



## Night Wind: storage of wind energy in cold stores

An EU – FP6 research project

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*To use a refrigerated warehouse as a giant battery for wind energy. To store all electricity produced during nighttime by windmills all over Europe, and to release this energy again during the peak electricity demand hours in daytime. That is, in short, what the EU “Night Wind” project wants to demonstrate. In the project refrigeration experts from The Netherlands and Bulgaria work together with wind energy experts from Denmark and Spain. The demonstration, in 2007/2008, will take place at a Dutch refrigerated warehouse.*

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### Research Partners:



### Industry Partners:



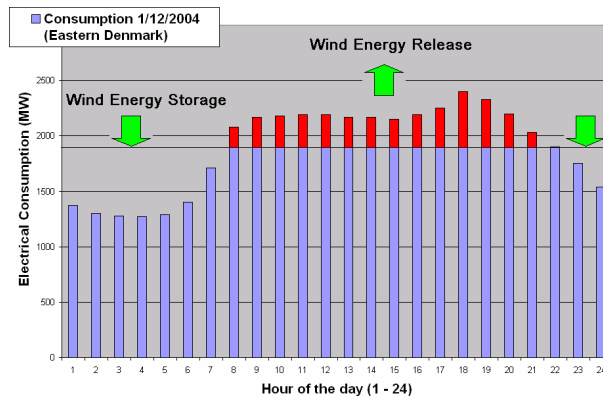
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### Challenges

The integration of wind power into the national or EU energy supply systems is becoming relatively more problematic with increasing installed capacity and production, especially due to a mismatch of supply and demand of energy. The wind energy is produced at rather random times, whereas the energy use pattern shows distinct demand peaks during day time and office hours, and low levels during the night.

The random production of wind energy cannot easily be accommodated on the grid by switching on and off conventional energy suppliers, like coal fired power plants, which would lead to an increase of CO<sub>2</sub> emissions, rather than the reduction of CO<sub>2</sub> emissions which is desired.

In order to accommodate the random production of wind energy in the grid, it would be most convenient when alternative (renewable and conventional) electricity producers could balance out the difference between production of wind energy and electricity demand. The Night Wind project aims to store wind energy produced at night in refrigerated warehouses, and to release this energy during daytime peak hours.



Optimum storage / release of wind energy in line with consumption pattern

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### ***Technical approach***

The whole idea for “Night Wind” makes use of existing technology, extended with novel control strategies. The new control strategies are needed to set the temperature level in refrigerated warehouses to a level that is derived from the actual balance between wind energy production and actual electricity demand. This is the case for “island operation” with delivery of surplus energy to the grid, and also for the case of Distributed Energy Resources (DER), where windmills are physically located elsewhere than the (existing) cold stores, but controlled in an interdependent way to support the European energy service network. Design of control strategies, with the help of powerful simulation tools will be the main task in the Night Wind project.

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### ***Project Structure***

The research stage of the project includes the following topics:

- potential, economic & trade aspects of Wind Power DER + Cold Store DSM
  - design & modelling of infrastructures for island operation of Wind Energy + Cold Store DSM
  - control concepts and algorithms for Wind Energy + Cold Store DSM grid integration
  - quality preservation of frozen products during minor temperature fluctuations
  - legal issues
  - demonstration & introduction outline plan
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### ***Expected Results***

The Night Wind Project intends to bring an idea into demonstration. It starts with a kick off meeting, followed by a phase in which literature will be surveyed and a technical specification will be set up. The benefits of the idea need to be detailed, both the benefits on a macroscopic scale from the European viewpoint of integrating RES with the energy network, and the benefits on a smaller scale to the energy distributors, warehouse owners and the end users. It

is furthermore necessary to address a number of basic research topics - such as the effect of temperature fluctuations on the quality of stored refrigerated and frozen products - before the idea can be demonstrated with minimal risks.

The demonstration phase of the project should mark the start of a larger scale implementation. Therefore, the project will include the preparation of an implementation outline plan, which will be based on the preliminary experiences gained in the demonstration, and will include an effort from representatives from the sectors in which are directly involved in the implementation: the refrigerated warehouse sector and the energy distribution sector.

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### **Objectives**

1. Integrating renewable energy resources into the European energy service network by providing new facilities for energy storage
2. Increasing the economic value of wind energy by providing means to deliver the energy at peak demand hours.
3. Increasing the competitiveness of SME Cold Storage facilities by providing adding “energy storage” as an additional service to be provided for the European energy service network.
4. Offer a solution to integrate wind energy with energy storage in the European electrical grid, giving space to a further growth in the use of wind energy worldwide and a contribution to the Kyoto targets at the same time.

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### **Project Information:**

Full Title: Grid Architecture for Wind Power Production with Energy Storage through load shifting in Refrigerated Warehouses  
Acronym: **Night Wind**  
Duration: june 2006 – june 2008 (2 years)  
EU Contract: FP6-2004 ENERGY – 3 / contract nr. 020045  
Contact: Netherlands Organization for Applied Scientific Research TNO  
S.M. van der Sluis, M.Sc ( [Sietze.vandersluis@tno.nl](mailto:Sietze.vandersluis@tno.nl) )  
Website: [www.tno.nl/rci](http://www.tno.nl/rci)

Project Partners	Country
The Netherlands Organization for Applied Scientific Research TNO	NL
RISØ Wind Energy Department	Dk
CENER (Spanish National Renewable Energies Centre)	Es
Technical University of Sofia (Food Refrigeration Dept.)	Bulgaria
ESSENT Energy Trading (Energy network operator)	NL
NEKOVRI (Dutch association of refrigerated Warehouses)	NL
Partner Logistics Europe BV (Cold store)	NL