

# Renewables: Part of the solution

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*Eisenhower International Conference on Energy*



**IBERDROLA**  
**RENOVABLES**

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**Current energy context**

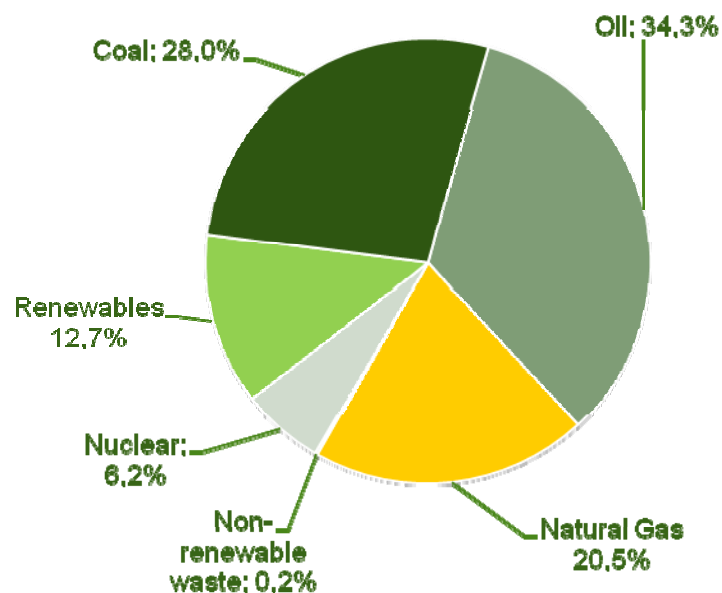
**Renewables: part of the solution**

**Present and future challenges**

# Starting point:

## The current energy model....

Global Energy Mix 2006



Source: IEA *Renewable perspective 2008*

## ...is unsustainable

**ENERGY POVERTY:** 1,600 million people have no access to electricity

**CLIMATE CHANGE:** linked to CO<sub>2</sub> emissions

**RESOURCE DEPLETION:** energy model based on limited fossil resources

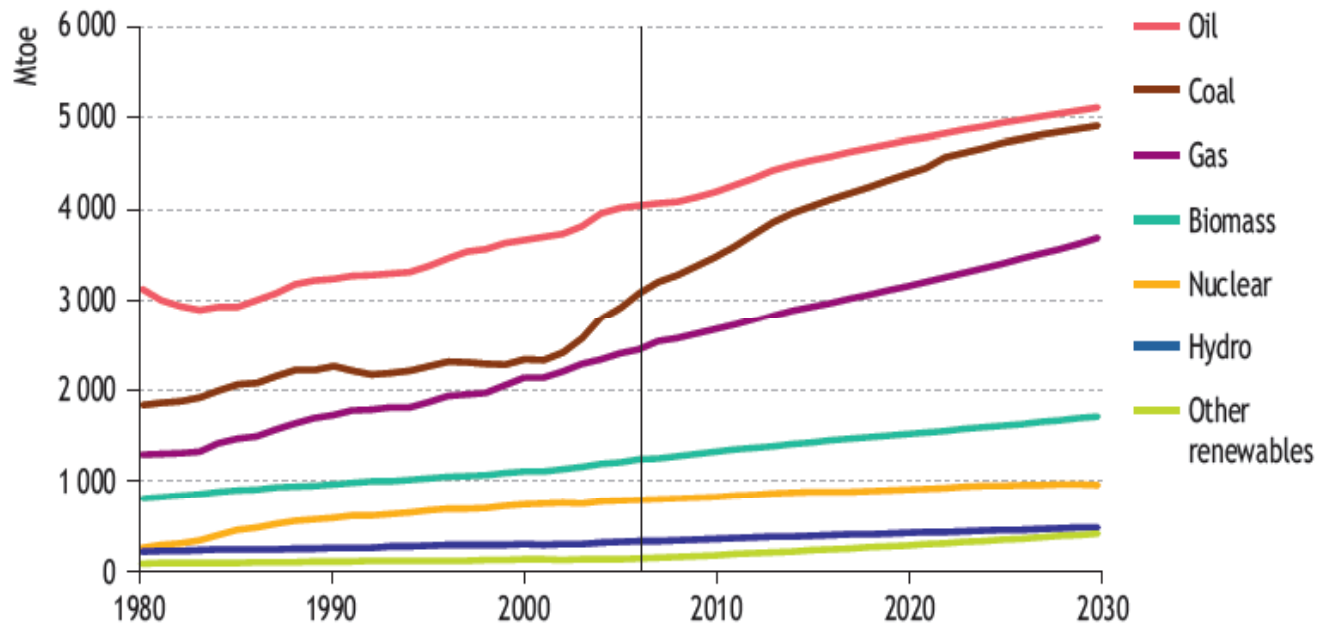
**INCREASED VULNERABILITY** to supply disruptions, because of energy dependence on imports from increasingly distant & remote areas.

All in the context of **SIGNIFICANT INCREASE IN DEMAND**

# World primary energy demand ever growing...



Global Primary Energy Demand by fuel in the IEA Reference Scenario



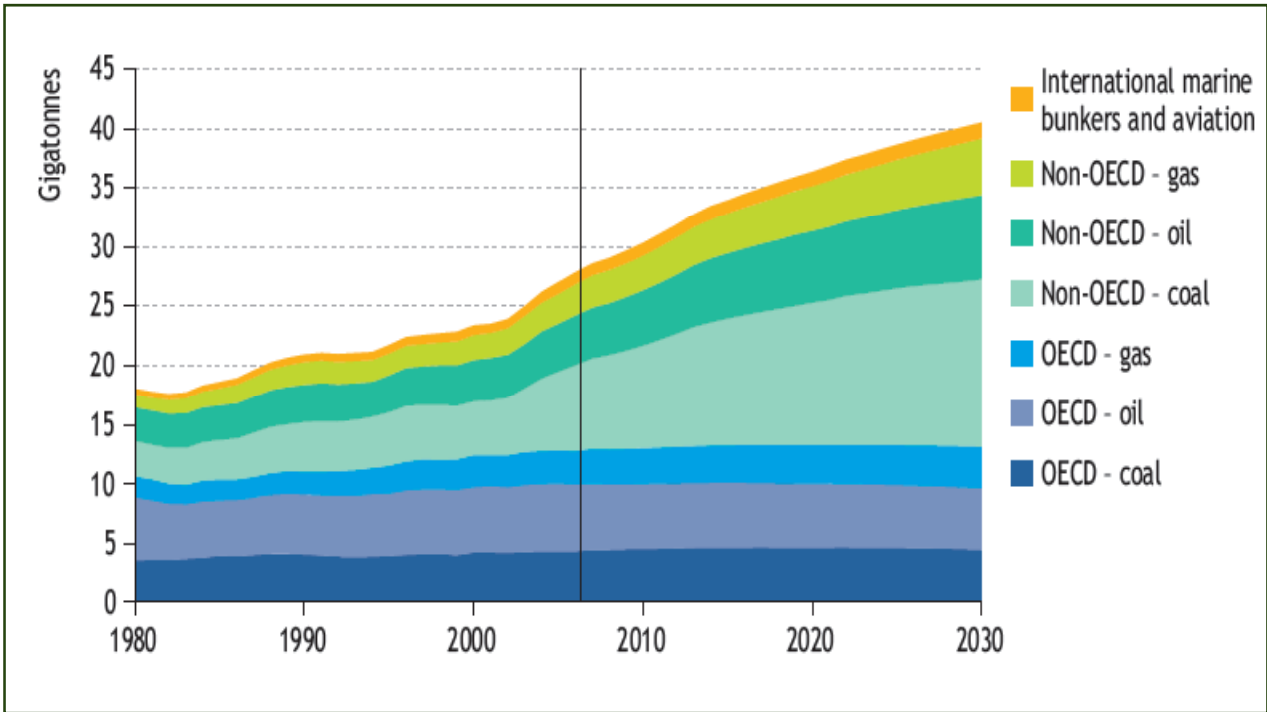
**Global primary energy demand +45% in 2006-2030**

- Developed countries, in spite of efficiency and saving Plans, will increase their demand
- Developing countries, will increase demand even at a faster pace, driven mainly by growth in China and India

# CO2 emissions will continue to grow



Energy-related CO2 emissions by fuel and region



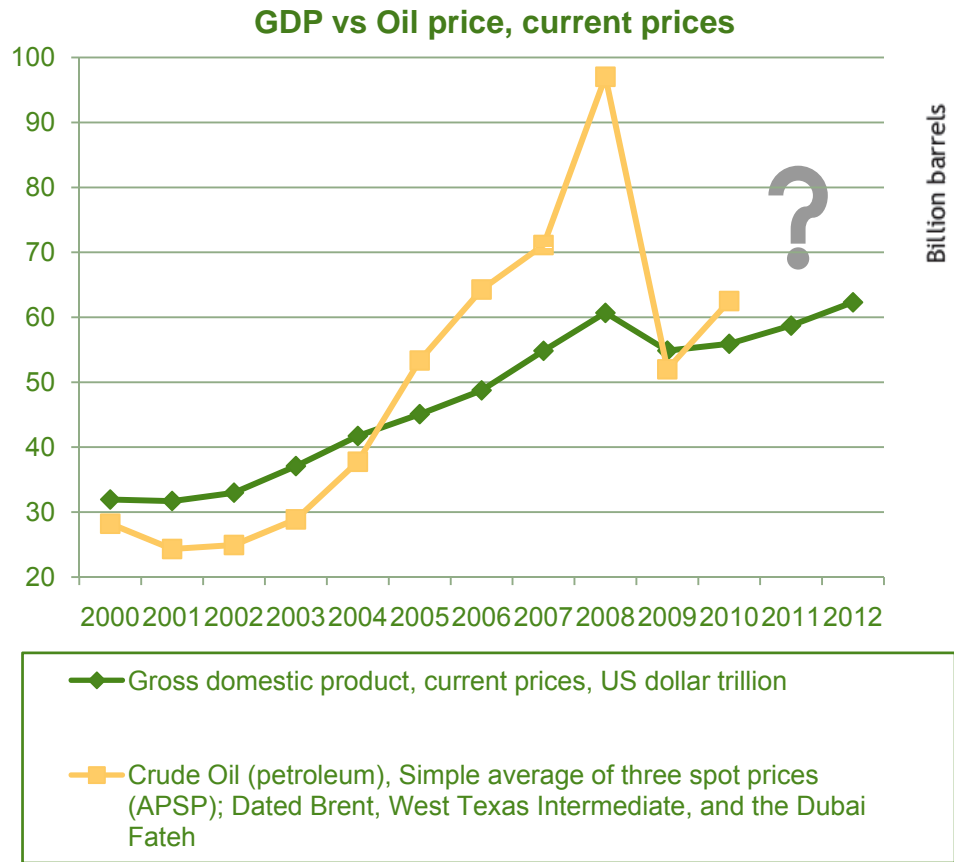
**Emissions:  
+45% by  
2030**

- Rising global use of fossil fuels is set to continue to drive up energy related CO2 emissions
- Non-OCDE countries account for almost all the projected growth in world emissions to 2030

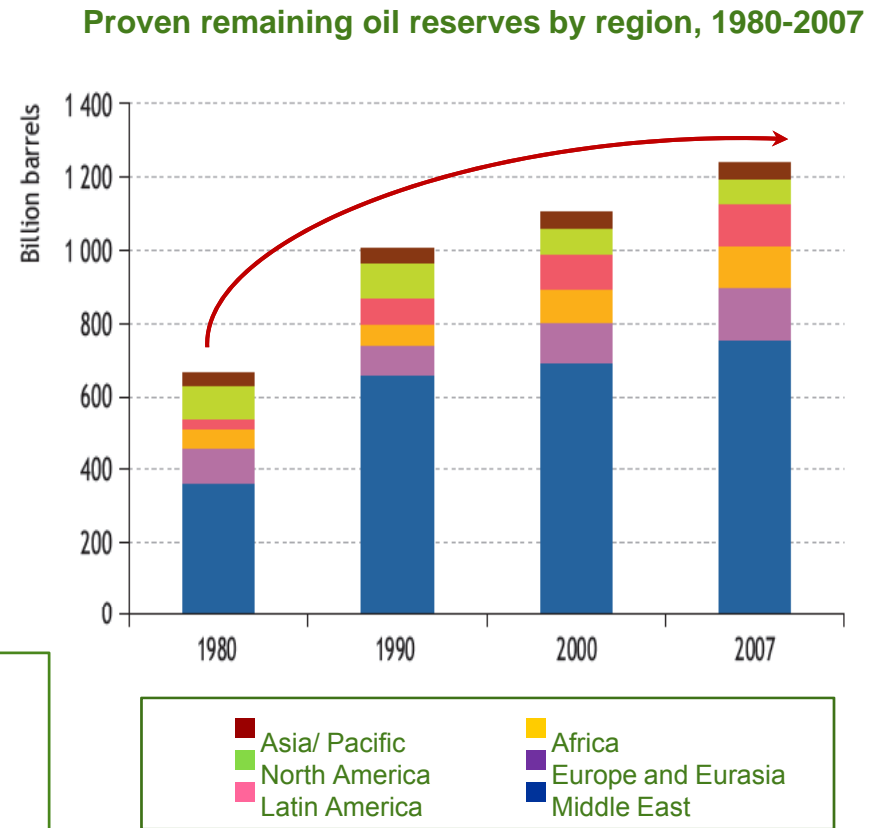
Source: World Energy Outlook 2008, IEA

# Forecast of rising oil prices

**Oil prices dropped 60% since July 2008 peak, though they are above the levels of the 90's**



Fuente: FMI database



Fuente: BP 2008

# Looking forward: What does the IEA tell us?



IEA BLUE Map scenario: 50% reduction in CO2 emissions by 2050/2005

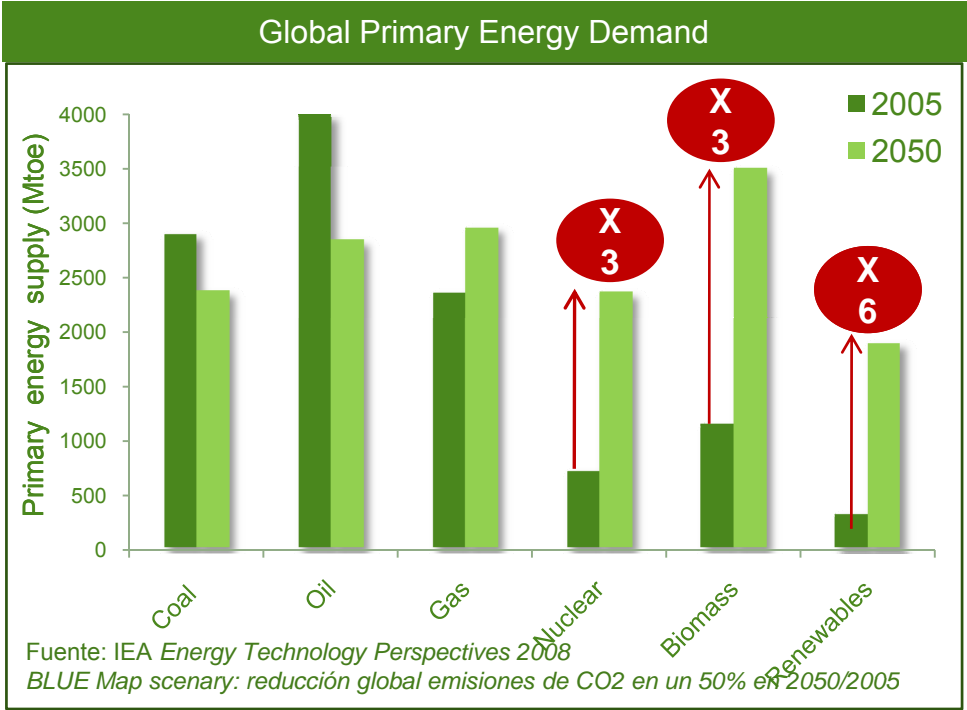
## By 2050...

**+/- stable**  
Global economy is expected to grow X4 → much higher use of energy → Global primary energy demand is projected to increase >40%

**Change from previous scenario**  
Massive switch to renewables in electricity generation. Nuclear plays also significant role.  
Energy efficiency improvements of 1,4% per year



Investment needs:  
45 trillion \$ up to 2050.



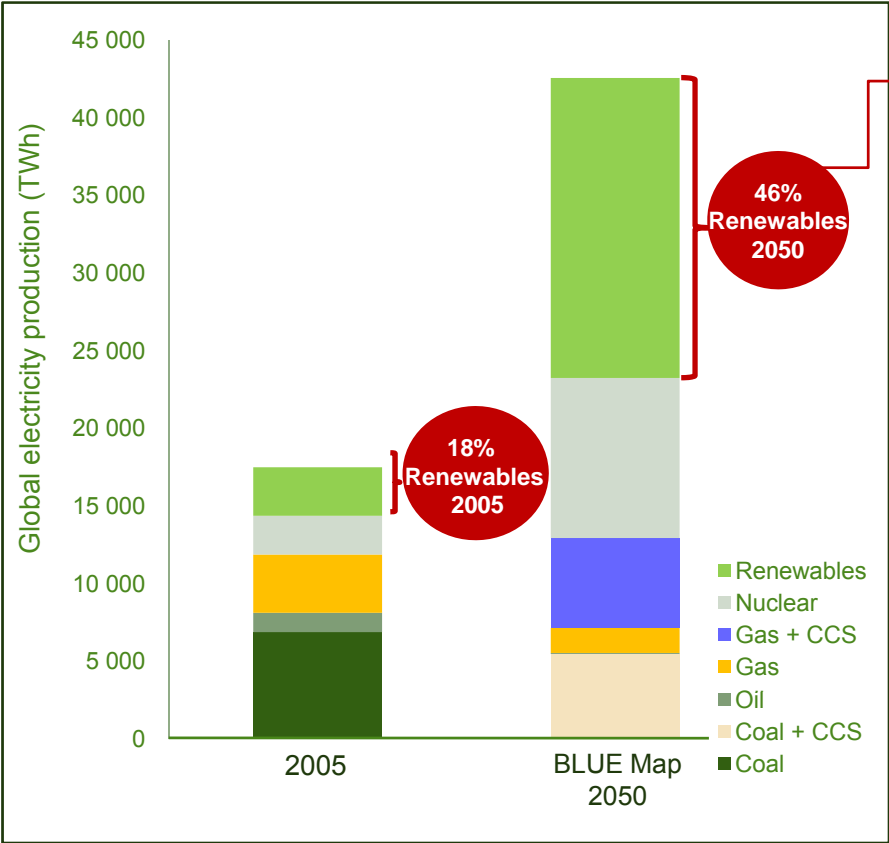
Oil demand in 2050 is 27% below de level of 2005

Renewables and nuclear energy will increase its share in the global energy mix by 2050

# ¿What about the electricity sector?

IEA BLUE Map scenario: 50% reduction in CO2 emissions by 2050/2005

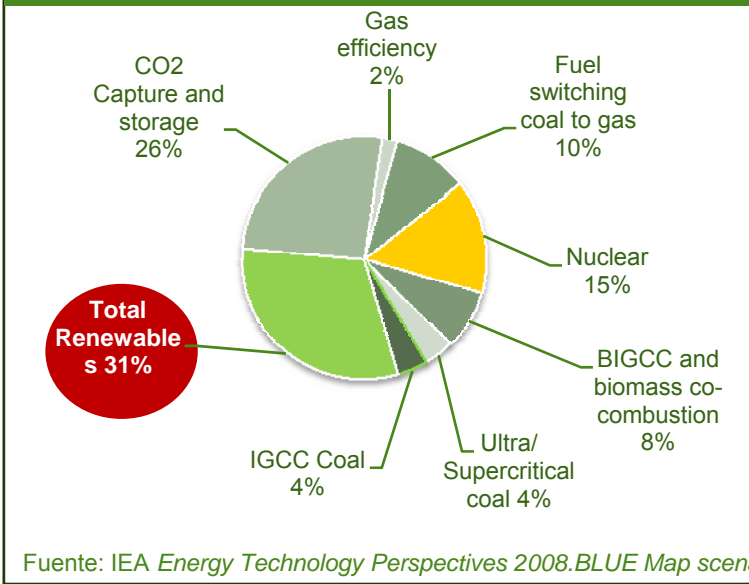
## Global electricity generation mix



Almost half of the global energy consumption from renewable sources .

The share of all electricity generation from renewables increases six fold from 2005.

## Reduction in CO2 emissions in the power sector 2050



Fuente: IEA Energy Technology Perspectives 2008.BLUE Map scenario

Fuente: IEA Energy Technology Perspectives 2008  
BLUE Map scenario: 50% reduction in CO2 emissions by 2050/2005

Renewables will contribute almost 1/3 to CO2 emission savings in the power sector

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**Current energy context**

**Renewables: part of the solution**

**Present and future challenges**

# Renewable energy offers huge benefits



**In the current economic crisis ...**

**.. Renewables, especially wind, create value for the economy**

## **Renewables are a driver for economic development.**

- Macroeconomic: contribution to GDP, impact on the Balance of Trade
- Energy security: reducing fossil fuel imports
- Environment: reducing CO2 emissions
- Social: employment creation and rural development

# Renewable energy reduces energy dependency and vulnerability to increasing prices



## Dependency

Renewable energies are based on indigenous resources (wind, sun...) that reduce the need to import fossil fuels

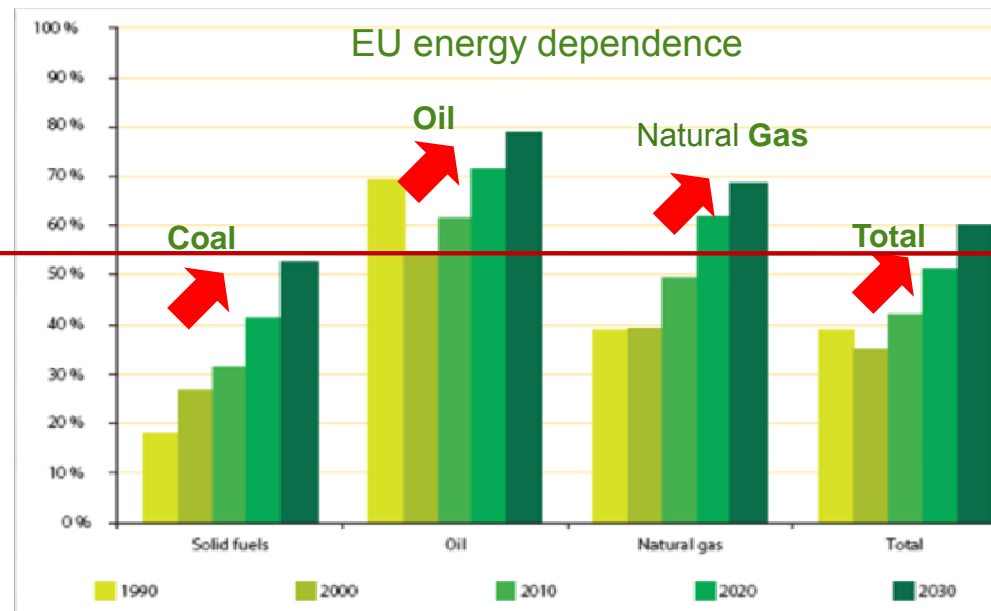
## Vulnerability

Renewable energies represent a natural hedge against price risk associated with fossil fuel price volatility

EU

**Especially important for the EU**

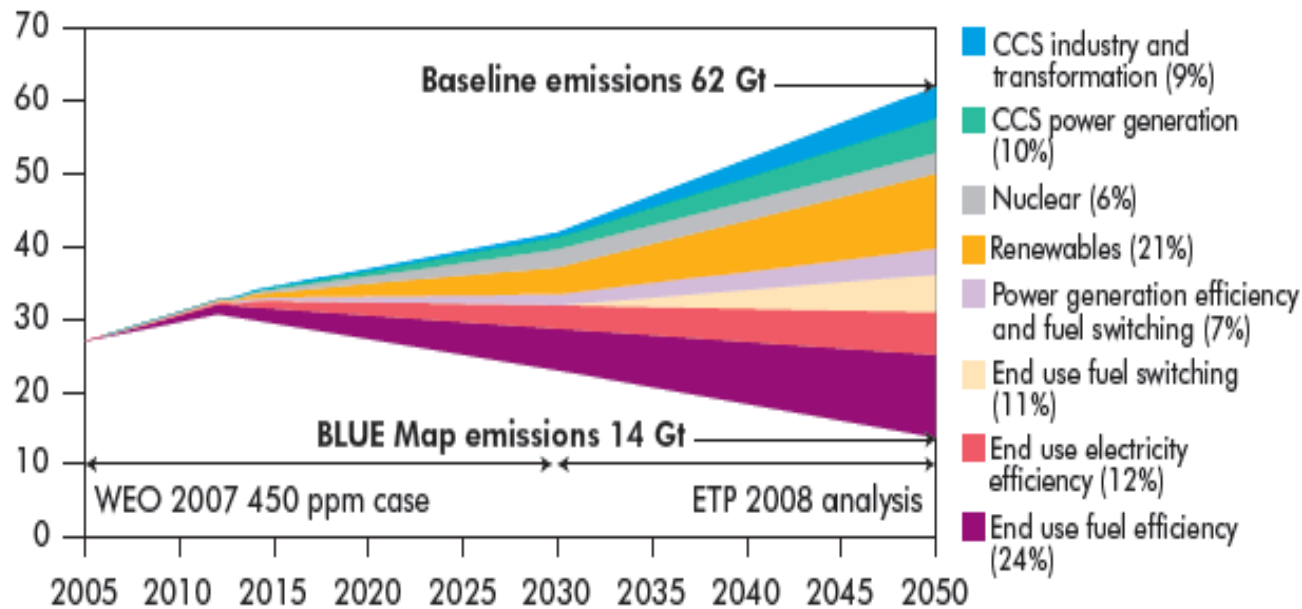
**By 2030, the EU could have a 60% energy dependence**



# Renewable energy contributes to reduce CO2 emissions



**Contribution to CO2 emissions reduction by technology in the BLUE scenario 2005-2050**



**Renewables will contribute to global CO2 emissions savings in a 21%**

➤ Renewable energies do not generate emissions and contribute to help achieve Kyoto commitments

# Renewables are a driver for social and economic development



## Social advantages in terms of employment

- More than 2.2 million jobs exist today in the renewable sector worldwide
- Highly qualified jobs

## Distributed generation dynamize rural areas

- Creates new jobs in rural areas contributing to the economic and social development of these areas

## Creates a new industry

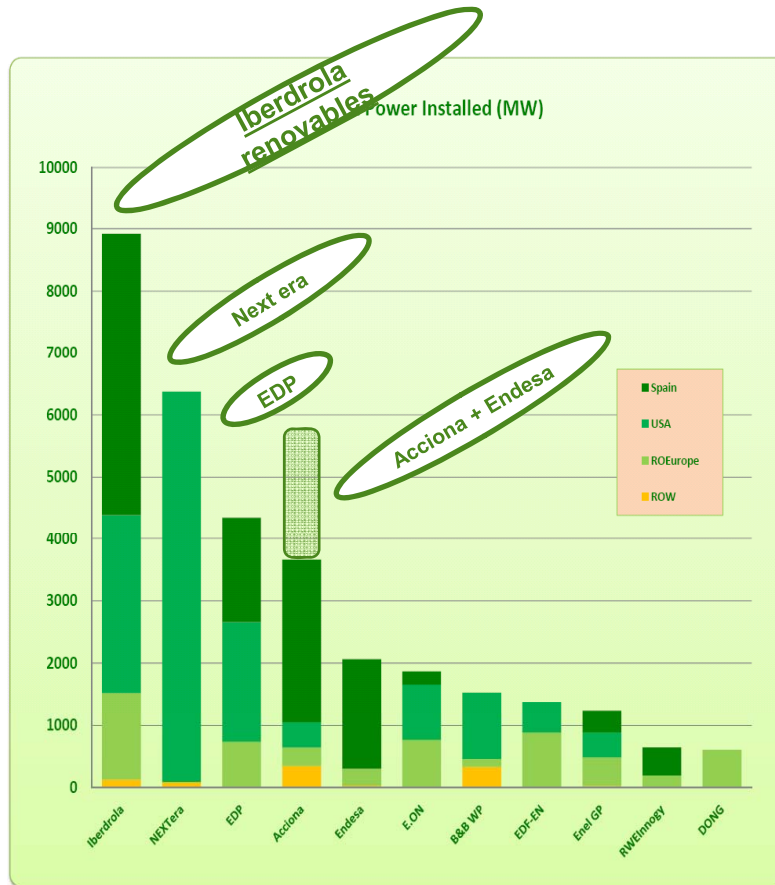
- Represents an opportunity to develop a whole new and domestic industry with high added value

**Renewables will strengthen global economy**

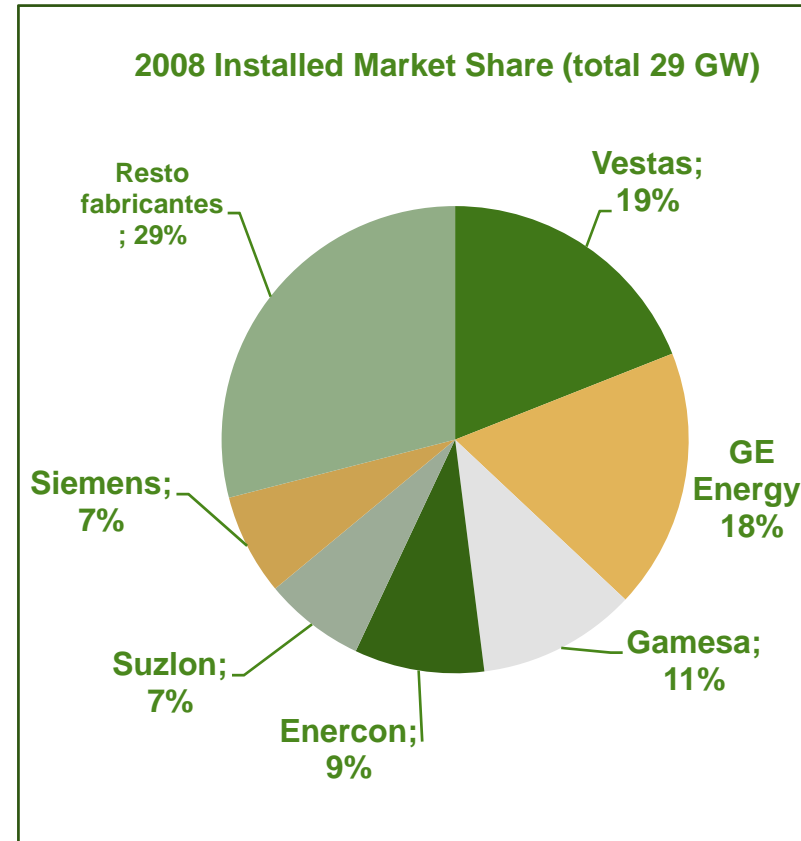
# Wind energy: A great industrial opportunity



**In Spain, an addecuate support scheme has contributed to the deployment of renewable industry**



Note: Endesa Spain includes Portugal



**Note: As of end 2008**  
**Fuente: Emerging Energy Research**

# Need to transform the pattern of power generation towards a more sustainable model

Renewables play an essential role  
in the definition of a sustainable energy model....

Advantages	<b>Environment</b>	<ul style="list-style-type: none"> <li>➤ No emissions</li> <li>➤ Key driver to reaching Kyoto commitments (2002), Bali (2007)</li> </ul>
	<b>Energy security</b>	<ul style="list-style-type: none"> <li>➤ Indigenous energy, inexhaustible resource</li> <li>➤ Reduces dependence from risky markets</li> <li>➤ Volatile prices and likely to be higher</li> </ul>
	<b>Competitiveness</b>	<ul style="list-style-type: none"> <li>➤ Driver needed to develop the industry and foster job creation</li> <li>➤ Right trend: no fuel costs and investment cost likely to be reduced</li> </ul>

Renewables are ready to face the challenges of the current global energy context

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**Current energy context**

**Renewables: part of the solution**

**Present and future challenges**

and challenges ...

## Challenges

- **Regulatory frameworks: Europe, United States**
- **Competitiveness:**
  - ✓ reduce energy generation cost (MW/h)
- **Integration into the grid and the system:**
  - ✓ Variability: back up power
  - ✓ Grid to accommodate new generation
  - ✓ Interconnections development
- **R&D:**
  - ✓ Further development of technologies with potential:  
Wind offshore, solar, marine

# Policy mechanisms to encourage renewables



## 1. Guaranteed purchase of production

## 2. Priority Access to the transmission and distribution Grid

## 3. Economic support:

- based in tariff, *feed in tariff*
- based in premiums, *feed in premium*
- based in the market, Green certificates system
- tax exemptions or reductions on production/investment

## 4. Other forms of economic support:

- Financial support for investment (grants, soft loans...)
- Other indirect systems: emissions trading systems (EU and Kyoto), Clean Development Mechanism (CDM)

# Europe New legislation in place



## New legislation in place... Right steps in the right direction

### Europe EU Renewables Directive

The political bet was translated in to the EU Renewables Directive for the promotion of renewable energies

- 20 % of the EU's overall energy consumption from renewable energy sources by 2020, equivalent to >35% of electricity

## Yet further steps still needed...

### EU: National Action Plans

Renewables Directive has to be mirrored in National Legislations and in the National Action Plans

# Europe's commitment in the promotion of renewables: Directive 20/20

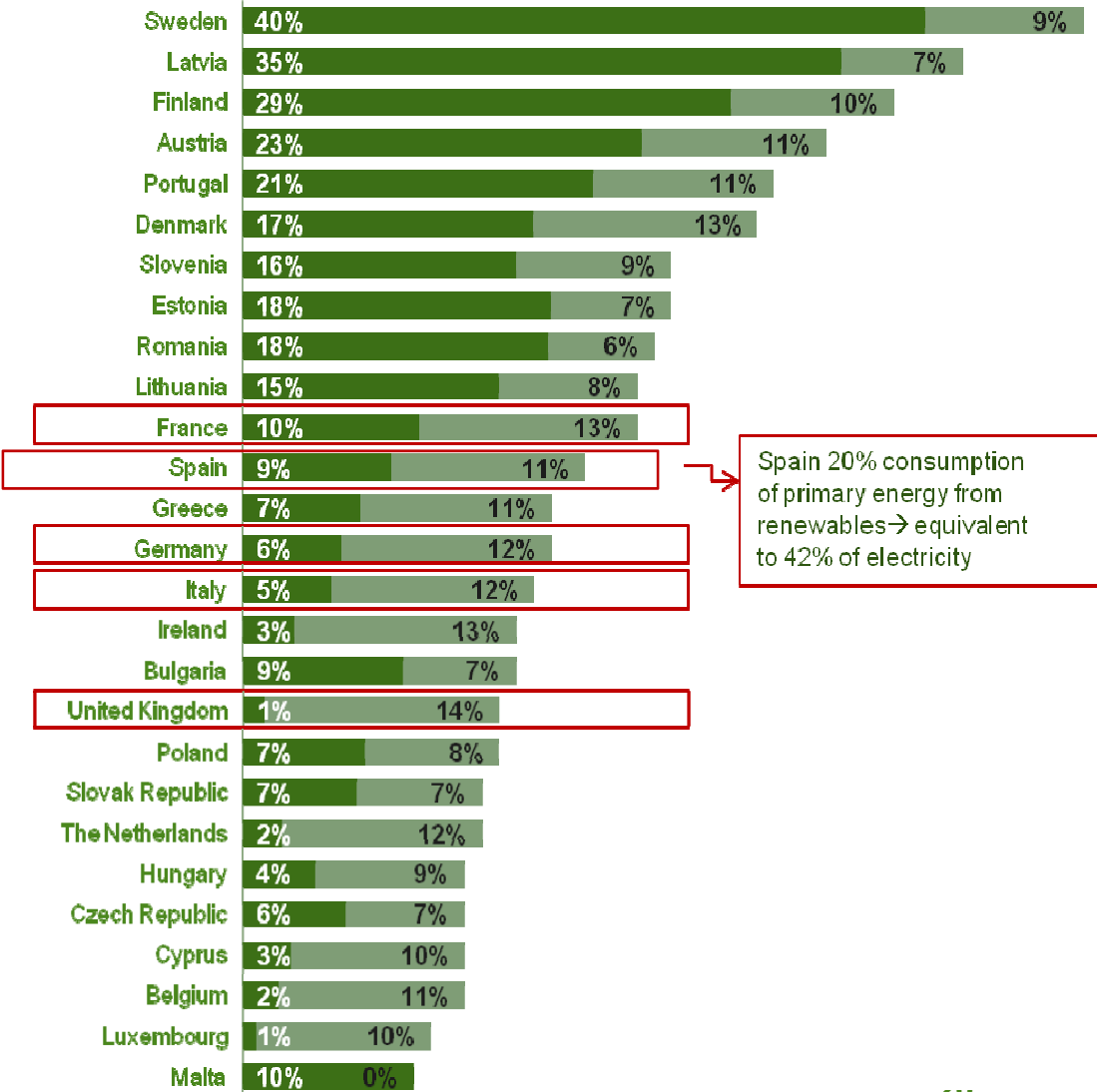


**EU Energy Policy**

**2020**  
 20% renewable  
 20% efficiency  
 -20% emissions

- Europe renewables Directive**
1. European target of 20% renewable energy by 2020
  2. Burden sharing: each MS must increase at least 6% its renewable energy. The rest will be distributed according to the GDP per capita
  3. MS will have new action plans in 2010
  4. Priority access to the grid
  5. Flexibility mechanisms

Individual renewable targets UE



Source: Directive of the European Parliament and of the Council

# United States with improving regulatory conditions



## New legislation in place... awaiting regulation

### USA Stimulus bill

#### Stimulus bill: incentives for renewable energy

- Three-year extension of PTC (production tax credit)
- Access to ITC (investment tax credit), instead of PTC
- Monetization of the ITC through a Treasury grant. The grant will be equal to 30% of the eligible investment costs of a project started in 2009 or 2010



## Yet further steps still needed...

### US New Energy policy

#### Two key legislative initiatives:

- Energy bill: \* establishment of a national RPS: the American Parliament is debating the scope of the new law
- "Cap & Trade" system for CO2 emissions, similar to EU ETS \*\*

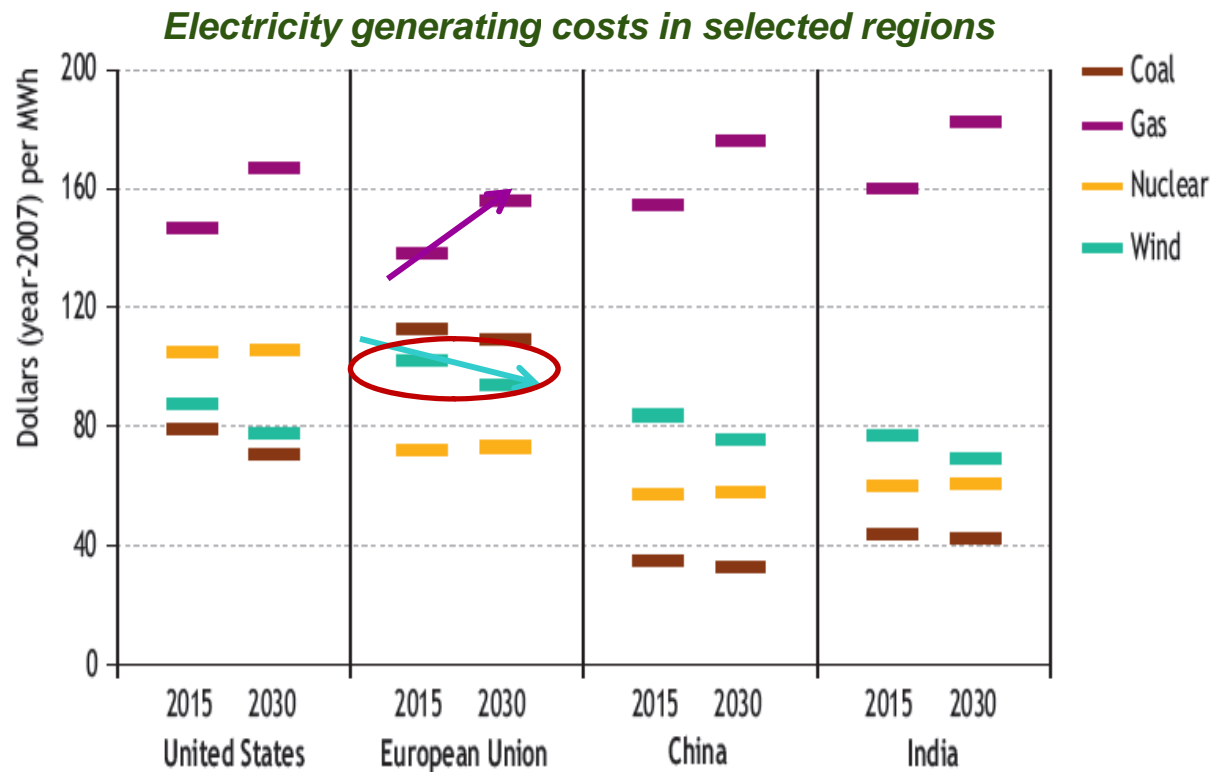
\* State level policy mandating the state to generate a percentage of its electricity from renewable sources

\*\* European Union Emission Trading System

# Renewable energy, particularly wind, is becoming increasingly competitive compared to conventional energy sources



The reduction in wind power generation costs and the increasing fossil fuel prices reduces the need of economic support mechanisms for this technology.



Fuente: WEO 2008, AIE

# Seizing an industrial opportunity

## The challenge: enhancing competitiveness



**Table 2: Wind electricity generation costs (€ per MWh), assuming 27% load factor**

Depreciation	28.5
Fuel and carbon cost	0.0
O&M	13.4
Cost of capital (1 <sup>st</sup> year)	42.8
<b>Total</b>	<b>84.7</b>

Source: UBS estimates

**Table 3: New entrant cost calculation for fossil and nuclear power**

(2010), data in €/MWh	CCGT	Coal	Nuclear
Fuel cost	59.1	33.4	4.8
Carbon	11.0	22.5	0.0
Operating & maintenance	3.9	5.2	14.0
Depreciation	3.4	5.7	7.6
ROIC	10.0	22.0	36.7
<b>Total (€/MWh)</b>	<b>87.3</b>	<b>88.8</b>	<b>63.1</b>

Source: UBS estimates

**The industry has the key to enhanced competitiveness**

- **R+D: technology for future lower turbine costs**
- **Offshore deployment**
- **System integration**
- **Reduced O& M costs**
- **Shortened construction times**

The challenge is to increase wind energy integration into the system in an efficient and safe manner



Issues to be addressed:

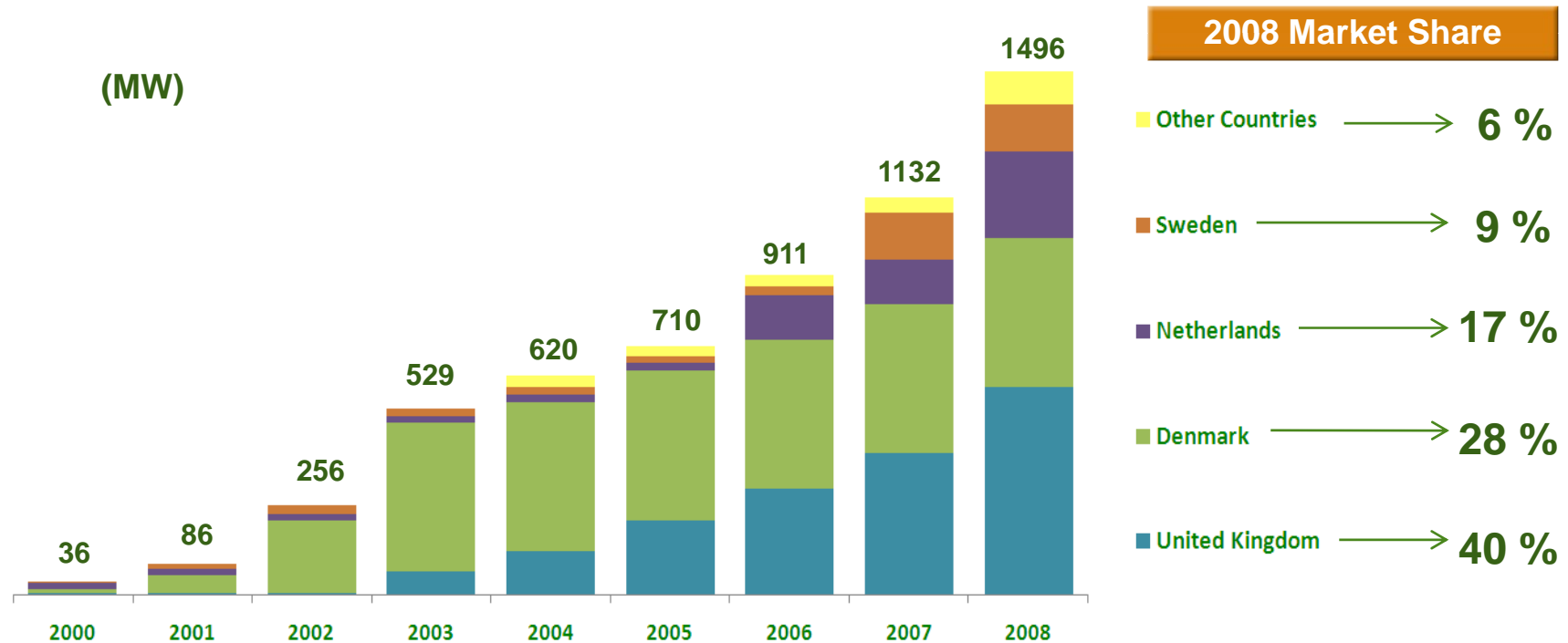
- ✓ best methods of predicting production
- ✓ new transmission and distribution grids
- ✓ development of international interconnections
- ✓ Energy storage and demand side management (electric cars)
- ✓ Back-up power required
- ✓ Enhanced performance of wind turbines

**It is clearly feasible to integrate large amounts of wind energy into the system**

# Technical challenges: offshore wind



## Global Cumulative Offshore Wind Power Capacity (\*)



- 1,496 MW installed capacity (≈70% in Denmark and UK). 40GW under development in the world
- Offshore wind projects are just behind onshore wind in cost effective renewable energy production. Estimated investment costs between 2,8 - 3,5 M €/MW

# Challenges of off-shore wind



## challenges

- Availability of reliable tested offshore wind turbines
- Uncertainty due to the scarce experience in Offshore wind O&M
- Vessels scarcity, although some contractors have introduced vessels exclusively designed to be used for offshore wind turbines and foundations
- Current technology (mainly Monopile Foundations) only covers limited water depth (approx. 30meters)

**Offshore industry is starting to show relevant developments  
Further consolidation of regulatory support and demand incentivizing  
investments in the supply chain, thus leading to further expansion and  
cost competitiveness**

# Renewables: Part of the solution

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Anex



# Wind energy is the leading renewable technology

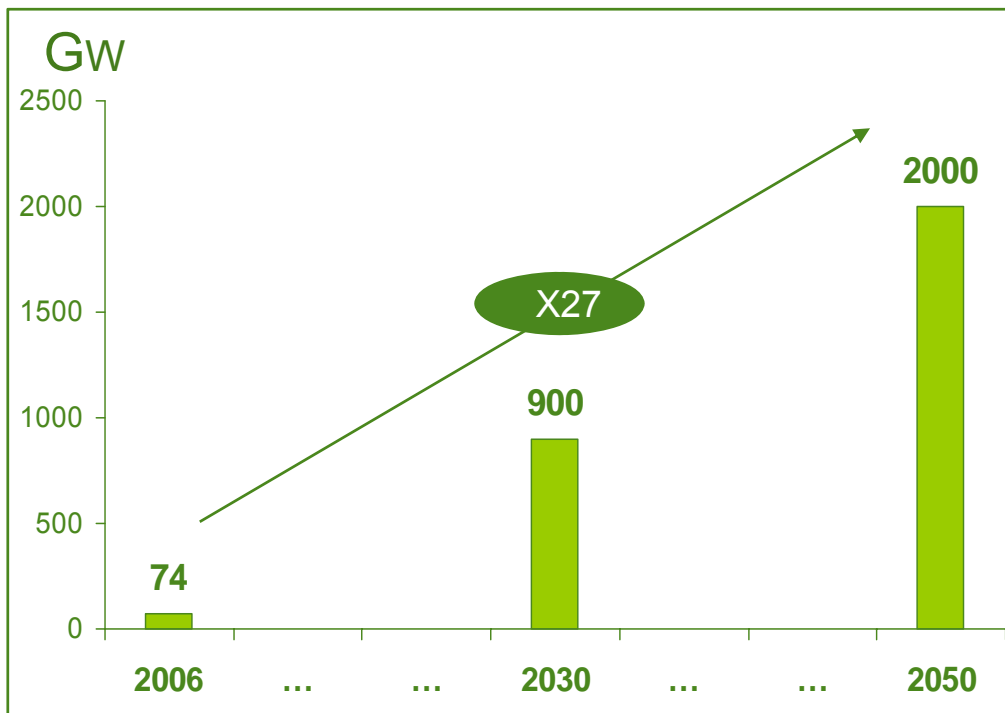


***Klondike, 400 MW en Oregón, EEUU***

# Wind energy: a mature technology and main growth driver



## Global growth



Source: IEA Energy Technology Perspectives 2008 (Blue scenario), WEO 2008

## Market Situation

### Geographic distribution

- Mainly in Germany, Spain and Denmark
- Emerging countries: UK, France, Poland , Italy

### Investment volume

- Additional market: ± 1900 GW (2006-2050)
- Investment costs: 1,3 M€/MW
- Total investment: 2.470 b€

**Position of Spanish Industry** \* \* \* \* \* 5/5

## Key Factors

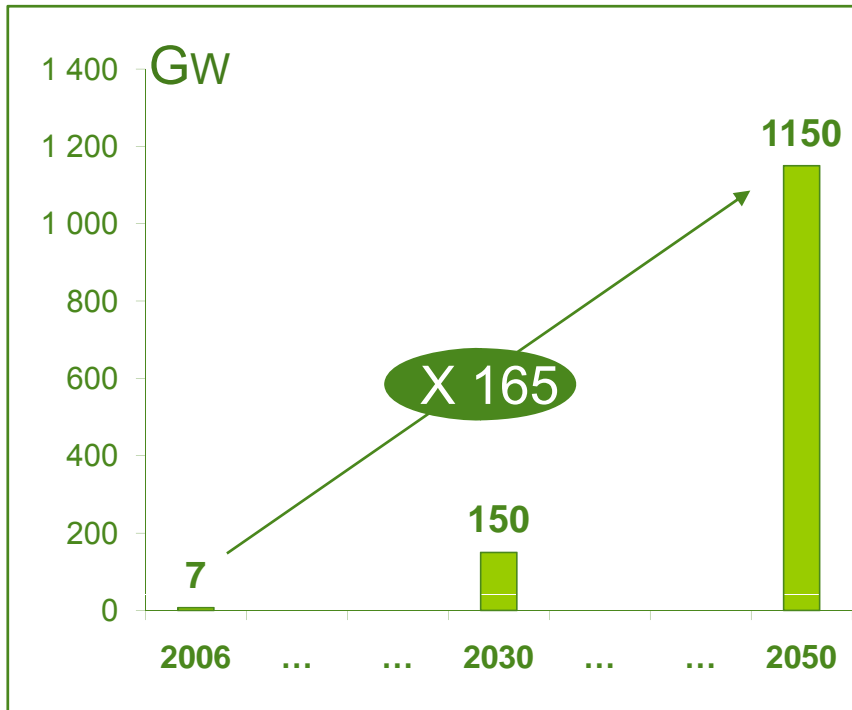
- Natural resources (wind) and electric network
- Integration of wind energy: into the grid and into the system
- Offshore: mid-term development.

# Solar PV: investment cost reduction is needed



# Solar PV: constant development worldwide

## Global growth



## Market Situation

### Geographic distribution

- Higher development in OCDE countries (due to the high investment costs)
- In developing countries to supply remote/isolated areas

### Investment volume

- Additional market: 1100 GW (2006-2050)
- Investment costs: 4 M€/MW
- Total investment ± 4.400 b€

Position Spanish Industry

\* \* \* \* \*

4/5

Source: IEA Energy Technology Perspectives 2008 (Blue scenario), WEO 2008

## Key Factors

- Costs reduction via technical improvements, development of emerging technologies like thinfilm.



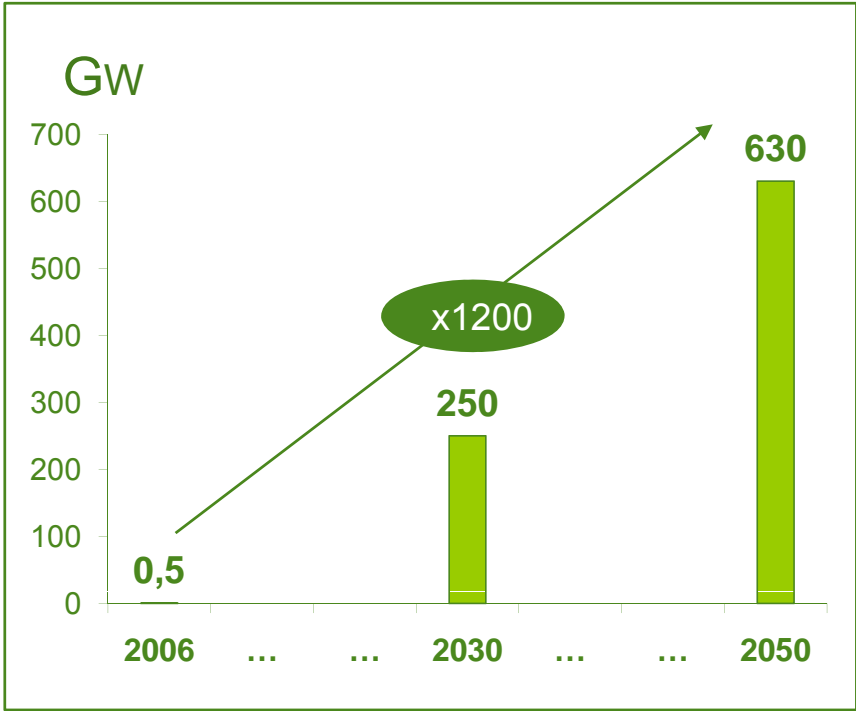
# Solar CSP : needs to improve its competitive position



*Puertollano, 50 MW*

# Solar CSP: taking off

## Global growth



## Market Situation

### Geographic distribution

- Mojave desert (California, EEUU), 300 MW
- In Spain, current development fostered by an adequate support framework
- Further development in industrialised countries (high costs)

### Investment volume

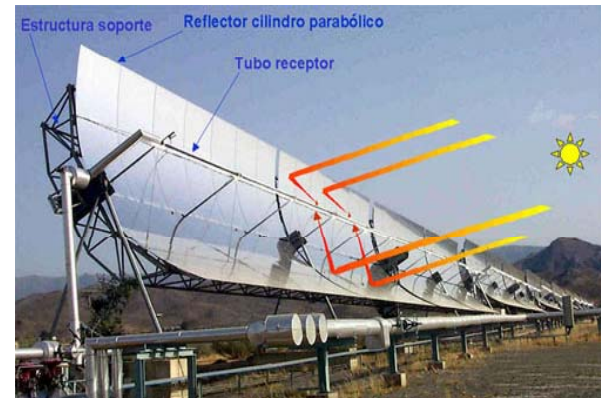
- Additional market: 630 GW (2006-2050)
- Investment costs: 4 M€/MW
- Total investment: 2.500 b€

**Position Spanish Industry** \* \* \* \* \* **4/5**

Source: IEA Energy Technology Perspectives 2008 (Blue scenario), WEO 2008

## Key Factors

- Experience. Support necessary
- Development of manufacturing procedures and techniques. Higher competitiveness
- Manageable power plants, better integration into the electric system



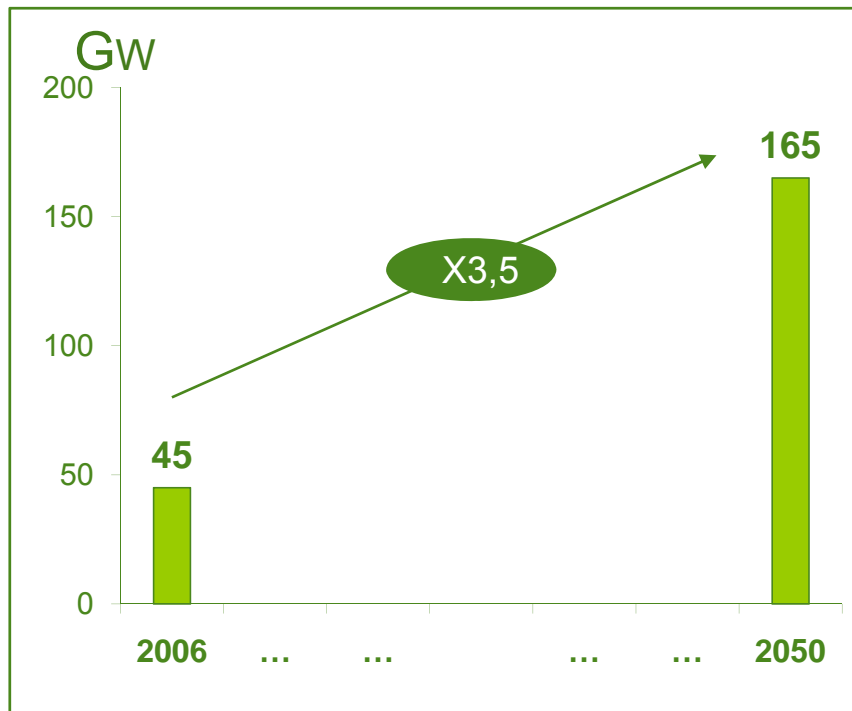
# Biomass: supply of fuel, the key factor



*Planta de Corduente 3 MW, Guadalajara*

# Biomass: stuck but with high potential

## Global growth



## Market situation

### Situation

- Stuck due to a lack of raw material and to the support mechanisms

### Investment volume

- Additional market: 120 GW (2006-2050)
- Investment costs: 2,4 M€/MW
- Total investment: 288 b€

Position Spanish Industry



2/5

Source: IEA Energy Technology Perspectives 2008 (Blue scenario), WEO 2008

## Key Factors

- LT supply of fuel in good quantity, quality, and price conditions
- Necessary involvement of other sectors: environment, food and agriculture