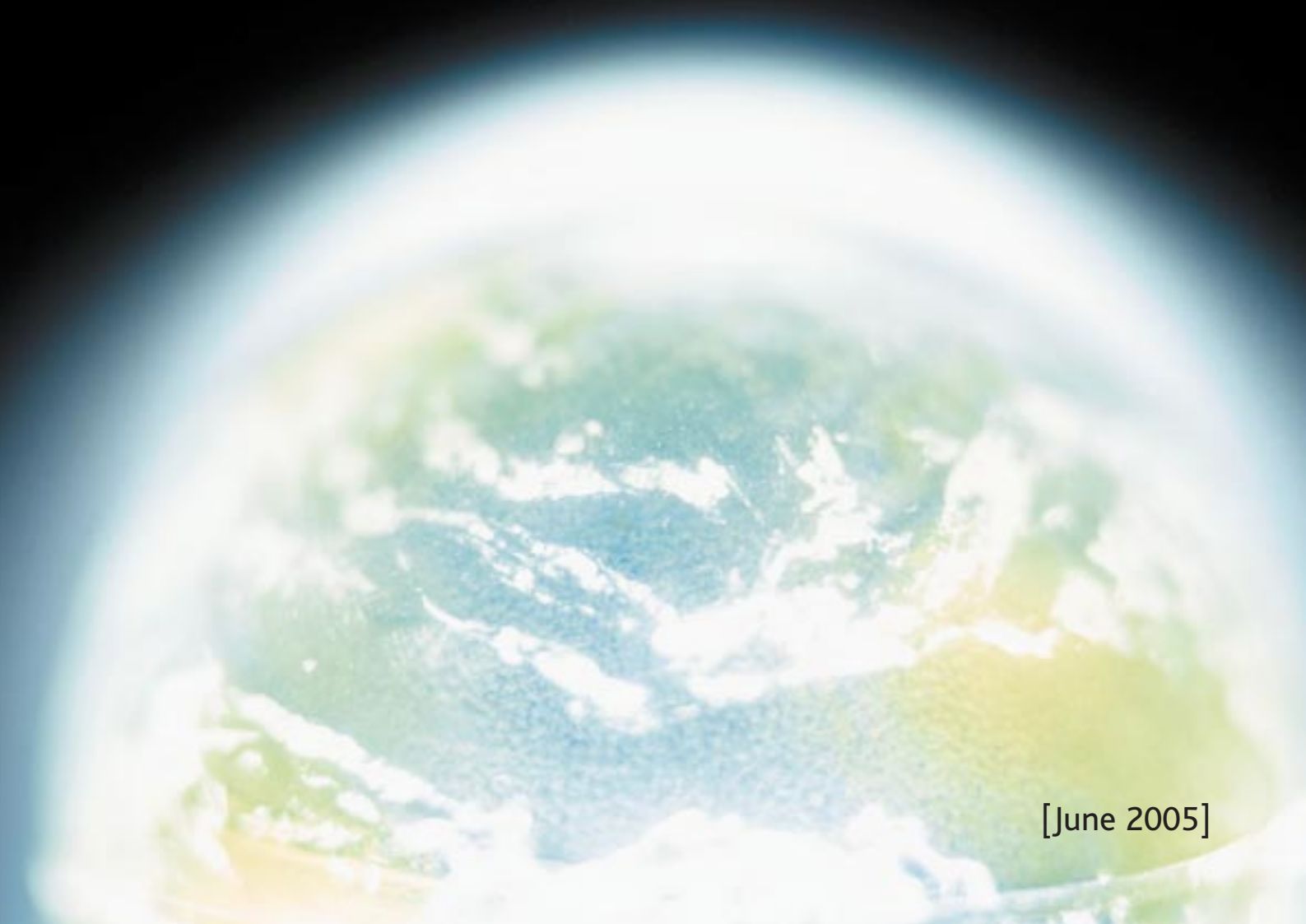


WIND FORCE 12

**A blueprint to achieve 12% of the world's electricity
from wind power by 2020**

[June 2005]



WIND FORCE 12 SUMMARY RESULTS IN 2020

Total MW installed	1,254,030
Annual MW installed	158,728
TWh generated to meet 12% global demand	3,054
Co ₂ reduction (annual million tonnes)	1,832
Co ₂ reduction (cumulative million tonnes)	10,771
Total investment per annum	€80 billion
Total job years	2.3 million
Installation costs in 2020	€512/kW
Electricity generation costs in 2020	€2.45cents/kWh



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OVERVIEW



Celle San Vito (FG), Puglia, Italy

"...THE IMPACTS OF GLOBAL WARMING ARE SUCH THAT I HAVE NO HESITATION IN DESCRIBING IT AS A "WEAPON OF MASS DESTRUCTION".

– Sir John Houghton,
the Guardian, 28th July 2003

GLOBAL SECURITY FROM WIND

The global energy challenge of our time is to tackle the threat of climate change, meet the rising demand for energy and to safeguard security of energy supplies. Wind energy is one of the most effective power technologies that is ready today for global deployment on a scale that can help tackle these problems. Wind power can be installed far quicker than conventional power stations. This is a significant factor in economies with rapid growth in electricity demand.

Wind energy is a significant and powerful resource. It is safe, clean, and abundant. Unlike conventional fuels, wind energy is a massive indigenous power source permanently available in virtually every nation in the world. It delivers the energy security benefits of avoided fuel costs, no long term fuel price risk, and wind power avoids the economic and supply risks that can with reliance on imported fuels and political dependence on other countries.

Wind Force 12 is a global industry blueprint which demonstrates that there are no technical, economic or resource barriers to supplying 12% of the world's electricity needs with wind power alone by 2020 - and this against the challenging backdrop of a projected two thirds increase of electricity demand by that date. By 2020, 1,250 GW of wind power can be installed.

The wind industry we have today is capable of becoming a dynamic, innovative € 80 billion annual business by 2020, helping to satisfy global energy demands and unlock a new era of economic growth, technological progress and environmental protection. The wind industry of today is one the world's fastest growing energy sectors and offers the best opportunity to begin the transition to a global economy based on sustainable energy.

POWERFUL PROGRESS

Wind energy has come a long way since the prototypes of just 25 years ago. Two decades of technological progress have resulted in today's wind turbines being state-of-the-art modern technology - modular and rapid to install. A single wind turbine can produce 200 times more power than its equivalent two decades ago.

In 2004 more than 8,000 Megawatts of wind power was installed worldwide, the turbine machinery alone worth about at €8 billion and generating enough electricity to power the equivalent of 19 million average European homes. The wind power sector includes some of the world's largest energy companies.

Unlike other 'solutions' to clean energy and climate protection, wind power does not need to be invented, nor is there need to wait for any magical 'breakthrough'; it is ready for global implementation now. Modern wind farms are already being built that provide bulk power equivalent to conventional power stations. In the future, this blueprint will see the boundaries of technological progress pushed further to bring far greater benefits.

"DELAYING ACTION FOR A DECADE,
OR EVEN JUST YEARS,
IS NOT A SERIOUS OPTION"

Sir David King
Science, 9th January 2004

POISED FOR GLOBAL DEPLOYMENT – OPENING NEW MARKETS

As outlined in the opening chapters of this report, the success of the industry to date has been largely created by the efforts of a handful of countries, led by Germany, Spain and Denmark. It is obvious that if other countries matched their efforts, the impact would be far reaching. However new market players such as the USA, which could be one of the biggest wind energy markets in 2005; and China, have put themselves on the global map of the wind industry.

The fact that just three countries have created the bulk of the progress to date underlines the fact that today's technology is merely the tip of the iceberg, and a huge potential remains untapped. Wind power is capable of continuing its successful history over the next two decades if positive political and regulatory frameworks are implemented, removing the obstacles and market distortions that currently constrain the industry's real potential.

The 2005 report highlights 13 key countries around the world that can play a leadership role to help unlock the major market deployment envisaged in the report. These markets are at an early but developing stage, and provide an insight into where this blueprint may be realized. These countries are Australia, Brazil, Canada, China, France, India, Italy, Japan, the Philippines, Poland, Turkey, the UK, and the USA. Offshore wind energy is included as it represents a significant international resource.

"MINISTERS AND GOVERNMENT REPRESENTATIVES REAFFIRM THEIR COMMITMENT TO SUBSTANTIALLY INCREASE WITH A SENSE OF URGENCY THE GLOBAL SHARE OF RENEWABLE ENERGY IN THE TOTAL ENERGY SUPPLY. THEY SHARE THE VISION THAT RENEWABLE ENERGIES, COMBINES WITH INCREASED ENERGY EFFICIENCY, WILL BECOME A MOST IMPORTANT AND WIDELY AVAILABLE SOURCE OF ENERGY AND WILL OFFER NEW OPPORTUNITES FOR CO-OPERATION AMONG ALL"

154 Ministers and Government representatives, International Conference for Renewable Energies Declaration, Bonn, Germany, June 2004

RISING POWER DEMAND

With no intervention, the IEA estimates that, under current trends the world's electricity demand could double from 2002 to 2030, accounting for 60% of new investment in energy supply by then. The global power sector requires 4,800GW - 2,000GW of this in the OECD - of new capacity to meet increasing demand and replacing aging infrastructure, at a cost of €10,000 billion in power generation, transmission and distribution. By 2030, the power sector could account for 45% of global carbon emissions. The investment choices made now will determine the level of emissions of carbon dioxide for many decades. Wind Force 12 shows that alternative paths are possible and that global installation of wind power by 2030 can reach 2,700GW.

CLIMATE CHANGE

The UK Government has prioritised climate change for their G8 and EU Presidencies this year. Both the International Climate Change Task Force convened by Tony Blair, and the European Council have confirmed that responsible climate policy means aiming to keep global mean temperature rise below 2°C. To do that requires urgent action to achieve deep cuts in emissions beyond the Kyoto Protocol's initial round for the period 2008-2012.

In January, the report 'Meeting the climate challenge' - Recommendations of the International Climate Change Task Force concurred with several of the Wind Force 12 policy recommendations;

"a long term objective be established to prevent global average temperature from rising more than 2°C above the pre-industrial level"

"G8 Governments establish national renewable portfolio standards to generate at least 25% of electricity from renewable energy sources by 2025, with higher targets needed for some G8 Governments"

"Governments remove barriers to and increase investment in renewable energy and energy efficient technologies and practice such measures as the phase-out of fossil fuel subsidies"

The key role of renewable energies like wind power in tackling climate change is acknowledged. The European Commission report Action on Climate Change post 2012 published in February this year stated that *"Renewable energies will have to play a much larger role in the future"*. The 2004 European Environment Agency (EEA) assessment on greenhouse gas emission trends in Europe concluded that *"the promotion of renewable energy has the greatest impact on emissions in most EU Member States for both implemented and planned policies"*.

Currently wind power installed in Europe today is already saving over 50 million tonnes of CO₂ every year. In terms of carbon delivery, wind energy is outperforming many other proposed solutions. The European Wind Energy Association's business-as-usual target for 2010 of 75GW, a doubling of installed capacity in 6 years, would deliver one third of the EU's Kyoto commitment.

Greenpeace's calculations show that to keep open the option of remaining below 2° C global temperature rise means cuts in industrialised country emissions of at least 30% by 2020. But while that might seem difficult, it pales in comparison with the task of both convincing and enabling the booming economies in China and India to take the urgent and necessary steps to decarbonise their economies to the point where they can talk about absolute emissions caps and, eventually, reductions - and to do this without sacrificing the economic growth and development their populations rightly demand.

One part of both convincing and enabling these countries to participate in the task of saving the climate will be to establish financial and technology transfer mechanisms which will allow the inevitably massive investment in their energy sectors to be primarily in renewable energies. Wind energy can and should play a major role in that.

GLOBAL FORCE

As a power technology which can cut carbon, help to meet growing electricity demand, and provide energy security, wind energy is a leading candidate. Wind power is one of the few energy supply technologies that have the maturity, clout and global muscle to deliver deep cuts in CO₂, while providing a hedge against fluctuating fossil fuel prices and reducing energy import dependence.

Wind Force 12 is a practical blueprint for action that governments can implement, and shows what is possible with just one renewable technology. The message from this report is clear. Wind power is world scale; it has the capacity to satisfy the energy and development needs of the world without destroying it; and it will play a key role in our future sustainable energy supply.



[Corin Millais]

Chief Executive,
European Wind Energy Association
Executive Council Representative, GWEC



[Sven Teske]

Renewables Director,
Greenpeace International

"CLIMATE CHANGE TOUCHES ON ALL ASPECTS OF OUR SOCIETY. IT IS A THREAT NOT ONLY TO THE ENVIRONMENT, BUT ALSO TO OUR ECONOMIES, AND, IN THE END OUR SECURITY"

Stavros Dimas, Environment
Commissioner, 18th April 2005, Speech
'Meeting the climate challenge'
Brookings Institute, Washington DC

THE GLOBAL MARKET STATUS OF WIND POWER

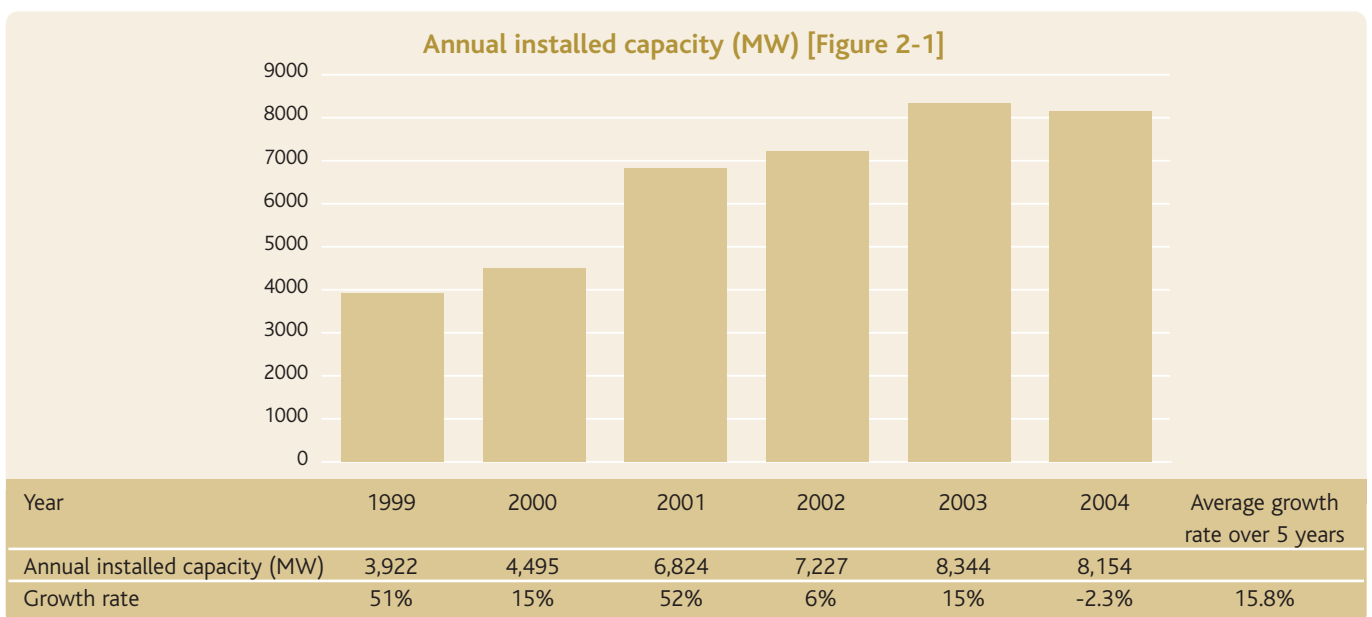


Wind turbines in Denmark

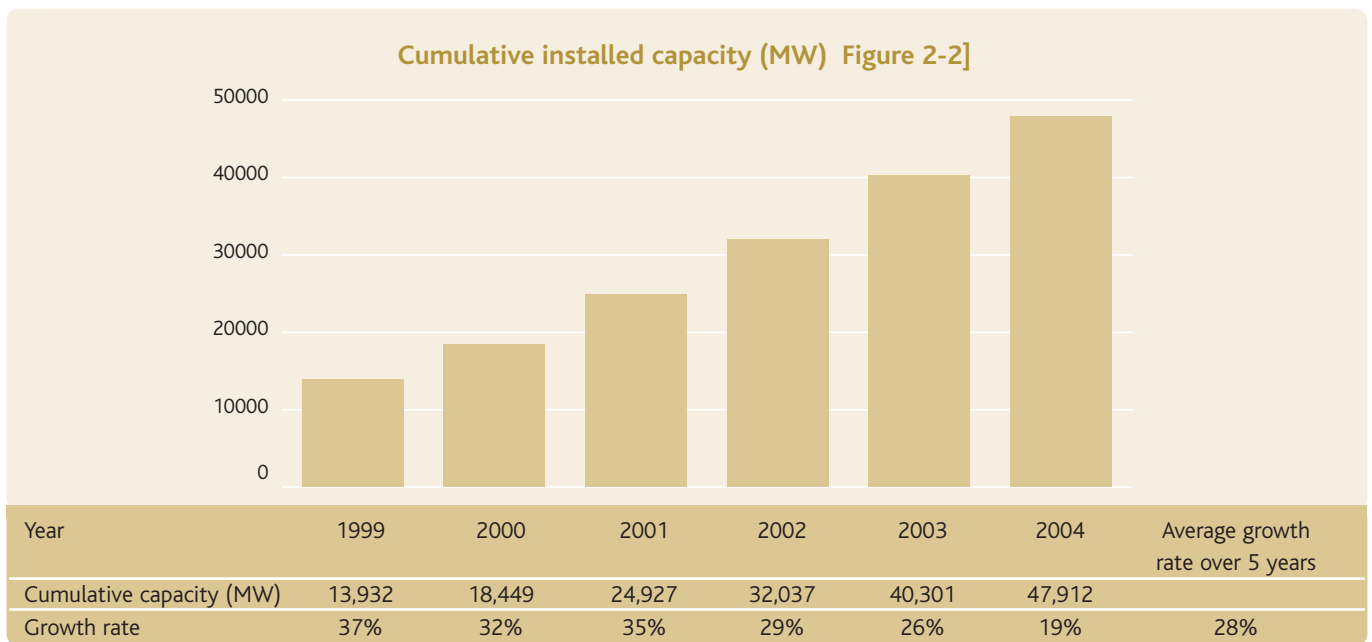
Over the past five years, global wind power capacity has continued to grow at an average cumulative rate of 28% (Figure 2-2). The increase in the rate of annual installation has been an average of 15.8% (Figure 2-1). During 2004 alone, more than 8,000 MW of new capacity was added to the electricity grid worldwide, representing a turbine business sector worth approximately €8 billion.

By the end of 2004, the capacity of wind energy installed globally had reached a level of almost 48,000 MW. Europe accounts for 72% of the total installed capacity and for 73% of the annual market growth during 2004. But other regions are beginning to emerge as substantial markets for the wind industry. Over 50 countries around the world now contribute to the global total, and the number of people employed by the industry worldwide is estimated to be 90-100,000, with 70-80,000 of these in Europe.

GROWTH IN WORLD WIND POWER MARKET 1999-2004



Cumulative installed capacity (MW) Figure 2-2]



WORLDWIDE MARKETS

Within Europe, Spain became the new market leader, with 2,064 MW of capacity installed during 2004. This was closely followed by Germany, with 2,054 MW. Germany still has by far the largest cumulative capacity both in Europe and globally, with a total of 16,649 MW by the end of the year.

Four other members of the European Union – Austria (192 MW), Italy (357 MW), the Netherlands (199 MW), Portugal (274 MW), and the UK (253 MW) saw impressive additions to their capacity during 2004. This means that three EU member states have either moved through or are close to the 1,000 MW cumulative total. These are Italy, with 1,261 MW, the Netherlands with 1,081 MW and the UK with 889 MW.

In the leading countries, Denmark meets 19% of its national electricity demand from wind power, in Spain the figure is 6% and in Germany it is 5%.

In the Americas, the United States market experienced a slowdown during 2004, which resulted in a reduction of the global growth rate, mainly as a result of the failure of Congress to renew the Production Tax Credit (PTC) incentive in good time. Total US capacity has now reached 6,750 MW. Canada, with one of the largest wind resources in the world, is looking increasingly promising as a market. A total of 444 MW had been reached by the end of 2004, and many large projects are progressing fast.

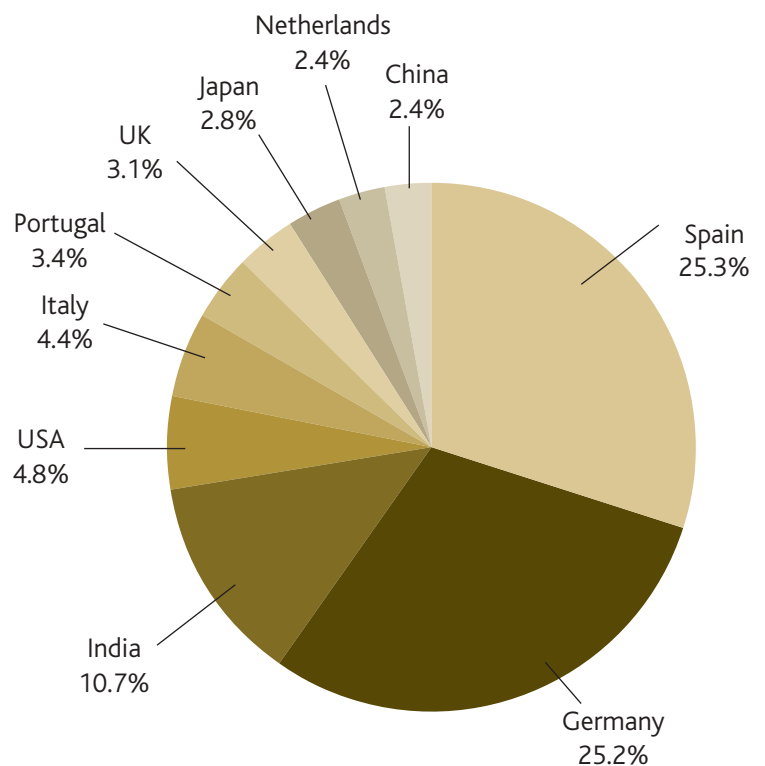
New markets are also opening up in other continents. Australia almost doubled its capacity in 2004 to reach 421 MW, with a large number of projects in the pipeline. In Asia, the Indian market has revived strongly after a quiet period in the late 1990s. During 2004, almost 900 MW was installed, the third largest country market, taking the total up to 3,000 MW. Japan also registered an improved performance in 2004, reaching a total of 991 MW, whilst China moved up to 769 MW.

In Africa, both Egypt and Morocco have shown what is possible with national planning and the backing of European developers. Morocco already gets 2% of its electricity from a 50 MW wind farm and tenders exist for another 200 MW, Egypt is continuing to develop sites along the Red Sea coast with the support of German, Japanese and Danish aid agencies.

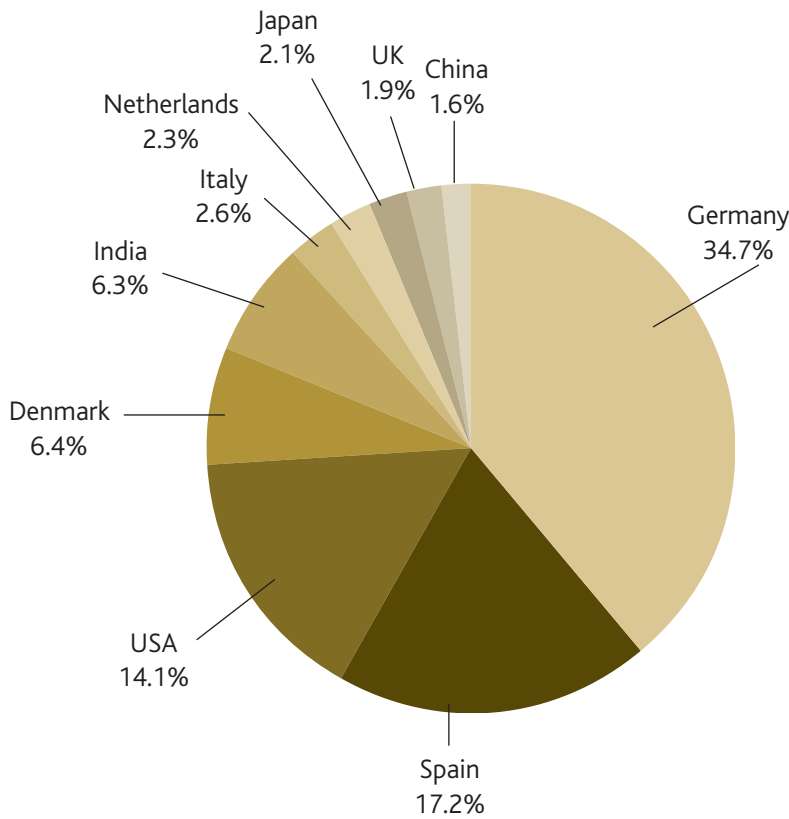
However the current global wind power market today is limited to a tiny handful of countries. Over 50% of the global market in 2004 was created in only 3 countries – Germany, Spain and India, with the first two counting for 40%. 66% of the entire wind energy installed in the world the world is located in only 3 countries - Germany, Spain and the USA.

TOP TEN WIND POWER MARKETS 2004: ANNUAL MW INSTALLED

Country	Installed capacity in 2004 (MW)
Spain	2,064
Germany	2,054
India	875
USA	389
Italy	357
Portugal	274
UK	253
Japan	230
Netherlands	199
China	198
Total	6,893



TOP TEN WIND POWER MARKETS 2004: CUMULATIVE MW INSTALLED



Country	Total capacity End 2004 (MW)
Germany	16,649
Spain	8,263
USA	6,750
Denmark	3,083
India	3,000
Italy	1,261
Netherlands	1,081
Japan	991
UK	889
China	769
Total	42,735

CUMULATIVE INSTALLATION (MW) IN THE TOP TEN WIND POWER MARKETS

Country	Cumulative installed end 2001	Cumulative installed end 2002	Cumulative installed end 2003	Cumulative installed end 2004	Growth rate 2003-2004 %	3 years average %
Germany	8,734	11,968	14,612	16,649	13.9%	24.0%
Spain	3,550	5,043	6,420	8,263	28.7%	32.5%
USA	4,245	4,674	6,361	6,750	6.1%	16.7%
Denmark	2,456	2,880	3,076	3,083	0.2%	7.9%
India	1,456	1,702	2,125	3,000	41.2%	27.3%
Italy	700	806	922	1,261	36.7%	21.7%
Netherlands	523	727	938	1,081	15.3%	27.4%
Japan	357	486	761	991	30.2%	40.5%
UK	525	570	759	889	17.1%	19.2%
P.R. China	406	473	571	769	34.7%	23.7%
Total "ten"	22,952	29,329	36,545	42,735	16.9%	23.0%

Source BTM Consult

THE GLOBAL BENEFITS OF WIND POWER

- Reduces climate change and other environmental pollution
- Creates employment, regional growth and innovation
- Diversifies energy supply, eliminates imported fuels
- Provides energy security and prevention of conflict over natural resources
- Reduces poverty through improved energy access
- Provides a hedge against the price volatility of fossil fuels
- Fuel source is free, abundant and inexhaustible
- Global wind resource is bigger than global power demand
- Delivers utility-scale power supply
- Modular and rapid to install

WIND POWER AND ENERGY POLICY REFORM



Turkey

At a time when governments around the world are in the process of liberalising their electricity markets, wind power's increasing competitiveness should lead to higher demand for wind turbines. Without political support, however, wind power remains at a competitive disadvantage, because of distortions in the world's electricity markets created by decades of massive financial, political and structural support to conventional technologies.

"WE NEED TO MAKE SUSTAINABLE ENERGY A RATIONAL ECONOMIC CHOICE FOR INVESTORS ACROSS THE GLOBE. THIS WILL BE A CENTRAL FOCUS OF THE UK'S PRESIDENCY OF BOTH THE G8 AND THE EU IN 2005."
Margaret Beckett, UK Environment Secretary, Refocus, 5th January 2005

The following is a summary of the current political frameworks for wind power and barriers that must be overcome in order to unlock wind power's great potential to become a major contributor to global energy supply in the future.

New wind power stations have to compete with old nuclear and fossil fuel power stations that produce electricity at marginal costs, because interest and depreciation on the investments have already been paid for by consumers and taxpayers.

More than 25 years of wind power experience in Europe shows that successful frameworks for the development and deployment of wind energy must include the appropriate measures in each of these five vital areas:

- Legally binding targets for Renewable Energy
- Well designed payment mechanism
- Grid access and strategic development of the grids
- Good governance and appropriate administrative procedures
- Public acceptance and support

1. LEGALLY BINDING TARGETS FOR RENEWABLE ENERGY

In recent years an increasing number of countries have established targets for renewable energy, as part of their greenhouse gas reduction policies. These are either expressed as specific amounts of installed capacity or as a percentage of energy consumption. The most ambitious target has been set by the European Union. In 2001, the European Council and the European Parliament adopted a Renewable Energy Directive establishing national targets for each member

"IN THE CONTEXT OF THE LISBON STRATEGY, THE KOK REPORT STRESSES THAT THE EU CAN GAIN A FIRST MOVER ADVANTAGE AND CAN CREATE A COMPETITIVE EDGE BY FOCUSING ON RESOURCE-EFFICIENT CLIMATE FRIENDLY TECHNOLOGIES THAT OTHER COUNTRIES WILL NEED TO ADOPT"

'Winning the battle against climate change', European Commission, 9th February 2005



Italy

country. Although these targets are indicative, they have served as a very important catalyst in initiating political initiatives throughout Europe to increase renewable energy's share of electricity supply. The Directive aims to double renewables' share of the energy mix from 6% to 12% by 2010, equal to 21% of EU electricity consumption. The next step forward from the Directive is that the Commission should submit proposals to the European Parliament and Council for mandatory renewables energy targets. Furthermore, targets should be set for 2020 and the adoption of a legally binding target to achieve a minimum 20% renewable energy by 2020 in the EU25 should be set. A time-horizon of six years is not long in an electricity sector where the investment horizon is up to 40 years.

Setting targets serve as a very important catalyst for governments to take action and develop the necessary regulatory frameworks to expand renewables such as financial frameworks, grid access regulation, planning and administrative procedures. However, targets have little value if they are not accompanied by policies which compensate for historical and present distortions in electricity markets, eliminate market barriers and create an environment which attracts investment capital.

2. SPECIFIC POLICY MECHANISMS

A clear market for wind generated power must be defined in order for a project developer to enter. As with any other investment, the lower the risk to the investor, the lower the costs of supplying the product. The most important measures for establishing new wind power markets are therefore those where the market for generated power is clearly defined in national laws, which include provisions for stable, long term fiscal measures which minimise investor risk and ensure an adequate return on investment.

The main purpose of the wide range of available economic measures to encourage renewable energy technology investments is to provide incentives for technological improvements and cost reductions of environmental technologies. That will ensure that we will have competitive, clean technologies available in the future as a competitive alternative to conventional, polluting power sources. Markets need to be strong, stable and reliable, with a clear commitment to long-term expansion. A number of mechanisms have been introduced in different countries to further these aims.

Overall, there are two types of incentives to promote deployment of renewable energy:

2.1 Fixed Price Systems where the government sets the electricity prices (or premiums) paid to the producer and lets the market determine the quantity. There are many variants of the fixed price system. The term is rather misleading as not all of them actually fix the total price per kWh paid to the producer but for analytical purposes it is valuable to make a distinction between fixed prices and fixed quantities:

1. Investment Subsidies
2. Fixed Feed-in Tariffs
3. Fixed Premium Systems
4. Tax Credits.

2.2 Renewable Quota Systems where the government sets the quantity of renewable electricity and leaves it to the market to determine the price. This system is used in some states in the USA, referred to as Renewable Portfolio Standards, and a number of EU countries such as the UK, Sweden, Belgium and Italy.

Two types of renewable quota systems have been employed in national wind power markets: Tendering Systems and Green Certificate Systems.

2.3 Design criteria

However, Incentive schemes need to 'fit' within the relevant national/regional context, but regardless of what type of scheme is chosen, 10 key criteria should be met when designing a support scheme:

1. Compatibility with the polluter pays principle
2. High investor confidence
3. Simple and transparent in design and implementation
4. High effectiveness in deployment of renewables
5. Encouraging technology diversity
6. Encouraging innovation, technology development and lower costs
7. Compatibility with the power market and with other policy instruments
8. Facilitating a smooth transition ("Grandfathering")
9. Encouraging local and regional benefits, public acceptance and site dispersion
10. Transparency and integrity: Protecting consumers, avoiding fraud and free riding

2.4 Defined and stable returns for investors

Policy measures adopted by governments need to be acceptable to the requirements of the investment community in order to be effective. There are two key issues:

- The price for renewable power must allow for risk return profiles that are competitive with other investment options.
- The duration of a project must allow investors to recoup their investment.

3. ELECTRICITY MARKET REFORM

Essential reforms in the electricity sector are necessary if new renewable energy technologies are to be accepted at a larger scale. These reforms include:

3.1 Removal of electricity sector barriers to renewables

Current energy legislation on planning, certification and grid access has been built around the existence of large centralised power plants, including extensive licensing requirements and specifications for access to the grid. This favours existing large scale electricity production and represents a significant market barrier to renewables. Furthermore it does not recognise the value of not having to transport decentralised power generation over long distances.

Distortions in the conventional power market include, for example: institutional and legal barriers; existence of regional and national dominant players; potential for abuse of dominant positions; barriers to third party access; limited interconnection between regional and national markets; discriminatory tariffs,



Carno Wind Farm, Wales.

"[...] WE NEED TO ACT NOW. DELAY WILL ONLY INCREASE THE SERIOUSNESS OF THE PROBLEMS WE NEED TO REVERSE, AND THE ECONOMIC DISRUPTION REQUIRED TO MOVE TO MORE RENEWABLE FORMS OF ENERGY AND SUSTAINABLE MANUFACTURING IN THE FUTURE..."

Tony Blair, UK Prime Minister,
The Economist, 1-7 January 2005

"IT IS NOT A CHOICE, AS SOME SUPPOSE, BETWEEN ECONOMIC PROSPERITY AND TACKLING CLIMATE CHANGE. IT IS TECHNOLOGICAL ADVANCES AND ECONOMIC DEVELOPMENT THAT WILL PROVIDE THE REALISTIC SOLUTION. IT IS THE FIRMS AND COUNTRIES THAT LEAD THE WAY IN ADAPTING TO THIS CHALLENGE THAT WILL HAVE THE COMPETITIVE ADVANTAGE IN THE FUTURE."

Tony Blair, UK Prime Minister, PA News, 29th December 2004

no effective unbundling of production and transmission. One big challenge is to make the necessary redesigns of the grid infrastructure, system management, grid regulation and grid codes that reflect the characteristics of renewable energy technologies. Cross-border electricity interconnectors are also vital for those markets that are not geographically isolated.

The reforms needed to address market barriers to renewables include:

- Streamlined and uniform planning procedures and permitting systems and integrated least cost network planning;
- Access to the grid at fair, transparent prices and removal of discriminatory access and transmission tariffs;
- Fair and transparent pricing for power throughout a network, with recognition and remuneration for the benefits of embedded generation;
- Unbundling of utilities into separate generation and distribution companies;
- The costs of grid infrastructure development and reinforcement must be carried by the grid management authority rather than individual renewable energy projects;
- Disclosure of fuel mix and environmental impact to end users to enable consumers to make an informed choice of power source.

3.2 Removal of market distortions

In addition to market barriers there are also market distortions which block the expansion of renewable energy. These distortions are in the form of direct and indirect subsidies, and the social cost of externalities currently excluded from costs of electricity production.

A major barrier preventing wind power from reaching its full potential is the fundamental lack of pricing structures in the energy markets that reflect the full costs to society of producing energy.

Furthermore, the overall electricity market framework is very different today from the one that existed when coal, gas, and nuclear technologies were introduced. For most of a century, power generation has been characterized by national monopolies with mandates to finance investments in new production capacity through state subsidies and/or levies on electricity bills. As many countries are moving in the direction of more liberalised electricity markets, those options are no longer available, which put new generating technologies, such as wind power, at a competitive disadvantage relative to existing technologies.

3.2.1 End subsidies to fossil fuel and nuclear power sources

Subsidies to fully competitive and polluting technologies are highly unproductive, seriously distort markets and increase the need to support renewables. Removing subsidies to conventional electricity would not only save taxpayers' money and reduce current market distortions in the electricity market. It would also dramatically reduce the need for renewables support. Wind power would not need special provisions if markets were not distorted by the fact that it is still virtually free for electricity producers to pollute.

Subsidies artificially reduce the price of power, keep renewables out of the market place, and prop up increasingly uncompetitive technologies and fuels. Eliminating direct and indirect subsidies to fossil fuels and nuclear power would help move us toward a level playing field across the energy sector.



Wind farms in Spain

Conventional energy sources receive an estimated \$250-300 billion in subsidies per year worldwide, and therefore markets are heavily distorted. The UNDP World Energy Assessment in 2000 stated that in the mid-1990s governments worldwide were subsidizing fossil fuel and nuclear power by around \$250-300 billion. In 1997, the World Bank estimated that annual fossil fuel subsidies were \$58 billion in the OECD and the 20 biggest countries outside the OECD.

R&D funding can make the crucial difference as to whether a technology becomes commercially viable, particularly at the early stage of development. It also accounts for about 40% of continued cost reductions in the technology. Over the last three decades 92% of all R&D funding – (\$267 billion) has been spent on non renewables, largely fossil fuel and nuclear technologies, compared to 8% (\$23 billion) for all renewable technologies.

3.2.2. Internalise the social and environmental costs of polluting energy

The real cost of energy production by conventional energy includes expenses absorbed by society, such as health impacts and local and regional environmental degradation – from mercury pollution to acid rain – as well as global impacts from climate change.

Hidden costs also include the waiving of nuclear accident insurance that is either unavailable or too expensive to be covered by the nuclear operators. In addition, costs for decommissioning, unsolved problems with the storage of high level nuclear waste, health costs associated with mining, drilling, etc are not added to the real costs of fossil and nuclear power.

Environmental damage should as a priority be rectified at source. Translated into energy generation that would mean that, ideally, production of energy should not pollute and that it is the energy producers' responsibility to prevent it. If they do pollute they should pay an amount equal to the damage the production causes to society as a whole.

The European Commission – through a project called ExternE – has tried to quantify the true costs, including environmental costs of electricity generation.

"THE PROMOTION OF RENEWABLE ENERGY HAS THE GREATEST IMPACT ON EMISSIONS IN MOST MEMBER STATES FOR BOTH IMPLEMENTED AND PLANNED POLICIES"

EEA report "Analysis of greenhouse gas emission trends and projections in Europe 2003", Technical report N°4/ December 2004



Novar Wind Farm, Scotland.

"OUR PLANET IS AT RISK. WITH CLIMATE CHANGE, THERE IS AN ECOLOGICAL TIME-BOMB TICKING AWAY, AND PEOPLE ARE BECOMING INCREASINGLY CONCERNED BY THE CHANGES AND EXTREME WEATHER EVENTS THEY ARE ALREADY SEEING. URGENT ACTION IS REQUIRED IF WE ARE TO WIN THE BATTLE AGAINST THIS PROBLEM. THAT CAN ONLY HAPPEN WITH STRONG POLITICAL LEADERSHIP."

Stephen Byers, UK MP,
co-chair International Climate Change
Taskforce, 24th January 2005

It estimates that the cost of producing electricity from coal or oil would double and the cost of electricity production from gas would increase by 30 %, if external costs, in the form of damage to the environment and health, were taken into account. The study further estimates that these costs amount to 1-2 % of EU GDP or between € 85 billion and € 170 billion/annum, not including the additional costs of the impacts of human-induced climate change on human health, agriculture and ecosystems. If those environmental costs were levied on electricity generation according to their impact, many renewables, including wind power, would not need any support to successfully compete in the marketplace. In the EU alone, wind power in 2005 avoids external cost of electricity production of approximately €5 billion.

As with other subsidies, such external costs must be factored into energy pricing if competition in the market is to be truly fair. This requires that governments apply a "polluter pays" system that charges the emitters accordingly, or applies suitable compensation to non-emitters. Adoption of polluter pays taxation to polluting electricity sources, or equivalent compensation to renewable energy sources, and exclusion of renewables from environment related energy taxation, is important to achieve fairer competition on the world's electricity markets.

INTERNATIONAL POLICIES



Wind farm in the Philippines

IMPLEMENTATION OF THE KYOTO PROTOCOL AND POST 2012 REDUCTIONS FRAMEWORK

Implementation of the Kyoto Protocol to the United Nations Framework Convention on Climate Change is a first vital step towards protecting the climate from dangerous anthropogenic climate change – the overall goal of the Climate Convention. The Protocol as a legally binding international instrument heralds the beginning of carbon constrained economies. In time, this will mean an increased demand for low and no carbon power production. Protecting the climate will demand more and deeper cuts in greenhouse gas emissions which will further increase the demand and market for renewable energy technologies such as wind power.

The international issue now is what objectives for reduction in greenhouse gases will follow on from the present 2008-12 target period. The EU Heads of states meeting in March recommended that "reduction pathways... in the order of 15-30% by 2020, compared to the baseline envisaged in the Kyoto Protocol... should be considered." Furthermore, it is critical that the next round of emissions reductions be agreed soon, so that the market is clear that the strong system sent by the entry into force of the Kyoto Protocol continues beyond 2012.

Emissions trading

Emissions trading in its current form at the European level will not be a short term boost for wind energy. The first steps in the Emission Trading system send a good signal to markets about the costs of carbon-intensive energy production, but they don't go far enough and need to be strengthened in the next round. In particular, free allocation of allowances should be replaced by 100% auctioning to avoid market distortions and apply the polluter pays principle.

A short term approach to emissions reductions will capture the once in a lifetime solutions, such a shift form coal to gas, but does not yet encourage the development of renewable technologies which are a precondition to combating climate change in the long run at the lowest possible cost. Emissions trading should not be seen as a substitute for environmental taxes or policies to support renewable energy.

"THE EUROPEAN COUNCIL ACKNOWLEDGES THAT CLIMATE CHANGE IS LIKELY TO HAVE MAJOR NEGATIVE GLOBAL ENVIRONMENTAL, ECONOMIC AND SOCIAL IMPLICATIONS.....REDUCTION PATHWAYS FOR THE GROUP OF DEVELOPED COUNTRIES IN THE ORDER OF 15-30% BY 2020 ...SHOULD BE CONSIDERED"
Presidency conclusions
Brussels European Council,
22 -23 March 2005



Bozcaada wind farm, Turkey

"G8 GOVERNMENT ESTABLISH NATIONAL RENEWABLE PORTFOLIO STANDARDS TO GENERATE AT LEAST 25% OF ELECTRICITY FROM RENEWABLE SOURCES BY 2025, WITH HIGHER TARGETS FOR SOME G8 GOVERNMENTS"

'Meeting the climate challenge'
Recommendations of the
International Climate Change Task
Force, January 2005

REFORM OF EXPORT CREDIT AGENCIES (ECAs), MULTI-LATERAL DEVELOPMENT BANKS (MDBs) AND INTERNATIONAL FINANCE INSTITUTIONS (IFIs)

Demand for energy, particularly electricity, is increasing worldwide. This is especially the case in developing countries, which rely heavily on export credit agencies and multi-lateral development banks to provide financing for energy and other industrial projects. To be consistent with the emerging international regime for limiting greenhouse gas emissions, ECAs and other international financial institutions which support or underwrite projects around the world must have policies consistent with the need for limiting greenhouse gas emissions and climate change protection. At the same time there needs to be a transition plan and flexible timeframes to avoid undue hardships on developing country economies overly reliant upon conventional energy sources and exports, whilst also recognising that meeting the development goals for the world's poorest will require subsidies for the foreseeable future.

Policies to address these issues must include:

- A defined and increasing percentage of overall energy sector lending directed to renewable energy projects.
- A rapid phase out of support for conventional, polluting energy projects.

G8 RECOMMENDATIONS

In January, the report 'Meeting the climate challenge' - Recommendations of the International Climate Change Task Force concurred with several of the Wind Force 12 policy recommendations;

"A long-term objective be established to prevent global average temperature from rising more than 2°C (3.6°F) above the pre-industrial level, to limit the extent and magnitude of climate-change impacts."

"G8 Governments establish national renewable portfolio standards to generate at least 25% of electricity from renewable energy sources by 2025, with higher targets needed for some G8 Governments"

"Government remove barriers to and increase investment in renewable energy and energy efficient technologies and practice such measures as the phase-out of fossil fuel subsidies"

Implementation of these recommendations would support the achievement of overall target of Wind Force 12.



Turkish wind farms



Turkish wind farms

POLICY SUMMARY

National policies

1. Establish legally binding targets for renewable energy
2. Create legally based market deployment instruments
3. Provide defined and stable returns for investors
 - The price for renewable power must allow for risk return profiles that are competitive with other investment options.
 - The duration of a project must allow investors to recoup their investment.
3. Electricity market reforms
 - 3.1. Remove electricity sector barriers to renewables
 - 3.2. Remove market distortions
 - Halt subsidies to fossil fuel and nuclear power sources.
 - Internalise social and environmental costs of polluting energy.

International policies

1. Kyoto Protocol and post 2012 cuts
2. Reform of Export Credit Agencies (ECAs), Multi-lateral Development Banks (MDBs) and International Finance Institutions (IFIs)
 - A defined and increasing percentage of overall energy sector lending directed to renewable energy projects.
 - A rapid phase out of support for conventional, polluting energy projects.
3. Implementation of key G8 task force recommendations

"AND AS ECONOMIC INSTABILITY INCREASES RISK AND UNDERMINES INVESTMENT, SO CLIMATE CHANGE WILL COME TO THREATEN OUR ECONOMIC DEVELOPMENT AND GROWTH"

UK Chancellor of Exchequer Gordon Brown, 15th March 2005.

COUNTRY REPORTS



Australia

For the Australian wind industry, the past three years have seen both exceptional growth and some uncertainty. While Australia has forty times less installed capacity than Germany, the world leader, the potential is enormous. Australia is twenty times larger than Germany, with one of the strongest and most abundant wind resources on the planet. This sparsely populated continent has therefore long been regarded as a potential hot spot for wind power generation.

CURRENT INDUSTRY GROWTH

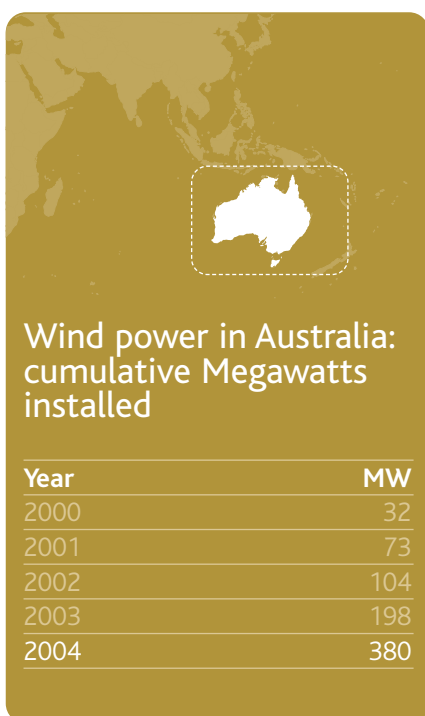
Wind energy capacity in Australia almost doubled last year, reaching 380 MW by the end of 2004. At the same time approximately 1,281 MW of new projects are either approved or under construction, with many more in the process of development. Once installed, these will provide enough electricity to meet the demands of about 750,000 homes.

A further 4,202 MW of projects have been identified at various stages of development, with a total of 6,221 MW of capacity in the pipeline. In addition, there are a large number of potential projects not yet in the public domain.

Growth of capital expenditure on wind farms has been equally rapid over the last two years and is forecast to continue at an extraordinary rate. Total expenditure of approximately A\$1.62 billion is expected by 2007 under current policy arrangements.

MANUFACTURING POTENTIAL

An important driver for the Australian industry has been the development of a local manufacturing industry. International manufacturers say they are attracted to the country because it is well situated to export throughout the Asia-Pacific region, and because it has political stability, a well developed



infrastructure and an array of other positive social, economic and financial factors.

Australia now has a nacelle assembly plant (Vestas), nacelle and nose cone manufacturer (AusTech Composites) and a turbine tower manufacturer (Haywards Engineering) situated in Tasmania. The steel industry is also benefiting significantly from the turbine construction business. Air-Ride Technologies, based in South Australia, is a major steel fabrication company supporting the industry, while there are also plans to establish local blade manufacturing in Victoria, where there is already a manufacturing plant building wind towers and components (Keppel Prince). Australian produced content in new wind farms is currently estimated at about 50 per cent, with the balance largely coming from Danish and German manufacturers.

KEY GROWTH DRIVERS

The growth of the renewable energy industry in Australia has been primarily supported by the strategic initiatives that have flowed from the federal government's 1998 National Greenhouse Strategy – the framework for advancing Australia's domestic greenhouse response. A number of initiatives were also introduced in the 2004 White Paper on energy and the environment, "Securing Australia's Energy Future".

The Australian government, through the Australian Greenhouse Office, delivers the majority of these initiatives under the A\$1.8 billion climate change strategy. These include a wide range of measures focusing on the energy, transport and agricultural sectors.

Mandatory Renewable Energy Target (MRET)

MRET is the cornerstone of the Australian renewable energy industry. This legislation, introduced in 2001, mandated an initial target of an additional two per cent (later converted to 9,500 gigawatt hours (GWh)) of renewable energy by 2010. This target requires electricity wholesalers and retailers to source an annually increasing percentage of their supply from registered renewable generators, or pay a shortfall penalty of A\$40 per megawatt hour (MWh).

A review of the MRET scheme in 2003 recommended increasing the target from 9,500 GWh in 2010 to 20,000 GWh by 2020, and holding the target at this level until 2035. The government's response in June 2004, however, was to retain the existing target, while refining some of the processes associated with its administration and operation. At the current rate of market growth, the existing MRET is expected to be filled by 2007.

AusWEA is currently exploring alternative industry development mechanisms with the Federal Government, and is confident that an outcome will eventually be reached which recognises the important contribution that wind energy can make to Australia's future energy supply needs.



Wind farm, Australia

"IN THE LONG TERM, CLIMATE CHANGE POSES A GREATER THREAT TO AUSTRALIA THAN TERRORISM. TO ATTRACT INVESTMENT IN RENEWABLE ENERGY, WE NEED TO PROVIDE FINANCIAL INCENTIVES FOR ELECTRICITY GENERATORS TO MOVE AWAY FROM DIRTY-COAL-FIRED ELECTRICITY TO ALTERNATIVES SUCH AS BIOMASS, SOLAR, WIND ENERGY, HYDRO AND HOT ROCKS." Premier Mike Rann. Premier of South Australia, 27th August 2004

State-based initiatives

In response to the federal decision not to increase the current MRET, several state governments initiated their own proposals for a state-based renewable energy target during 2004. As a result, state energy ministers from New South Wales, Victoria, South Australia and Tasmania have agreed to:

1. Accelerate the current work being done on emissions trading.
2. Establish an Inter-jurisdictional Working Group to recommend ways to increase the MRET from the current level and time frame, noting the recommendations of the federal government commissioned review of MRET as a minimum outcome.
3. Demand immediate action by the federal government to offer incentives to promote energy efficiency and demand management.

In addition, some Australian states have also established their own greenhouse gas abatement programs and wind energy targets.

FUTURE GROWTH POTENTIAL

Pressure is mounting on Australian governments to respond to the country's rising greenhouse gas emissions. The Australian Greenhouse Office's National Greenhouse Gas Inventory shows that the energy sector has experienced the largest increases in greenhouse gas emissions, with a 31 per cent increase since 1990. Australia's rising energy emissions have sparked an energy debate around the country, focused on looking for alternative fuel sources such as wind energy as the way forward for future energy growth.

A report commissioned in 2003 by the Australian Greenhouse Office found that the national electricity market could readily accept an installed wind capacity of 8,000 MW with appropriate siting, commercial wind output forecasting and the continual enhancement of interstate connectivity. This is over twenty times Australia's current installed capacity, attainable without significant wind specific modifications to existing electrical infrastructure. Given a stronger political commitment to a cleaner energy future for Australia and appropriate investment in electrical infrastructure, the future role for wind power in Australia could be even more substantial.

Although there are a wide range of technologies that can help to contribute to reducing Australia's greenhouse emissions, including those which reduce or eliminate the emissions from traditional fossil fuel sources, the costs of many of these technologies are as yet unknown and they are complex and site sensitive. It is likely that many of them will prove to be more expensive than wind power.

The cost of electricity from wind today has already declined globally by three quarters since the 1970s and a recent report commissioned by AusWEA predicts that the cost of wind energy in Australia could be competitive with fossil fuels within 10-15 years, even without additional costs imposed on fossil fuels to reduce emissions¹.

¹ Transition Institute (2004), *Cost Convergence of Wind Power and Conventional Generation in Australia*, <http://www.thewind.info/downloads/WindConvergenceReport.pdf>
www.wwf.org.au/News_and_information/Publications/PDF/Report/clean_energy_future_report.pdf

A report produced for the Australian Clean Energy Futures Group in 2004 which looks at scenarios in which greenhouse emissions from Australian stationary energy in 2040 are 50% of their level in 2001 found that wind power would have a significant role to play in achieving such reductions. As a relatively low, cost zero emission technology wind power will “need to be adopted to the point where it starts to require significant back-up generation (from gas turbine plant) in order to achieve acceptable levels of availability, having regards to the diversity available through differences in prevailing wind conditions at any given time across the extensive areas covered by the two major Australian grids (eastern and south west).” The report estimated that this would equate to a contribution of around 20% of the required total generation in 2040 or an installed capacity of 19,000 MW and assessed that there were sufficient sites in Australia capable of generating wind energy at reasonable cost, for wind power to be able to supply this level of generation.

Brazil

Among the nations of South America, Brazil has emerged as the most promising market for wind power development. The largest country in the continent currently gets 70% of its power from large hydroelectric schemes, with the rest coming from thermal fossil fuel stations (14%), nuclear (2%), small renewables – solar, biomass and small hydro (5%) and imports (9%). Only 29 MW of wind capacity has so far been installed.

This situation is about to change following the introduction of the Proinfa programme to promote the introduction of new sources of renewable energy. Apart from environmental considerations a major impetus behind Proinfa was the power crisis faced by Brazil after a period of low rainfall and subsequent poor performance by the country’s large hydro plants, resulting in electricity cuts.

The aim of the Proinfa legislation is to support the installation of 3,300 MW of renewable capacity by the end of 2006, one of the world’s most ambitious targets. About 1,100 MW of this is expected to come from solar PV, 1,100 MW from small hydro and 1,100 MW from wind. The Brazilian Wind Energy Centre expects up to 1,350 MW of wind capacity to be installed by the end of 2006. In addition, over 3,000 MW of wind projects have been approved for implementation.

In a second phase of the Proinfa policy, the Brazilian government has set a target for 10% of the country’s electricity to come from renewables (wind, biomass and small hydro) by 2022. This could mean between 100 and 200 MW of wind capacity being installed each year.

CURRENT STATUS

By the autumn of 2004, power purchase agreements had already been signed for well over 1,000 MW of wind capacity. Of these proposed projects, 483 MW were located along the country’s north east coastline and 454 MW in the far south. Under Proinfa, wind energy producers receive a premium price and 20 years power purchase contracts. All Brazilian consumers pay for this price



OECD NORTH AMERICA

12% wind power in 2020 (GW)	310
12% electricity production from wind power 2020 (TW/h)	800
Annual reduction of CO ₂ in 2020 (billion tonnes)	480.0
Cumulative invest. up to 2020 (€ billion)	176.1
Annual installed capacity (MW)	30,000
Employment (1,000 job-year)	444

OECD EUROPE

12% wind power in 2020 (GW)	230
12% electricity production from wind power 2020 (TW/h)	626.0
Annual reduction of CO ₂ in 2020 (billion tonnes)	375.6
Cumulative invest. up to 2020 (€ billion)	130.6
Annual installed capacity (MW)	15,000
Employment (1,000 job-year)	222

LATIN AMERICA

12% wind power in 2020 (GW)	100
12% electricity production from wind power 2020 (TW/h)	245.2
Annual reduction of CO ₂ in 2020 (billion tonnes)	147.1
Cumulative invest. up to 2020 (€ billion)	61.4
Annual installed capacity (MW)	17,000
Employment (1,000 job-year)	251.8

AFRICA

12% wind power in 2020 (GW)	25
12% electricity production from wind power 2020 (TW/h)	61.3
Annual reduction of CO ₂ in 2020 (billion tonnes)	36.8
Cumulative invest. up to 2020 (€ billion)	15.4
Annual installed capacity (MW)	3,000
Employment (1,000 job-year)	44.4

DEFINITIONS OF REGIONS IN ACCORDANCE WITH IEA CLASSIFICATION

OECD-Europe: The EU-15 plus Czech Republic, Hungary, Iceland, Norway, Switzerland and Turkey

OECD N. America: USA and Canada

OECD Pacific: Japan, Australia and New Zealand

Transition Economies: Albania, Bulgaria, Romania, Slovak Republic, Former Yugoslavia and Former Soviet Union and Poland

South Asia: India, Pakistan, Bangladesh Sri Lanka and Nepal

Latin America: All Central and South American countries and islands in the Caribbean

East Asia: Brunei, Dem. Republic of Korea, Indonesia, Malaysia, Philippines, Singapore, Rep. of Korea, Chinese Taipei, Thailand, Vietnam and some smaller countries, including the Polynesian Islands

Africa: Most African countries in the North and the South

Middle East: Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates and Yemen

MIDDLE EAST

12% wind power in 2020 (GW)	25
12% electricity production from wind power 2020 (TW/h)	61.3
Annual reduction of CO ₂ in 2020 (billion tonnes)	36.8
Cumulative invest. up to 2020 (€ billion)	14.0
Annual installed capacity (MW)	3,000
Employment (1,000 job-year)	44.4

TRANSITION ECONOMIES

12% wind power in 2020 (GW)	130
12% electricity production from wind power 2020 (TW/h)	318.9
Annual reduction of CO ₂ in 2020 (billion tonnes)	221.6
Cumulative invest. up to 2020 (€ billion)	79.8
Annual installed capacity (MW)	22,000
Employment (1,000 job-year)	325.6

CHINA

12% wind power in 2020 (GW)	170
12% electricity production from wind power 2020 (TW/h)	416.9
Annual reduction of CO ₂ in 2020 (billion tonnes)	325.2
Cumulative invest. up to 2020 (€ billion)	104.7
Annual installed capacity (MW)	30,000
Employment (1,000 job-year)	444

EAST ASIA

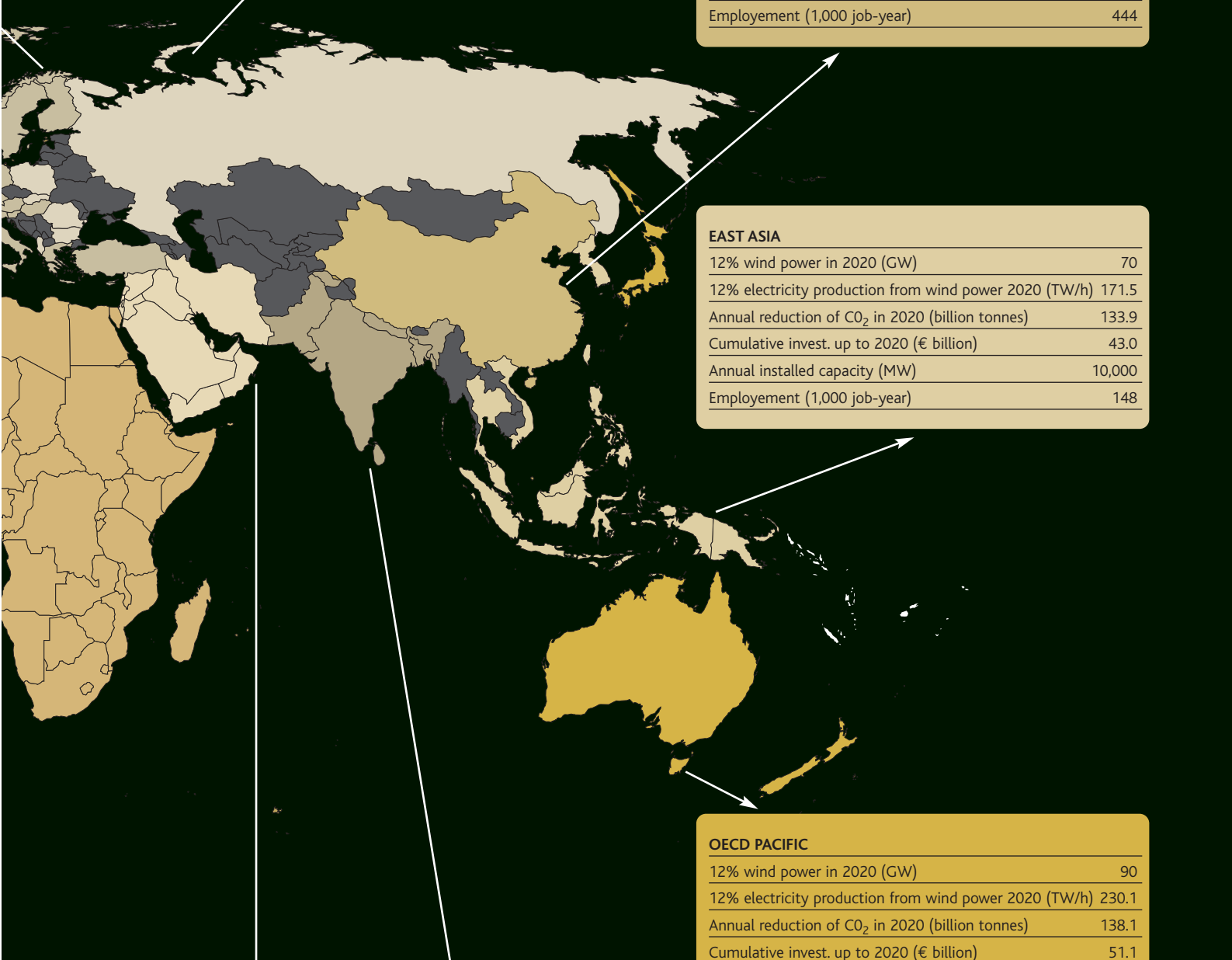
12% wind power in 2020 (GW)	70
12% electricity production from wind power 2020 (TW/h)	171.5
Annual reduction of CO ₂ in 2020 (billion tonnes)	133.9
Cumulative invest. up to 2020 (€ billion)	43.0
Annual installed capacity (MW)	10,000
Employment (1,000 job-year)	148

OECD PACIFIC

12% wind power in 2020 (GW)	90
12% electricity production from wind power 2020 (TW/h)	230.1
Annual reduction of CO ₂ in 2020 (billion tonnes)	138.1
Cumulative invest. up to 2020 (€ billion)	51.1
Annual installed capacity (MW)	10,000
Employment (1,000 job-year)	148

SOUTH ASIA

12% wind power in 2020 (GW)	50
12% electricity production from wind power 2020 (TW/h)	122.6
Annual reduction of CO ₂ in 2020 (billion tonnes)	95.6
Cumulative invest. up to 2020 (€ billion)	30.8
Annual installed capacity (MW)	18,000
Employment (1,000 job-year)	266.4





Mucuripe wind farm, Brazil

support through a small additional payment on their electricity bills.

The agreed price for the output from these projects is 6.25 €cents per kWh, as long as their capacity factor is less than 32.4%. Renewable projects also benefit from attractive loan rates for up to 80% of the investment cost.

One of the rules applied to the first phase of the Proinfa support scheme is that 60% of the total value of the development must be sourced from components and services located in Brazil. Under the second phase of Proinfa, the proportion of domestic input is expected to rise to 90%. Alongside financing, sourcing this domestic contribution to the hardware has proved a stumbling block to the initial success of the programme.

One of the advantages of wind energy for Brazil is that its output profile blends in well with the country's large proportion of hydro capacity. Once its teething problems have been overcome, wind power should start to make a major contribution, and show the way forward for other Latin American markets.

Canada

Wind power capacity has expanded more rapidly in Canada over the past two years as a result of a mixture of federal incentives and initiatives by individual provinces to increase the contribution from renewable energy. This should result in North America's second nation exploiting its substantial wind resource as effectively as its neighbour to the south.

By the end of 2004 installed capacity had reached 444 MW. During 2005 it is expected to increase again by a record amount. A minimum of 350 MW is scheduled to be commissioned, taking the total close to 800 MW.

An important contributor to Canada's more vibrant market has been the federal government's Wind Power Production Incentive (WPPI). This was extended in the 2005 budget to provide a payment to wind power generators of 1 cent per kilowatt hour for ten years and to support the development of up to 4,000 MW of capacity over the period to 2010.

The other factor has been policy commitments and targets adopted by provincial governments. These could see more than 5,000 MW in place by 2012. A province by province breakdown of projects already completed, in the pipeline and planned for the future is given below. This includes both RFPs (Requests for Proposals) initiated by provincial power utilities for a specific quantity of renewable or wind energy, and RPSs (Renewable Portfolio

Wind power in Canada : cumulative Megawatts installed

Year	MW
2000	137 MW
2001	198 MW
2002	236 MW
2003	322 MW
2004	444 MW

Standards), where the power utility or provincial government sets a target for the contribution from renewables/wind:

Quebec

- 113 MW in operation
- 90 MW under construction
- 1,200 MW of signed contracts for new wind power to be in place by 2012
- An additional 1,000 MW wind power RFP expected in autumn 2005, with the capacity to be in place by 2012



Castle River wind farm, Pincher Creek, Alberta, Canada

Ontario

- 15 MW in operation
- 350 MW of signed contracts for new wind power to be in place by 2007
- Commitment under a RPS to 1,350 MW of new renewable energy capacity by 2007 and 2,700 MW of renewables by 2010
- RFP for an additional 1,000 MW of renewable energy released in April 2005
- A minimum of 1,400 MW wind capacity expected to be in place by 2010

Manitoba

- 99 MW under construction
- Wind energy RFP expected in autumn 2005
- Provincial power utility Manitoba Hydro has a target for 250 MW by 2012; the Manitoba government has a target of 600 MW by approximately 2012

Alberta

- 274 MW in operation
- 600 MW permitted, awaiting transmission line enhancements
- Target for 800 MW by 2008 under a voluntary RPS

Saskatchewan

- 22 MW in operation
- 150 MW+ under construction
- By end of 2005, wind energy should account for 5% of electricity demand

Prince Edward Island

- 14 MW in operation
- Additional 50 MW projected by 2010
- Government RPS for 15% of electricity demand from wind energy by 2010
- Wind-hydrogen demonstration programme and aim for significantly higher wind penetration by 2015

Nova Scotia

- 5 MW in operation
- 27 MW under construction
- An additional 25 MW selected under an RFP, with a 30 MW RFP following on
- 75 MW projected by 2010 under RPS

New Brunswick

- 20 MW project selected under an RFP
- New Brunswick Power has target for 100 MW by 2010
- RPS under development

British Columbia

- 50 MW project selected under an RFP

Newfoundland

- Developing a wind energy strategy

This increased level of activity across the majority of Canada's ten provinces has in turn resulted in demand for domestic sourcing of turbine equipment. Until recently this had been limited to tower manufacture. In 2005, however, announcements were made that three new manufacturing facilities would be opened. Danish blade manufacturer LM Glasfiber announced that it would open a blade factory in Quebec in January 2006, with an annual production capacity of up to 240 MW, while Canadian company Marmen said it would develop both a tower production and nacelle assembly plant.

The primary challenge in meeting the targets set by provincial governments, according to the Canadian Wind Energy Association (CanWEA), is the need to get upgrades to the transmission network in place in time for this expansion in wind capacity. Other issues of concern to CanWEA are the process of permitting by municipal authorities, the environmental assessment process and the tax treatment of wind energy investment and projects.

CANWEA believes that Canada's outstanding wind resources and plentiful hydroelectric resources make it quite feasible for Canada to satisfy at least 20% of its electricity needs from wind energy. That would require a total capacity of 50,000MW. Canada has an outstanding wind resource, and the 5,000 MW or more which could be in operation by 2012 barely scratches the surface of what is possible. Nonetheless, there is no policy framework in place for the post-2012 period, making it difficult to speculate on how rapidly wind power development could proceed after that point.



China

With its large land mass and long coastline, China is rich in wind energy potential. Estimates by the Chinese Meteorology Research Institute show the land-based exploitable wind resource with a potential power generation capacity of 253 GW (based on the relatively low height of ten metres above ground). Areas with rich wind resources are located mainly along the south-east coast and nearby islands and in Inner Mongolia, Xinjiang, Gansu Province's Hexi Corridor, and in some parts of Northeast China, Northwest China, North China and the Qinghai-Tibetan Plateau. The ocean-based wind resource is capable of supporting a further 750 GW of capacity.

The first Chinese wind farm went on line in 1986 as a demonstration project. With finance from foreign grants or soft loans, more grid connected turbines were installed, then in 1994 the former Ministry of Electric Power made a decision to develop wind farms as a new clean power source. Regulations were issued to cover grid connection and the payment for electricity generated, making wind power commercially viable. By the end of 2004, total installations in mainland China had reached 764 MW, with 43 wind farms.

Although satisfying electricity demand and reducing air pollution are the usual driving forces behind wind power, this has been made more difficult in China, where coal-fired generation is very much cheaper than wind. Wind power development must therefore focus on cost reduction through large scale projects and the local manufacture of wind turbines.

Localisation of wind turbine manufacture has the advantage of lower costs and benefiting the local economy. It is estimated that costs can be up to 15% lower, a figure that will increase with the use of advanced technologies. Since most good wind sites are located in remote and poor rural areas, wind farm construction will benefit the local economy through the annual income tax paid to county governments - a significant proportion of their budget. Other benefits include power grid extension for rural electrification and employment in wind farm construction and maintenance.

CONCESSION PROJECTS

To create a stable market it is crucial to establish a wind turbine manufacturing industry. The National Development and Reform Commission (NRDC) is therefore promoting "Wind Power Concessions" for large scale commercial development. The basic concept is that local authorities invite investors, both international and domestic, to develop 100 MW size wind farms at potential sites, with a tendering procedure aimed at bringing down the generating cost and increasing the proportion of locally made components.

The major elements of a wind power concession project are:

- Each project should be 100 MW and the wind turbine no smaller than 600 kW.
- 70% of the wind turbine components should be made in China.
- Local authorities are responsible for building access roads to the wind farm sub-station, and the grid company for transmission lines to the sub-station.
- Project investors are selected by public bidding, with the lowest feed-in tariff (price per kWh) obtaining the contract. The length of the contract is 25 years.
- After the first 30,000 full load hours of operation for a turbine, the feed-in tariff reduces to the average for the power market at that time.
- All electricity produced by the project must be purchased by the provincial power grid company, which covers the extra cost of wind power generation.

By the end of 2004 the total installed capacity of wind power concession projects had reached 850 MW. A further 450 MW are planned in 2005. But although the aim of the concession scheme has been to encourage a reduction in the price of wind power within China's reformed electricity industry, where operation of power generation and the power grid are now separated, the negative aspect has been that the feed-in tariffs offered by winning concessions have been extremely low, providing little incentive for further investment.

On the manufacturing side, imported turbines have so far dominated the Chinese market. To increase the domestic capability, several government agencies have sponsored national initiatives, including "Ride the Wind" and the "National Debt Funded Wind Power" programmes. By the end of 2004, the market share of domestic made turbines had already reached 18%. Even so, there is only one Chinese wind turbine manufacturer to have achieved a volume production capability.

FUTURE PROSPECTS

According to the list of approved projects and those under construction, 1,000 MW of wind capacity could be installed by the end of 2005. Based on the "learning curve" theory of cost reduction, however, it will take a market of 3,000 MW in order to bring the cost of wind power down closer to that of coal. The goal for wind power in China by the end of 2010 is 4,000 MW, requiring an annual increase from 2005 onwards of 600 MW.

Looking further ahead, 20 GW of wind power has been currently proposed by the Chinese government in its long term planning for 2020; this would mean an annual installation level of 1,600 MW over the decade from 2011 onwards. By the end of 2020 it is estimated that, in order to satisfy growing demand, the total power capacity in China will reach 1,000 GW.

In order to help achieve the government target, a new Chinese Renewable Energy Promotion Law was proposed to the State Council and submitted to the People's Congress at the end of 2003. It was finally established by the central government in February 2005. This new law, which includes three mechanisms – a fixed price feed-in tariff system similar to those operating in Europe, guaranteed grid access and a renewable energy fund - will be further developed during 2005, and is expected to come into effect in January 2006.

France

With the introduction four years ago of a new payment system for wind generation, France should have moved faster into the vanguard of European wind power. At the beginning of 2005, a total capacity of 400 MW was in service, 140 MW of which were installed during 2004. But although the pace has quickened, it is still not fast enough to achieve the French government's target.

Following the failure of a previous mechanism (Eole 2005), the French government introduced a "feed-in" tariff system for wind energy in June 2001. This provides for a 15 year contract with the grid operator and a fixed tariff of about 8 €cents per kWh during the first five years of operation. After this, the tariff reduces to between 3 and 8 €cents, depending on the productivity of the site – 3 €cents/kWh for sites with more than 3,600 full load hours (equivalent hours of maximum output), 8 €cents for sites with less than 2,000 full load hours.

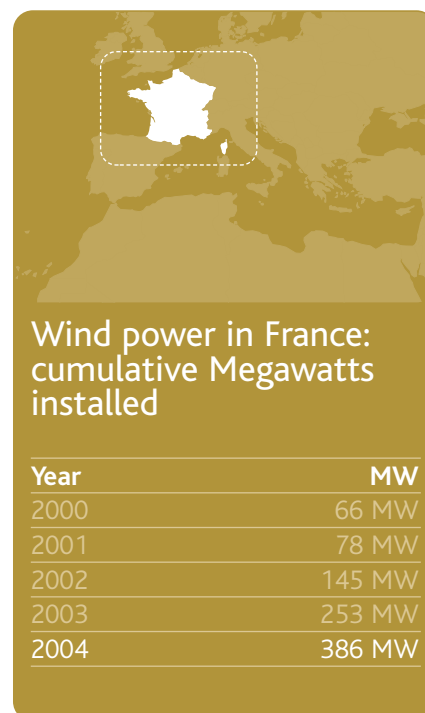
A disadvantage of the system is that the tariff is reduced at the beginning of every year by 3.3% for new installations applying for a contract. Once 1,500 MW has been installed, a further 10% reduction is applied. The size of wind farms eligible for the tariff is also limited to a maximum of 12 MW. Despite this limitation, the French wind industry has accepted that, apart from the 10% reduction (which could bite as soon as 2007), the basic economic framework is sufficient to support development, whilst grid connection conditions, although still open to improvement, are acceptable.

In parallel to this, the French government has launched two calls for tenders in order to accelerate development. An offshore wind energy tender was closed in August 2004 and an onshore wind energy tender in January 2005. Both are designed to approve up to 500 MW of projects. None of these have been awarded yet, however, and lengthy delays in the process have been accompanied by criticism that too much emphasis was placed on the price bid, rather than environmental and other benefits.

ADMINISTRATIVE BARRIERS

The main reason for the slow development of wind energy in France stems from administrative barriers, especially the building permit procedure. This tends to be lengthy, with requests for a large number of consultations with local organisations, who often try to place localised conditions on any approval.

In addition, there is now the possibility that the French parliament will introduce further limitations. One would establish "wind energy development zones" in which new wind farms would have to be implemented. Another would limit payment of the existing feed-in tariff to projects larger than 20 MW, rather than the existing 12 MW ceiling. Whatever the outcome, these changes could further slow down the administrative procedures for projects waiting for their building permit.



Wind farm, France

EU TARGET

Under the European Union’s renewables directive, France is committed to sourcing 21% of electricity from renewable sources by 2010 (starting from 15% in 1997). In order to fulfil this objective, at least 10,000 MW of wind capacity will have to be installed, along with additional capacities of hydroelectricity, biomass and solar.

Although it is unlikely that this figure will be reached, two scenarios are envisaged by SER, the French Renewable Energy Federation, and its wind energy branch, FEE, the French Wind Energy Association. One is a “government support” scenario, where the 10% drop in the feed-in tariff after 1,500 MW is withdrawn and where the administrative barriers are raised. This could lead to 6,000 MW or more being installed by 2010. The other is “business as usual”, where no changes to the system mean that it is likely that only 2,500 MW will be installed. Offshore capacity could contribute between 500 and 1,000 MW by 2010, depending on the result of the current call for tenders.

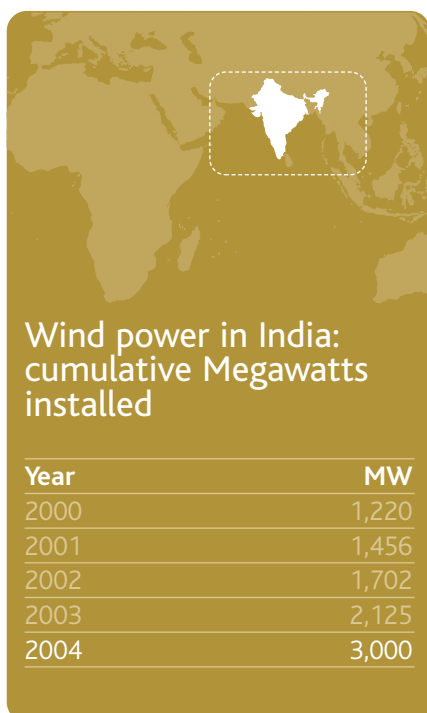
The limitations inherent in the existing feed-in tariff system, coupled with the threat of further changes being introduced by parliament, are therefore still causing uncertainty in the French market. The result is that although at least 6,000 MW of wind energy could be installed by 2010, given the right conditions, any projection beyond that would be speculative.

India

India’s wind energy sector registered impressive growth and expansion during 2004-05. Total installed capacity stood at 3,595 MW in March 2005, an increase of more than 1,112 MW over the previous year. India now occupies an enviable position as the wind leader in Asia, and has maintained its world ranking as the fifth largest producer in the world. The growth witnessed during 2004 was also the highest ever in a single year, a massive 45 per cent increase over the previous year. Even so, given the country’s vast potential, progress could be further accelerated.

WIND POTENTIAL

The original impetus to develop wind energy in India came in the early 1980s from the then Department of Non-Conventional Energy Sources, now known as the Ministry of Non-Conventional Energy Sources (MNES). Its purpose was to encourage a diversification of fuel sources away from the growing demand for coal, oil and gas required to feed the country’s rapid economic growth. MNES undertook an extensive study of the wind regime, establishing a countrywide network of wind speed measurement stations. These have made it possible to assess the national wind potential and identify suitable areas for harnessing wind power for commercial use. The total potential for wind power in India is estimated at 45,000 MW.



INCENTIVES

The fiscal incentives extended by the Indian government to the wind energy sector include:

- Direct taxes – 80 per cent depreciation in the first year of installation of a project.
- Tax holiday for 10 years.

MNES has also issued guidelines to all state governments to create an attractive environment for the export, purchase, wheeling and banking of electricity generated by wind power projects. Individual states have their own incentive schemes, including capital cost subsidies.

One result of these incentives has been to encourage industrial companies and businesses to invest in wind power. An important attraction is that owning a wind turbine assures them of a power supply to their factory or business in a country where power cuts are common. Wind farms in India therefore often consist of clusters of individually owned generators. More than 97% of investment in the wind sector in India has come from the private sector.



Muppandal wind farm, Tamil Nadu, India

MANUFACTURING BASE


Over the past few years, however, both the government and the wind power industry have succeeded in injecting greater stability into the Indian market. This has encouraged larger private and public sector enterprises to invest. It has also stimulated a stronger domestic manufacturing sector; some companies now source more than 80% of the components for their turbines in India. This has resulted both in more cost effective production and in creating additional local employment. Most recently, some Indian manufacturers have started to export their products.

About ten wind turbine manufacturers are currently offering their products on the Indian market.

The geographical spread of Indian wind power has so far been concentrated in a few regions, especially the southern state of Tamil Nadu, which accounts for more than half of all installations. This is beginning to change, with other states, including Maharashtra, Gujarat, Rajasthan and Andhra Pradesh, starting to catch up. The result is that wind farms can be seen under construction right across the country, from the coastal plains to the hilly hinterland and sandy deserts.

The Indian government now envisages a capacity addition of around 5,000 MW by 2012. If the present expansion rate is maintained, this target will easily be surpassed.

Italy



**Wind power in Italy:
cumulative Megawatts
installed**

Year	MW
2000	427
2001	697
2002	785
2003	904
2004	1,125

The target established for Italy under the European Union’s Renewable Energy Directive is that at least 25% of electricity supply should come from renewable sources by 2010. Although this seemed an ambitious target at the time, especially given the uncertainty which then characterised the available financial incentives, the introduction of a green certificate based system (linked to an obligation on power producers to source an increasing percentage of their supply from renewables) has since created more stability. This combination, coupled with the support given by the Italian government through ratification of the European Directive (through national decree 387), has reinforced backing for renewable energy.

Although the use of both geothermal and hydroelectric energy is widespread in Italy, and the photovoltaic market is slowly emerging, wind energy is the most realistic way of reaching the EU targets in a reasonable timescale and at competitive cost. The confidence that the market is currently showing towards wind energy is reflected in the latest statistics. By the end of 2004 Italy had reached a level of 1,200 MW (wind farms completed, although not all grid connected), taking it to fourth position in the European league table. Studies show that there is the potential to install at least 5,000 MW.

LEGISLATIVE FRAMEWORK

The first important opening for renewable energy in Italy came with the introduction of national regulation CIP 6/92. This established a fixed feed-in tariff for the first eight years of a plant’s production, enabling investors to see a predictable return on their investment. In 1999, however, the Bersani decree (79/99) restructured the Italian electricity market in line with the European Union’s liberalisation directive. Since 2002, the support system has been changing from a feed-in price mechanism to a renewable energy quota system based on green certificates. This new system fixed the proportion of energy to be produced from renewable sources at 2%, with the condition that it must come

from new or repowered plants which came into operation after 1 April 1999.

In 2002 the Italian government also confirmed its commitment towards the Kyoto Protocol by setting a target for the reduction of CO2 emissions by 6.5% by 2010. Linked to this was a goal to achieve at least 2,500 MW of wind energy capacity by the same year.

Another step towards reaching this target came in December 2003, when the government approved a decree implementing EU directive 2001/77/EC. This increased the quota of new renewables by 0.35% per year, reaching approximately 5% by 2012.



Florinas, Sardinia, Italy

DEVELOPMENT TRENDS

One result of the more attractive market for wind energy in Italy is that as well as the arrival of several new Italian players, there has been growing interest from foreign developers. The involvement of these new investors and an increase in competition has in turn led to the search for potential sites outside the traditional areas in the southern Italian mainland. In 1998 just two regions represented 78% of the total market in Italy; today this has dropped to just over 50%. New areas of exploration have included both the islands of Sicily and Sardinia. In order to encourage the local population to accept having a wind farm in their area, one important incentive has been the use of a local workforce for both on site construction and maintenance activities. The Italian wind industry today employs more than 2,000 people.

The types of turbines installed in the Italian market to date have been mainly in the medium size range, between 500 and 850 kW. The trend is now moving towards larger MW turbines, despite the fact that installations of this size can be difficult to construct, with many sites located in complex and hilly terrain, where transportation and access are challenging.

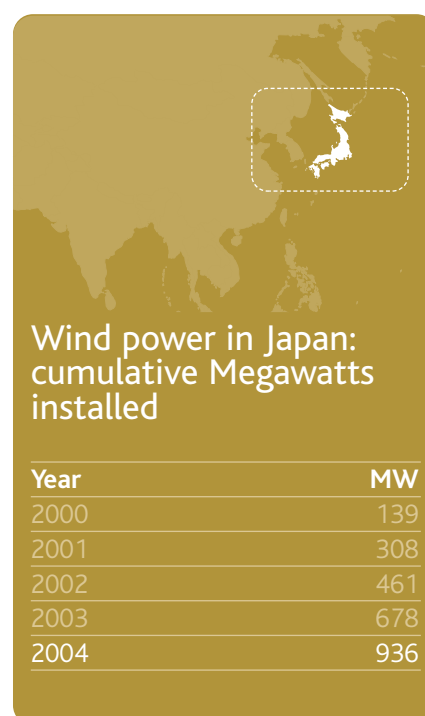
Some obstacles need to be addressed. In the region of Sardinia, for example, the authorities recently called a halt to all installations, including those which they had previously approved. Both the Italian National Wind Energy Association and the government have responded critically to the decision taken in a region where the potential for development is high.

Despite these problems, the year 2004 fulfilled the wind energy industry's expectations and even surpassed the results achieved in 2001. The prospects for 2005 are for a similar level of activity. Looking ahead, the installed capacity of projects which have already requested approval from the relevant authorities is many times larger than the amount currently installed. Nonetheless, although the targets set by the Italian government are realistic for the period up to 2006, additional political support will be required if the 2010 goal is to be achieved.

Japan

Japan's wind energy industry has surged forward in recent years, partly spurred by a government requirement for electricity companies to source an increasing percentage of their supply from renewables. Development has also been encouraged by the introduction of market incentives, both in terms of the price paid for the output from renewable plants and in the form of capital grants towards clean energy projects. Power purchase agreements for renewables also have a relatively long lifespan of 17 years, which helps to encourage investor confidence. The result has been an increase in Japan's installed capacity from 461 MW at the end of 2002 (fiscal year) to more than 900 MW by spring 2005.

In pursuit of the Kyoto Protocol objectives, Japan has a target to reduce the level of its greenhouse gas emissions by 6% (compared to their 1990 level) by





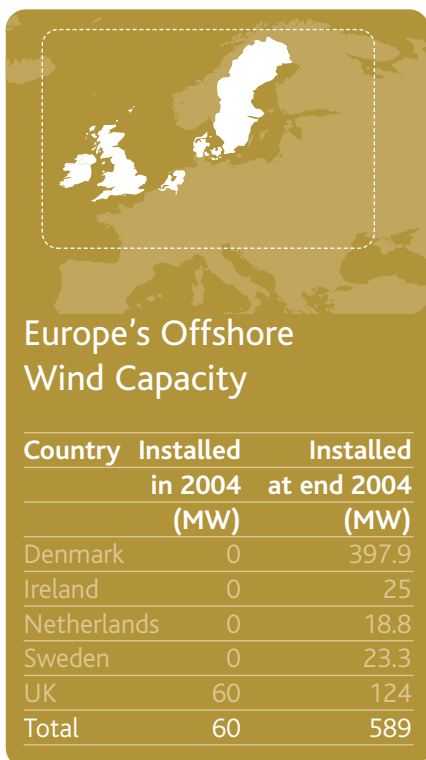
Kamaishi wind farm, Japan

2008-12. To help achieve this goal, the Japanese government introduced a Renewable Portfolio Standard (RPS) law in April 2003 with the aim of stimulating renewable energy to provide 1.35 per cent of total electricity supply in 2010. However, the law has a number of weaknesses, including a very low target (almost one tenth of Germany's), the inclusion of electricity generated by waste incineration as "renewable" and insufficient market incentives. Apart from the RPS, the Japanese wind industry also benefits from the government's Field Test and New Energy Business Support Programmes.

The leading regions for wind power development in Japan are Tohoku and Hokkaido in the north of the country, with an installed capacity respectively of 275 and 159 MW, and Kyushu in the south, with 113 MW. Japanese turbine manufacturer Mitsubishi took about a third of the supply market in 2004, the remainder being serviced by European companies.

Two issues have created challenges for Japanese wind developers. Firstly, the country is relatively densely populated in areas where construction is feasible, and secondly, some of the terrain is complex, with the added risk of typhoons. Both the Japanese Wind Energy Association and the Japanese Wind Power Association have therefore been supporting further R&D activity in the areas of grid stability, technical safety, lightning protection and generation output prediction. Partly as a result of these issues, serious consideration is being given to offshore development round Japan's coastline, although this is limited by available water depth.

The official government target for wind power in Japan by 2010 is 3,000 MW. Achieving this figure could face unnecessary difficulties, however, due to the current RPS law and the lack of co-operation from power companies in introducing renewable energy, especially wind projects, into the grid. Despite these handicaps, the Japanese Wind Power Association recently proposed to the government that the new target for wind energy by 2030 should be set at a level of 11,800 MW.



Source: BTM Consult ApS - March 2005

Offshore

Offshore sites are the new frontier for the wind industry. In northern Europe alone many thousands of megawatts of capacity are planned off the coasts of a dozen countries. Eventually, this new offshore business could challenge the oil and gas producers on their home territory.

The main motivation for going offshore stems from the considerably higher and more predictable wind speeds to be found out at sea. With average speeds well above 8 metres per second at a height of 60 metres, most of the marine sites being considered in northern European waters are expected to deliver between 20% and 40% more energy than good shoreline sites. A second advantage is that placing wind farms offshore reduces their impact on the

landscape, with many of the developments now being planned virtually invisible from the shore.

It is currently more expensive to build wind turbines out at sea. Offshore wind farms require strong foundations which must be firmly lodged in the sea bed. Many kilometres of cabling is required to bring their power back to shore, and both construction and maintenance work must be carried out in reasonable weather conditions using specialist boats and equipment. Nonetheless, as demand increases the industry is beginning to substitute expensive specialised components in prototypes with cheaper standard components and facilities, driving down electricity costs, as has happened on land.

By the end of 2004 a total of almost 600 MW of offshore capacity had been installed around the coastlines and large inland waters of five European countries – Denmark, the UK, Sweden, the Netherlands and Ireland. The largest of these, at Nysted in Denmark, has a capacity of 165.6 MW.

In the future, however, much larger offshore projects are envisaged, with total capacities rising to above 1,000 MW and with individual turbines in a size range up to 5 MW. These would benefit from economies of scale and a resulting reduction in unit production cost.

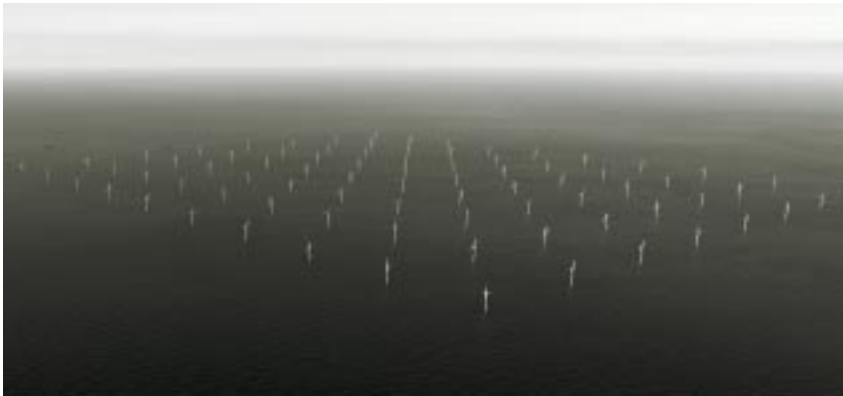
The targets set and licenses issued by a number of European countries show the expectation for substantial growth in the offshore market over the next 20-25 years. Among the eight leading nations with offshore plans the aim is for a total of more than 50 GW of capacity to be installed over the next 25 years. The target set by the European Wind Energy Association is for 70 GW by 2020.

NATIONAL PLANS

At the cutting edge in the offshore race has been **Denmark**. The first large wind farm was constructed at Horns Rev, between 14 and 20 kilometres from the North Sea coast, in 2002. With eighty 2 MW turbines this had a capacity of 160 MW, enough to satisfy 2% of Denmark's demand. The slightly larger Nysted project was installed in the Baltic Sea during 2003. Tender processes for two further large projects of 200 MW each are under way.

Danish plans are now being matched by those of the **United Kingdom**. Overseen by the Crown Estate, which owns the rights to exploration in the seas round Britain, an initial allocation round resulted in proposals for more than 1,000 MW of capacity. Two wind farms have already been built - 60 MW at North Hoyle off the west coast and 60 MW at Scroby Sands off the east – with two more – at Kentish Flats and Barrow (both 90 MW) starting construction this year.

In a second allocation round, announced in 2003, a series of far larger projects were proposed. Fifteen wind farms with a total capacity of up to 7,200 MW are planned in three strategic sea areas. The largest, in the Greater Wash area off eastern England, would alone have a capacity of 1,200 MW. When completed, these "second round" projects could provide enough power for four



Horns Rev, off the West coast of Jutland, is the world's largest offshore wind farm.

million homes, or one in six UK households, according to calculations by the British Wind Energy Association.

Germany also has extremely ambitious offshore plans, with a long list of companies and development consortia proposing more than 60,000 MW of offshore capacity. In order to avoid coastal conservation zones, many of these are set at distances of up to 60 kilometres from the shore, and in water depths of up to 35

metres. Construction permits from the national maritime authority have already been granted to six projects in the North and Baltic Seas with a total capacity of up to 1,200 MW. None has yet started construction, however.

The goal of the German Government is to see up to 25,000 MW of wind parks in the sea by 2025-30. This would satisfy roughly 15% of the country's (1998) electricity demand. Under the Renewable Energy Law, offshore schemes started up before 2008 are also eligible to receive the maximum guaranteed "feed-in" tariff for their output over twelve years, as opposed to the normal five for on shore projects.

Other European countries with advanced offshore plans include the **Netherlands, Belgium, Ireland and Sweden**. **Ireland** saw the first pilot phase of the 520 MW Arklow Bank wind farm built in 2003. In the **Netherlands**, a consortium led by Econcert has plans to start construction soon on its 120 MW scheme, with a second 99 MW project planned close to the shore. In **Belgium**, the C-Power consortium is also poised to start work on a 300 MW project. **Sweden** has given approval for its largest scheme so far – 48 turbines in the Øresund strait at the entrance to the Baltic Sea. In the United States, there are also plans for a number of offshore developments on the eastern seaboard, including up to 420 MW of turbines near Nantucket Island off the coast of Massachusetts.

With the longer lead times required for offshore developments, including detailed monitoring of fauna and flora, the period during which these plans are expected to seriously take off is from 2006 onwards. Eventually, it is estimated that a sea area of 150,000 square kilometres with a water depth of less than 35 metres could be available for offshore schemes. This would provide enough power to satisfy all of Europe's current demand.

Philippines

Within the next decade, the Philippines hope to become the leading wind power producer in Southeast Asia. The country's goal is to double its renewable energy capacity by 2013. A strong collaborative partnership between the government and the private sector is being pursued, with the government's vision to install at least 417 MW of wind-based power projects within ten years.

According to a study by the US-based National Renewable Energy Laboratory, the Philippines offer a land area of more than 10,000 km² with a "good-to-excellent" wind resource. This represents less than 4% of the country's total land mass. Using conservative assumptions of 7 MW per km², these areas could support over 70,000 MW of installed capacity, delivering more than 195 billion kWh per year. However, to assess the wind potential more accurately, additional studies are required, taking into account factors such as the existing transmission grid and accessibility.

Last December, **Department of Energy Secretary Vincent Perez** said *"Being situated on the fringes of the Asia Pacific monsoon belt, the Philippines have great potential for wind energy. Our long-term goal is to double the renewable energy-based capacity for power generation by 2013, thereby lessening our dependence on imported energy and broadening our resource base with an indigenous and environmentally desirable option."*

FIRST WIND FARM

In a major milestone for wind power development in Southeast Asia, the first wind farm in the Philippines is due to be commissioned in June 2005. This \$47.6 million project has been developed by Northwind Power Development Corp. in a 40% Danish, 60% Filipino partnership.

The project financing was enabled through support from Danida, the Danish government aid organization, providing \$11.2 million in capital to seed the project and some \$8 million in grants for its completion. An export credit facility of \$29.35 million has been arranged under a loan agreement between the Northwind Power Development Corp., the Trade and Investment Development Corp. of the Philippines, ABN-AMRO Bank NV and the Danish Export Credit Agency, payable in 10 years without interest. The Philippine Export-Import Agency has agreed to guarantee up to \$28.8m of the total project cost. The project consists of fifteen 1.65 MW wind turbines, with a total capacity of 24.75 MW. NorthWind will construct a 50 kilometre 69 kV overhead transmission line to deliver the power to the switchyard of the off-taker in Laoag City. All power produced will be sold to the Ilocos Norte Electric Cooperative (INEC), which has the exclusive franchise to distribute electricity in the area. Another fifteen wind turbines will be added during the project's second phase to provide an additional 20 MW.



"WE STRONGLY SUPPORT THE INITIATIVE TO DEVELOP THE WORLD'S WIND ENERGY RESOURCES. IN THE PHILIPPINES, WE HAVE JUST BEGUN WITH 25MW OF WIND ENERGY AND PROJECT GROWTH IN THE NEXT 5 YEARS. WIND POWER WILL HELP US ACHIEVE GREATER INDEPENDENCE FROM FOSSIL FUEL AND IMPORTED ENERGY WHILE EXPANDING OPPORTUNITIES FOR CLEAN, INDIGENOUS AND RENEWABLE SOURCES OF ENERGY."

**Raphael Lotilla, Secretary,
Department of Energy,
Philippines**



Wind farm in the Philippines

FUTURE DEVELOPMENTS

Apart from the Northwind project, several wind farms are now in various stages of development. The state-run Philippine National Oil Company's Energy Development Corp. will start constructing a 40 MW wind farm in Burgos, Ilocos Norte later this year. Smith Bell Resco will also be setting up a 30 MW wind farm in San Carlos City, Negros Occidental. Several anemometer stations are also currently gathering wind data in Luzon, Cebu, Panay and Negros islands, initiated by local companies and in some cases by non-government organisations working with the private sector.

During the wind summit in December 2004, the Philippine Department of Energy identified 16 areas for wind power investment with a total capacity of up to 345 MW. Three local firms were awarded contracts to explore and develop six of these sites, with a combined capacity of 140 MW.

Poland

Poland, one of new member states to join the European Union in 2004, is potentially the most promising market in Central Europe. However, its success largely depends on a new support scheme for renewable energy implemented by recent amendments to the Polish Energy Law.

There are currently approximately 40 wind turbines with a total capacity of 63 MW in Poland, of which 53 MW is located in three modern wind farms on the Baltic Sea coast - Barzowicach (5 MW), Cisowo (18 MW) and Zagórze (30 MW). But the country's future potential is based on a favourable wind regime, especially in the north along the Baltic coast, where the average wind speed varies between 6.5 and 7.3 metres/second (at a height of 80 metres). In addition, a vast area of easily accessible land is available for investors and developers.

Another advantage of Poland is the relative simplicity of administrative procedures. Local communes are encouraging investors, seeing wind power as a source of small but stable revenue. Some communes encourage investment by enabling a lower rate of real estate tax to be paid.

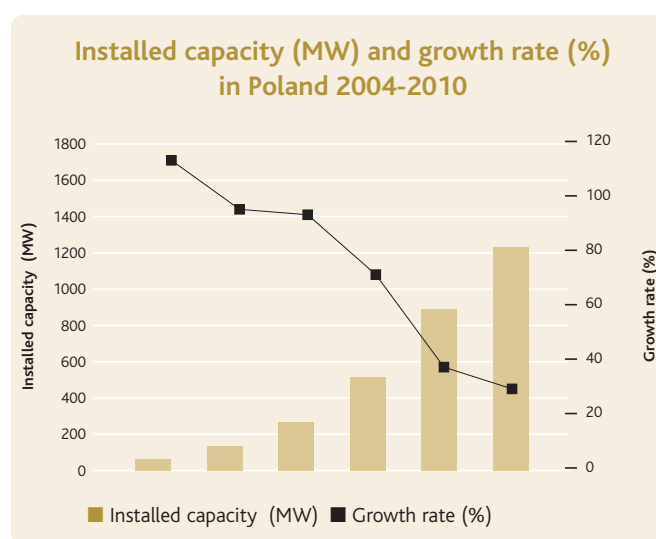
One of the main barriers hindering development relates to power engineering and grid connection. The transmission grid in northern Poland is poorly developed and sometimes technically obsolete. The grid operator placing onerous conditions on wind farm developers, usually involving large investments, and not necessarily all related to the specific connection. In turn this has led to market distortions, with investors effectively blocking the grid by acquiring power connection permits, sometimes for speculative purposes.



REVISED ENERGY LAW

The future expansion of wind power in Poland should now be encouraged, however, by an amended Energy Law, scheduled to enter into force in autumn 2005. This will replace the existing rules for selling electricity with a system based on a percentage quota for renewable energy allocated to all power supply companies. This percentage will rise from 3% in 2005 to 9% in 2010. Proof that companies have purchased enough renewable electricity to satisfy their quota will be based on certificates of origin. The market price of tradable green certificates is expected to settle close to the level of the penalty fee paid by supply companies which do not meet their quota, about 6 €cents/kWh. As in the UK, renewable generators will therefore receive income from both the sale of electricity and the "green certificates", with total revenues from producing and selling 1 kWh of green energy under long-term contracts expected to amount to about 8 €cents (less the cost of taking part in Poland's balancing electricity market).

Promotion of renewable energy is also included in the Polish government's overall policy strategy for the power sector. This includes the goal for renewables to achieve a 9% share of total energy supply by 2010, although this is only an indicative target.




NEW INVESTMENT

The new support system for renewables should encourage investors to revive previously suspended projects. More than a dozen projects with a total capacity of approximately 1,500 MW are estimated to be on hold, of which some 500 MW have already acquired all the permits and authorisations required by Polish law. Provided that power purchase agreements (PPAs) are concluded under the new legal regime, the construction and operation of some of these farms should start from 2006. Meanwhile, two significant projects promoted by Polish developers are scheduled for commissioning in 2005: a 22 MW project near Puck developed by EPA and a 50 MW project near S_upsk developed by EEZ. These would increase Poland's installed capacity to 135 MW.

Vis Venti, the Polish Wind Energy Association, anticipates that growth rates in the wind power sector could be as high as 90% over the next three to five years. The number of projects waiting for favourable PPAs and significant investor engagement could lead to the commissioning of up to 1,500 MW during the period 2006-2011.

On current projections it is anticipated that by the end of 2009 all wind farms presently ready for construction will be completed. After that period growth rates will decline because of the need to modernise the transmission infrastructure. Nonetheless, the annual rate of new installed capacity could still continue in the range of 300 to 400 MW.



**Wind power in Turkey:
cumulative Megawatts
installed**

Year	MW
2000	22
2001	22
2002	22
2003	23
2004	23

"RENEWABLE ENERGY SOURCES, WITHOUT POLLUTING OUR SEAS, OUR WATER AND THE ATMOSPHERE, OPENS THE ROADS TO AN INITIATIVE WHICH RESPECTS THE ENVIRONMENT AND HUMAN AS WELL AS BEING A CRUCIAL ISSUE FOR ENVIRONMENT AND HUMAN RIGHTS. IN TURKEY'S NATIONAL PROGRAM, WHICH IS RELATED TO UNDERTAKING OF EU ACQUIS COMMUNITAIRE, MAKING A PLAN TO USE RENEWABLE ENERGY AND USING RENEWABLE ENERGY SOURCES IN SHORT TERM WERE WRITTEN AMONGST THE PRIORITIES OF ENERGY AREA. HERE, USING RENEWABLE ENERGY FOR THE SECURITY OF SUPPLY IS DESCRIBED AS A NATIONAL POLICY AND ALSO THE IMPORTANT PART OF THE ENERGY POLICIES. EU'S DIRECTIVE OF 2001/77/EC DATED 27TH OF SEPTEMBER, 2001 ALSO BINDS TURKEY. USE OF RENEWABLE ENERGY SOURCES WILL TRANSFORM OUR SOURCES TO ENERGY AND BECOME A FIRM ROUTE MAP FOR CREATING JOBS AND AREA OF EMPLOYMENT."

Dr. Soner Aksoy, Kutahya Deputy, Chairman of TBMM Industry Trade, Energy, Natural Resources, Knowledge & Technology Committee

Turkey

Turkey has a very large potential for wind power, with a technical potential of 88,000 MW. Surrounded by mountains, its unique geographical character creates a regular and moderate air inflow through its mountainous straits and passages. Its location between the colder European and warmer Asian and African systems also causes a wide variety of temperature and climate difference.

Measurements made by the EIE (General Directorate of Electrical Power Resources) over a number of years show that the average wind speed ranges from 4.5-5.5 metres/second in many of the inland regions up to 6.5-7.5 m/s in some coastal areas of the Mediterranean and the Black Sea.

According to a European Commission study⁵, Turkey has a wind potential index of 2000. This compares with Denmark, rated at 100, and the UK at 2800, the only country with a higher rating. If Denmark has been able to install over 3,500 MW of wind capacity, Turkey could therefore theoretically see more than 71,000 MW installed. In practice, restrictions resulting from an inadequate grid infrastructure, including transformers and transmission lines, will not allow this level to be reached in the near future. Nonetheless, it is expected that installed capacity could exceed 10,000 MW within a few years if the necessary investments were made.

Turkey is also likely to experience an energy shortage, according to projections by the Ministry of Energy and Natural Resources and the Energy Market Regulation Authority. These projections show that the gap between energy supply and demand is expected to increase to the point where Turkey will be obliged to import 80% of her energy by the year 2020 if no investment is made in renewables. It will therefore be necessary to utilise every source of energy, especially clean sources such as wind, solar and geothermal, in order to close this gap.

CURRENT STATUS

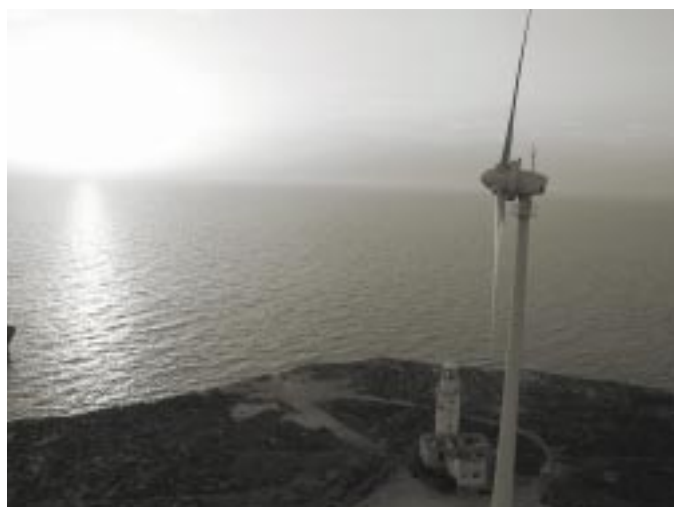
At present there are just two wind farms operating in Turkey built through a Build-Operate-Transfer (BOT) scheme, and two "auto producer plants" supplying local industrial demand. One of the two wind farms is located in the Izmir-Çesme Alaçatı region, with an installed capacity of 7.2 MW; the other is in the Çanakkale Bozcaada region, with 10.2 MW installed capacity. The country's total capacity is 21 MW.

In addition, however, a total of 39 wind power projects with a capacity of approximately 1,269 MW have already received generation licences, and have been waiting for the legalisation of a proposed new Renewable Energy Law to start the investment process. Projects with a capacity exceeding 3,000 MW are also waiting for the new law to be legalised in order to start the process of applying for generation licences. About 80% of companies involved in investment in wind energy in Turkey are members of the Wind Energy Power Plant Investors Association (WEPPIA).

The Renewable Energy Law, which was finally passed on 10 May 2005, introduces a number of incentives. These include:

- An obligation on retail companies to purchase renewable energy from producers
- An authorisation for the government to increase renewable energy prices by 20% above the average wholesale price
- Expropriation rights for renewable energy investments
- The availability of discounts when forestry areas are used for renewable energy investment

It is hoped that this package of measures will finally encourage Turkey's major wind energy potential to begin to be properly exploited.



Bozcaada wind farm, Turkey

United Kingdom

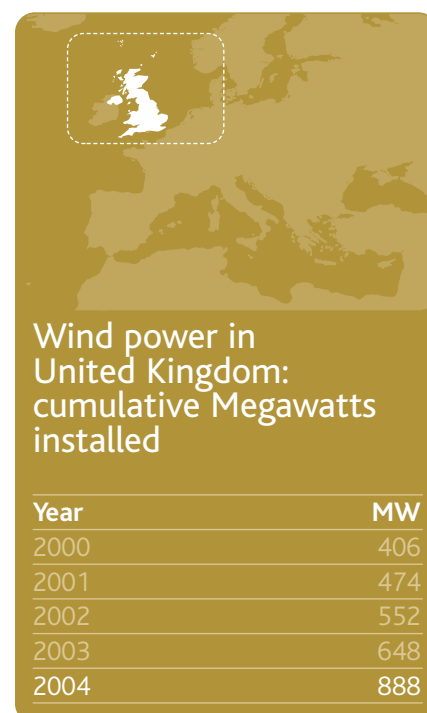
The UK government has a target for 10% of the country's electricity supply to be provided by renewable sources in 2010, and wind energy is expected to be the main contributor. Projections by the British Wind Energy Association (BWEA) show that a total of up to 7,500 MW of capacity could be installed by the end of the decade. This would meet more than three-quarters of the national target.

Britain has the best wind regime of any country in Europe, but the growth of its market has been hampered in the past by a mixture of opposition to development at a local level and lack of clear government policy. Both those elements have improved over the last few years, encouraged by clearer guidelines to local authorities, a strong campaign by the British Wind Energy Association BWEA to promote the benefits of wind power, and the introduction of a green certificate-based market incentive providing greater security to investors.

The result is that 2004 was the best year ever for construction of wind farms in the UK. A total capacity of 240 MW was commissioned, a threefold increase on 2003, taking the total to almost 900 MW. A further 500 MW is already under construction, and should be completed during 2005, with the largest project being a 120 MW wind farm in South Ayrshire, Scotland. But as importantly, a long list of further projects either already have permission to go ahead or are waiting for a decision from the relevant authorities, providing confidence that the UK's ambitious target is achievable.

PLANNING SUCCESS

According to the BWEA's latest annual survey, roughly 1,000 MW of onshore capacity had gained consent, but has not yet gone forward to construction, and even more is waiting for determination. In Scotland alone, a total of 3,900 MW is waiting for a decision to be made, most of that under a separate procedure for handling projects of more than 50 MW installed capacity. Evidence of





Beinn Ghlas Wind Farm, Scotland.

increased developer confidence is that even in England, where gaining planning consent has historically proved more difficult, a record number of applications – for 321 MW of capacity – were submitted during 2004.

What these figures show is that, despite the perennial UK problem of determined local opposition to specific projects, substantial progress is now being made. The situation is better in Scotland than in the other UK regions, with Scottish wind farms accounting for a clear majority of recent developments, but both England and Wales are showing signs of revival. Important encouragement has

come from the publication of new national planning guidelines (PPS22), which stress the need for renewable energy.

The level of activity around the UK is also evidence that the Renewables Obligation, the green certificate based support system introduced in 2001, is creating sufficient confidence in the market. A review of the RO is scheduled to take place this year, but the government has indicated that it does not intend to change the basic parameters.

OFFSHORE DEVELOPMENT

If the 2010 target is to be achieved, however, an important contribution is expected to be made by wind farms built around the UK's coastline. These have been encouraged by two successive rounds of sea bed lease allocation, both organised by the Crown Estate, which owns the seabed out to the 12 nautical mile territorial limit.

In the first round, projects with the potential for more than 1,000 MW of capacity were allocated leases. Two of these have already been built - at North Hoyle (60 MW) off the north coast of Wales and Scroby Sands (60 MW) off East Anglia. Both have provided valuable experience of how to handle the demands of marine installation. This year should see construction completed at the much larger Kentish Flats development in the Thames Estuary and good progress made at Barrow off the coast of Cumbria. Each of these will have a capacity of 90 MW. A number of other projects are out to tender with a view to construction in 2006/7.

The potential from the second offshore round is even greater. Leases have been granted by the Crown Estate on 15 sites in three strategic areas, all further out to sea than in the first round, and with the projects proposed ranging in size up to 1,200 MW. When built, these would have a total capacity of up to 7,200 MW, equivalent to 7% of the UK's electricity supply.

Whilst the Round 1 projects have benefited from capital grants provided by the UK government, however, there is currently no similar scheme for Round 2. In order to make the much larger Round 2 projects viable, the BWEA is therefore calling for a targeted package of measures, including a strategic contribution towards their grid connection costs. This would be similar to the situation in Denmark, where the Danish government has supported grid connection of the first offshore wind farms. Only if this happens, the BWEA argues, will offshore

wind energy be able to make its full contribution to the 2010 renewables target.

Meanwhile, starting with the 1,000 MW London Array scheme, up to seven Round 2 projects are expected to apply for construction consent during 2005, a process that could take up to a year to complete. When the first of these dips its foundations in the sea, it will place the UK firmly in the vanguard of the European offshore league.

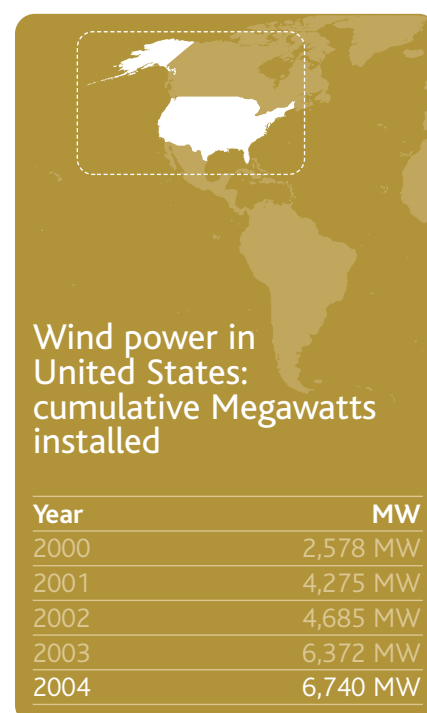
Looking further ahead, the UK Government has an aspiration to have 20% of the country's electricity generated by renewables by 2020. This has yet to be translated into firm policy, but if it is realised then wind should continue to provide the lion's share of the energy, with offshore becoming increasingly significant as time goes on. While wind is currently the technology of choice for fulfilling renewable obligations, after 2010 other resources, such as wave, tidal and biomass, should be claiming an increasing share of the market. Up to 2020, wind should still be providing more than half of the target, perhaps 10-15% by that time with the exact level determined by the progress of offshore. As the portfolio of renewables diversifies, concerns about variability should diminish due to the smoothing effect of multiple intermittent contributions, as well as a similar effect from the geographical spread of wind farms. This will allow high penetrations of renewables into the power sector by the middle of this century.

In order to reach the UK's ambitious target of 60% CO₂ savings by 2050, wind will undoubtedly play a significant part given the country's excellent wind resource, though to exploit this potential to the full will require massive extension of the transmission grid. Much of the wind resource, and the wave and tidal stream resources as well, lies in remote parts of Scotland, necessitating investment in new and/or larger lines. As yet there is no clear plan for this, but it will have to be addressed sooner rather than later given the lead times required for transmission line development, permitting and construction.

United States

A record-breaking year is predicted for the United States wind energy industry in 2005, with up to 2,500 MW of new capacity installed. This should confirm the position of the US as one of the largest wind power markets in the world.

This year's crop of developments includes a number of wind farms of well over 100 MW capacity, arrays which it is possible to accommodate in the wide open spaces of many US states. Examples of projects expected to be completed before the end of the year include wind farms at Hopkins Ridge, in south eastern Washington State, Judith Gap in Montana, Elk River in Kansas and the Intrepid project spanning two counties in north central Iowa. Each of these will have an eventual capacity of 150 MW. FPL Energy, the largest developer of wind farms in the US, says its goal is to add up to 700 MW of capacity by the end of 2005. This includes the 220 MW Horse Hollow wind farm near Abilene in Texas.





Rockriver wind farm, Wyoming, USA

The American Wind Energy Association (AWEA) assesses that these new developments will produce enough clean power for the equivalent of 700,000 US homes, bring US\$3 billion of immediate investment into the power generation sector and generate an estimated 10,000 job-years of employment nationwide.

PRODUCTION TAX CREDIT

The United States was one of the pioneers in wind energy development, with hundreds of turbines erected across the mountain passes of California during the 1980s. In recent years, however, it has been held back from realising its full potential by the intermittent nature of the main federal incentive introduced to encourage development.

First brought into force in 1992, the Production Tax Credit (PTC) currently provides a 1.9 cent per kilowatt hour credit for electricity produced commercially from a wind energy facility during the first ten years of its operation. In order to qualify, a wind farm must be completed and start generating power while the credit is in place.

Justification for the credit is that it both recognises the environmental benefits of wind energy and helps to level the playing field with the subsidies available to other fuels used for power generation.

When the credit expires, however, as it has three times over the past six years, contracts are put on hold, investments trickle to a halt and jobs are lost. During the period from the PTC's last expiry in December 2003 until its extension in October 2004, for example, thousands of jobs were lost and over US\$2 billion in investment put on hold. By the end of 2004, following the credit's renewal, the industry had brought into service only 389 MW of new capacity, well under what would otherwise have been installed. Renewal of the PTC is the main reason for the boom in construction activity during 2005.

The American Wind Energy Association is continuing to lobby in and outside Congress for a longer term renewal of the PTC so that both financial stability and continuity can be maintained in the wind power industry.

RENEWABLE PORTFOLIO STANDARDS

A second factor which has encouraged wind energy in the US has been the introduction in a number of states of a Renewable Portfolio Standard. This lays down an increasing percentage of renewable electricity which utilities are expected to source within a prescribed timescale. Twenty states have now introduced some form of RPS, plus the District of Columbia. In Illinois for example, the aim of the RPS is for renewables to reach a contribution to electricity supply of 8% by 2012.

The introduction of an RPS in New York State has provided the impetus behind the largest wind park yet planned for any of the east coast states, where development has so far lagged behind other parts of the US. The New York RPS calls for 25% of the state's electricity to be supplied by renewable energy in 2013, resulting in five power generators being selected in a first phase. Among them is the Maple Ridge project for 120 Vestas 1.65 MW turbines to be erected on a site not far from the town of Harrisburg. The wind farm will eventually expand to a capacity of 240 MW.

UTILITY INVESTMENT

The rising cost of natural gas, which now accounts for about 20% of US electricity generation, has also encouraged some utilities to look more closely at the attractions of wind. Wind energy provides stable, affordable insurance against the risk of increases in the price of natural gas and other fuels. Wind energy development can also cut consumers' bills by lowering demand for natural gas — particularly during winter peak demand periods — and extending its supply.

A growing number of energy companies have started to invest in the wind power business. Recent examples include AES Corporation, which acquired California-based wind developer SeaWest Wind Power, and Goldman Sachs, which bought Houston-based developer Zilkha Renewable Energy.

Jobs are an important bonus of the US wind industry's increased level of activity. A major study released last autumn by the Renewable Energy Policy Project reported that boosting wind energy from 6,000 MW to 50,000 MW would create 150,000 manufacturing jobs. A number of companies have recently announced plans for new or expanded production in the US, including Spanish turbine maker Gamesa, blade manufacturer LM Glasfiber and turbine maker Vestas-American Wind Technology.

The AWEA estimates, using growth projections of 3,000 MW installed every two years over the next four years, that the US could reach 15,000 MW of capacity by the end of 2009. If the PTC were renewed on a continuing basis, that figure could be substantially higher. Current AWEA estimates are that by 2020 wind power could provide 6% of US electricity, from 100GW of wind, a share similar to today's contribution from hydro-electric plants.

The Global Wind Energy Council (GWEC) is the global forum for the wind energy sector, uniting the wind industry and its representative associations.

The members of GWEC operate in more than fifty countries and represent:

- **Over 1,500 companies, organisations and institutions**
- **100% of the world's wind turbine manufacturers**
- **99% of the world's circa 48.000 MW of installed wind power capacity**

GWEC's mission is to ensure that wind power establishes itself as one of the world's leading energy sources, providing substantial environmental and economic benefits.

The main objective of GWEC is to promote the development and growth of wind energy around the world through:

- **Policy development**

To participate in policy and regulatory forums that can assist the creation of frameworks for wind power development.

- **Business leadership**

To provide the strategic and business leadership needed to engage external stakeholders.

- **Global outreach**

To work with emerging markets to transfer know-how and strengthen the development of wind energy worldwide.

- **Information and education**

To serve as a platform for providing quality information, expertise, analysis and data about wind energy.

The founding association members of GWEC are:

American Wind Energy Association

Australian Wind Energy Association

Canadian Wind Energy Association

Chinese Renewable Energy Industries Association

European Wind Energy Association

Indian Wind Turbine Manufacturers Association

Japanese Wind Energy Association and Japanese Wind Power Association



Wind Force 12 is a blueprint to achieve 12% of the world's electricity from wind power by 2020 and is the main global wind energy assessment. It has been conducted since 1999 by EWEA (the European Wind Energy Association) and Greenpeace International. The 2005 report, the sixth version of the report, has been completed by Greenpeace International and EWEA on behalf of the GWEC - Global Wind Energy Council.



EWEA is the voice of the wind industry - promoting the best interest of the sector in Europe and worldwide.

EWEA members include manufacturers covering 98% of the global wind power market, as well as component suppliers, research institutes, national wind and renewables associations, developers, electricity providers, finance and insurance companies and consultants. The combined strength of more than 250 members from over 40 countries makes EWEA the world's largest renewable energy association.

Located in Brussels, the EWEA Secretariat co-ordinates international policy, communications, research and analysis. EWEA manages European programmes, hosts events and supports the needs of its members.

EWEA is a founding member of the European Renewable Energy Council (EREC) which groups the 8 key renewable industry and research associations under one roof, and is a founding Member of GWEC.

EWEA

Renewable Energy House

rue du Trône 26 • 1000 Brussels - Belgium

T : + 32 2 546 19 40 • F : +32 2 546 19 44 • www.ewea.org

GREENPEACE

Greenpeace is a global organisation that uses non-violent direct action to tackle the most crucial threats to our planet's biodiversity and environment.

Greenpeace is a non-profit organisation, present in 40 countries across Europe, the Americas, Asia and the Pacific. It speaks for 2.8 million supporters worldwide, and inspires many millions more to take action every day. To maintain its independence, Greenpeace does not accept donations from governments or corporations but relies on contributions from individual supporters and foundation grants.

Greenpeace has been campaigning against environmental degradation since 1971 when a small boat of volunteers and journalists sailed into Amchitka, an area north of Alaska, where the US Government was conducting underground nuclear tests. This tradition of 'bearing witness' in a non-violent manner continues today, and ships are an important part of all its campaign work.

Greenpeace International

Otto Helderstraat 5 • 1066 AZ Amsterdam • The Netherlands

T: +31 20 7182000 • F: +31 20 5148151 • www.greenpeace.org

Scenario by
BTM Consult

Text edited by
Crispin Aubrey,
Christian Kjaer,
Corin Millais,
Sven Teske

Design by
www.inextremis.be

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