Renewables: Part of the solution

Carlos Gascó, Prospective Regulatory Department, Head

ICREP annual meeting
Granada, 23 march 2010

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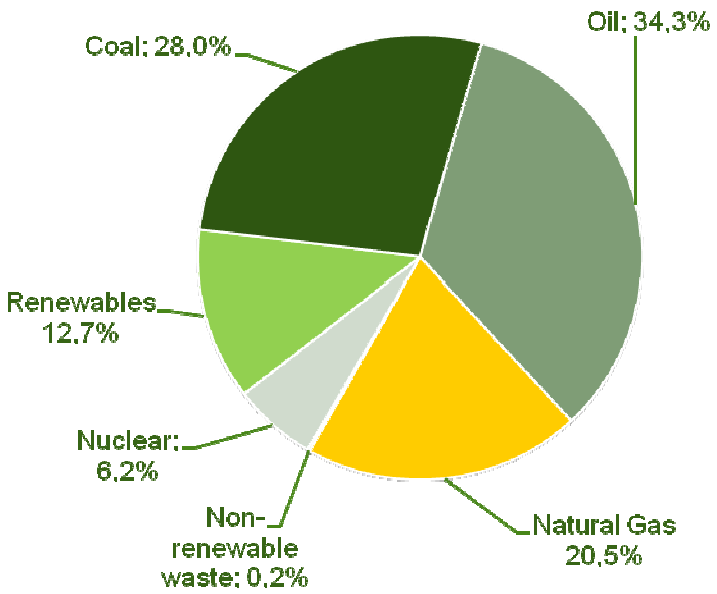
Starting point:

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 CO2 emissions

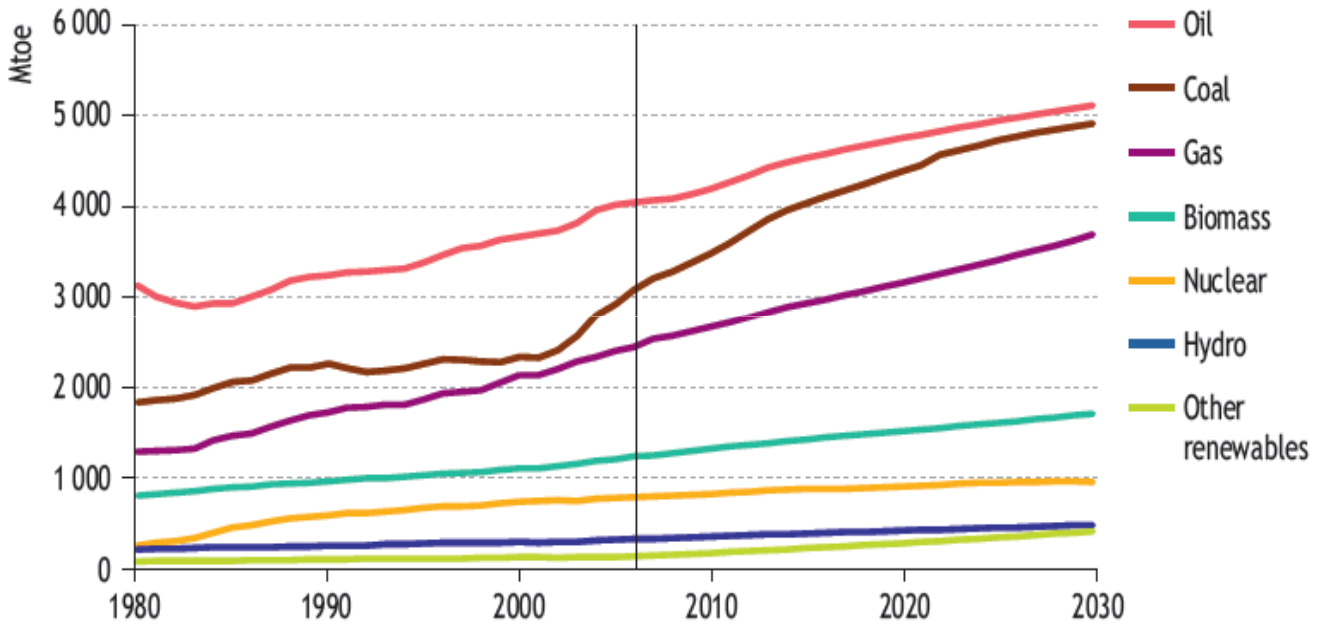
RESOURCE DEPLETION: energy model based on limited fossil resources

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**

Source: IEA, WEO 2008

CO2 emissions will continue to grow

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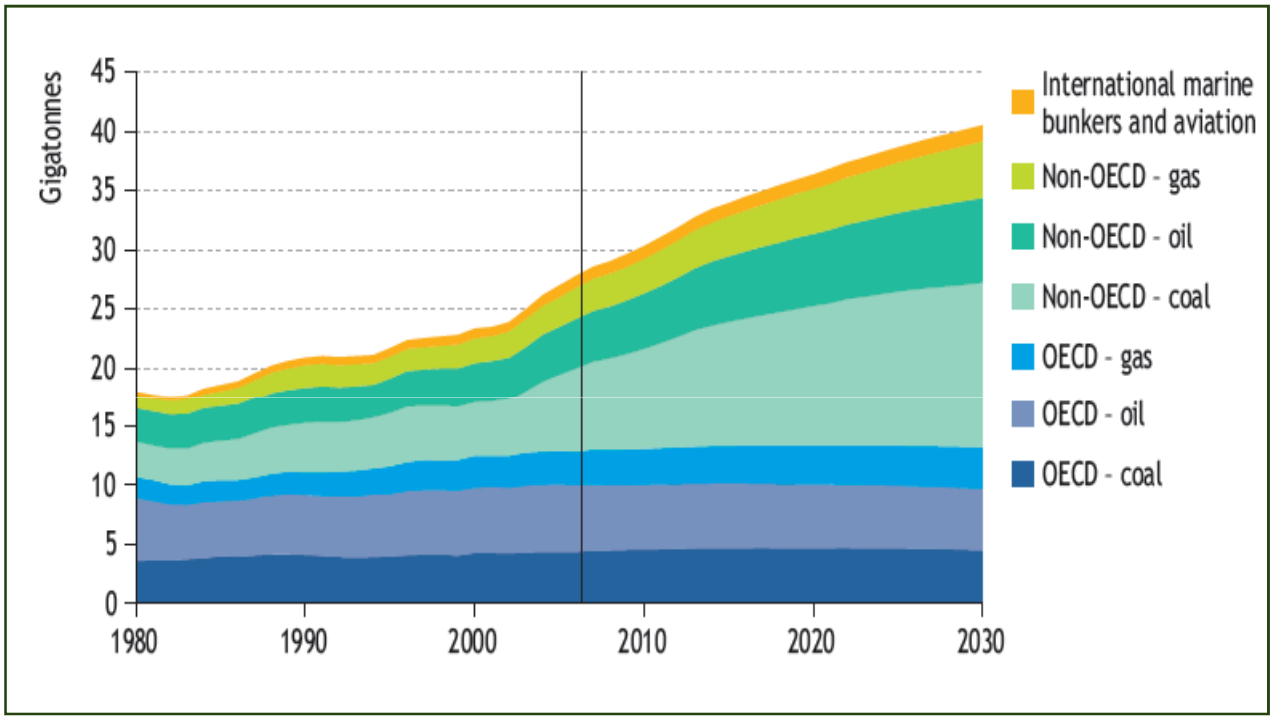
Energy-related CO2 emissions by fuel and region



Emissions: +45% by 2030

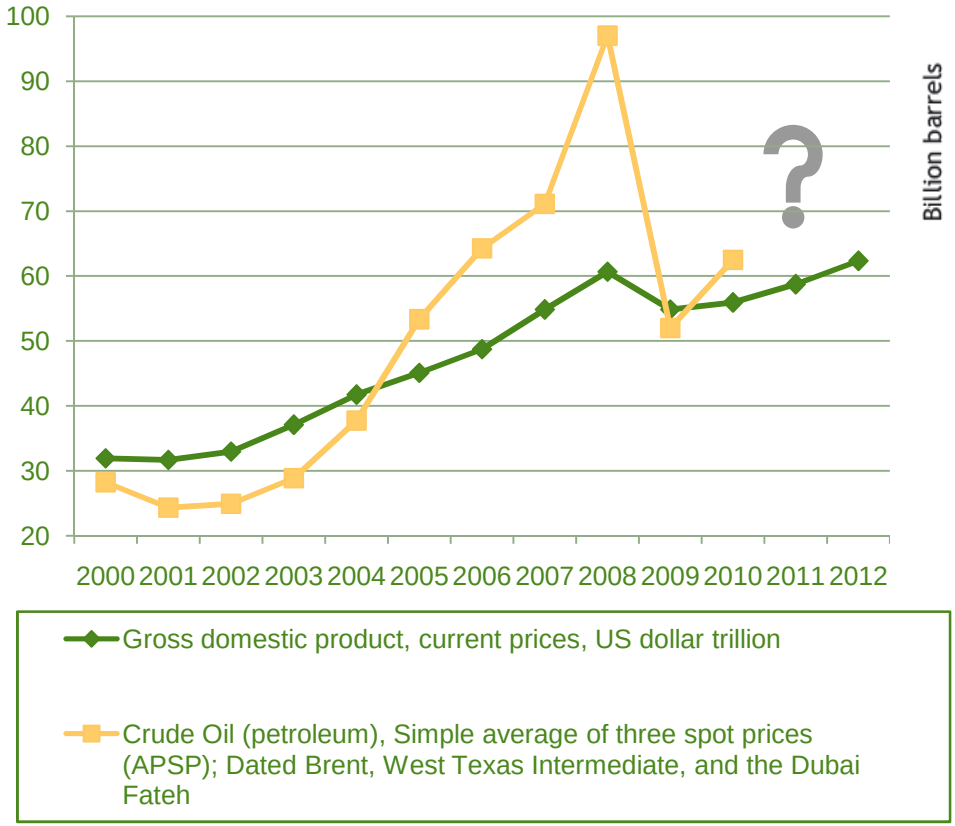
- Rising global use of fossil fuels is set to continue to drive up energy related CO2 emissions
- Non-OCDE countries account for almost all the projected growth in world emissions to 2030

Source: World Energy Outlook 2008, IEA

Forecast of rising oil prices

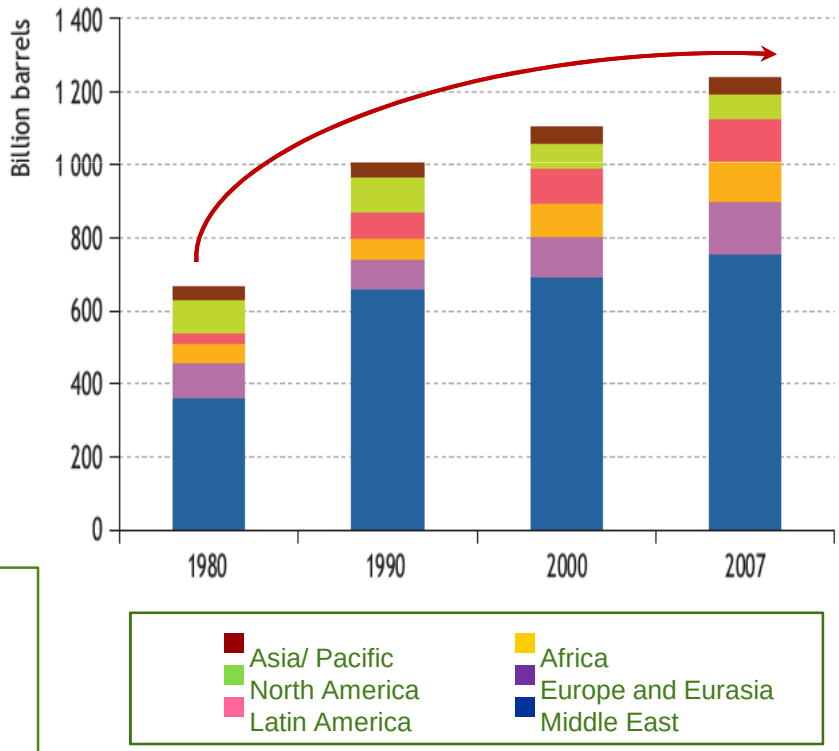
Oil prices dropped 60% since July 2008 peak, though they are above the levels of the 90's

GDP vs Oil price, current prices



Fuente: FMI database

Proven remaining oil reserves by region, 1980-2007



Fuente: BP 2008

Looking forward: What does the IEA tell us?

IEA BLUE Map scenary: 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%

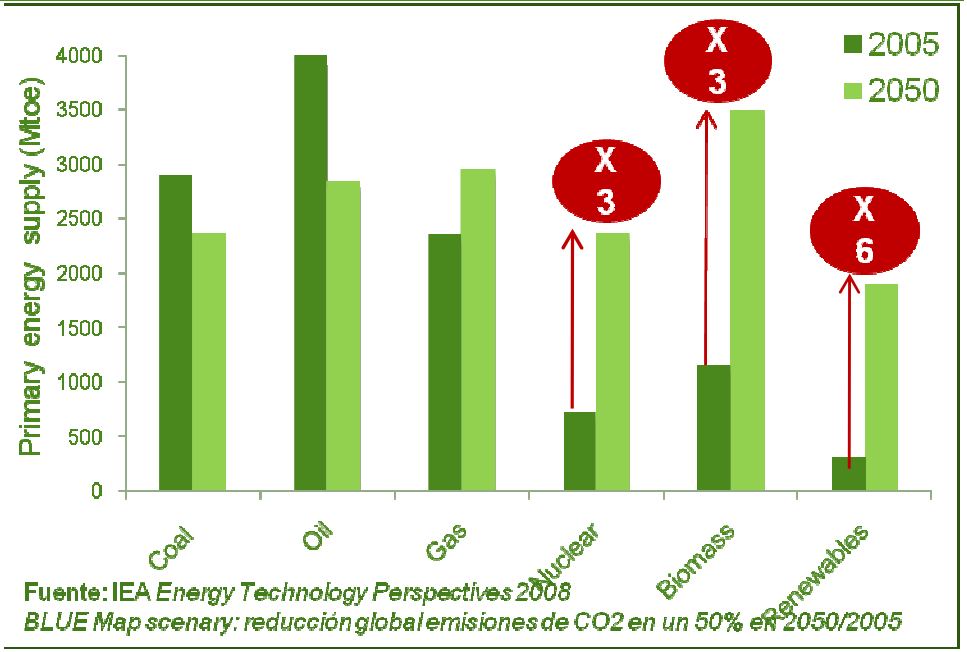
Change from previous scenario

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.

Global Primary Energy Demand



Fuente: IEA *Energy Technology Perspectives 2008*
BLUE Map scenary: reducción global emisiones de CO2 en un 50% en 2050/2005

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?

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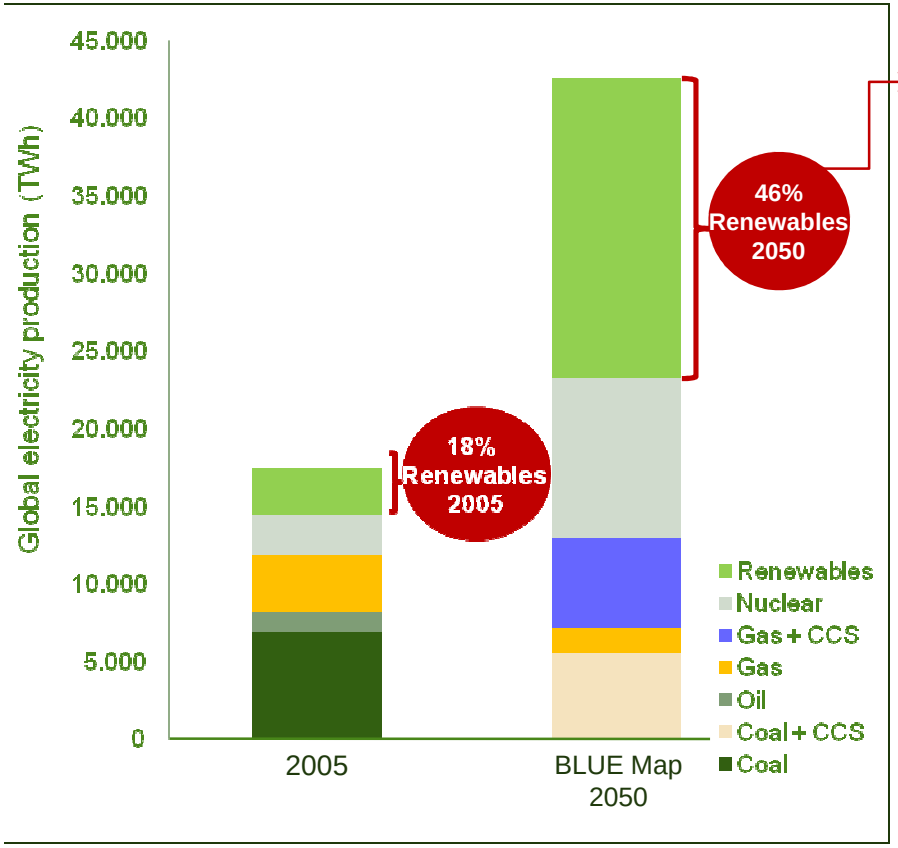
IEA BLUE Map scenary: 50% reduction in CO2 emissions by 2050/2005

Global electricity generation mix

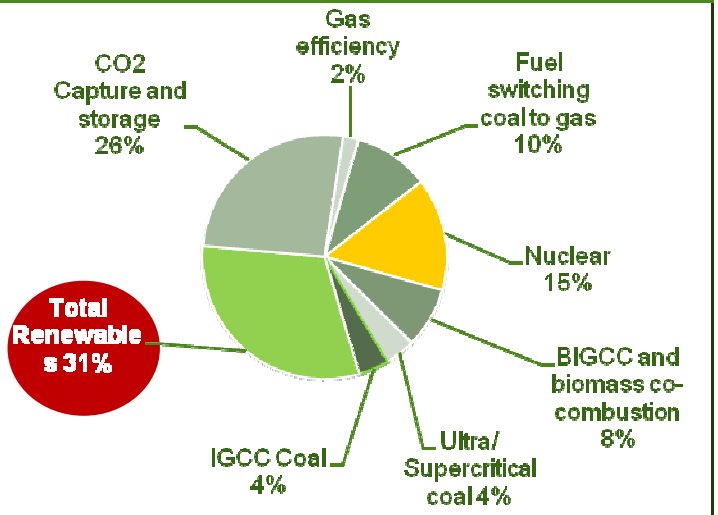


Fuente: IEA *Energy Technology Perspectives 2008*
BLUE Map scenary: 50% reduction in CO2 emissions by 2050/2005

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 scen*

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

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Renewable energy offers huge benefits

In the current economic crisis ...

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

<u>Renewables are a driver for economic development.</u>

- 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

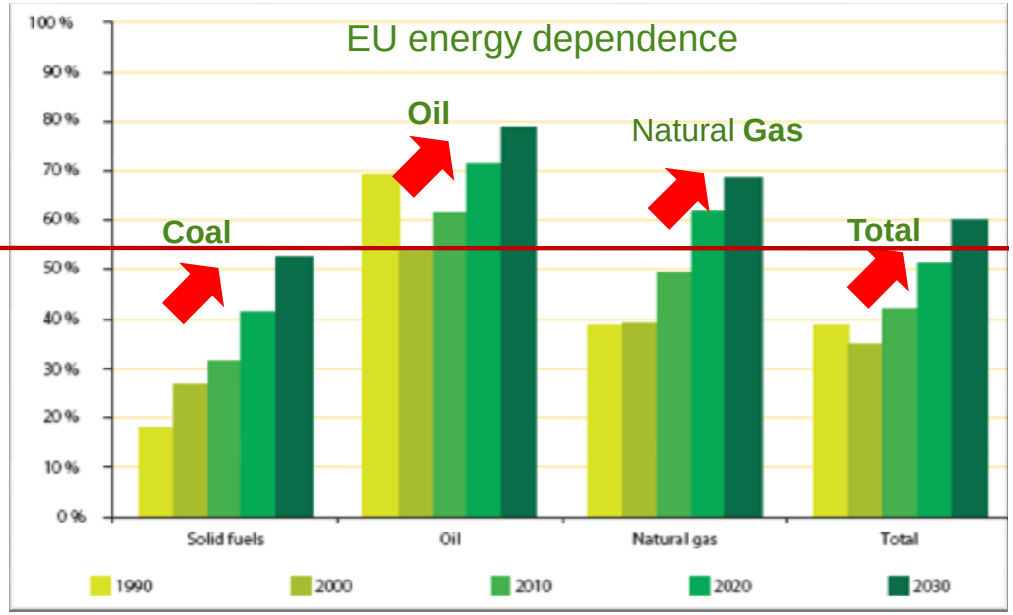
Vulnerability

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



Source: Green paper "Towards a European strategy for the security of energy supply", European Commission

Renewable energy contributes to reduce CO2 emissions

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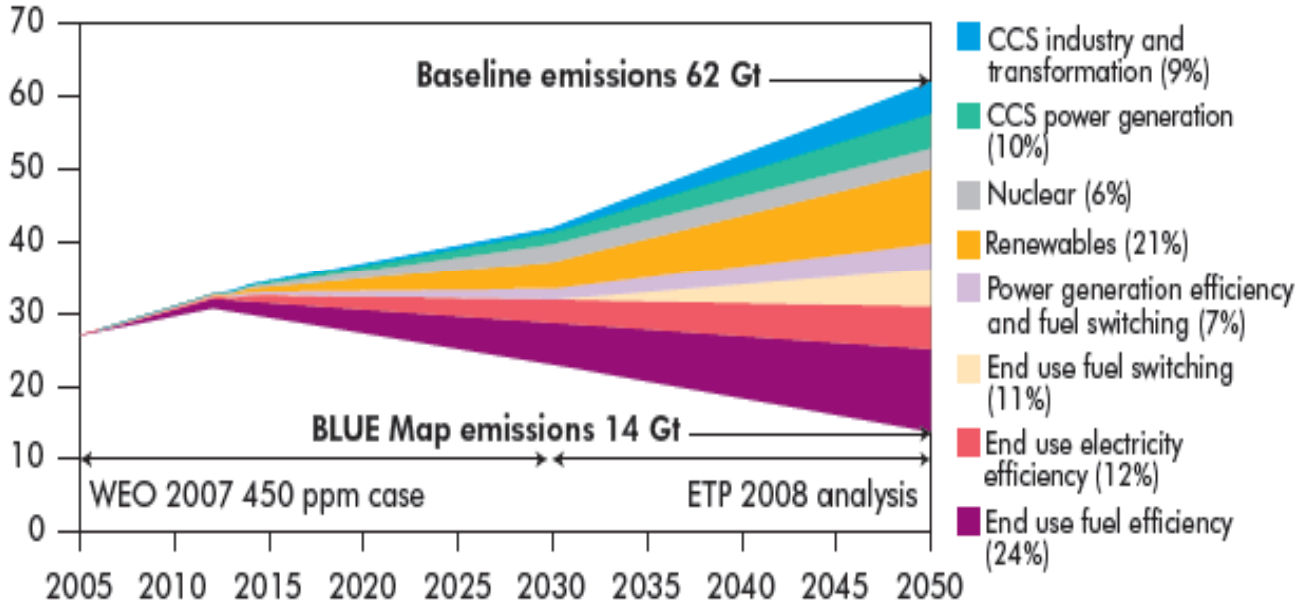
Contribution to CO2 emissions reduction by technology in the BLUE scenario 2005-2050



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

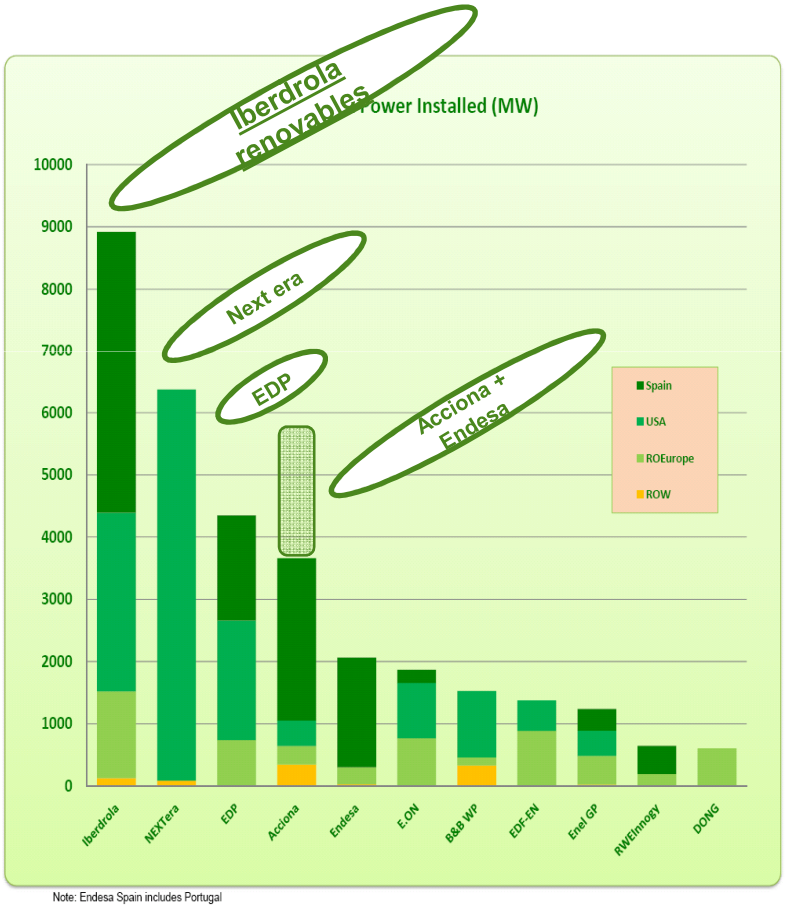
Creates a new industry

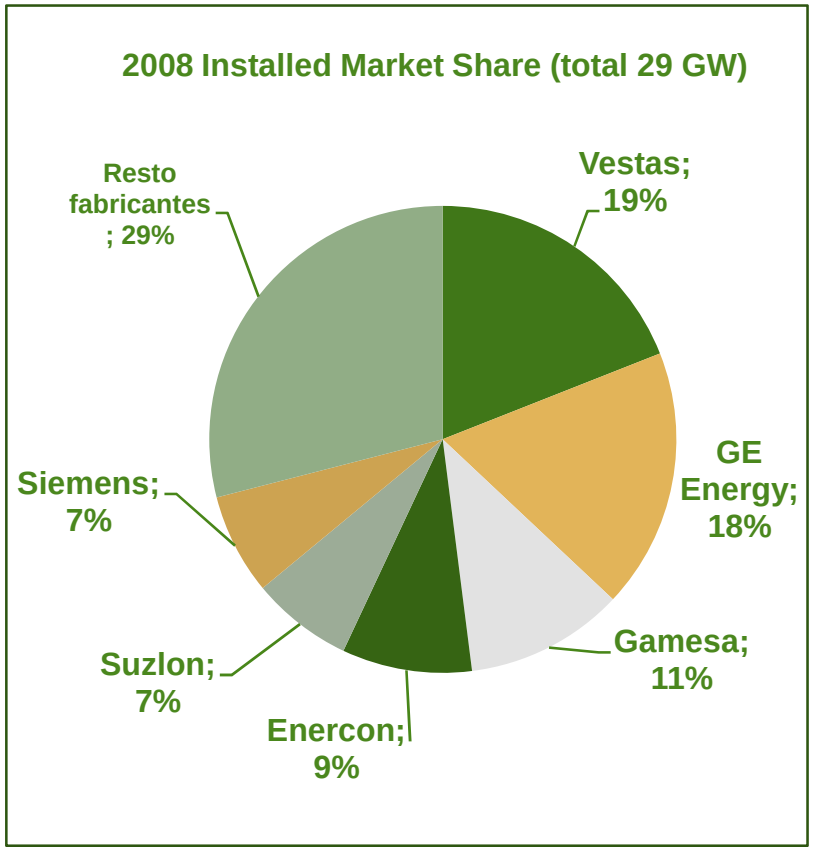
- Represents an opportunity to develope a whole new and domestic industry with high added value

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: 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		
	Environment	➢No emissions ➢Key driver to reaching Kyoto commitments (2002), Bali (2007)
	Energy security	➢Indigenous energy, inexahustible resource ➢Reduces dependence from risky markets ➢Volatile prices and likely to be higher
	Competitiviness	➢Driver needed to develop the industry and foster job creation ➢Right trend: no fuel costs and investment cost likely to be reduced

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

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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 tariffs, *feed in tariff***
   - **based in premiums, *feed in premium***
   - **based in market dynamics, green certificates system**
   - **tax benefits: for production *(≈ feed in premium)* or capex**

4. **Other forms of economic support:**
   - Financial benefits: grants, soft loans, etc.
   - Other indirect systems: carbon markets

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

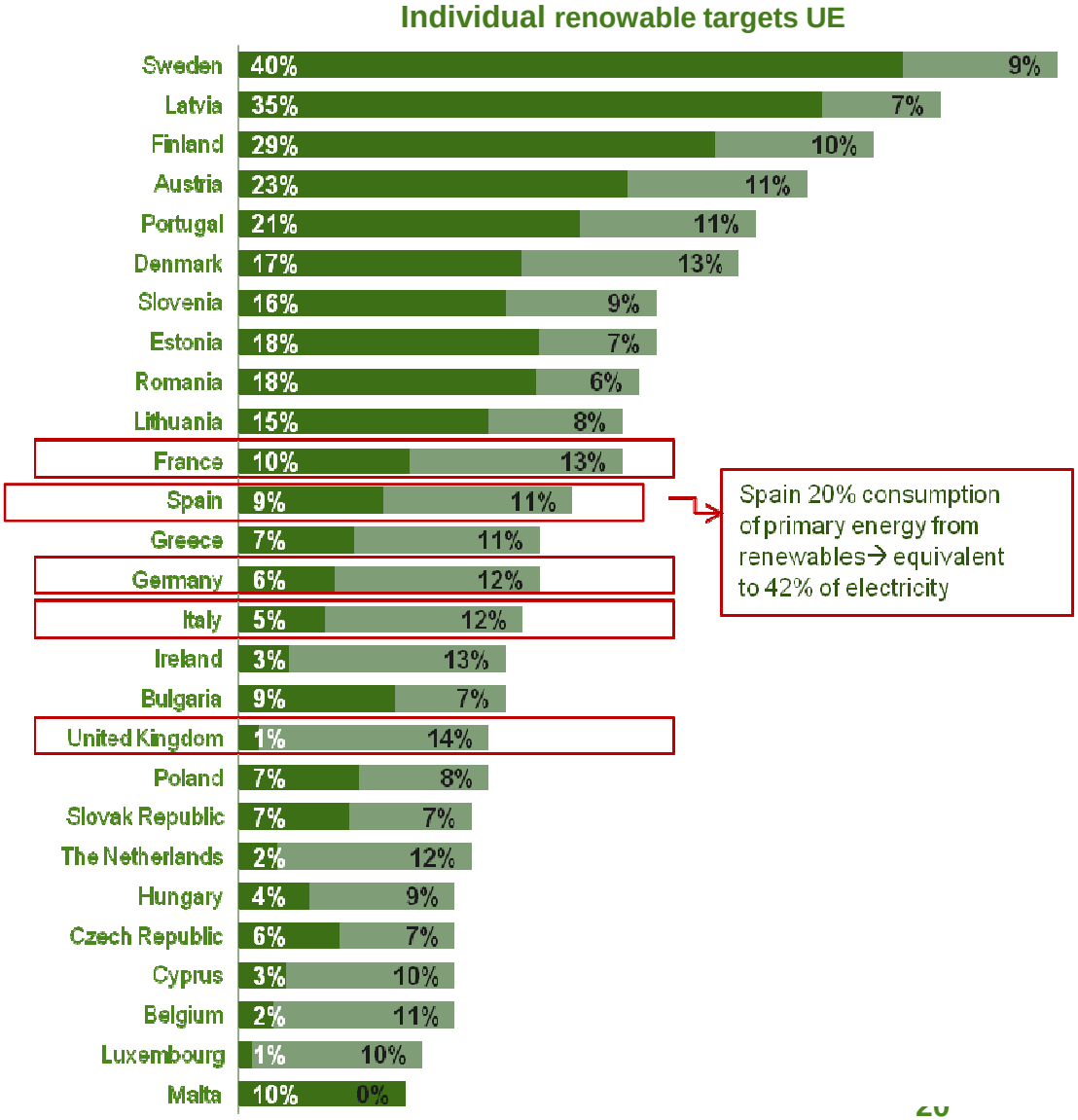
EU Energy Policy

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

Source: Directive of the European Parlament 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. Will be equal to 30% of the eligible investment costs of a project started in 2009 or 2010**

Yet further steps still needed…

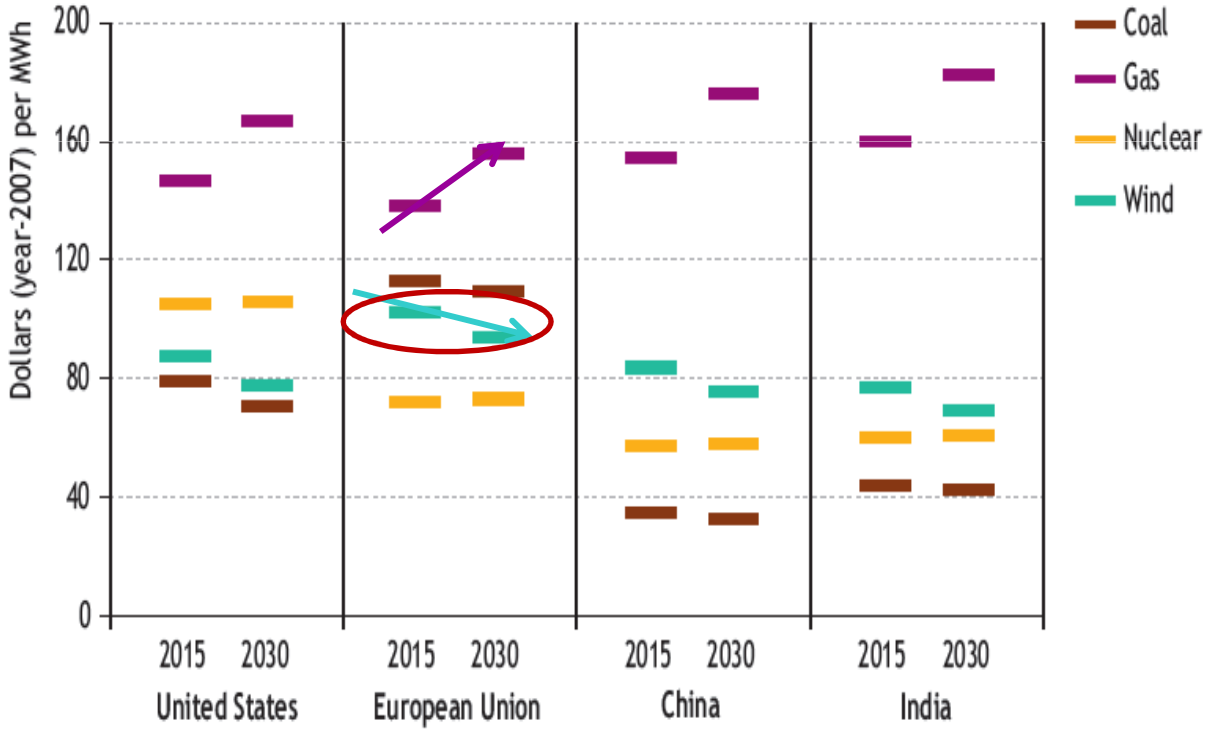
US New Energy policy	**Two key legislative initiatives:** ➢**Energy bill: * establishment of a national RPS: the American Parliament is debating the scope of the new law** ➢**"Cap & Trade" system for CO2 emissions, similar to EU ETS ****

* State level policy mandating the state to generate a percentage of its electricity from renewable sources
** European Union Emission Trading System

Renewable energy, particulary 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.

Electricity generating costs in selected regions



Fuente: WEO 2008, AIE

Seizing an industrial opportunity
The challenge: enhancing competitiveness

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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 (1st year)	42.8
Total	**84.7**

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
Total (€/MWh)	**87.3**	**88.8**	**63.1**

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

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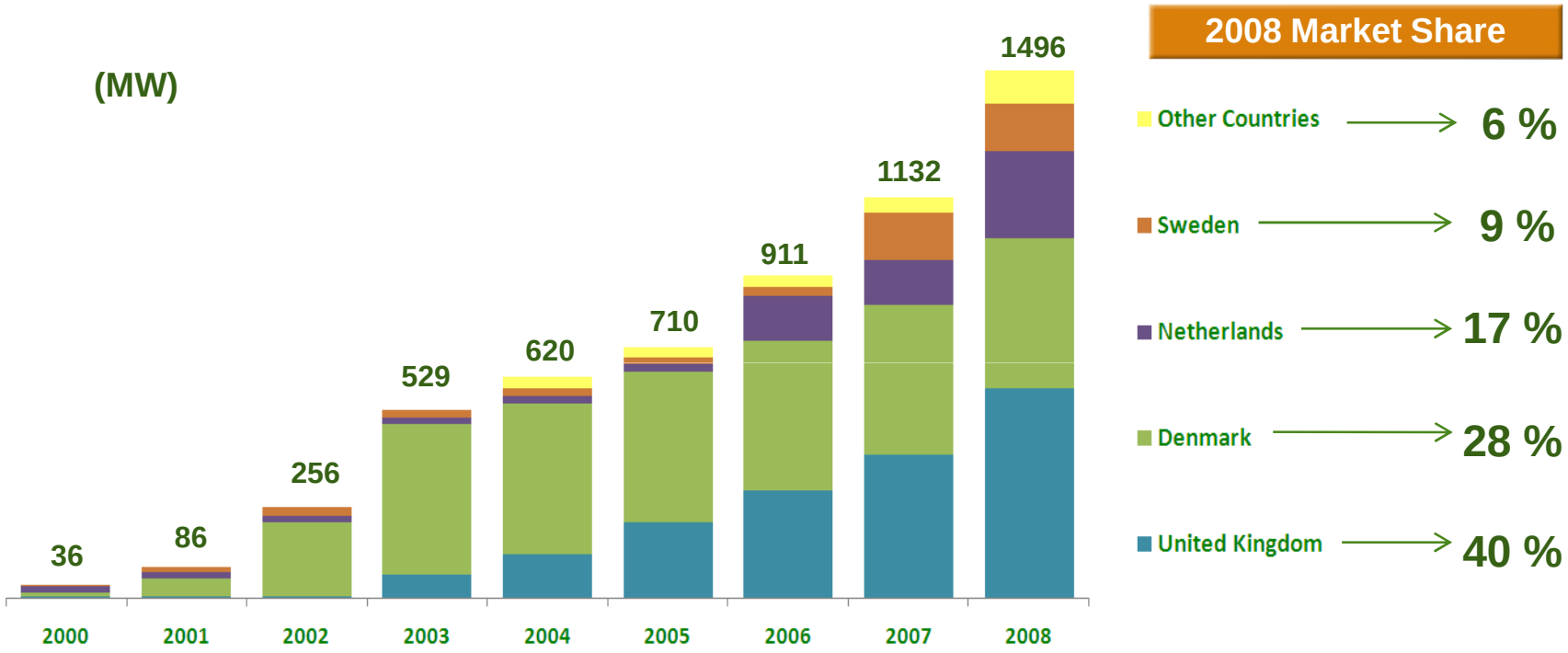
Issues to be addressed:

- ✓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 (*)



2008 Market Share

- Other Countries → 6 %
- Sweden → 9 %
- Netherlands → 17 %
- Denmark → 28 %
- United Kingdom → 40 %

- 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

Source: EWEA and Company Data

(*) As of 31st December 2008

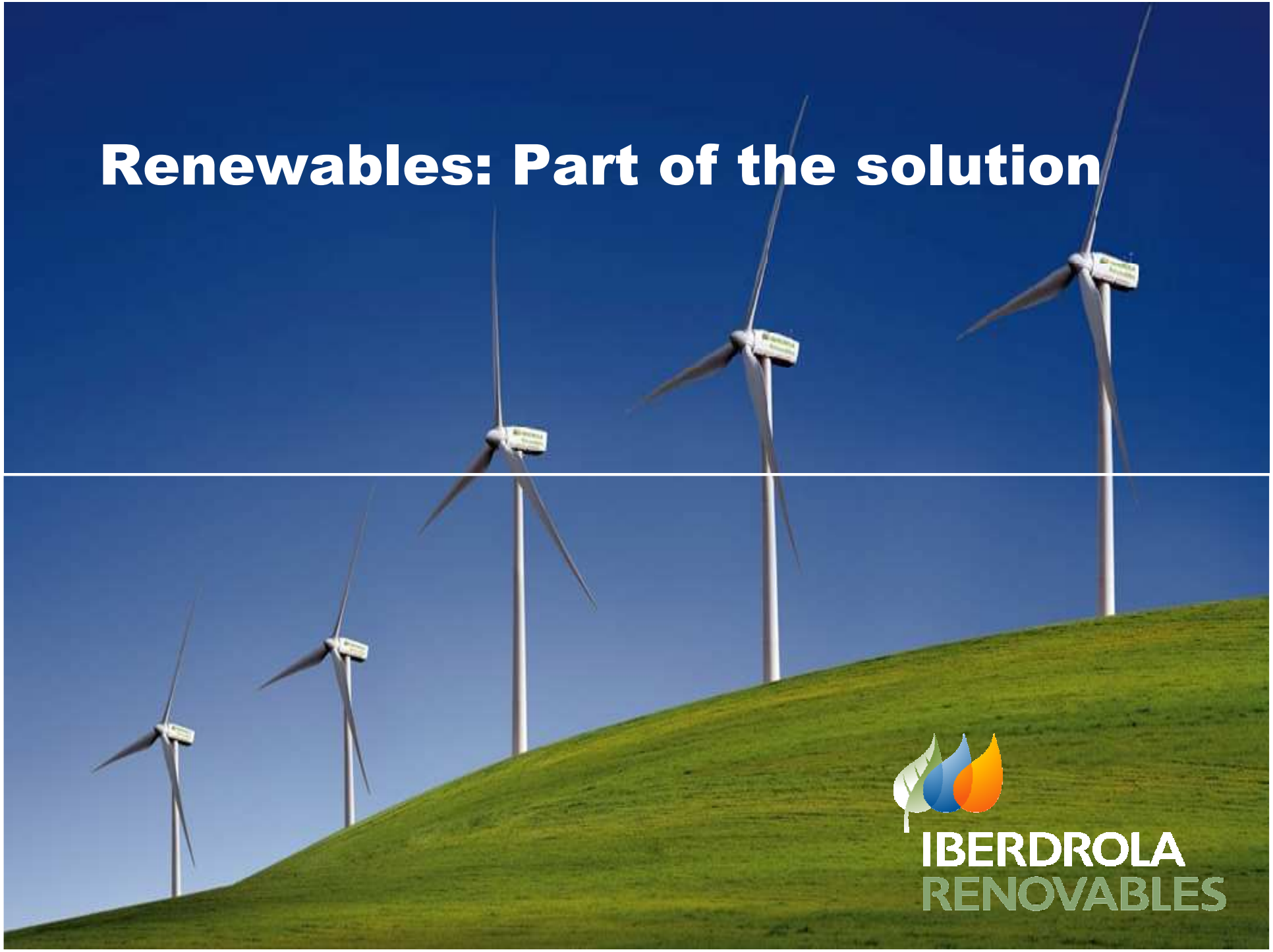
Challenges of off-shore wind

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



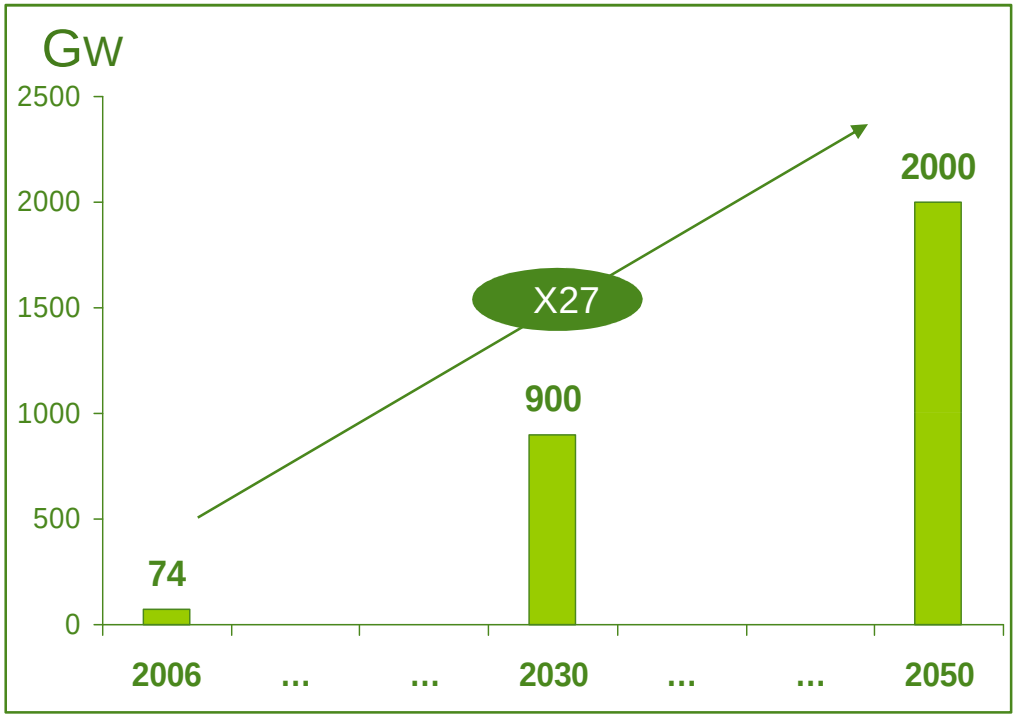
Anex

Wind energy is the leading renewable technology

Klondike wind farm, 400 MW en Oregon, USA

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

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

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

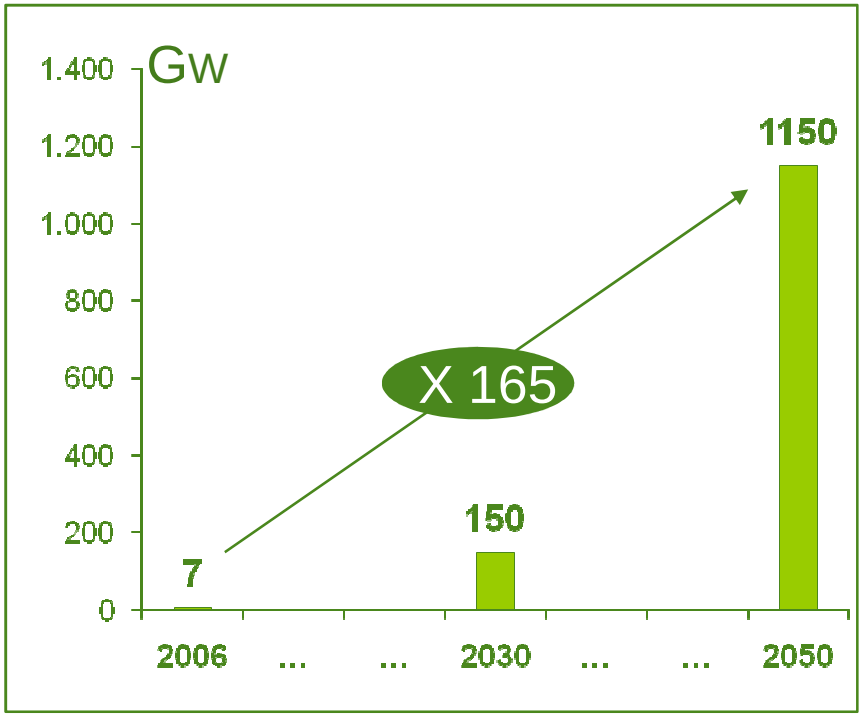
Key Factors

- 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



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

Market Situation

Geographic distribution

- Higher development in OCDE countries (due to the high investmentcosts)
- 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***

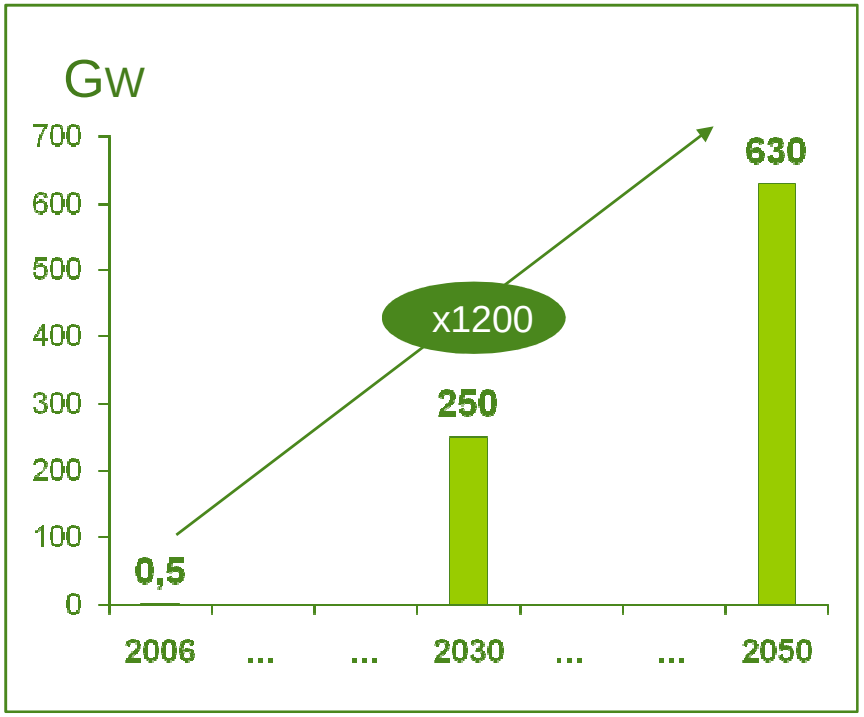
Key Factors

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

Solar CSP : needs to improve its competitive position

Solar CSP: taking off

Global growth



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

Market Situation

Geographic distribution

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

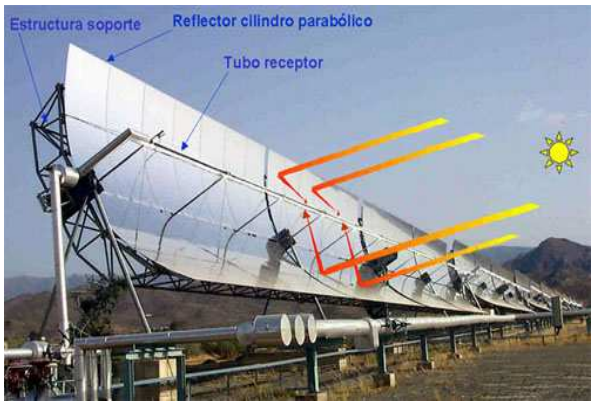
Investment volume

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

Position Spanish Industry ★ ★ ★ ★ ★ *4/5*

Key Factors

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

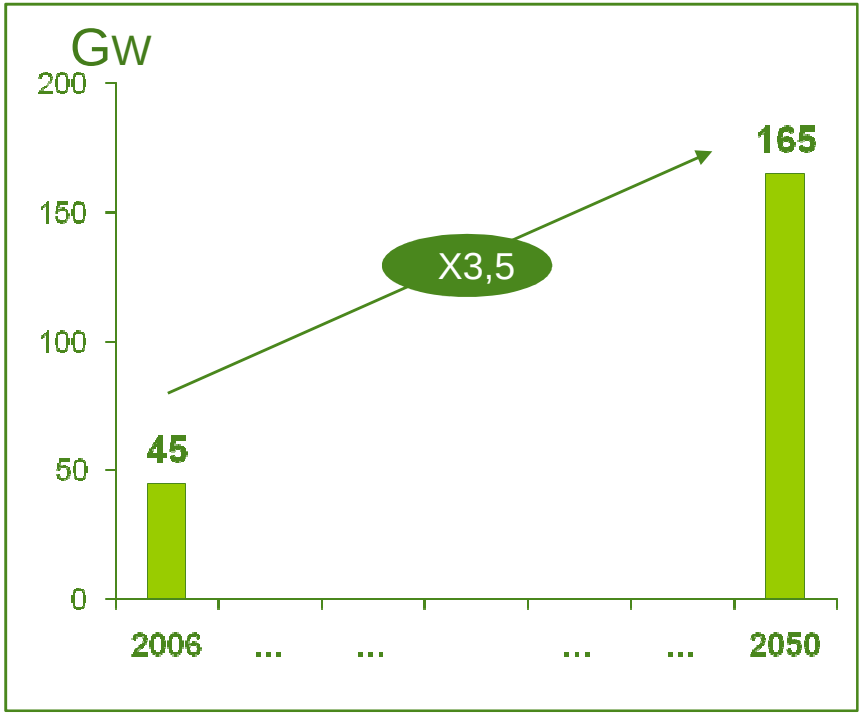


Biomass: supply of fuel, the key factor

Corduente ,3 MW, Guadalajara, Spain

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 involvemet of other sectors: environment, food and agriculture

Renewables: Part of the solution

Carlos Gascó, Prospective Regulatory Department, Head

ICREP annual meeting
Granada, 23 march 2010