

Fremtidens vindmøller og vindmølleindustri

- Ståldagen 2009

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Vicedirektør

Vindmølleindustrien



..om Vindmølleindustrien



Brancheforening for 236 virksomheder

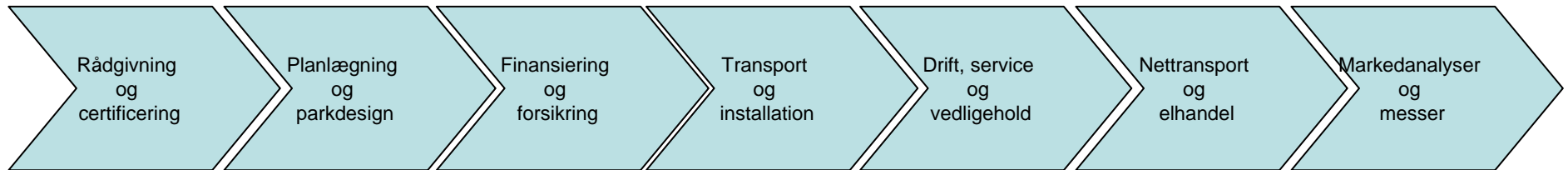
:

- Varetager industriens politiske interesser
- Netværk og mødested for industrien
- Producerer information og analyser om vindkraft og vindmølleindustri

....mission: at styrke **Danmark som Wind Power Hub**

Læs mere på windpower.org

The Supply Chain...



Delta
 Difko
 DNV
 FORCE
 Garrad Hassan
 Ramboll
 Teknologisk institut
 Balslev
 Bjerregaard
 COWI
 Carl Bro
 CT offshore
 Falck Nutec
 Fugro
 Tripod

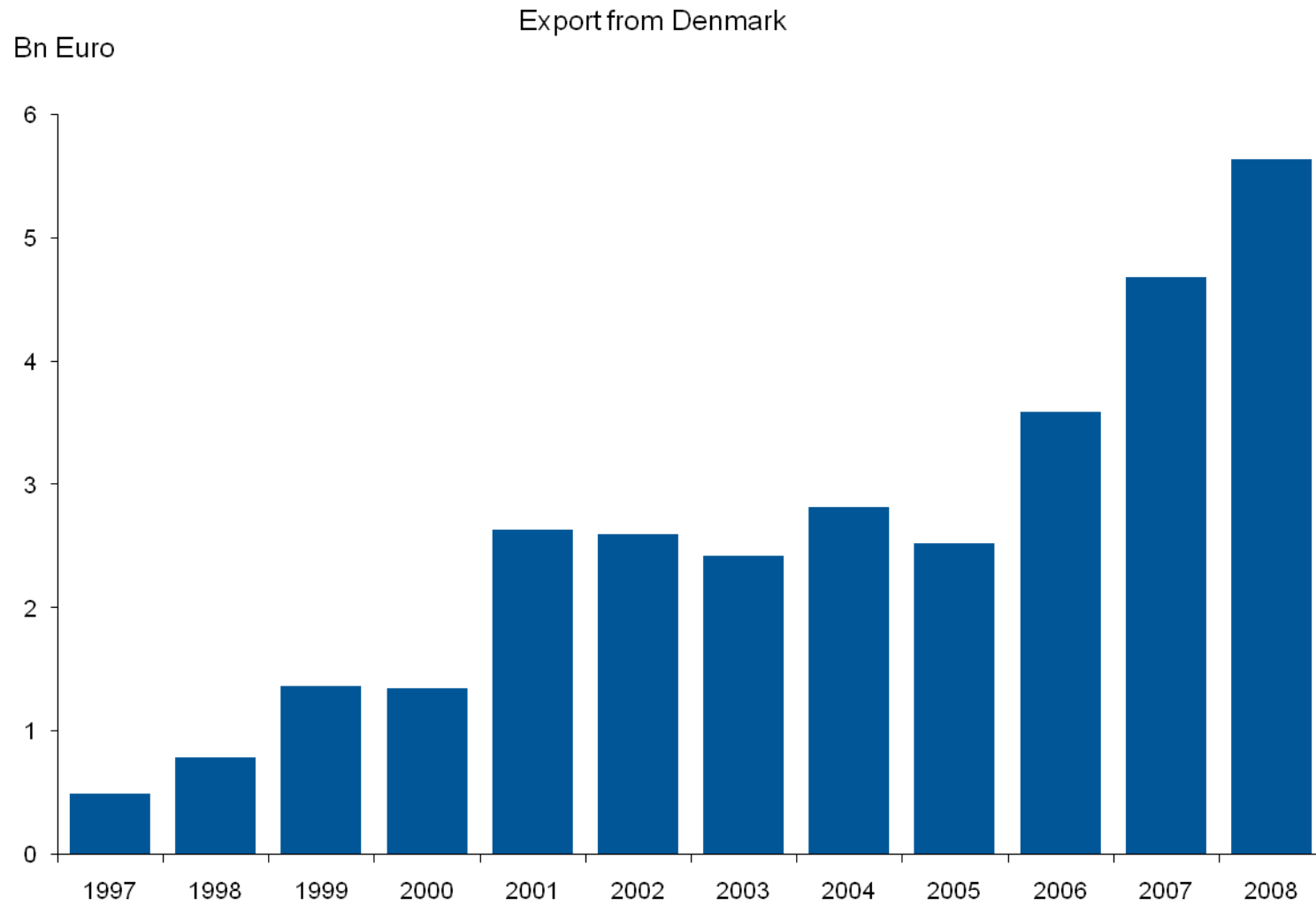
Suzlon
 Gamesa
 Vestas
 Siemens
 Birk Nielsen
 Garrad Hassan

Suzlon
 Gamesa
 Vestas
 Siemens
 Atradius
 Difko
 Sølyst

A2SEA
 BaltShip
 Blua Water
 Deugro
 KR Wind
 Krangården
 E. Søndergaard
 Fyns Kranudstyr
 Liftra
 Tripod
 Vamdrup

Suzlon
 Gamesa
 Vestas
 Siemens

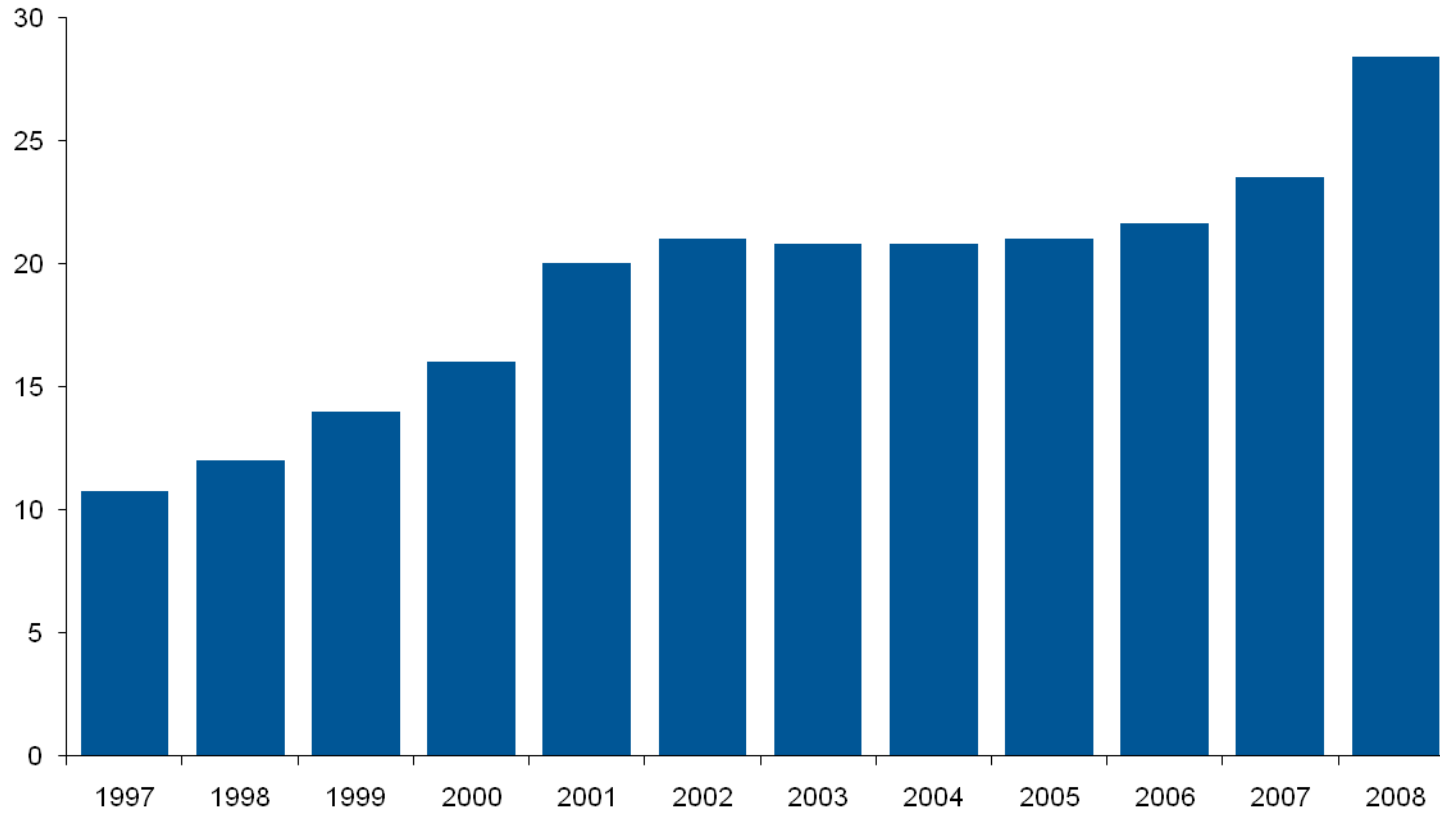
BTM
 MAKE Consult
 Exportforeningen

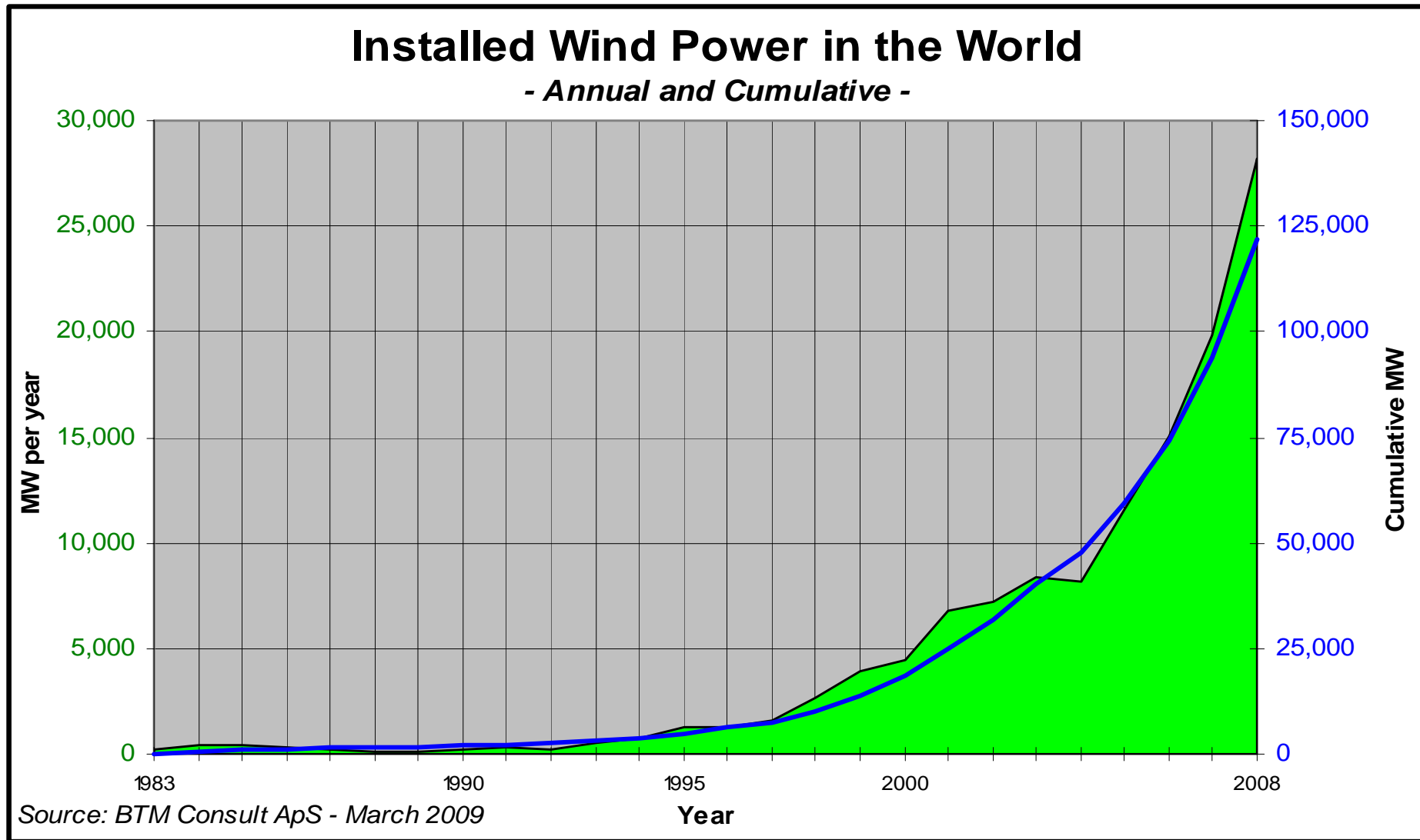




Employment, 1.000 per.

Employment in Denmark





Muir & Riggs Glacier Alaska 1941 & 2004



USGS / 1941

USGS / Bruce Molnia

Grønland "surface-melt"



1992



2002



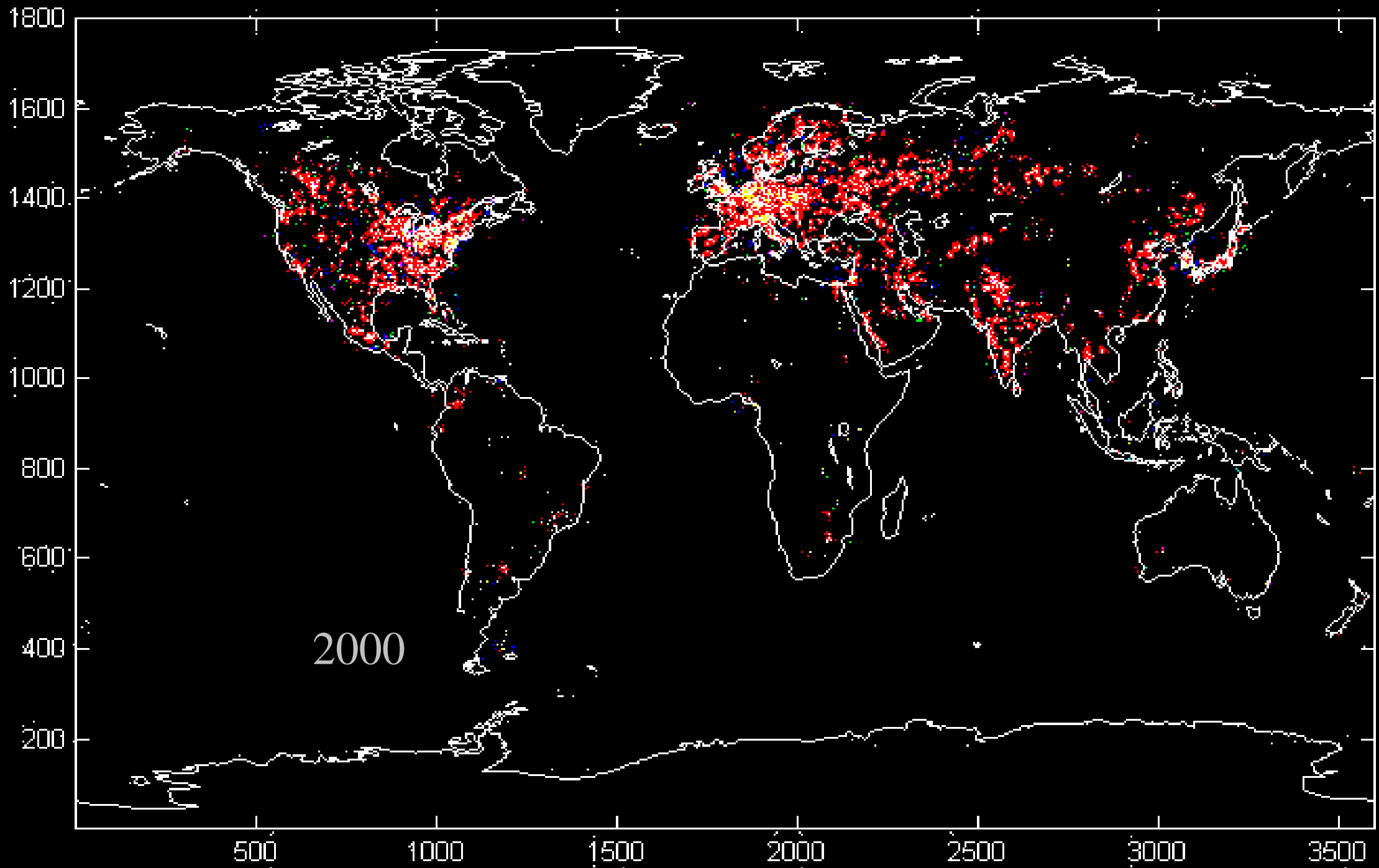
2005

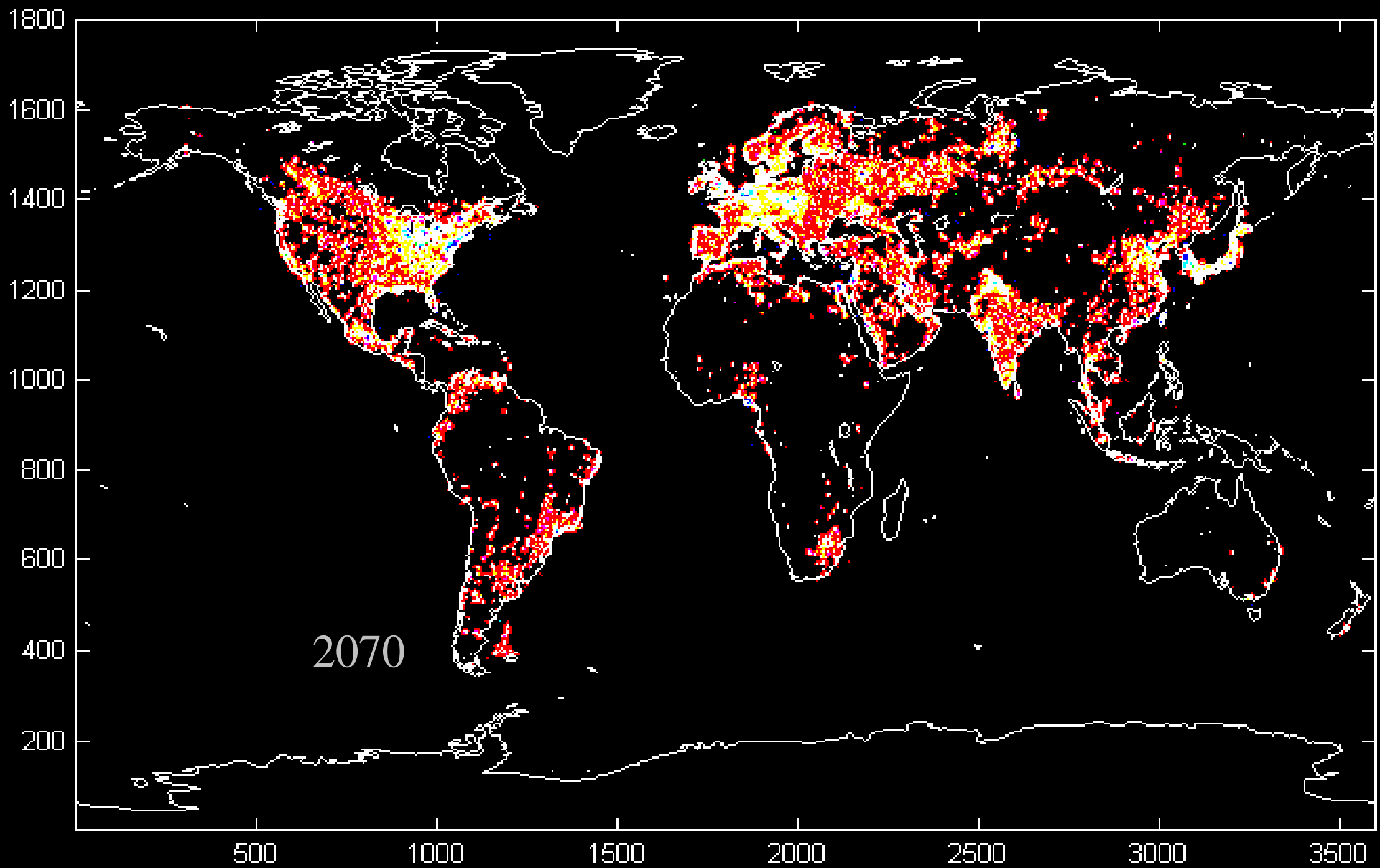


DENMARK – WIND POWER HUB

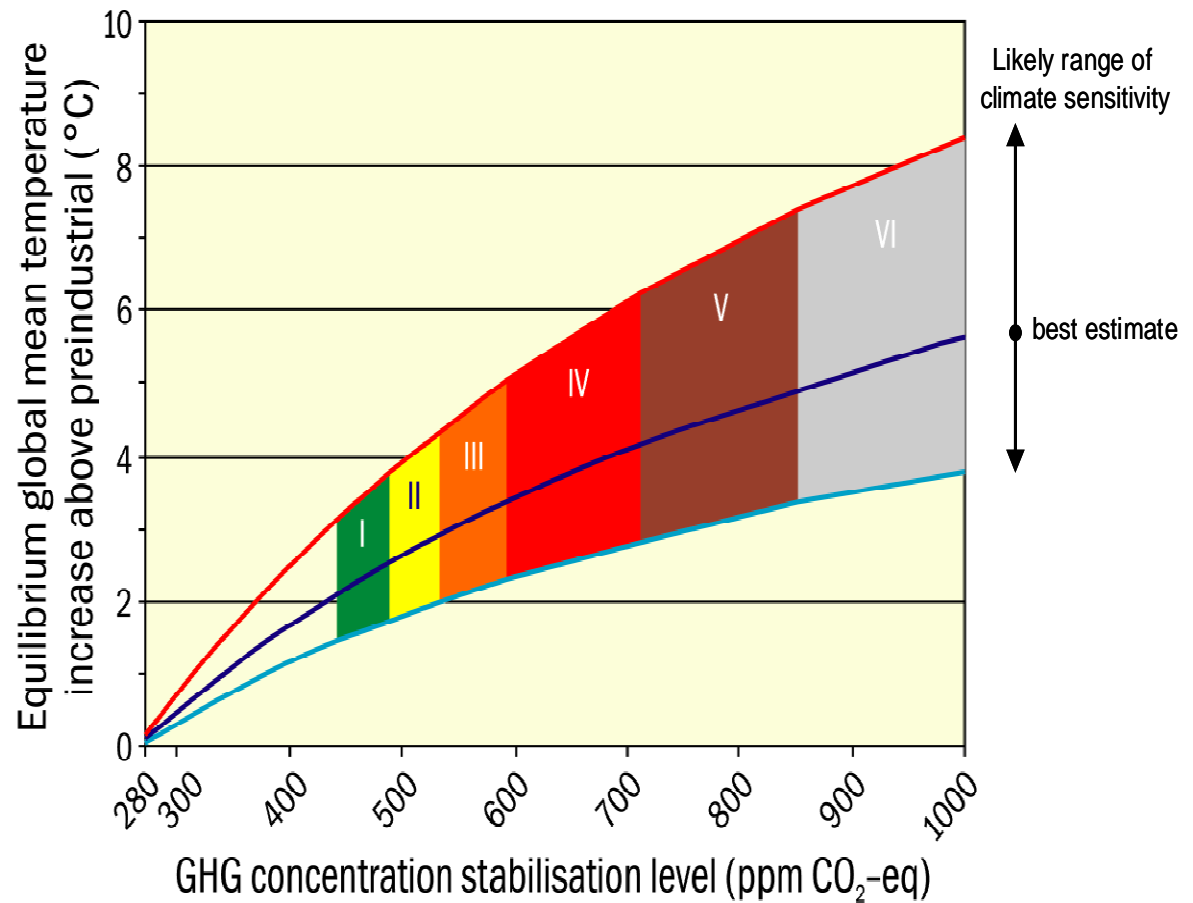
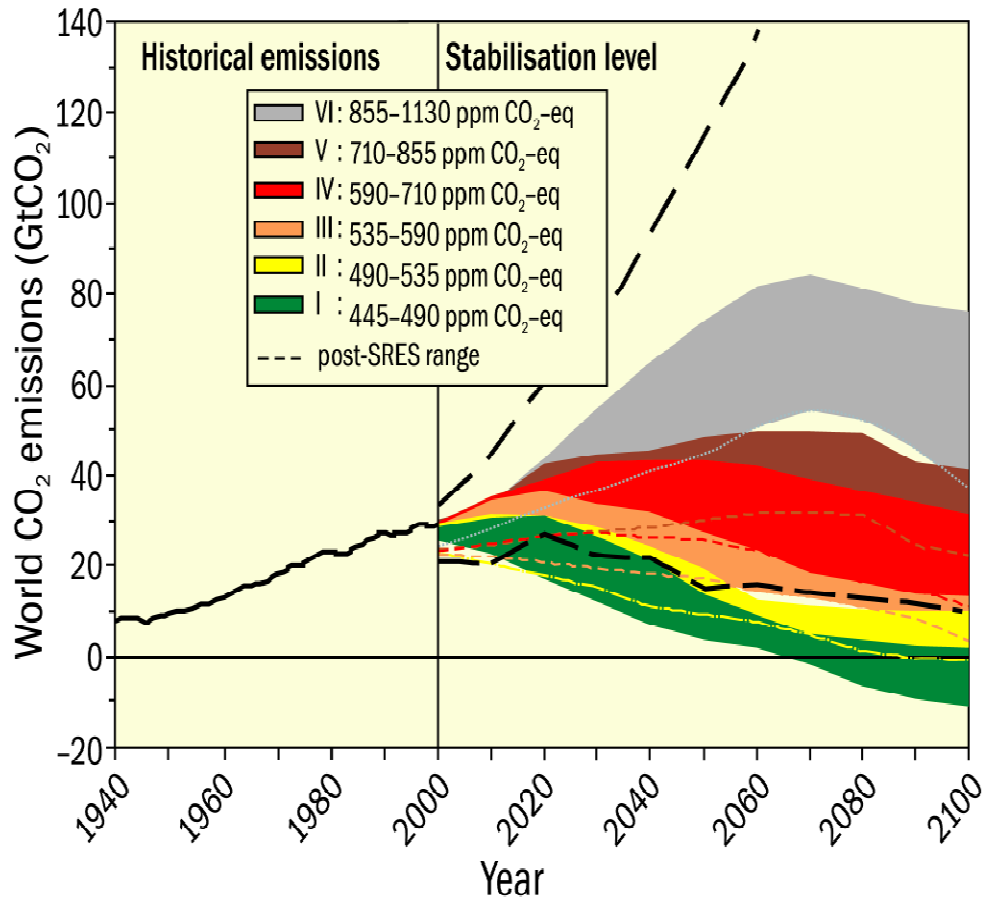
VINDMØLLEINDUSTRIEN

Source: ACIA, 2004 and CIRES, 2005;
(and Michael Liebrich, new energy finance)

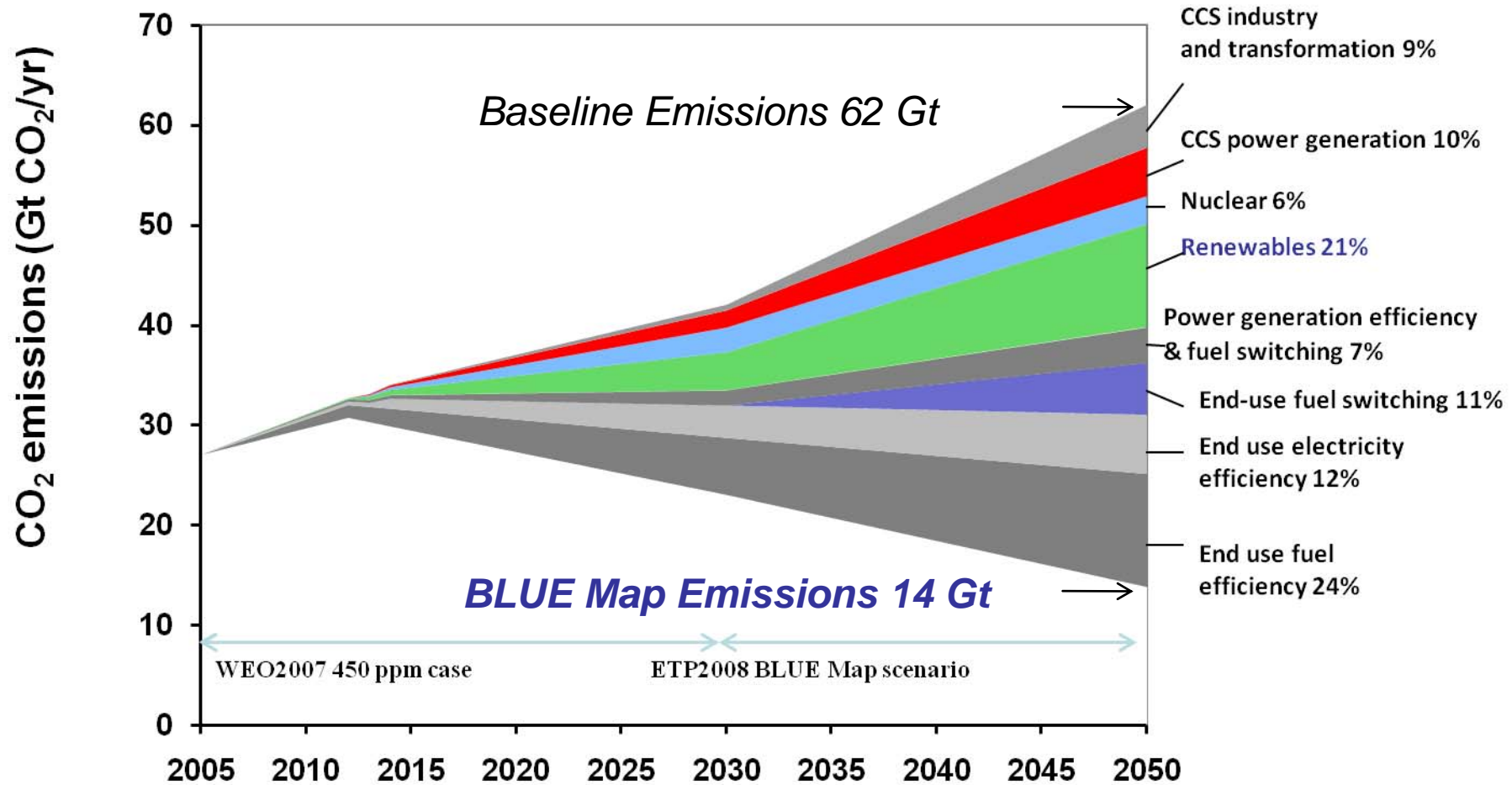




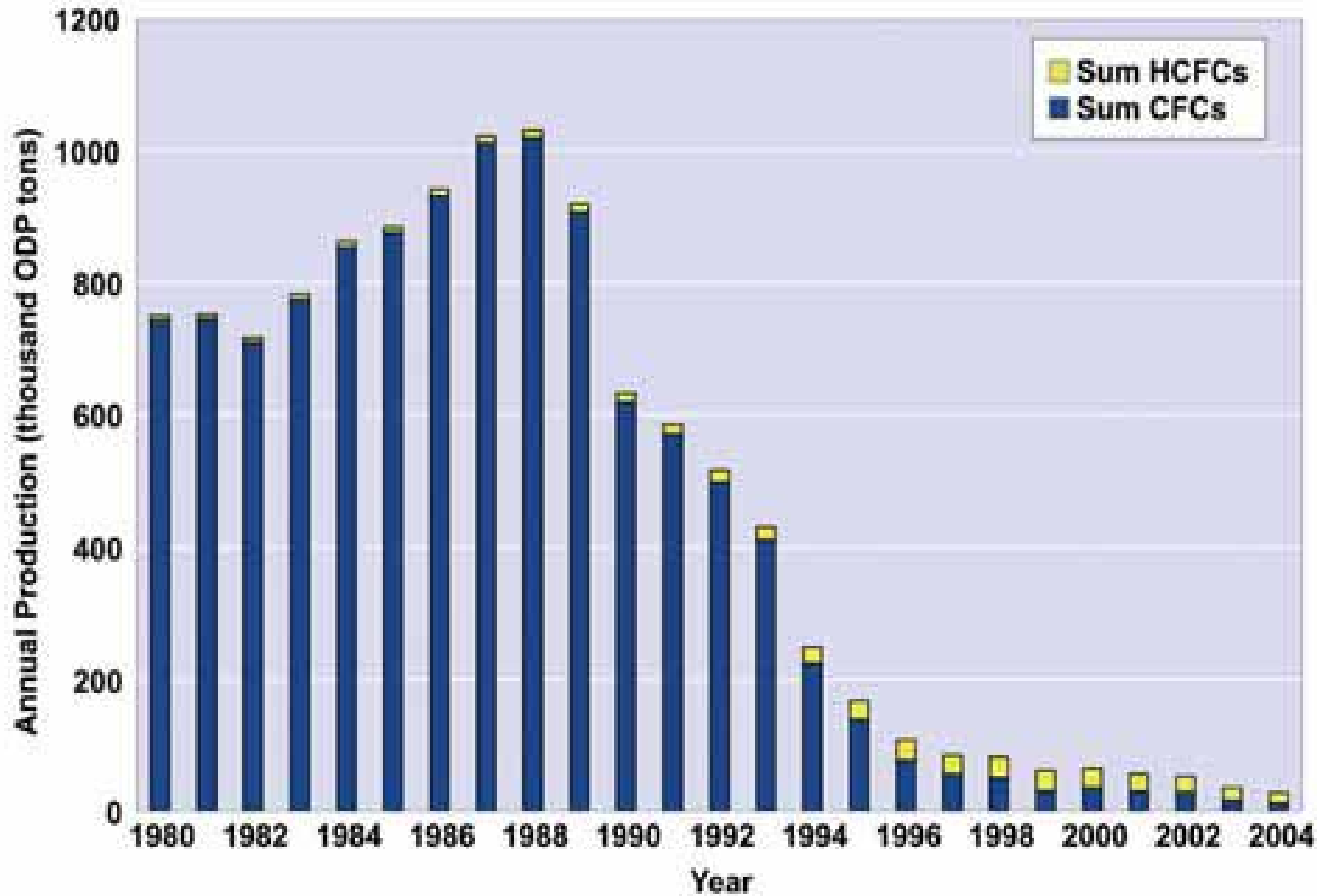
UN Intergovernmental Panel on Climate Change



IEA Blue Map

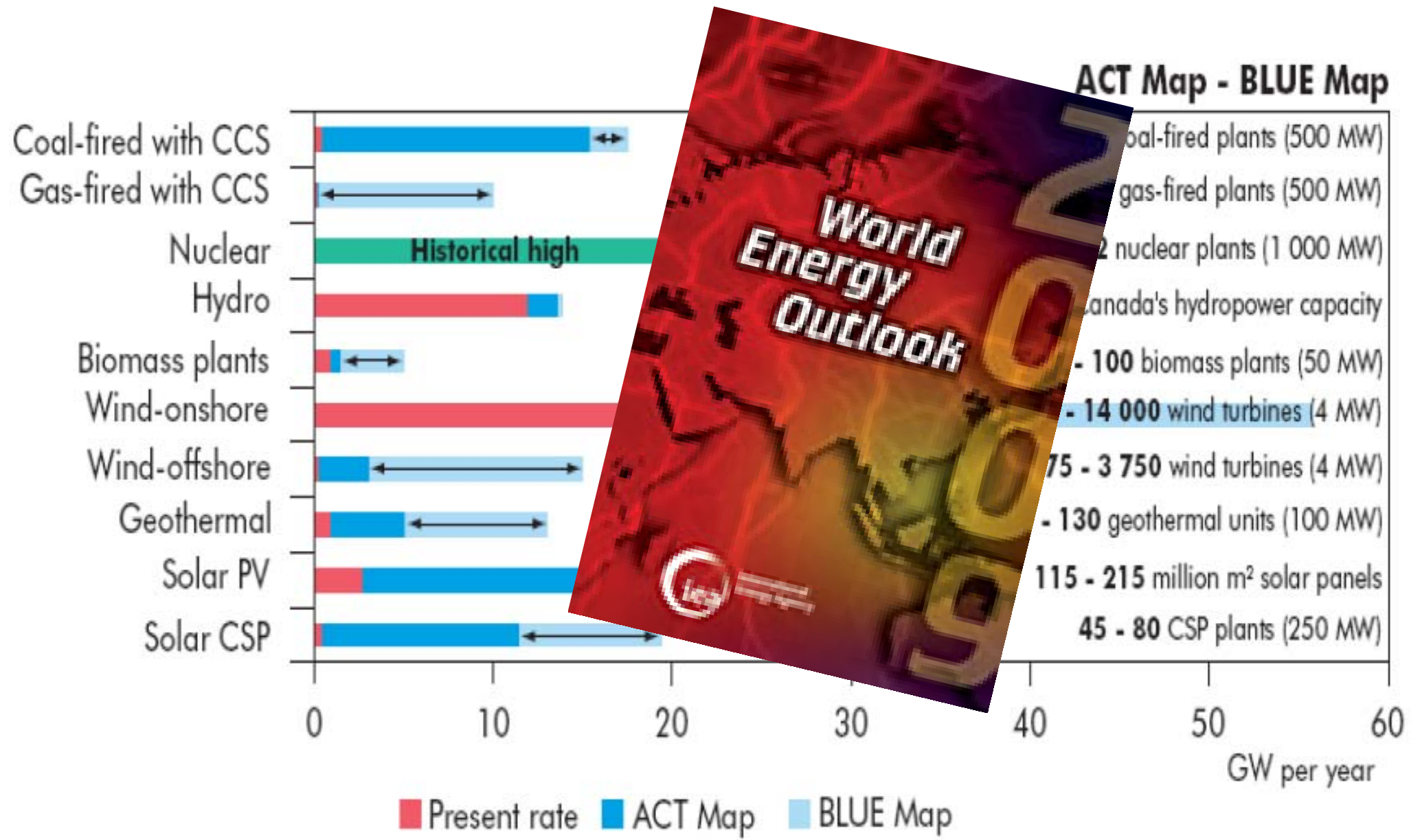


Yes we can!

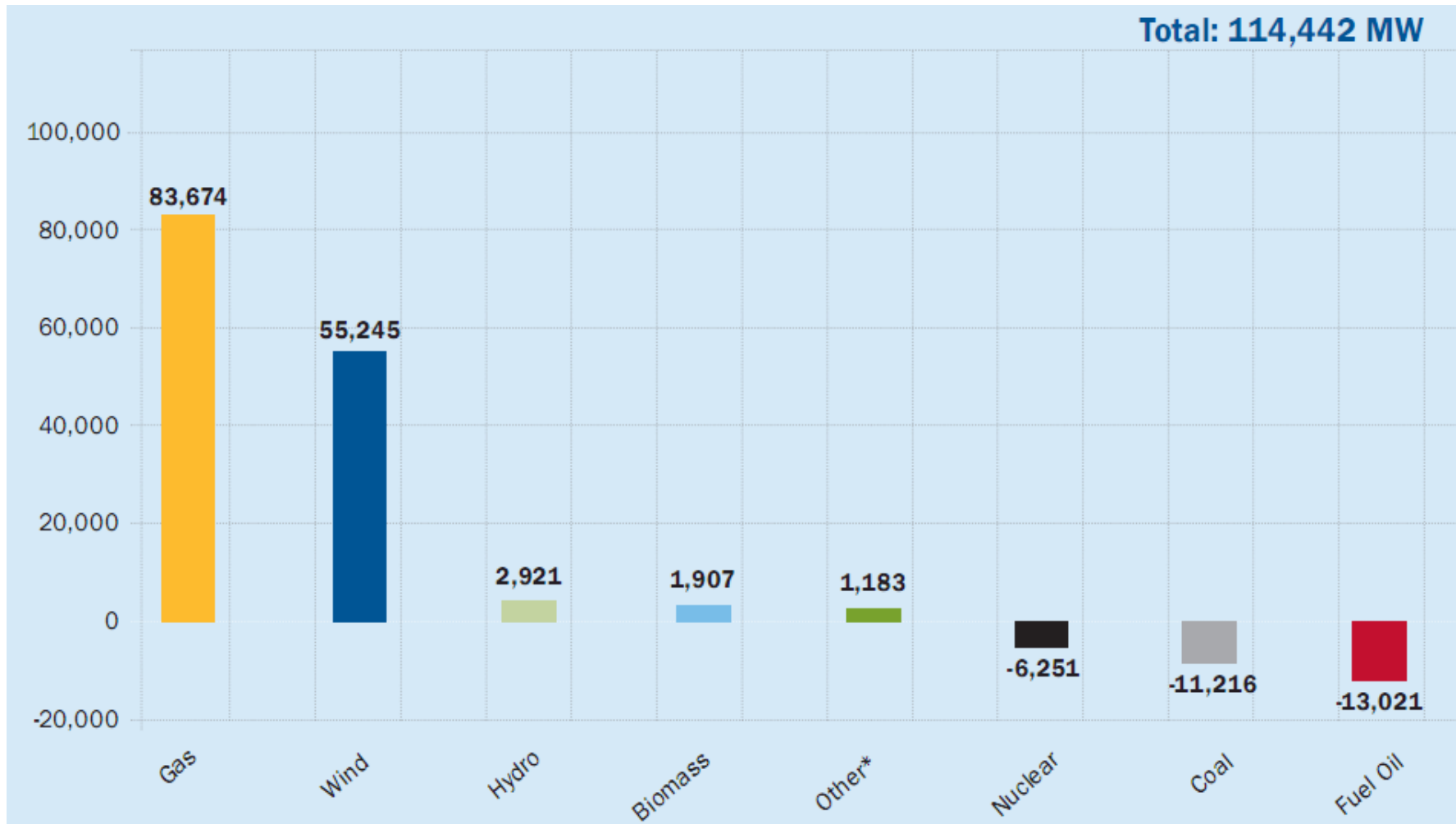


Montreal Protocol
nedbragte ozon-
skadelige stoffer
hurtigt og effektivt

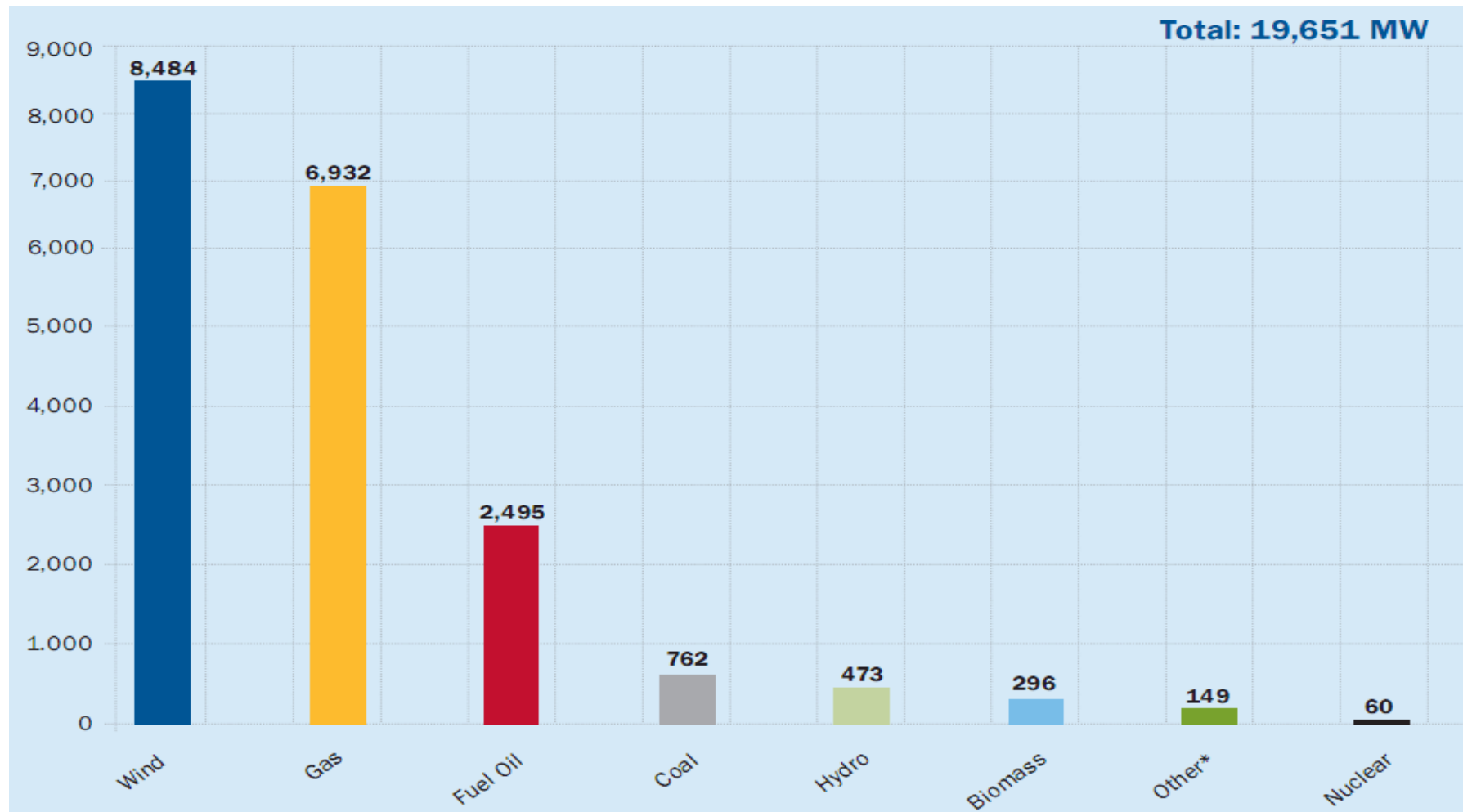
IEA Blue Map



EU net capacity change last ten years



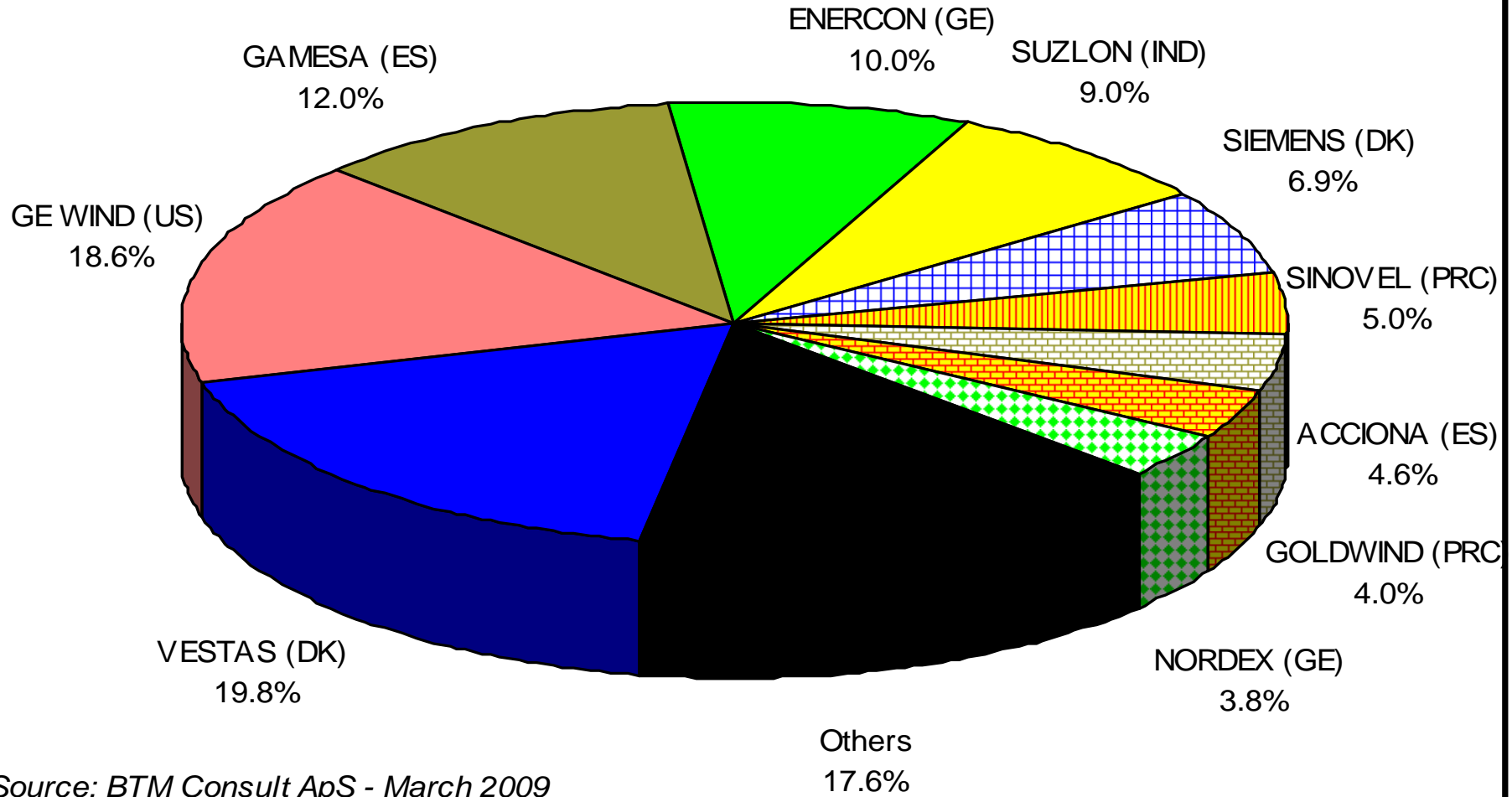
New energy capacity build in EU in 2008





Top-10 Suppliers in 2008

% of the total market 28,190MW

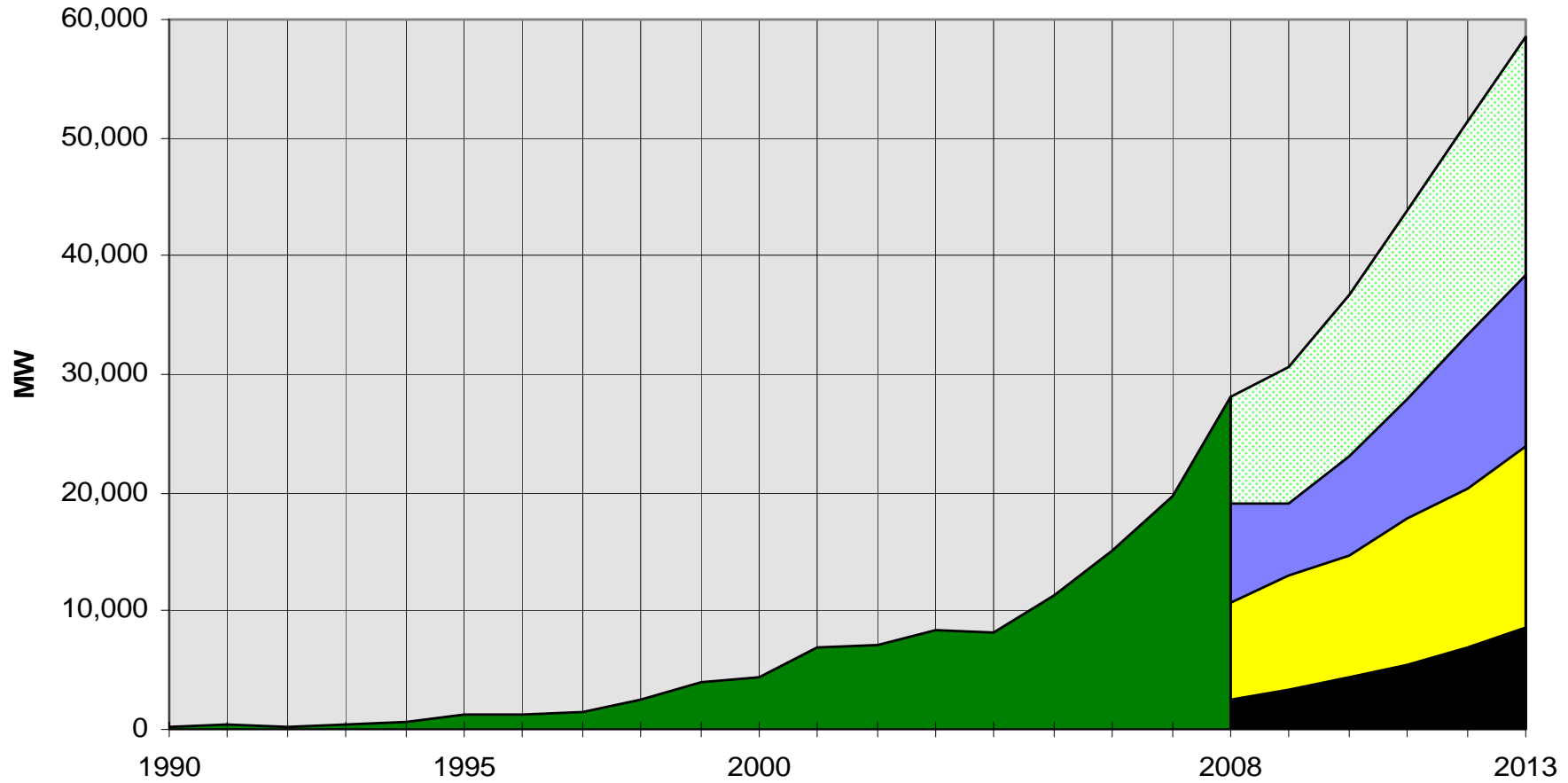


Source: BTM Consult ApS - March 2009



Annual Wind Power Development

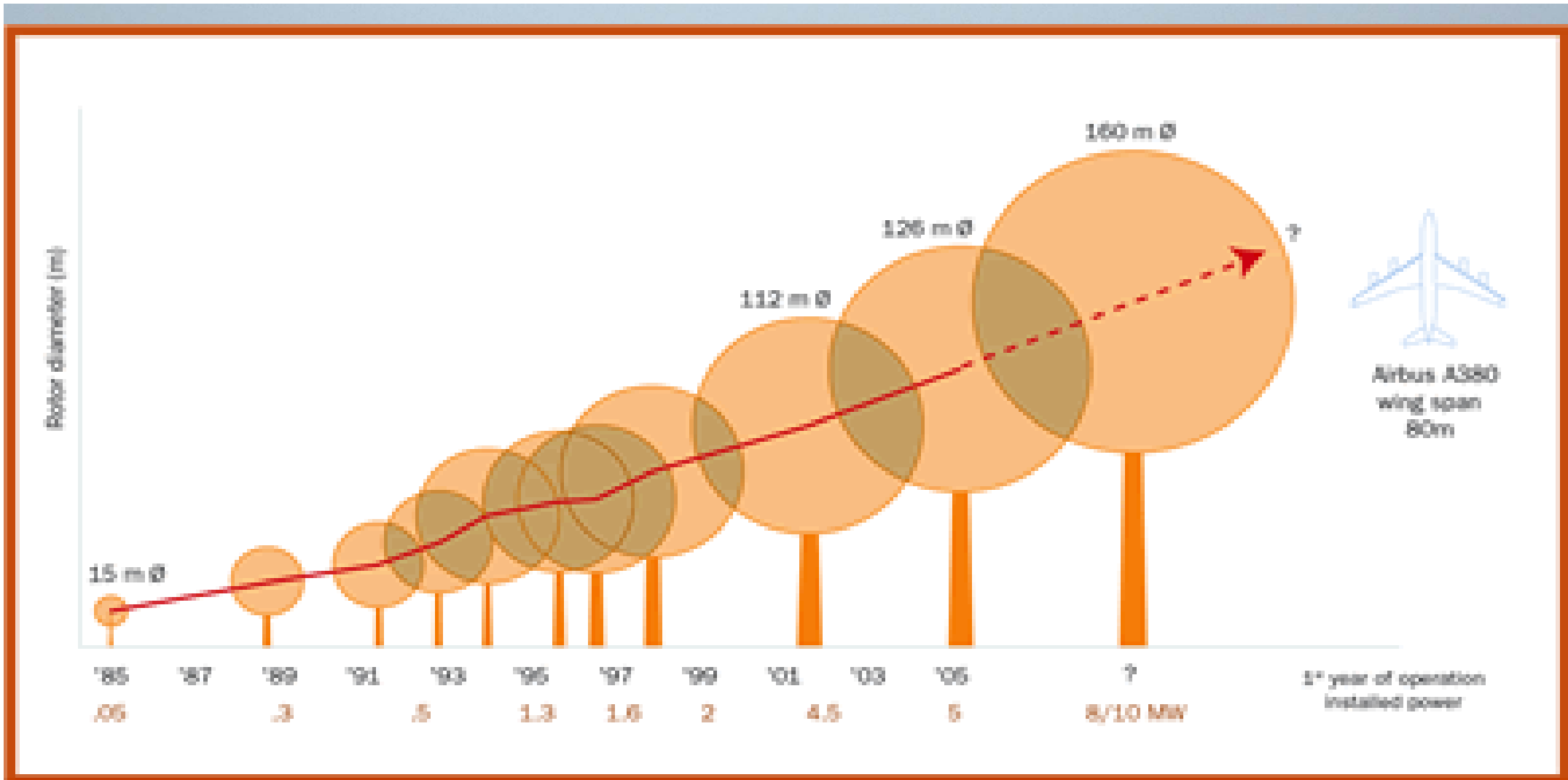
Actual 1990-2008 & Forecast 2009-2013



Source: BTM Consult ApS - March 2009

■ Europe ■ USA ■ Asia ■ Rest of World ■ Existing

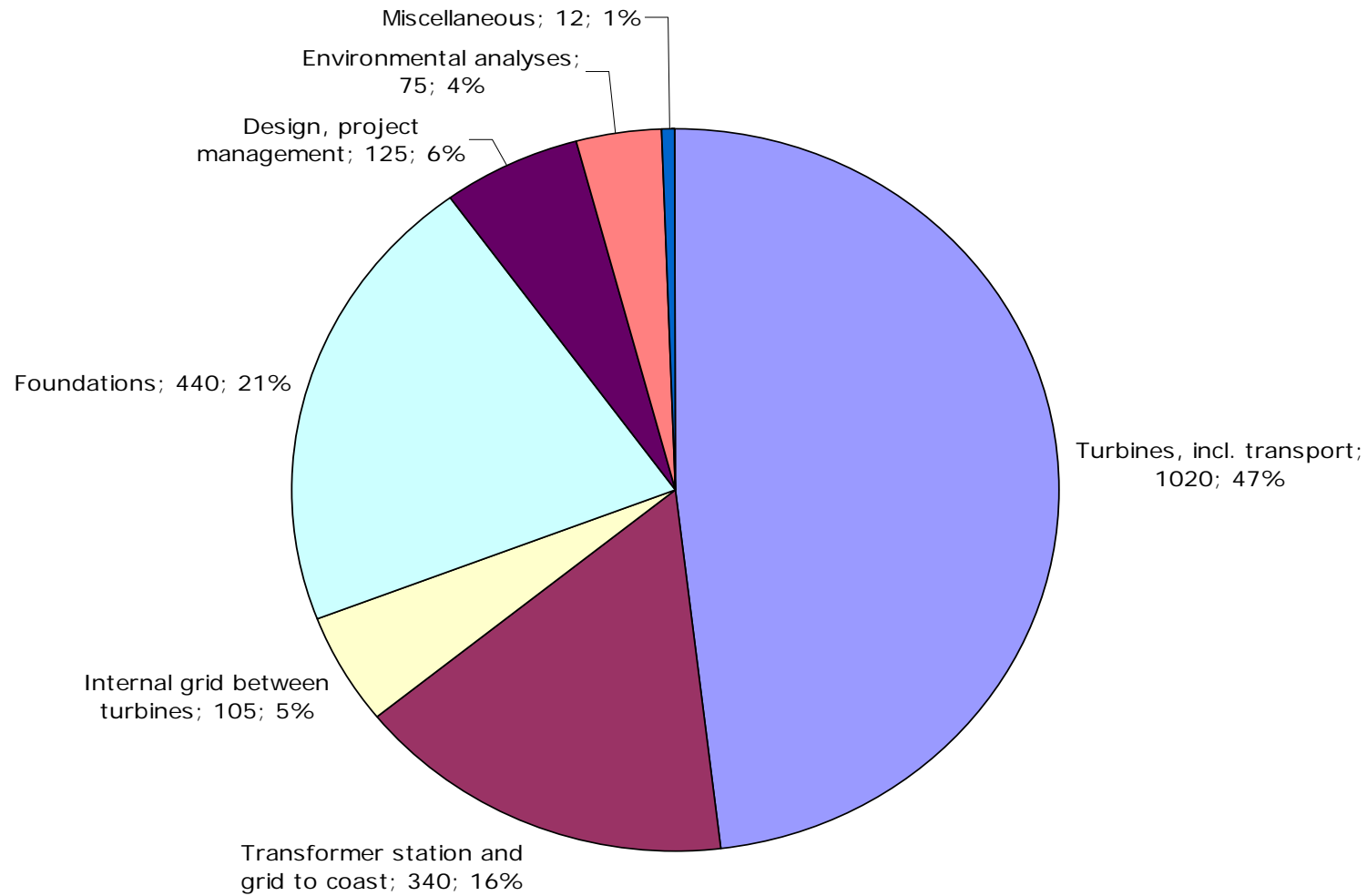
Turbine Size Development



Source: Jos Brunskens, ECN

Investment cost breakdown for offshore wind

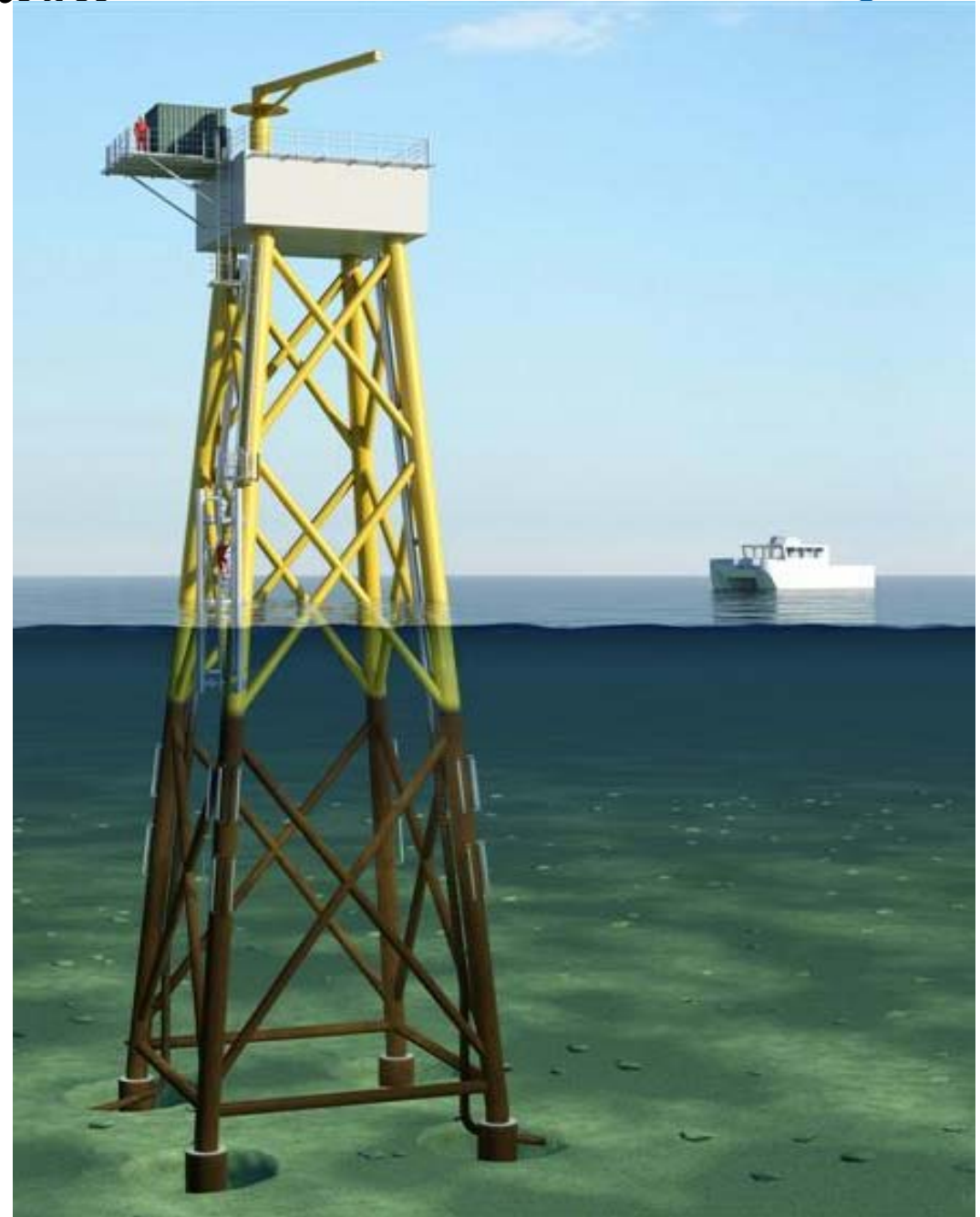
(IEA, 2008) – turbine is only half the cost (USD/MW)



Jacket Wind Turbine Foundation



- 5MW WTG
- Water Depth 25m
- Footprint 12m x 12m
- Top 7m x 7m
- Leg OD 1000mm
- Brace OD 600mm
- Overall Weight 300mT
- Pile OD 1727mm (68")
- Pile Weight 4 * 71mT



Cost per kilo in 2008



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~2 € per kilo



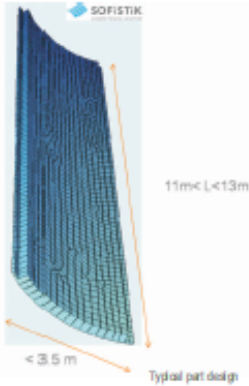
VINDMØLLEINDUSTRIEN

~5 € per kilo

Stål vs. betong ??



Consolis Group is developing two different solutions to the problems caused by increasing height: full concrete (up to 100m) and hybrid concrete-steel (100-150m). Both are valid solutions for the same problem, that of raising turbine height to increase the energy obtained. Using the hybrid solution (conceived of as a one-half or even two-thirds of the tower manufactured in concrete, and the upper part in steel), heights of up to 150m can be reached cost-effectively.



The Consolis Hormifuste tower consists of a number of rings. These are 11-13m high on average, making transport easy. Their maximum cord is usually 3.5m and their maximum weight 40 tons. The rings are mounted on top of each other to build the tower. Once the tower has been assembled, post-tensioning is performed and a transition piece ensures continuity with the upper steel part. Post-tensioning of the tower guarantees that neither part is subject to traction force.



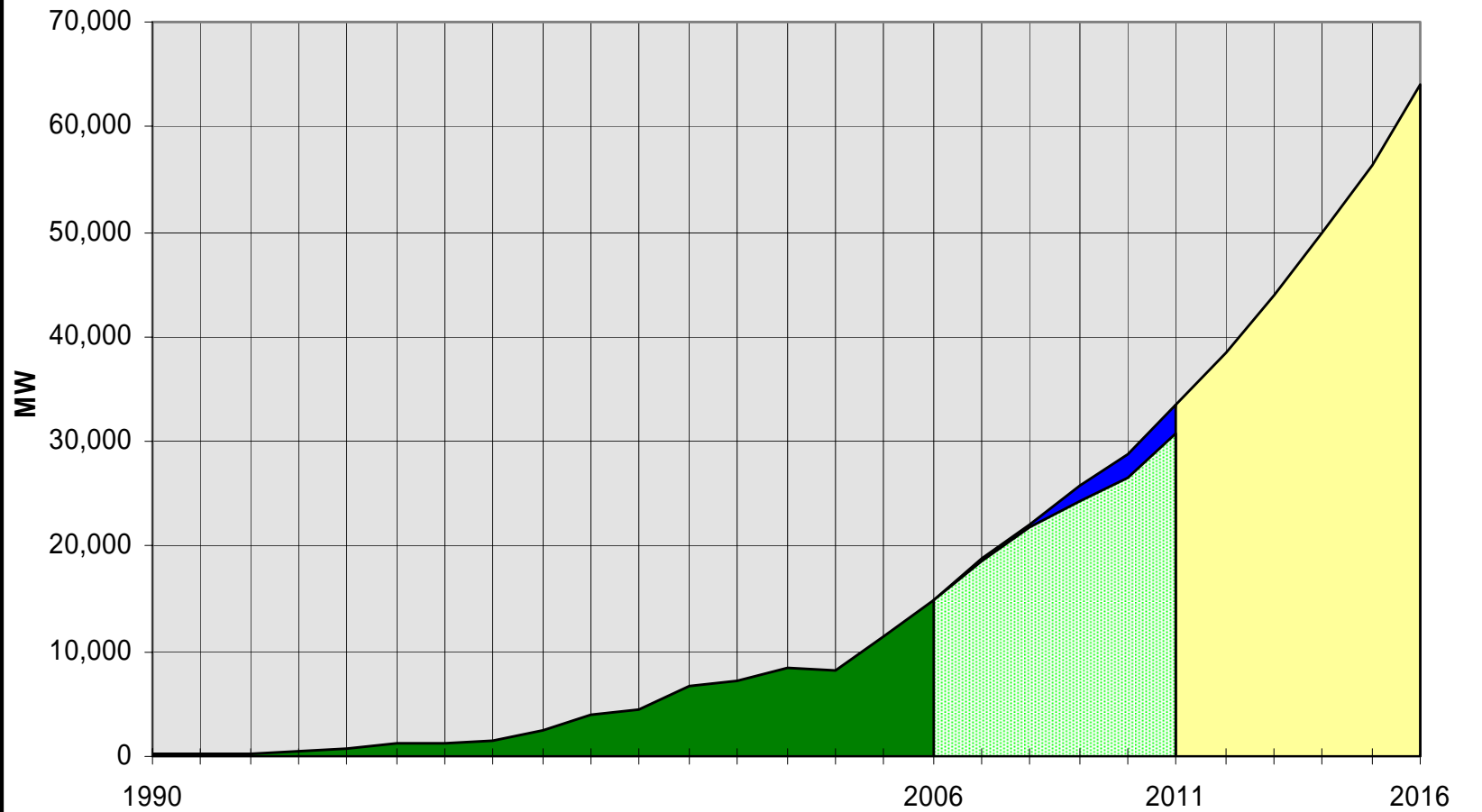
The tower assembly procedure is shown in the diagrams below





Annual Global Wind Power Development

Actual 1990-2006 Forecast 2007-2011 Prediction 2012-2016



Source: BTM Consult ApS - March 2007

■ Prediction ■ Offshore (Forecast) ■ Forecast ■ Existing capacity



Keep it cool

WIND POWER WORKS



Vestas 750 kW Mølle BC



LM 61,5 meter vinge ved Bella Center



Guidede ture til Middelgrunden



VINDMØ





Keep it cool

WIND POWER WORKS









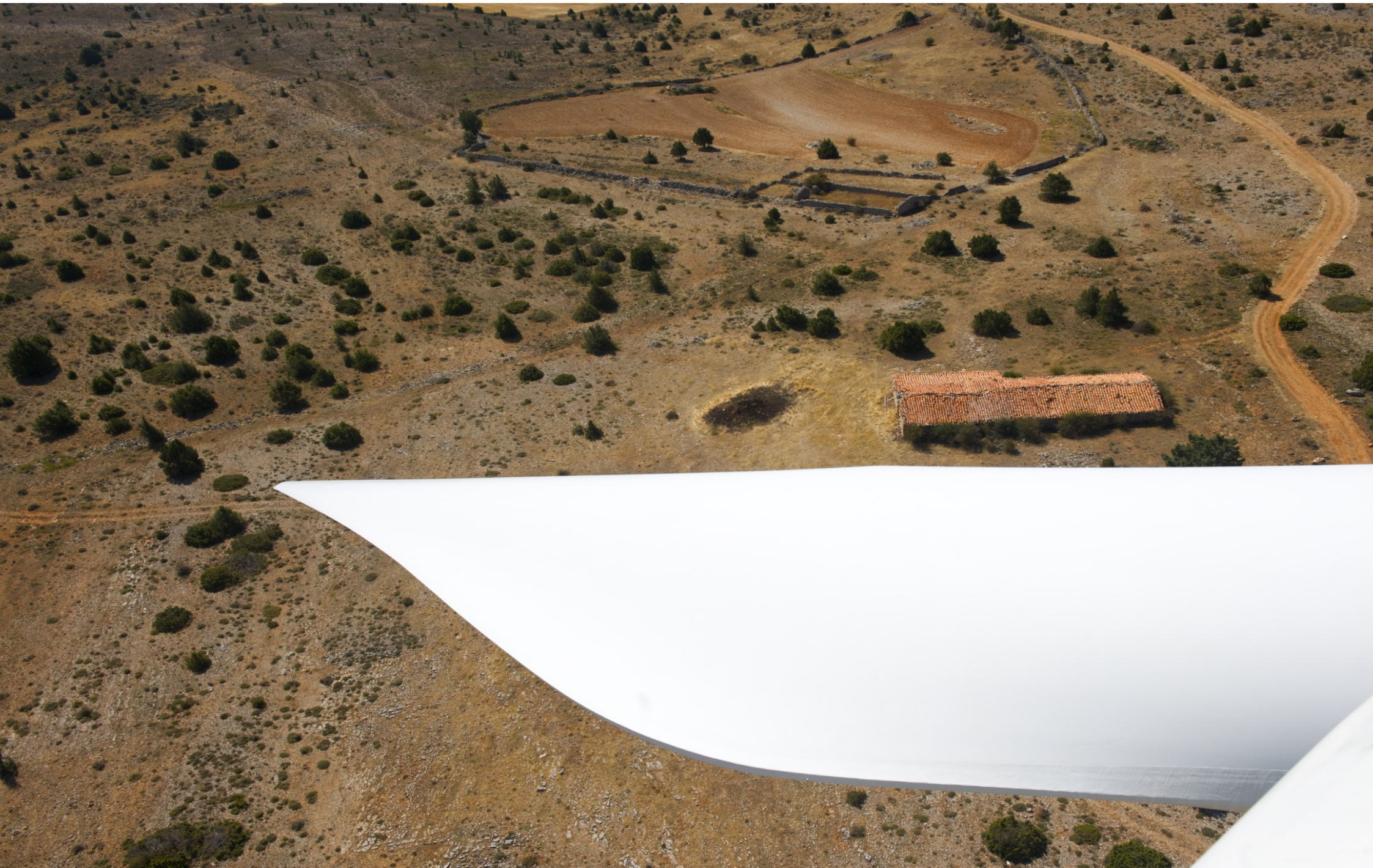
















Keep it cool

WIND POWER WORKS





Thank you for your attention

More information:

windpower.org

windpowerworks.info