Wind Turbine Markets – Trends and Challenges of the Next Years

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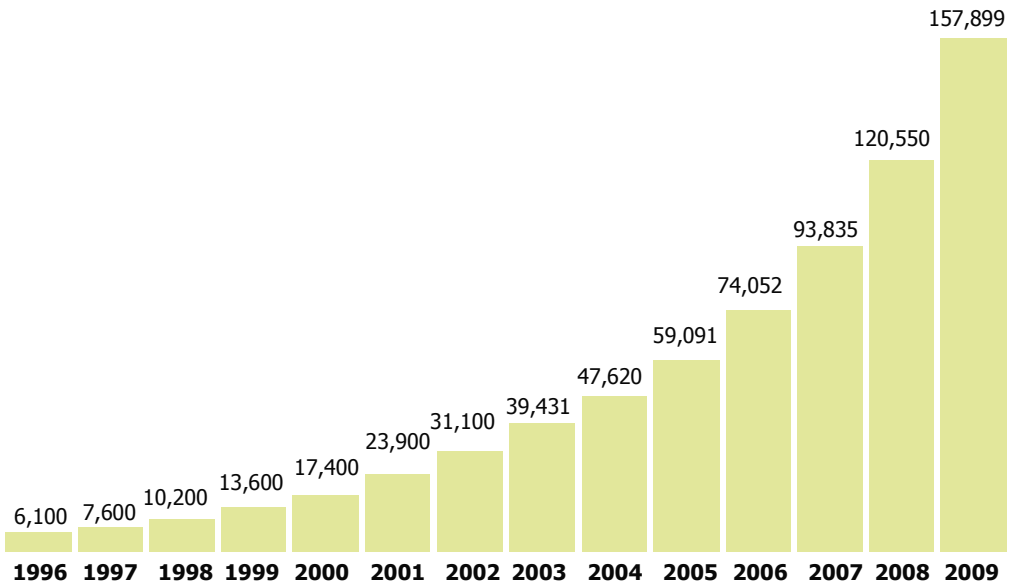
Gamesa

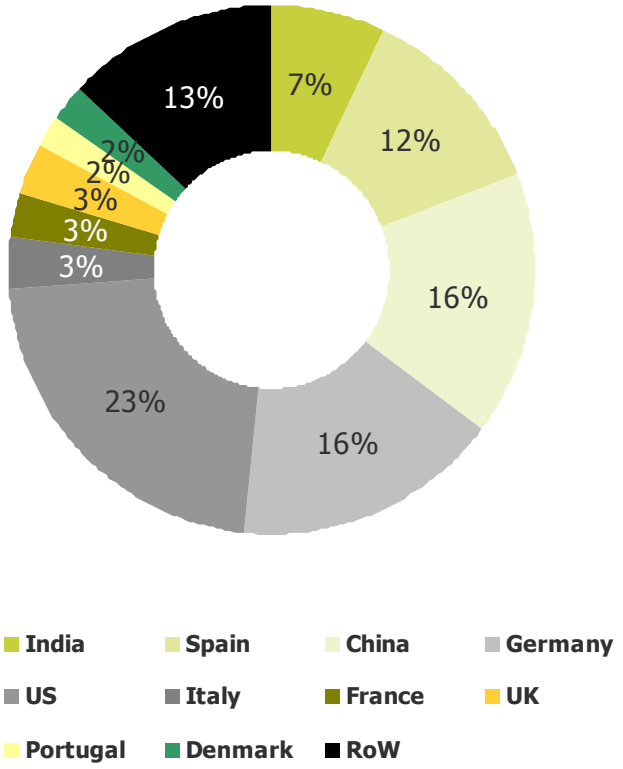
Mature technology in demand worldwide

Versus cliché "emerging energy"

Global installed wind power capacity

Cumulative MW





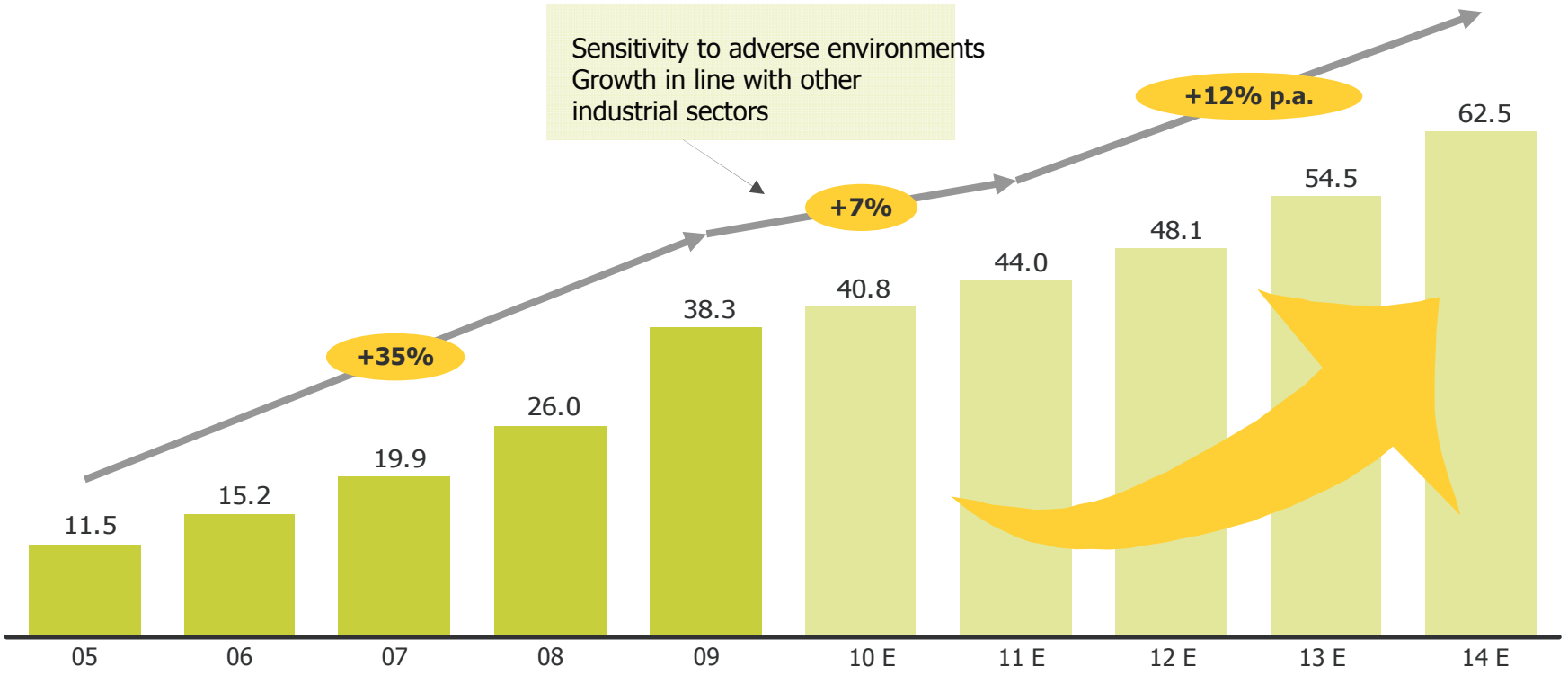
Source: GWEC

Gradual and predictable growth

Versus cliché "the wind power bubble"

Global installed wind turbines

GW



Source: GWEC

Drop in wind generation costs

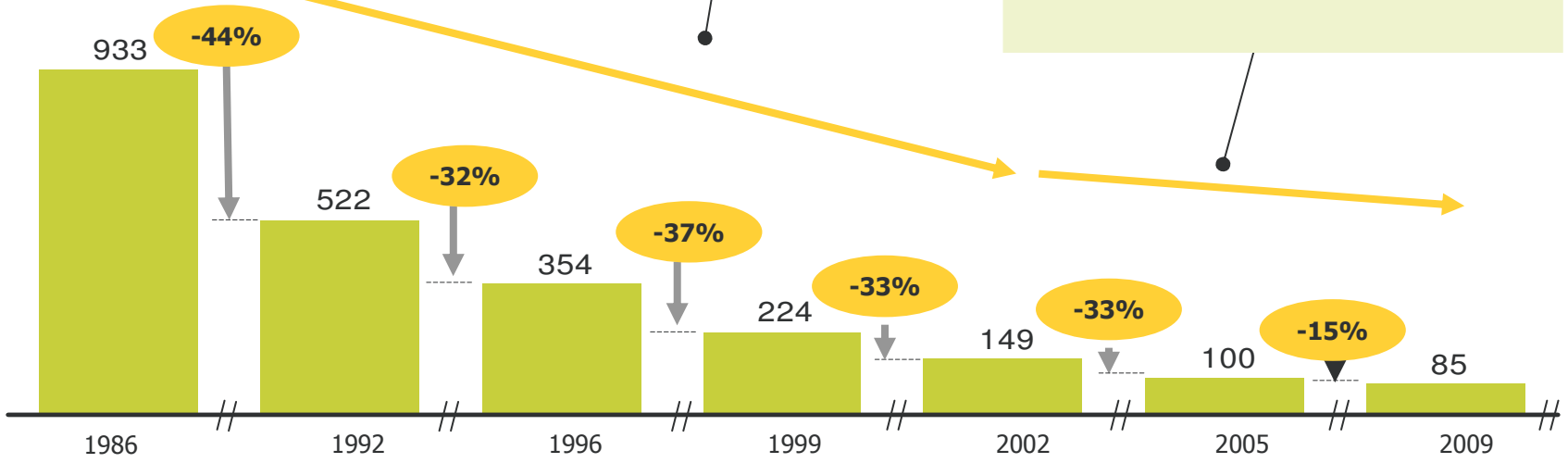
Learning curve in technological solutions

Wind power costs (per kWh) indexed to 2005 = 100

Economies of scale
Technological development

Less margin for error and introduction of improved methods
Technological development
Shortening product launch cycles

Narrowing increases in production costs and economies of scale
Downtrend in maintenance costs
Technological development of less importance. Operating and control strategies

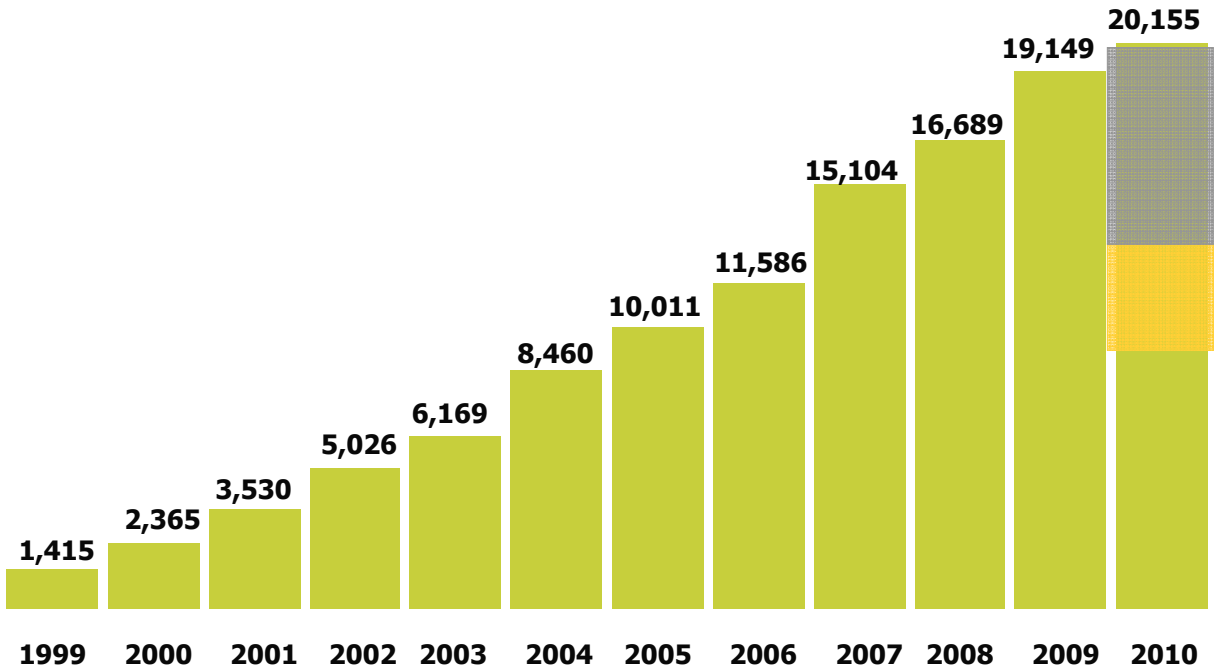


Source: NREL and BTM

Predictable and orderly expansion

Versus cliché "the wind power bubble"

Wind power, the only technology in Spain to meet all targets under the 2005-2010 Renewable Energy Plan



Source: AEE

2005-2010 Renewable Energy Plan: 20,155 MW

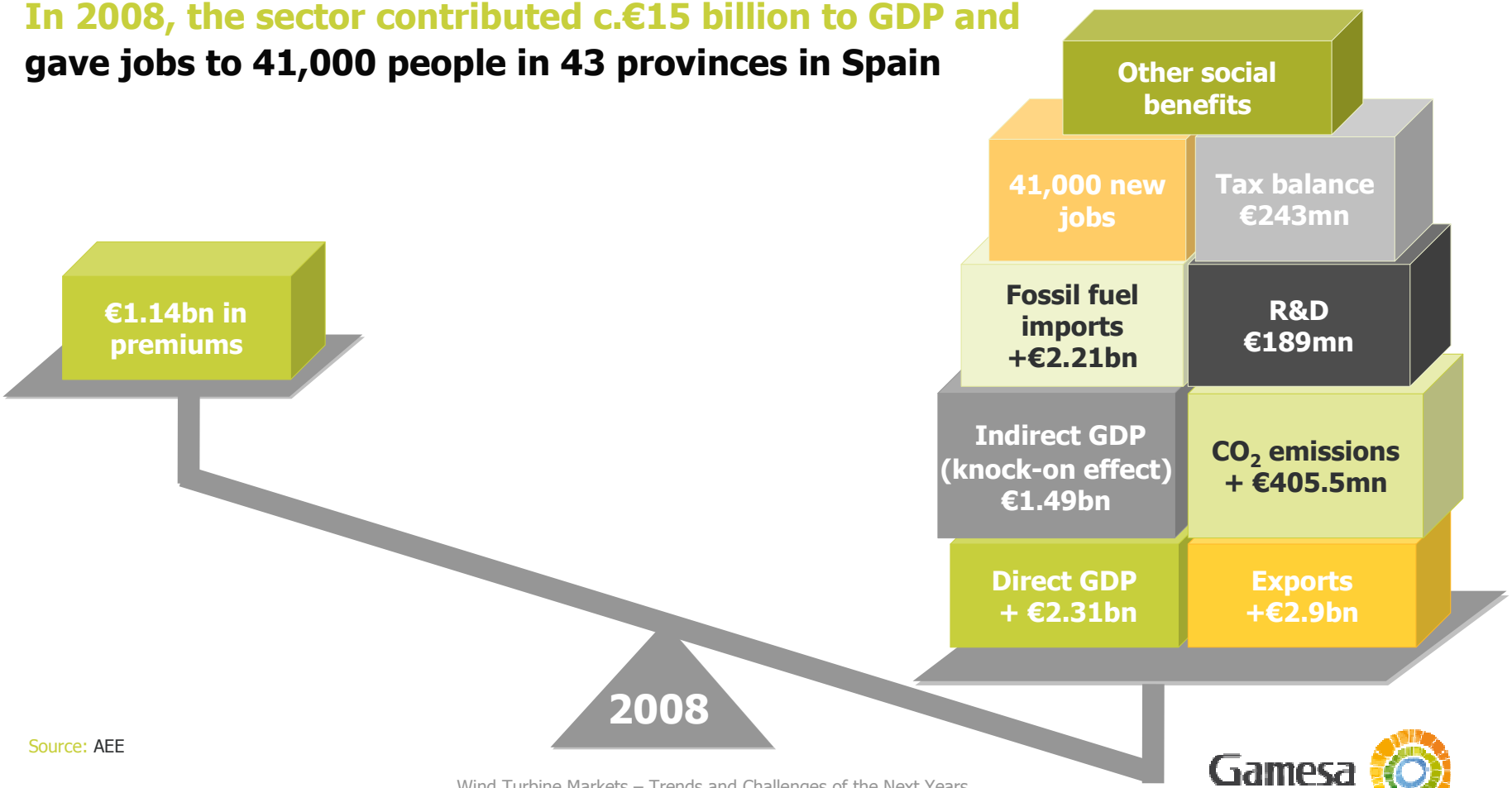
2002 Infrastructure Plan: 13,000 MW

1999 Renewable Energy Development Plan: 8,974 MW

Wind power and wealth generation

Versus cliché "generates excessive premiums"

In 2008, the sector contributed c.€15 billion to GDP and gave jobs to 41,000 people in 43 provinces in Spain



Source: AEE

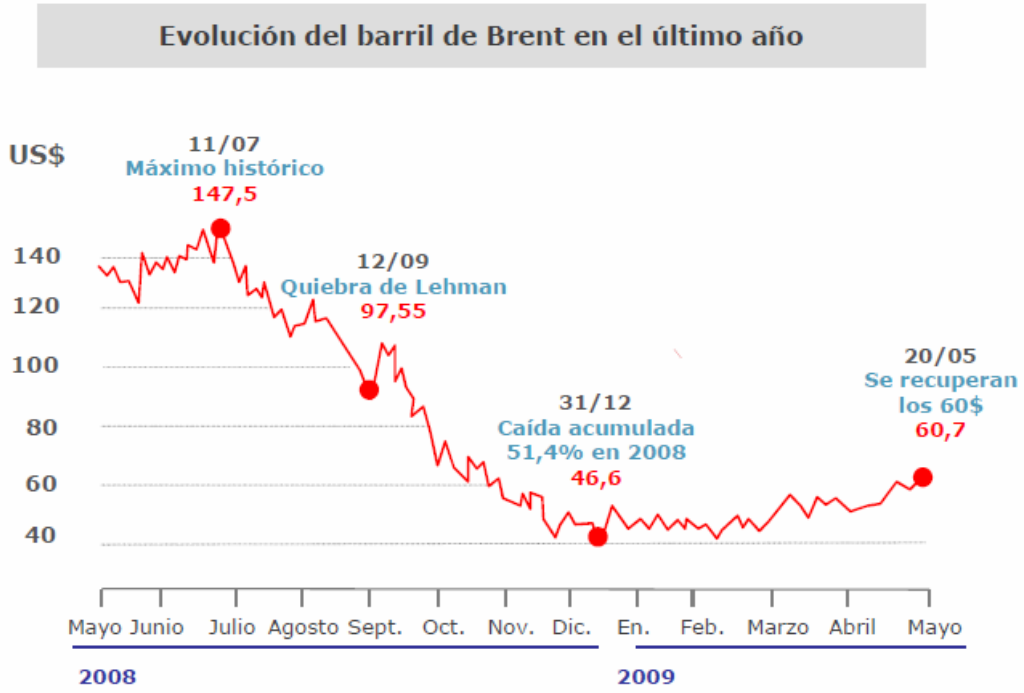
An answer to the strategic and environmental challenges

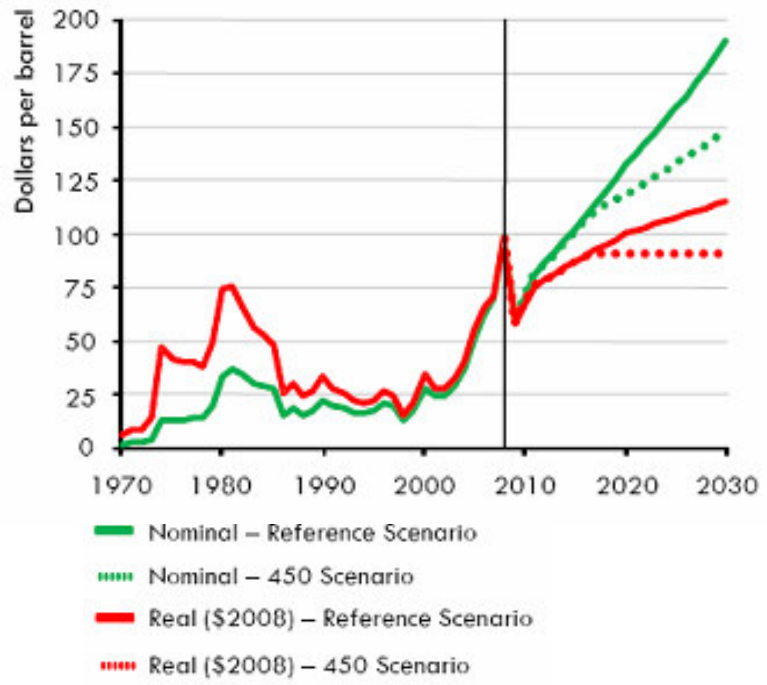
The current economic crisis is seasonal, but the energy crisis is structural and has two main themes:

- **Strategic**
  - **Spain has an 82% external energy dependence.** The European Union average is 50%
  - In coming years **energy demand and price volatility will rise** as India and China consumption emerge
- **Enironmental**
  - **Energy is the key factor of climate change.** Spain has to limit its CO2 emissions to +15% with reference to 1990. In 2008 emissions rose 42.7%

In this context, wind energy is a guarantee of competitiveness: it is an autonomous, emission-free source and the reference renewable technology

Economic certainty: fossil fuel high volatility





Fossil fuel prices are forecasted to strongly increase in the 2030 horizon, due to reserve exhaustion and a 40% increase in global energy demand (IEA)

When the economic crisis finishes, wind power will be a competitiveness factor

- The economic downturn interrupted the rise in energy prices, but the rise is actually resuming and the upward trend will be increased, due to the demand increase that will undergo emerging countries like China, India or Brazil

Energy demand per capita (toe)	1990	2007
USA	7,5	7,6
European Union	3,5	3,5
China	0,8	1,5
India	0,4	0,5

- Wind energy will play a key role as a guarantee of supply, contributing to increase energy, economic and political independence
- Fight against climate change will require a "decarbonization" of the energy system. To achieve it, energy efficiency and renewables will be essential, particularly wind energy

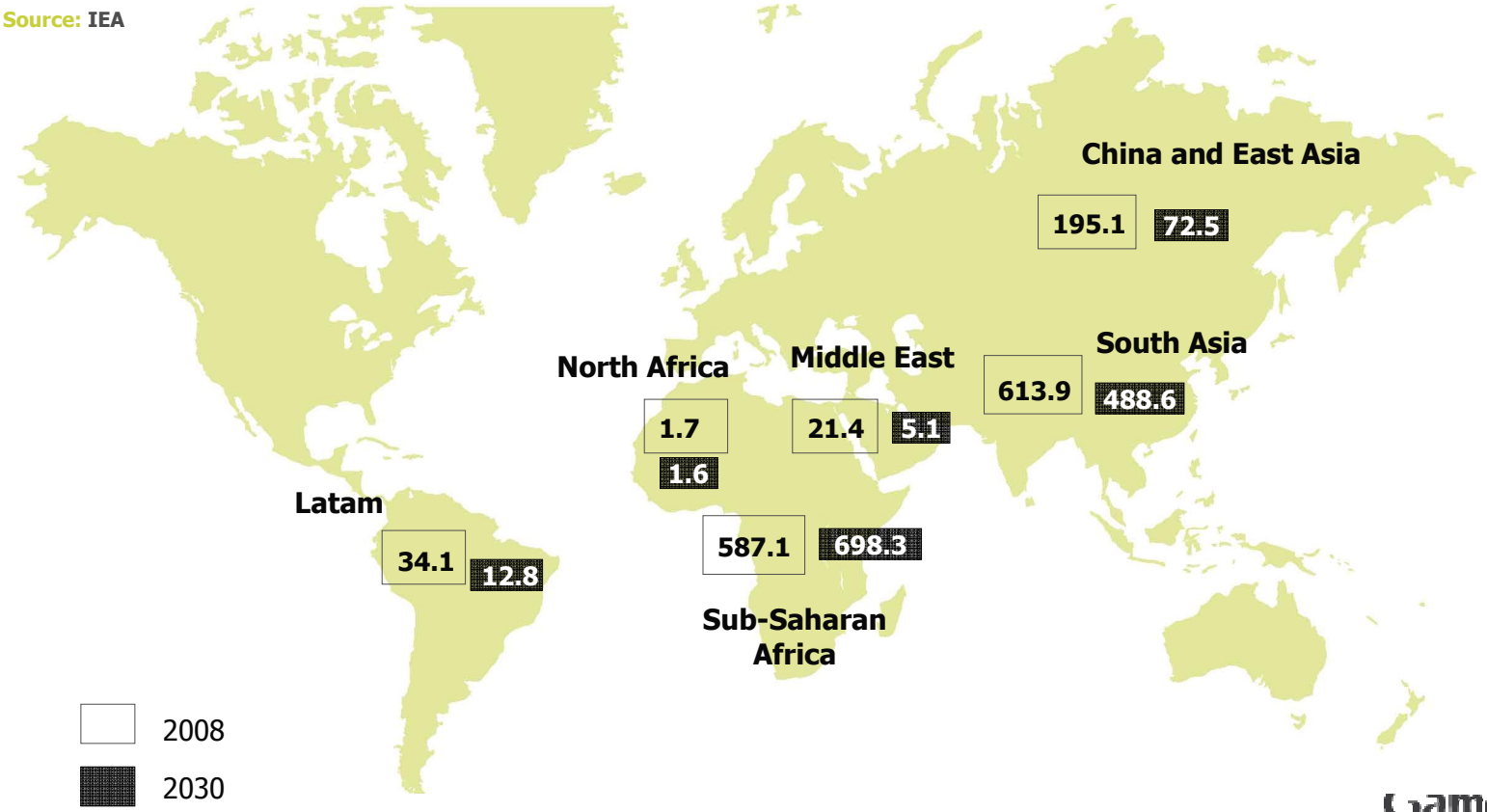
Growth in global demand

In emerging nations, mainly Asia

Population without access to electricity:

1.5bn in 2008 and an estimated 1.3bn in 2030

Source: IEA



Trends and challenges of the next years

Opportunities

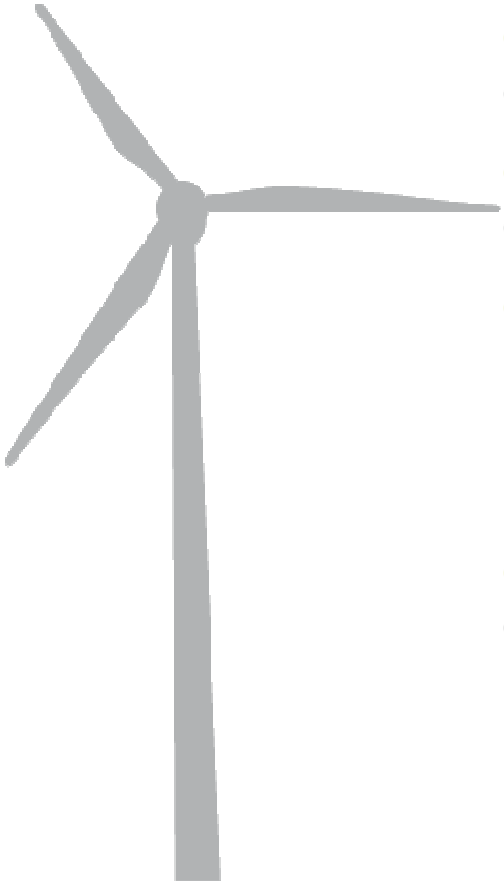
- Growing energy demand in emerging countries will produce a constant upward trend and volatility of energy prices: wind energy is a guarantee of competitiveness
- Energy independence: wind as a guarantee of supply, increasing energy, economic and political independence
- Renewable energy sources have long term support
- Fight against climate change: energy is the key factor and renewables will be essential, particularly wind energy
- Gradual improvement in wind power competitiveness

Threats

- Inadequate regulation
- Growing protectionism in the international markets

Reducing the Cost of Energy (CoE) to be more competitive

Wind vs conventional generation CoE



- Raising trend in wind power CoE due to both reduction in average capacity factor of new sites and increase of price of raw materials
- CoE from conventional generation grows proportional to the fossil fuels cost
- Wind power faces a dual challenge:
  - Being more competitive in terms of CoE than conventional generation
  - Supplying increasing energy demand meeting customers' needs in terms of time-to-market and quality
- Reducing CoE leads to continuous Total Cost or Ownership (TCO) optimization: higher revenues and lower costs
  - Technical improvements on the product
  - Performance enhancement
  - Sourcing an supply chain improvements

Contents

5 Immediate challenges

- Need for stable framework
- Shift in demand and industrial overcapacity
- New market requirements - customers
- Technology and innovation to reach full penetration
- Storage and pan-European interconnection solutions

Stable framework

Strategic and long-term planning, with balanced participation of all available technologies

Beyond premiums. Beyond ideologies

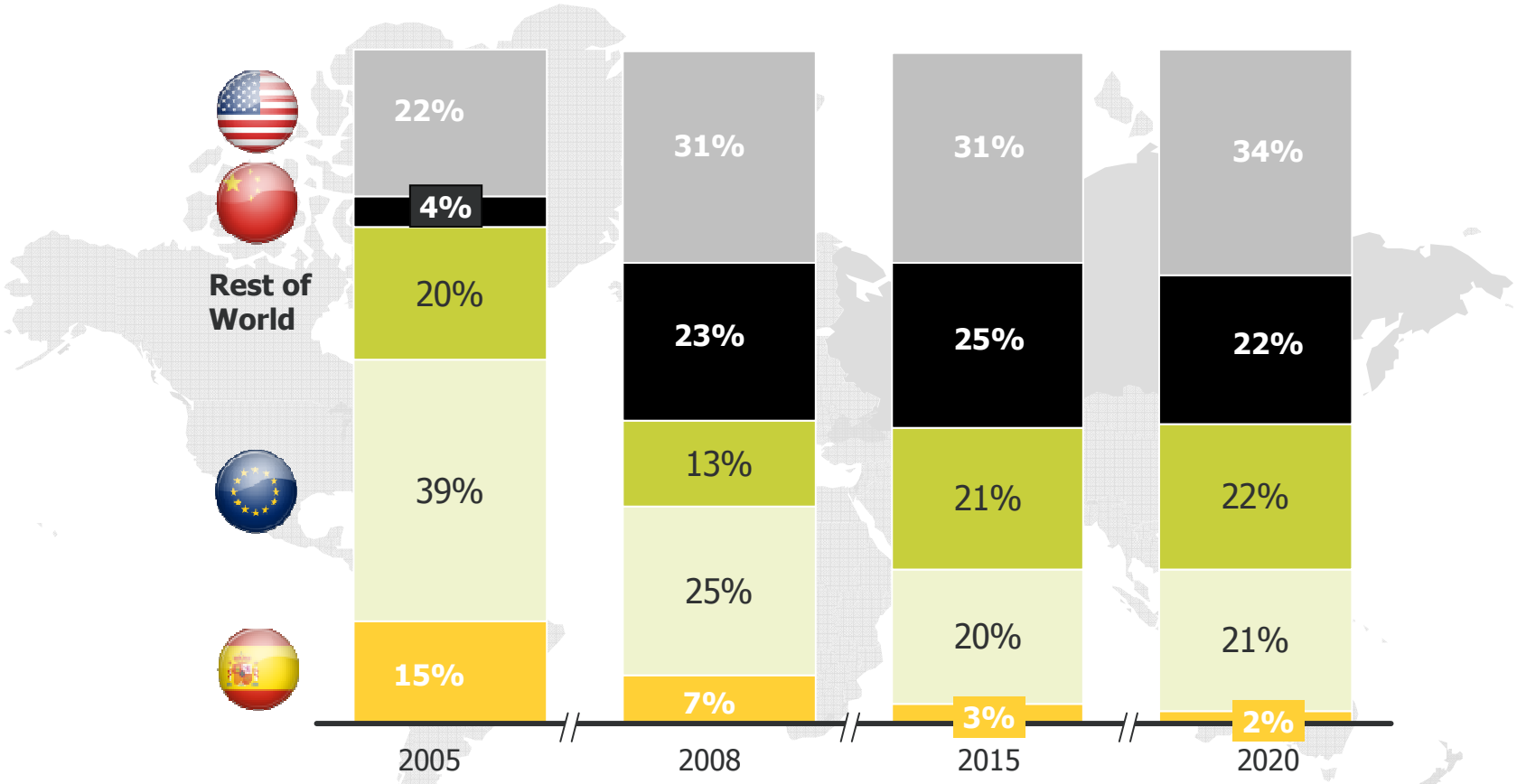
Diversification
Reduced vulnerability
Improved storage solutions

Ensure minimum cost
Boost economy's competitive positioning

Minimisation of environmental fallout
Response to society demands

Shift in demand

US, China and RoW, the growth markets



Source: BTM Consulting, Make, EER

The new wind power industry

New and more sophisticated demands, greater competition and pressure

The new wind power industry

Demand

- **Demand shifting to new geographies**
- **Technology and innovation, key competitive differentiators**
- **More sophisticated customers/demands**

Competition

- **Traditional players need to react swiftly to hold on to competitive advantages**
- **Advent of newcomers, particularly in the low cost segment/markets**

Regulation

- **Growing pressure on the support mechanisms designed to foster growth of renewable energy**

Wind energy technology evolution: bigger wind turbines

Increases competitiveness

Reduced visual impact

More production for projects with limited room to install. Optimisation of the most energetical sites

Lower noise levels

Adaptation to the most demanding grid codes (energy storage – smart grids – electric vehicles)

Offshore as a new technological development

Wind energy technology evolution

Bigger diameter and taller rotors

Rotor challenges

- o Aerodynamic efficiency
- o Noise
- o Transport weight and length
- o Installation

Nacelle challenges

- o Height
- o Length and width
- o Maximum weight for transport
- o Installation and cranes

Resistant structure challenges

- o Weight / Cost
- o Transport Length and width
- o Foundations

Gamesa answers to the technological challenge

Wind conditions

- Great R&D effort to understand the response of wind turbines in complex terrains
- Develop new measurements techniques for wind speed and wind turbine signals
- Use of computational fluid dynamics (CFD) in order to get more precise knowledge of the wind flux around the rotor blades
- Developing tools for wind farm lay-out optimization

Wind turbine technology

- Aerodynamics R&D: 3D effects, CFD, Blades design
- Mechanical R&D: New gearbox concepts, Towers, Power train
- WT design R&D: Development of the new G10X-4.5 MW wind turbine, Cenit´s Windlider program
- Electric/electronics R&D: Synchronous generators, Converters, New topologies
- Reliability and Maintenance R&D: Reliawind

Wind energy integration

- Wind power plant capabilities
- Grid planning and operation
- Energy and power management
- Energy markets

Conclusions

Wind power is here and has a brilliant future ahead of it as a driver of competitiveness:

- guaranteeing supply security and delivery of environmental targets at a price not subject to volatility

- contributing to raising energy, economic and political independence

Economic and social returns far in excess of premiums received

R&D, key to increase competitiveness and to respond in the most effective way to market demand

Gamesa, an innovative and global leader

"The nation that leads the clean energy economy will be the nation that leads the global economy"

Barack Obama
State of the Union address, January 27, 2010