



# **European Wind Integration Study (EWIS) Towards a Successful Integration of Wind Power into European Electricity Grids**

**EWIS Concluding Discussion  
13th April 2010, Brussels**

**Quantification of Costs and Benefits  
Mr. Thomas Meister**



# Overview

- Main Findings**
- Benefits of adding wind power to the system**
- Integration Costs**
- Adding 29 cross-border grid reinforcements → “Enhanced Network”**
- Support Costs**
- Storage as efficient mitigation measure ?**

## *Main findings<sup>1</sup>*

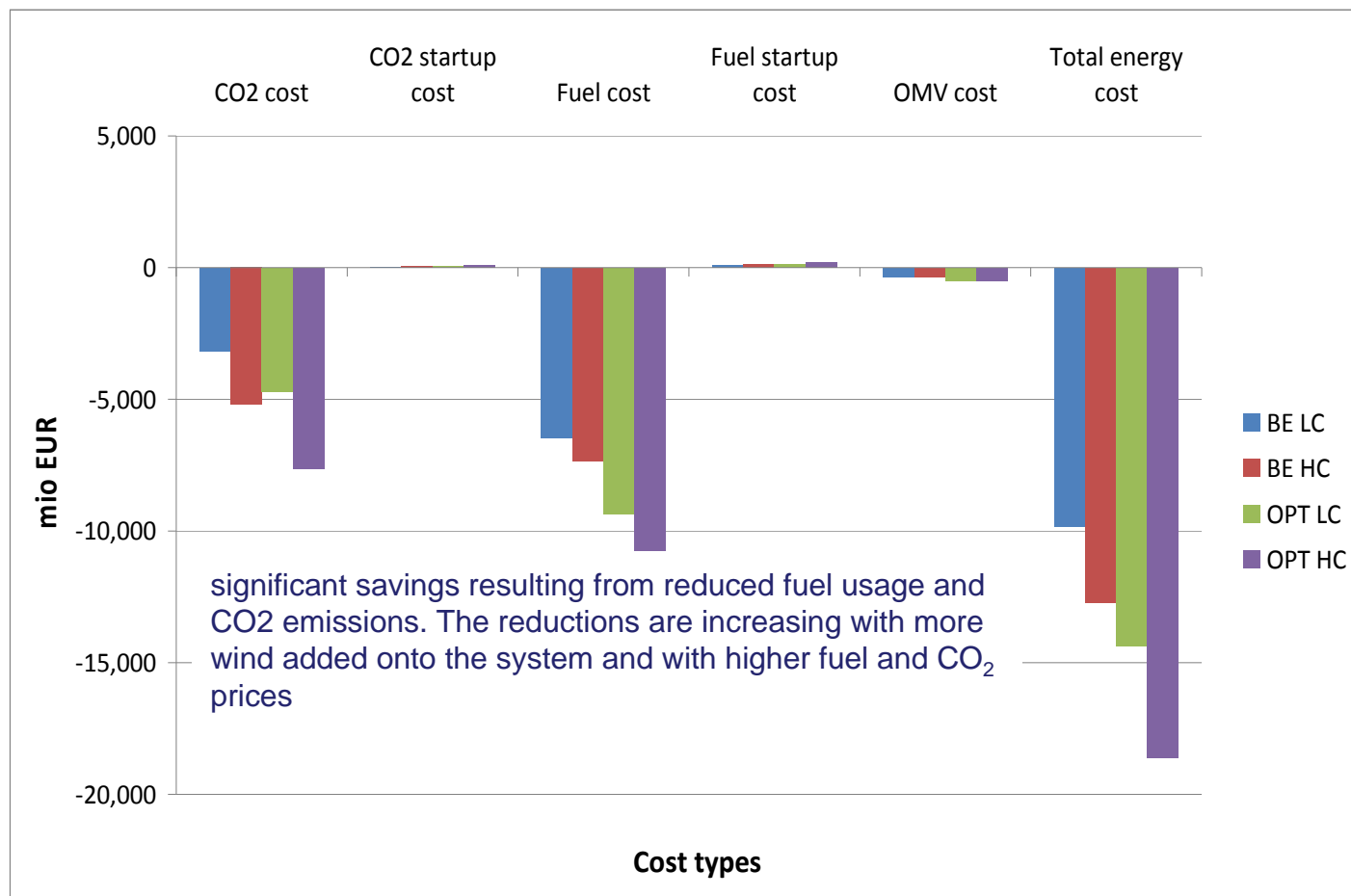
- ❑ **Benefits** due to reduced CO<sub>2</sub>-emission and fossil fuel usage are **significant**
  - reduction in operational costs ~ 20B€/yr
- ❑ **Integration Costs** are **relatively small** compared to benefits ~ 770M€
- ❑ Imminent and continuing **need for grid reinforcements** as these levy congestions and introduce welfare gains !
  - indicative cost for necessary internal grid reinforcements ~ 10,5B€
  - 29 cross-border grid reinforcements : indicative cost ~12,3B€  
: indicative benefit ~1,95B€/yr

*(cfr. ENTSO-E 10YNWDP estimating 28B€ grid investments needed over next 5 years)*

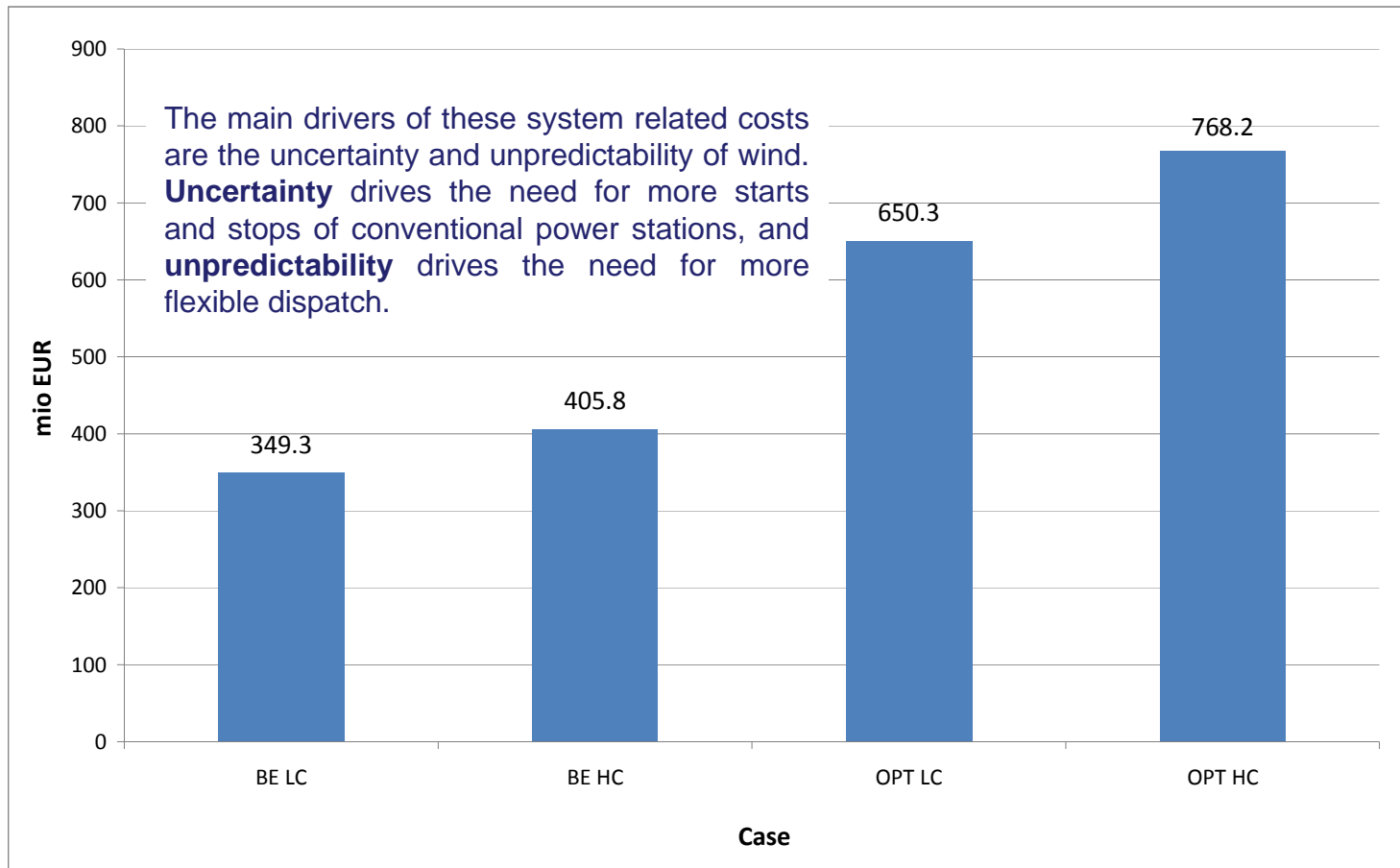
- ❑ **Significant support** to wind energy in order to achieve 2020 target

<sup>1</sup>: assuming high fuel and CO<sub>2</sub> prices and ca. 185GW wind capacity installed in 2015

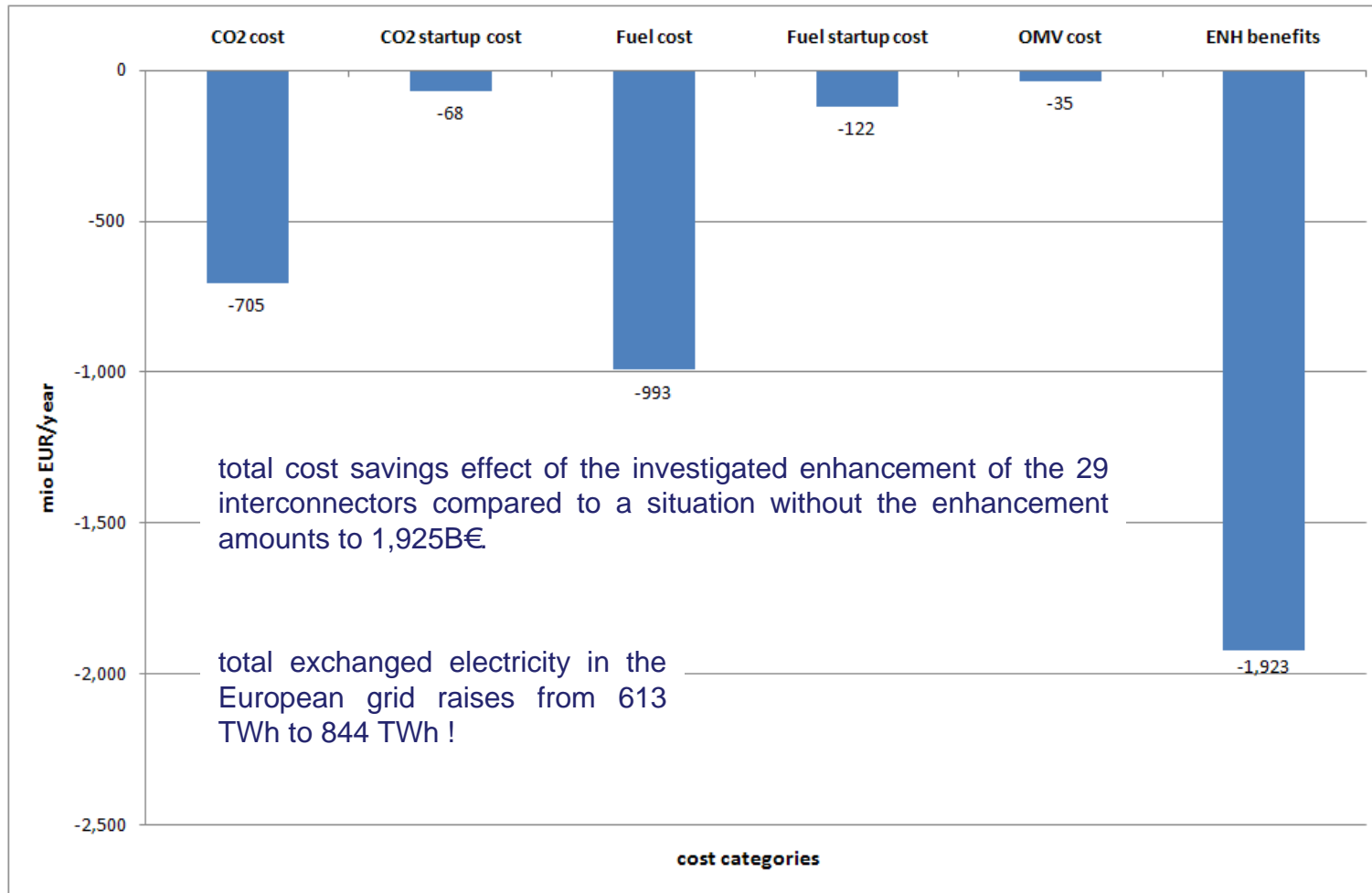
# Benefits of adding wind power to the system



# Integration Costs

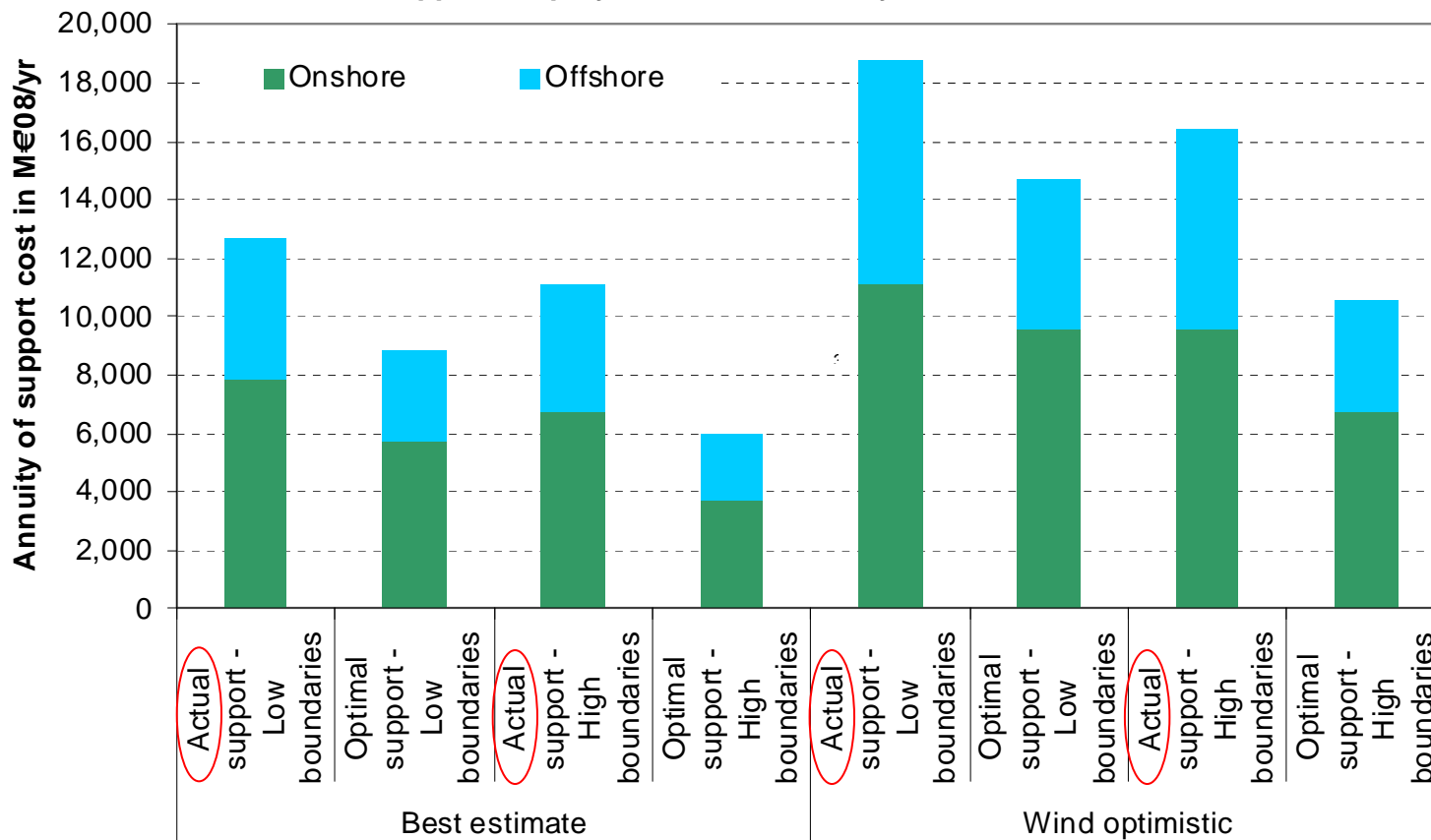


# Adding 29 cross-border reinforcements ...



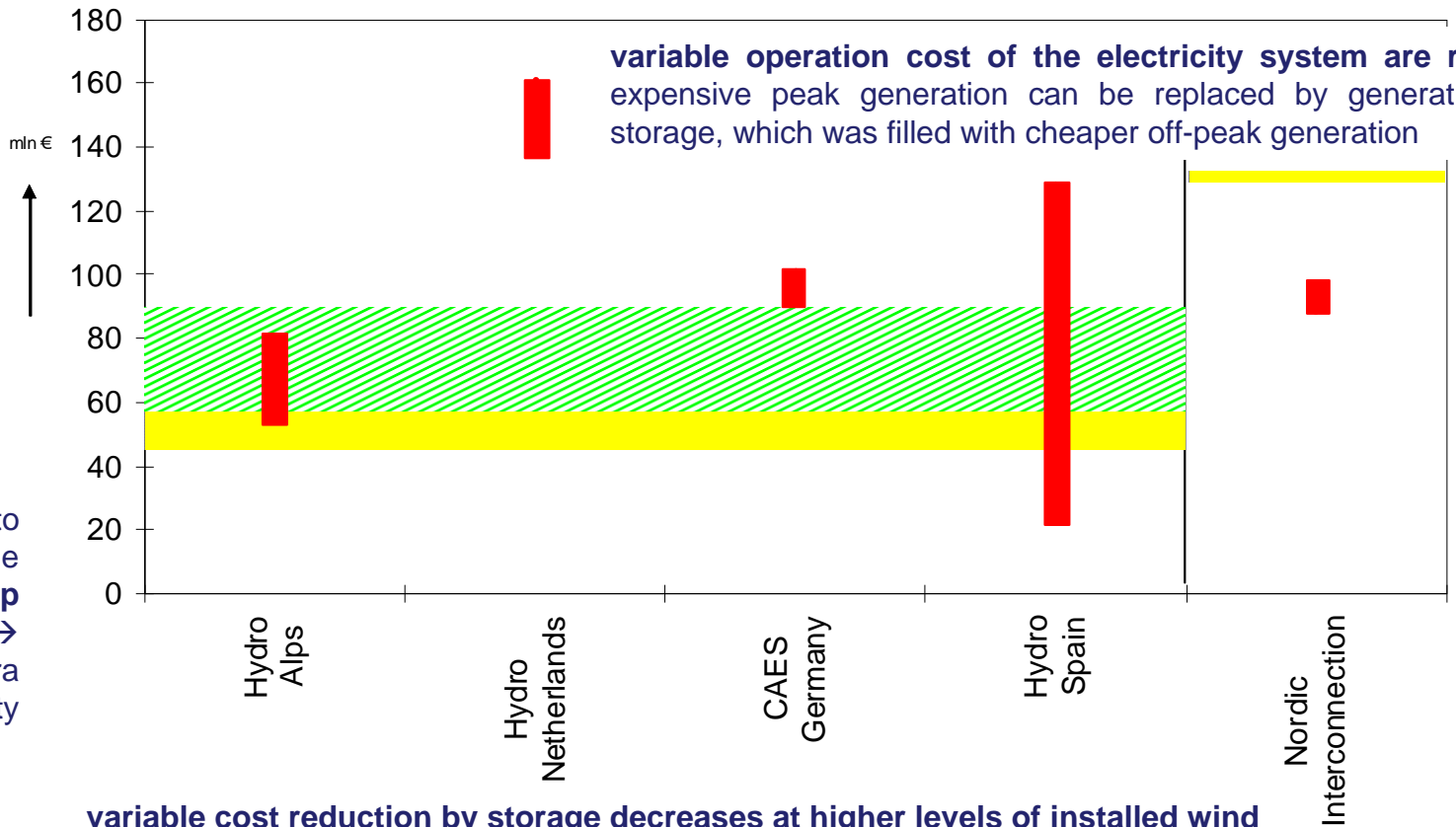
# Support costs applied on 2015 capacities

Comparison of overall support cost for new installations (2008-2015) for different support, deployment and boundary condition scenarios



# Storage as efficient mitigation measure ?

- Range of annual fixed cost per GW (investment and fixed O&M) for different storage options and for increasing interconnection capacity to Nordic region
- Range of operational cost savings (fuel, CO2, var O&M) per GW installed storage capacity in Reference scenario (mln €/year)
- Range of operational cost savings (fuel, CO2, var O&M) per GW installed storage capacity in scenario Wind Optimistic (mln €/year)



**variable operation cost of the electricity system are reduced:**  
 expensive peak generation can be replaced by generation from storage, which was filled with cheaper off-peak generation

large scale pumped hydro storage appears **not economic in the Netherlands**, due to high capital cost. To a lesser extent this is **also true for the CAES in Germany**.

low capital cost to increase storage capacity in the **Alp region and Spain** → installation of extra storage capacity could be **beneficial**

**variable cost reduction by storage decreases at higher levels of installed wind capacity.** This is caused by the fact that the difference in peak and of peak cost decreases in general if more wind is brought into the system