets and services between public authorities for the purpose of public tasks and the Environmental Information Directive’
- **Birds and Habitats Directive** – ‘establish a network known as Natura 2000 (SPA, SACs)
- **Data Collection Framework for Fisheries** – ‘collect, manage and provide high quality fisheries data for the purpose of scientific advice, mainly for appropriate fisheries management decisions’

Shading = initiatives to manage data to satisfy EC Legislation

There are many directives and initiatives underway

Marine Knowledge 2020 :

Marine Data and Observation for Smart and Sustainable Growth

Launched 13 September 2010

Led by Iain Shephard

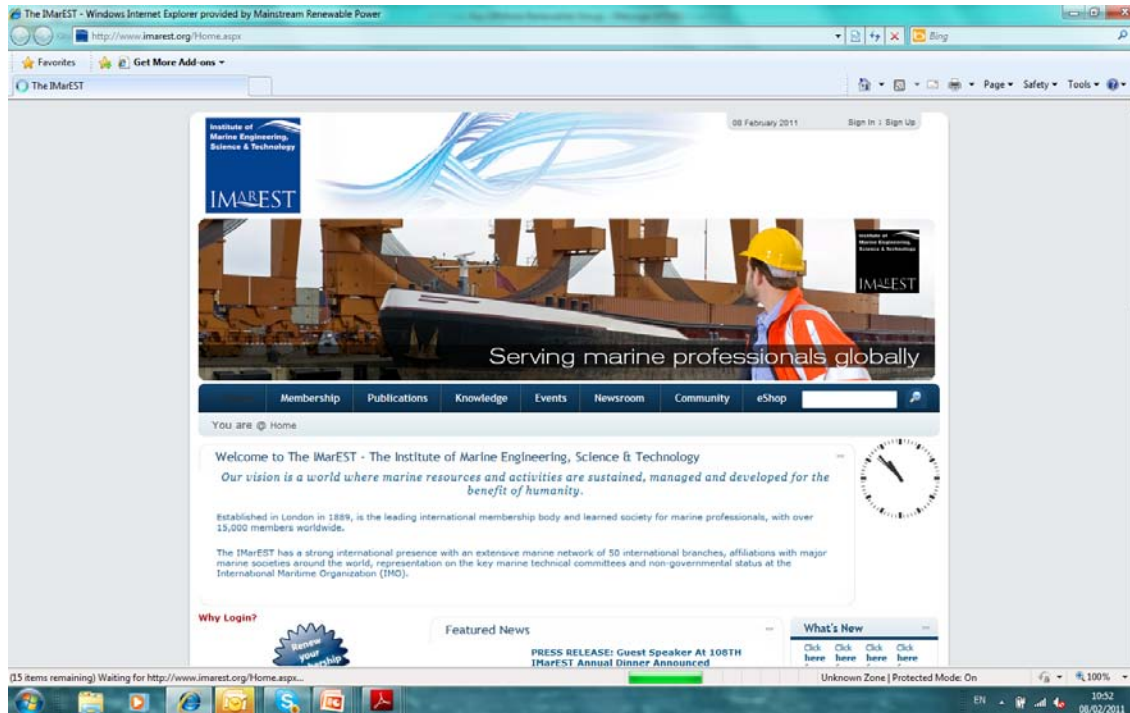
Key Objectives

This Initiative from the Commission will ensure the following are achieved ;

- ***Data from the EU-supported** research programmes are more available for re-use*
- ***Common** standards and policies*
- ***Contribute towards** an interoperable global marine knowledge system*

Cost

- €110.0 Million spent per year by EU on marine data collection
- € 18.5 Million additional allocation per year for EU's Marine Knowledge 2020 initiative



The Institute of Marine Engineering, Science and Technology (IMarEST) is the leading international membership body and learned society for marine professionals, with over 15,000 members worldwide.

Special Interest Group established for Offshore Renewables. December 2010

Led by John Sturman, Chairman, IMarEST Offshore Renewables SIG

Aim is to be the global professional organization that represents the offshore renewables industry.

Important activities will include knowledge sharing amongst members, policy formulation and standard setting.

An ICT Working Party is in place.

The UK Marine Environmental Data and Information Network (MEDIN) is a collaborative partnership driving improved management and access of marine data.

Key Achievements

01 September 2010

- Wide public and private sector involvement ; 30 organisations, including Mainstream
- Created a set of common standards : Tender Specification Clause
- Established 4 Data Archive Centres (DAC) Network : priority public marine data sets
- Launched web portal ; central search capability <http://www.oceannet.org/>

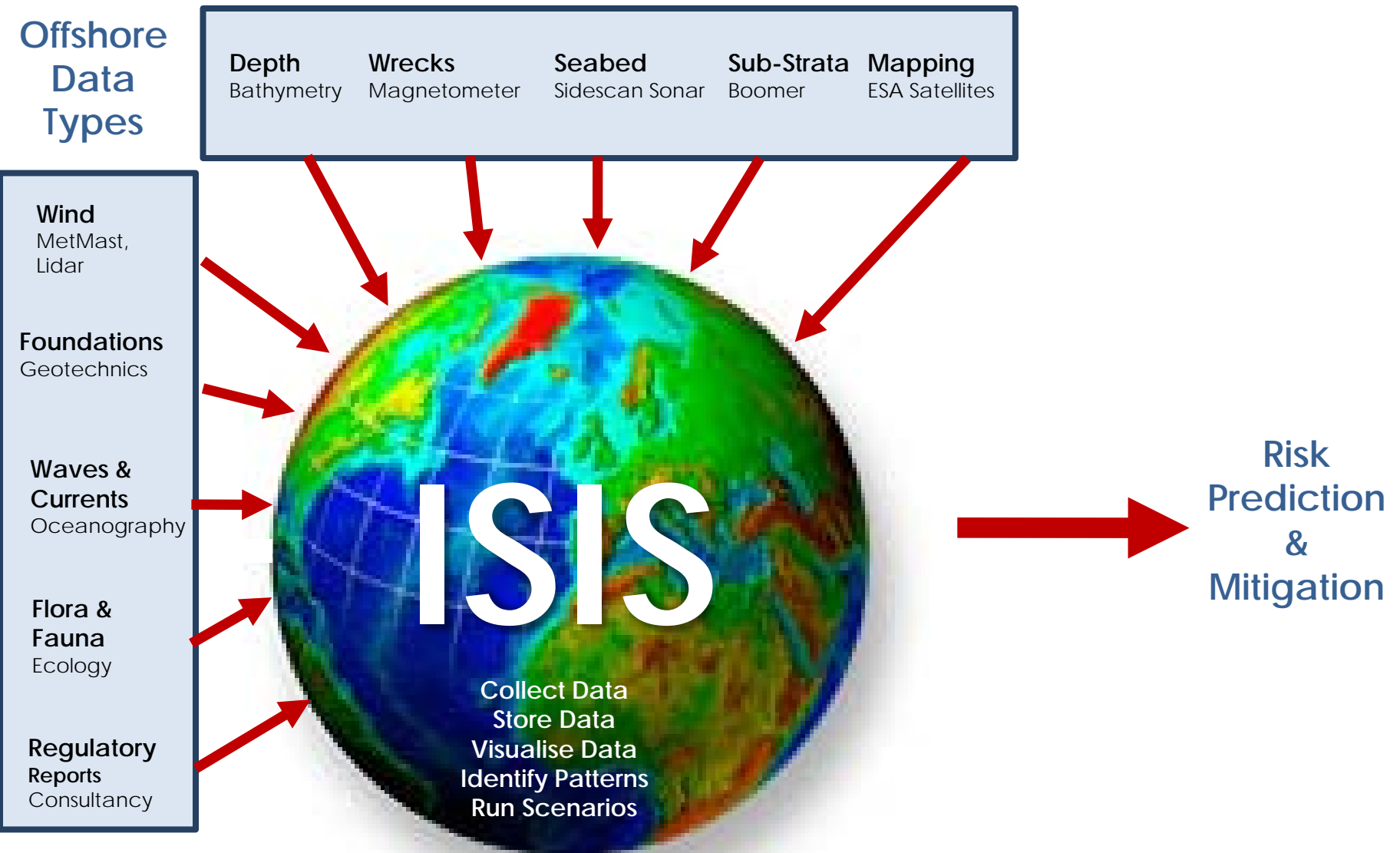
Key Gaps

- No obligation for Industry-collected data
- Granularity for project-specific data storage
- No 3D Visualisation, No Simulation

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Convert Data into Wisdom



An Integrated Sea Information System (ISIS) is needed : doesn't currently exist

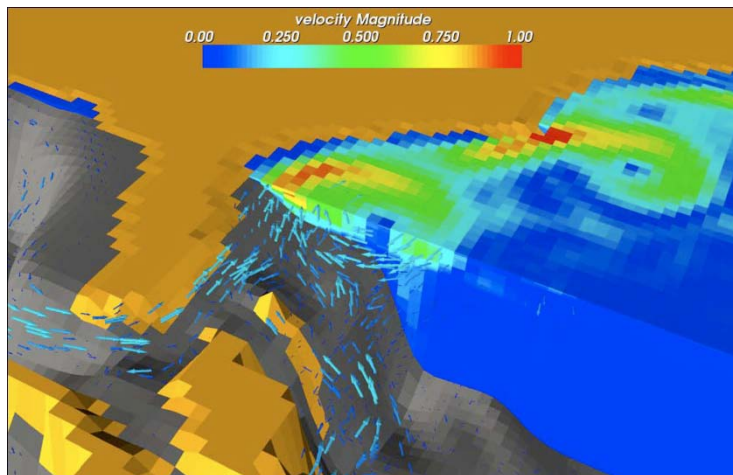
Precedent: 3D Data Visualisation

Pittsburgh Supercomputing Center (PSC) computational scientist consultants work closely with discipline scientists to provide tools for visualization and analysis on their Cray XT3.

“too much information.”: When it comes to a scientist’s desire to simulate physical phenomena in realistic detail, there is no such thing.

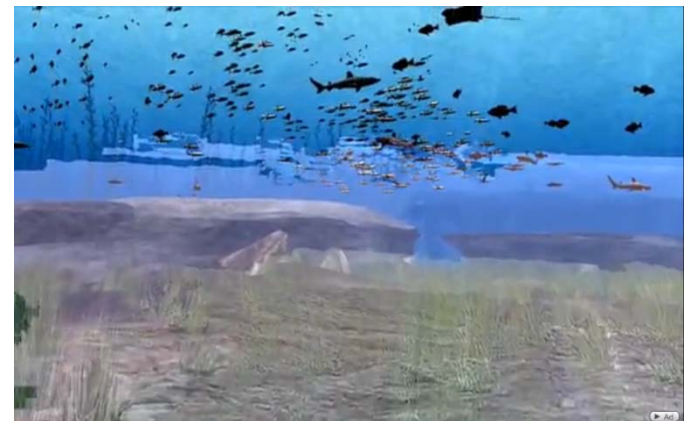
3D visualisation of Atlantic Currents

University of Miami & PSC



Realtime Ocean Visualisation

Lenfest Ocean Future Blender 2.48



http://www.youtube.com/watch?v=Z5Q1Pwrp8bw&feature=youtube_gdata_player

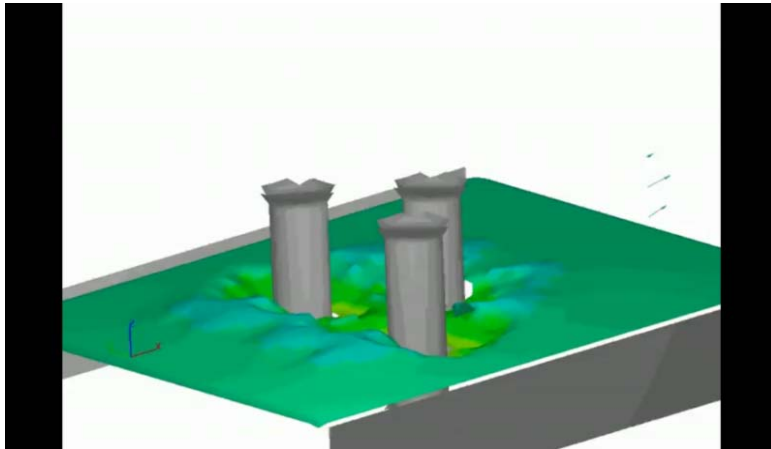
Precedent: Running What If Scenarios

Visualising data makes it easier to identify risk.

Simulating scenarios makes it easier to predict future risk.

Sediment Scour Simulation

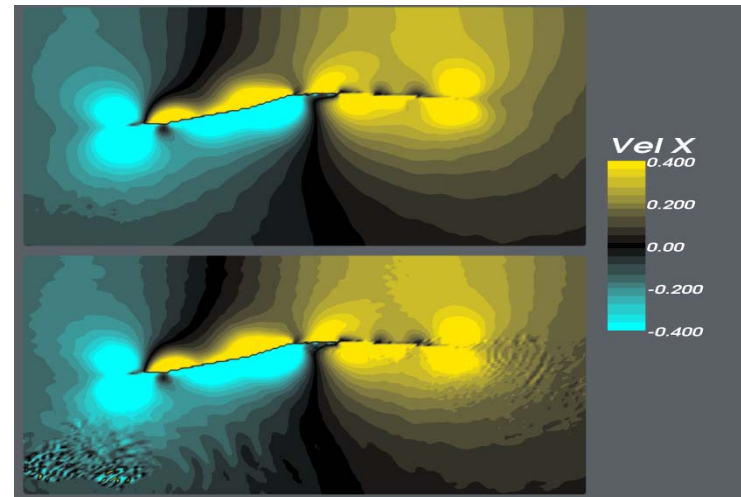
Northwest Hydraulics Consultants. CUDA



http://www.youtube.com/watch?v=NIGzrlshOg&feature=youtube_gdata_player

3D visualisation of Soil Displacement

Carnegie Mellon University & PSC



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Step 1. Form ISIS Consortium; prospective members



The consortium must represent all key stakeholders

Step 2. Agree The ISIS Problem Statement

Business Problem :

As Europe expands Offshore Wind Energy, Developers need to collect and analyse large quantities of data and meet regulatory requirements. In the absence of an Integrated Sea Information System, a variety of methods will be used to collect, store, analyse and compile data leading to delays and inefficiencies.

	Current State	Integrated Sea Information System (ISIS)
Work Flow	Inefficient, disparate methods across the Offshore Industry, No agreed workflow methodologies exist across multiple stakeholders.	Integrated Approach
Single version of the truth	No single data repository exists, No single data analysis methodology exists. Difficult to move between 3 rd party providers of data	Integrated approach to data management. all collected data stored in a single n-dimensional database, standardised visualisation method
Speed of decision-making	Risks not captured in unitary manner	Integrated approach to risk management: rule-based decision-making to predict and mitigate risk, to identify trends and patterns, to run what-of scenarios, to peer into the future
Fast Learning	Difficult to move between 3 rd Party providers of data	Integrated approach to Knowledge Management. standard Reports for Regulatory Compliance
Security	Loose Security: Position unknown, difficult to enforce.	Complies with ISO27001. Tight Security :Position known, protected.
Cost	High repeating cost for individual organisations. High Total Cost of Ownership.	Low Total Cost of Ownership. Initial high cost to develop, lower cost to operate, all stakeholders share the cost.
Personal & Team Productivity	Inefficient	Satisfy all Stakeholders with one system. Clear, Single Repository for all Data. Measure Once, Use Manage times, Open Systems Standards

ISIS : faster, better, more reliable, more secure

Step 3. Identity & Address ISIS Barriers

- **Innovation is inhibited by data licence issues:**
 - **Data licence issue** throughout European waters
 - **Over 400 legal entities** have licensed ownership of data in Britain
 - **Need EU Data Ownership Policy**
- **Innovation is inhibited by regional data strategy variation:**
 - **National data archives** are at different levels of maturity
 - **Low Interoperability** of data and metadata across EU
 - **Need EU standard** for data archives
- **Role for EU Commission:**
 - **Build on existing progress** made by data communities
 - **Provide sustainable funding** for Innovation
 - **Provide framework** for licensing and re-use of data

There is a compelling need for Standard Policy

Conclusion

ISIS needs a consortium from across Industry,
Commission, Academia to define policies,
standards, specifications

The basic building-blocks for ISIS exist

ISIS will accelerate Offshore Wind Energy
Development

Further information

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