



SafeWind

Wind Power Forecasting with Focus on Extremes
Workshop, Palais Brongniart, 31.08.12, Paris

"Leading-edge R&D in Wind Power Forecasting - From ANEMOS to SafeWind"

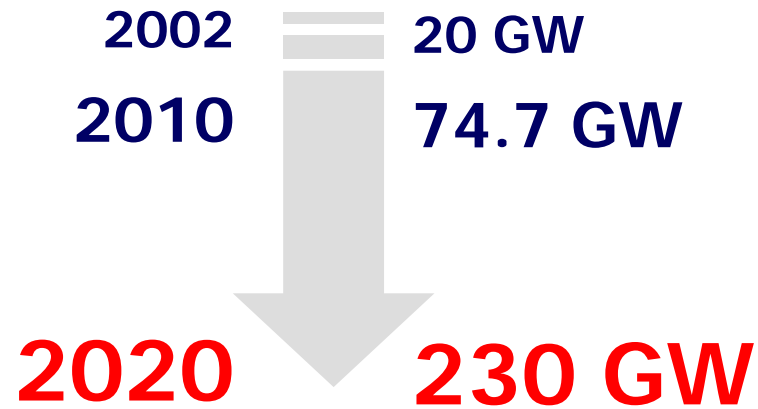
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www.safewind.eu

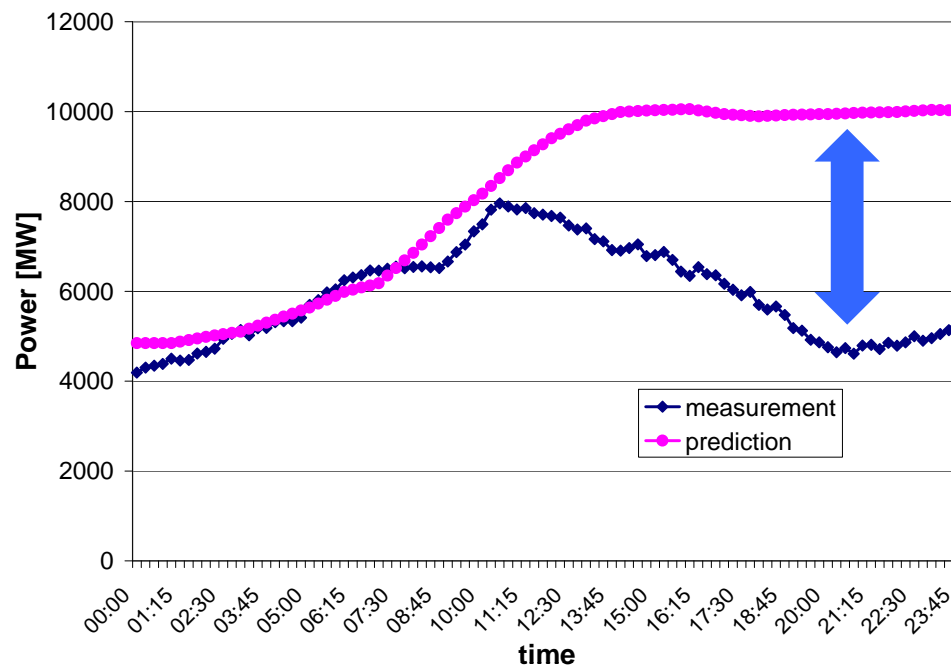


- Ambitious targets for wind integration in EU



- Challenges for the power system management
- **Short-term forecasting** of wind generation is recognized as a prerequisite for an efficient wind integration

- The actual wind power forecasting technology is quite **mature**
- However, in some situations large forecast errors may have an **important impact** on power system operation



Example in Germany:

Path of low-pressure system was different than predicted,

Maximum error: **5500 MW...**

- Considerable research carried out in the last 20 years

HIGHLIGHT PROJECTS :

ANEMOS : FP5, 2002-2006

Meteorology



Wind power
forecasting technology

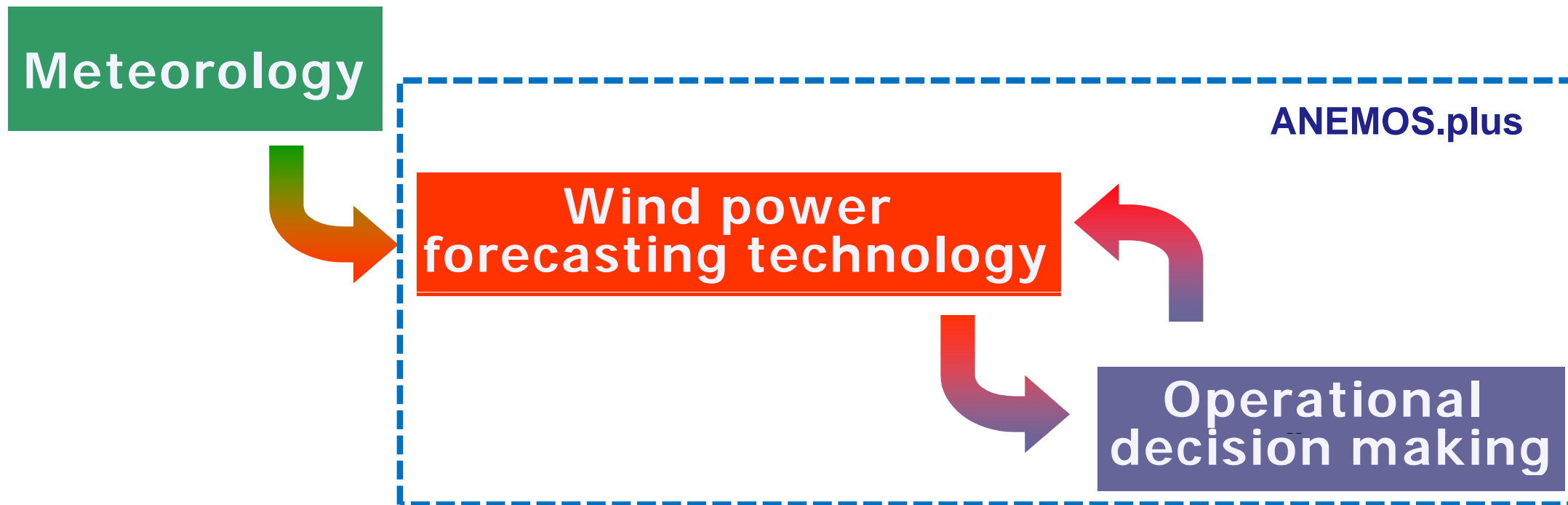


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HIGHLIGHT PROJECTS :

ANEMOS : FP5, 2002-2006

ANEMOS.plus : FP6, 2008-2011



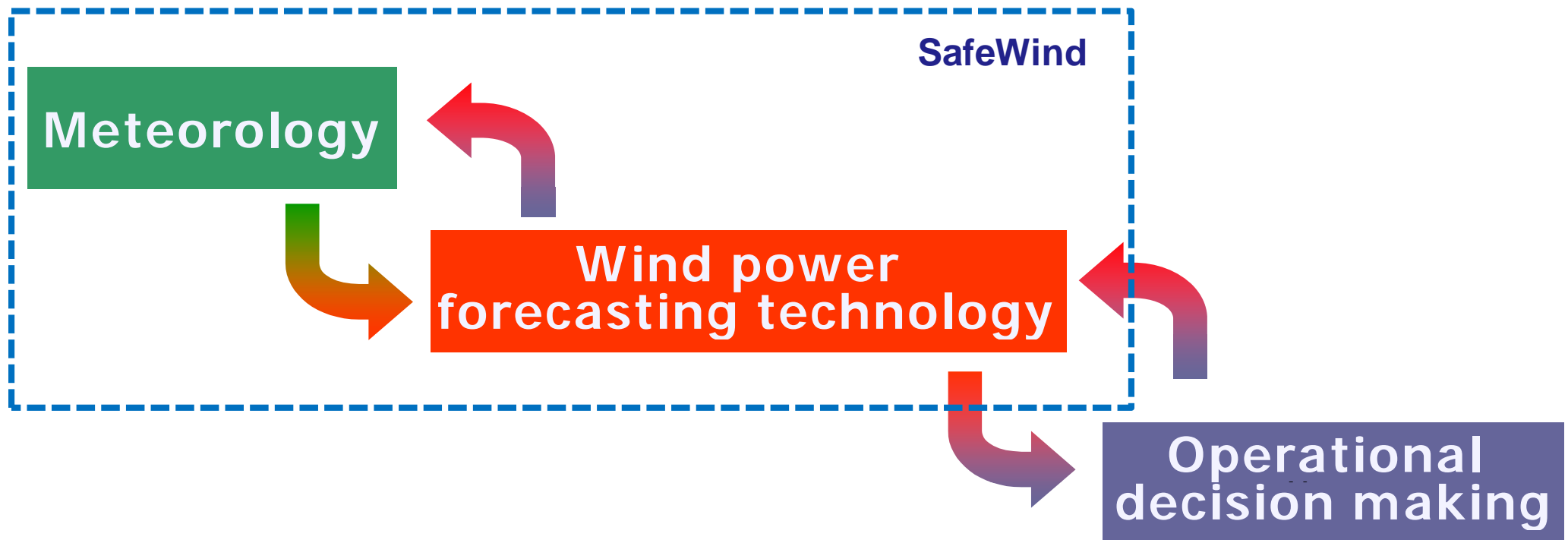
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HIGHLIGHT PROJECTS :

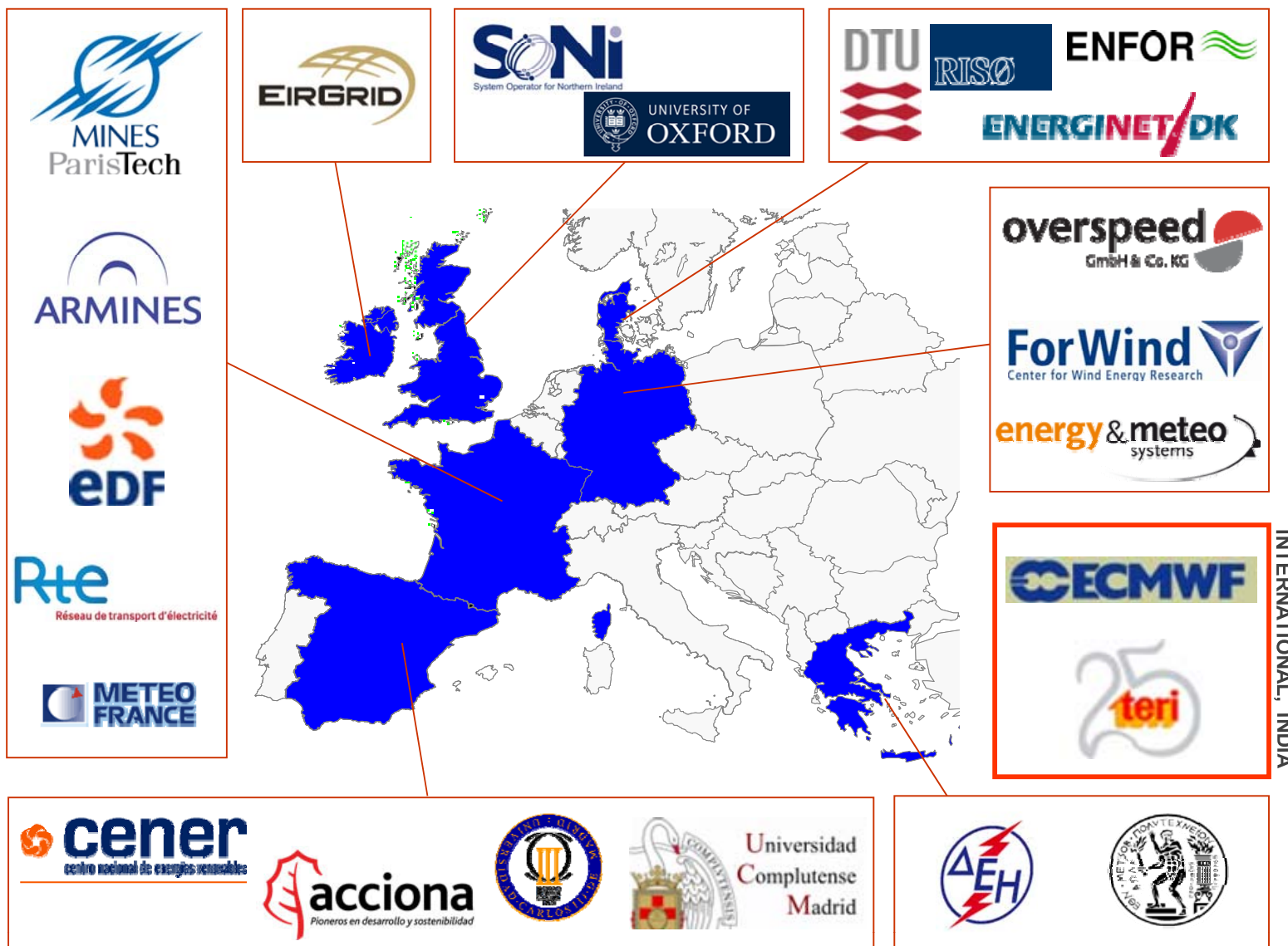
ANEMOS : FP5, 2002-2006

SafeWind : FP7, 2008-2012

ANEMOS.plus : FP6, 2008-2011



The SafeWind project



2008-2012

**9 countries,
23 partners**

End-users

Industry

Research

Universities

Meteorologists



Budget: 5.6 Mio€

Duration: 4 years

Contribute to a **smooth** and **smart** integration of large shares of wind power into European power systems.

Prepare the way for the coordinated management of 200+ GW wind generation in Europe.

Towards breakthroughs in wind power forecasting.

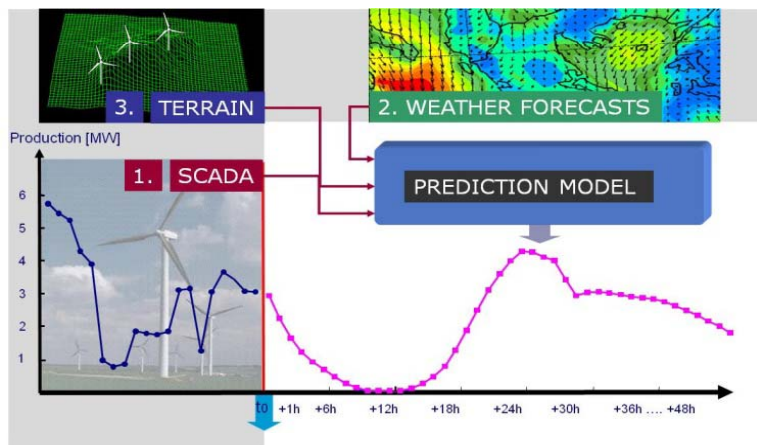
- Significantly reduce error
- Contribute to the "3% vision" of TPWind.

Therefore, TPWind proposes an ambitious long-term '3% vision'. Current techniques must be improved so that given the geographic coordinates of any wind farm (flat terrain, complex terrain or offshore; or in a region covered by extensive data sets or largely unknown), predictions **with an uncertainty of less than 3%** can be made concerning:

- the annual energy production ('resource')⁵;
- the wind conditions that will affect the design of the turbine ('design conditions'); and
- a short-term forecasting scheme for power production and wind conditions.

Vision of SafeWind: create the path

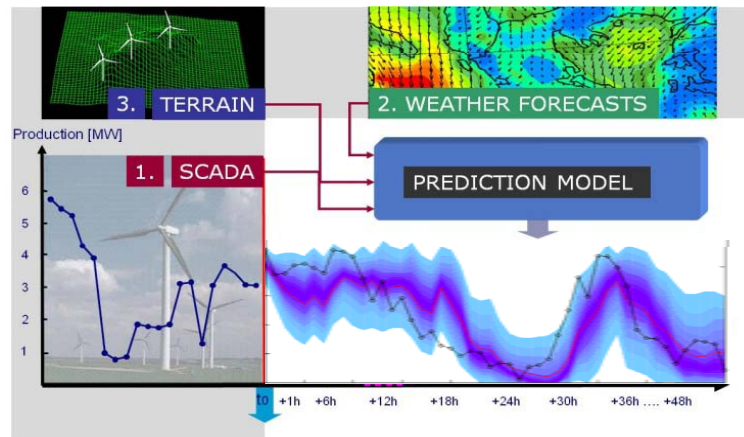
Deterministic approaches



Next generation of tools

Diversify predicted information
Portfolio of products

1990 2002 Anemos 2008 SafeWind 2012



Probabilistic view

?

Improve wind predictability with focus on **extremes** :

- at various **temporal** scales
 - Very short-term (order of 5 min)
 - Short term (hours to days)
 - Longer term (beyond few days ahead)
- at various **spatial** scales :
 - **local scale**: Extreme gusts or shears.
 - **regional scale**: Extreme events (like thunderstorms) can cause the loss of significant amounts of wind energy with potential impact on the grid management.
 - **continental (European) scale**: Extreme weather situations (like fronts) can propagate causing impacts in different member states.

Scientific & Technical Objectives (2)

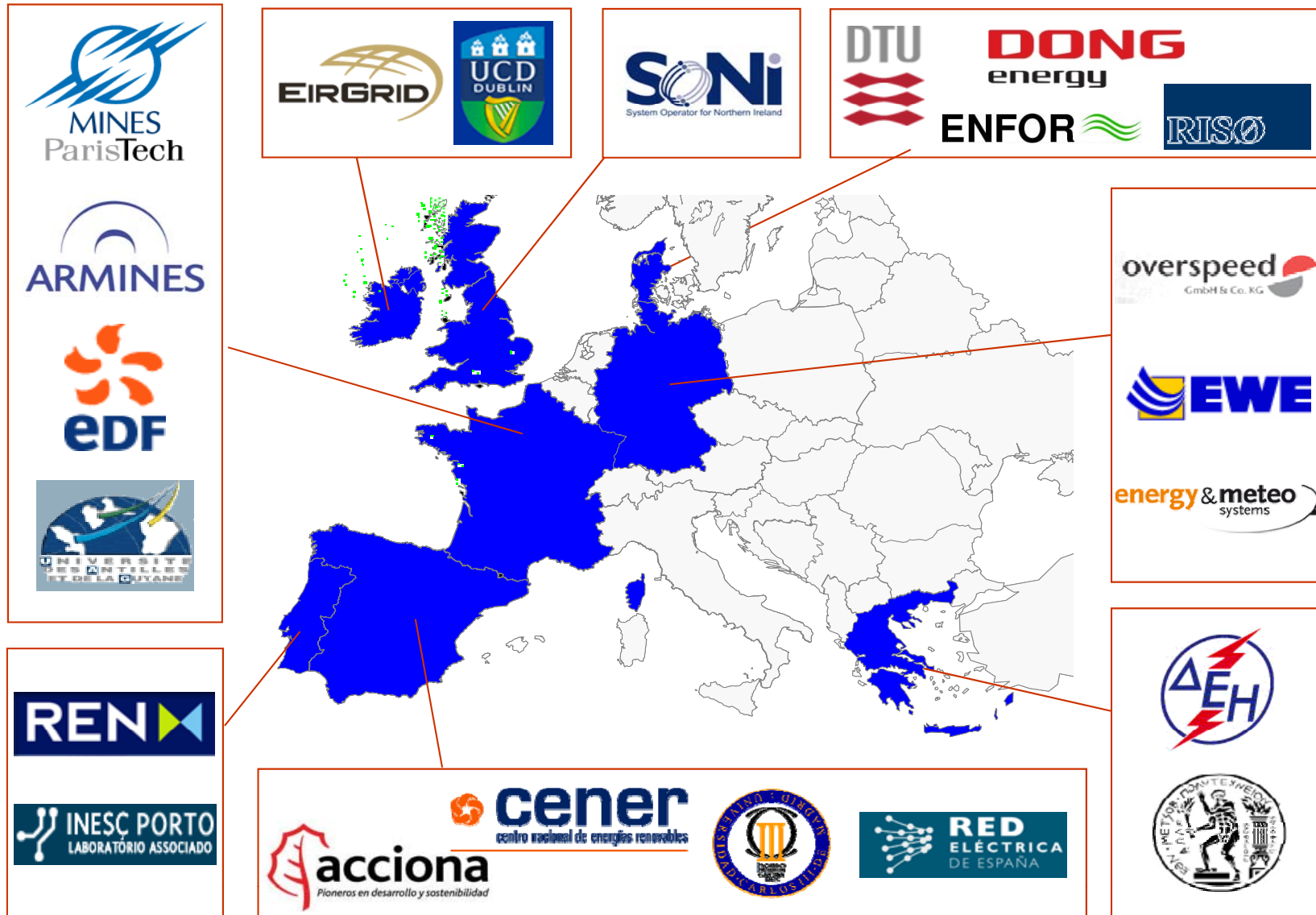
- New **forecasting** methods for wind generation focusing on uncertainty and challenging situations/extremes;
- Models for "**alarming**": providing information for the level of predictability in the **very short-term**.
 - They use near-real time online observations for alerts on potential extreme prediction errors and for immediate updates of short-term (0-6h) wind power predictions on regional and local scale;
- Models for "**warning**": providing information for the level of predictability in the **medium-term** (next day(s)).
 - Such tools, based on ensemble weather forecasts and weather pattern identification, can be used to moderate risks in decision making procedures related to market participation, reserves estimation etc.

Scientific & Technical Objectives (3)

- Develop a **European vision** for wind power forecasting
- Develop **research in meteorology orientated to wind forecasting.**
- Link resource assessment to wind predictability.
- Analyse how **new measurement technologies** like Lidars can be beneficial for better evaluation of external conditions, resource assessment and forecasting purposes.
- Demonstrate the **operational benefits** from new models.

The ANEMOS.plus Project

<http://www.anemos-plus.eu>



2008-2011

**8 countries,
22 partners**

End-users (9)

SMEs (2)

Research (4)

Universities (5)

Meteorologists *



Coordination
ARMINES/
Mines ParisTech

- Demonstrate the performance of advanced wind power forecasting functionalities and resulting benefits.
- Demonstrate the benefits from the application of decision support tools based on stochastic analysis and optimization. Comparison to actual practices for the management of wind generation.

✓ **Enhanced reliability, robustness & ergonomics of forecasting tools**

- Multi-NWP (Numerical Weather Prediction) approach
- Multi-model/combined approach
- Intelligent handling of situations with incomplete information
- Adaptability of prediction tools to changing environment (i.e. evolution of installed capacity)

✓ **Extended prediction functionalities**

- Very short-term predictions
- Probabilistic forecasting (including ensembles)
- Prediction scenarios
- Prediction risk indices for warning on large errors.

✓ **Standardization**

- Interfaces, Data handling, Security aspects, Alarming,...

- ✓ **Optimal management of electricity grids with large-scale wind power generation**
 - development of new management tools for addressing the variability of wind power
 - emphasis is given on the integration of wind power forecasts and related uncertainty in power system key management functions

- ✓ **Application of wind power uncertainty forecasts on the electricity trading by wind power producers**
 - development of strategies to reduce financial risks from imbalances induced by forecast errors
 - development of coordination strategies between wind farms and pumping storage plants (using probabilistic wind power forecasts)

- ✓ **Fully operational tools**

Technical Objectives

Functions considered:

Power
system
scheduling

Reserves
estimation

Probabilistic
forecasting

Congestion
management

Wind/
storage
coordination

Optimal
trading

ANEMOS.plus
demos

End-users :

- TSOs
- DSOs
- Island system operators
- Utilities
- Traders

Demonstration cases

	Transmission System Operators (TSO)				Distribution System Operator (DSO)	Utilities	Indep. Power Producer	Island system operators	
	REN	REE	EirGrid	SONI	EWE	DONG	ACCIONA	PPC	EDF
Wind prediction -Anemos									
Reserves									
Congestion management									
Trading									
Scheduling									
Storage									

- Economy :
 - Increased competitiveness of wind energy in markets
 - Reduced project risk due to better site selection
 - New services business
 - ...
- Technology, Innovation :
 - New or improved software tools
 - Better decision making for wind energy management through the proposed tools
 - Maintain excellence of European R&D in the field
 - **Publications: ANEMOS : 82, ANEMOS.plus : 45, SafeWind : >120**
 - **Total: 245 publications**
- Environment:
 - Higher wind penetration = > CO2 savings
 - SafeWind SOTA deliverable will be the reference input to IPCC (Intergovernmental Panel on Climate Change) on wind forecasting.



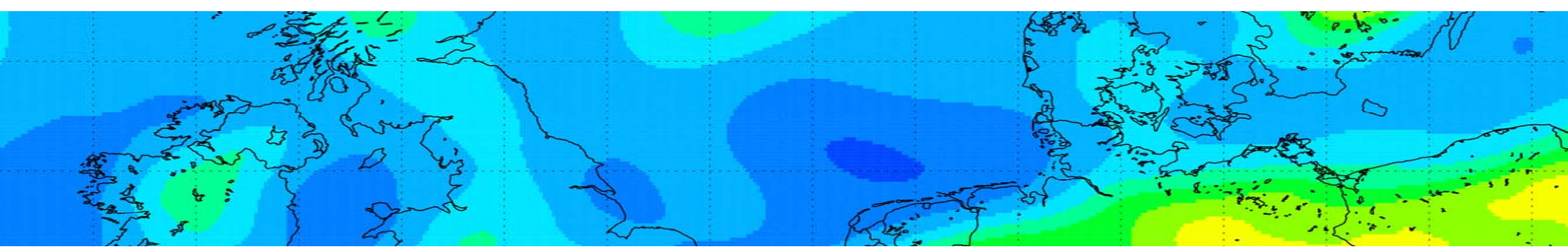
COST Action ES1002 “WIRE”

Weather Intelligence for Renewable Energies

http://www.cost.esf.org/domains_actions/essem/Actions/wire

Thank you for your attention





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Workshop - 31.08.2012

L'Auditorium, Palais Brongniart, Paris



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