

Analysis:

History of wind policy development across key national markets

This report investigates the history of policy and regulatory framework for wind energy. Wind energy technologies are growing strongly and are proving to be both cost-effective and scalable in developing and developed countries.

In 2011, the global investment in renewable energy increased by 17% to reach a record level at USD 257 billion. Developing countries represented 35% of the total investment made, with developed countries accounting for the other 65% of the investments (United Nations Environment Programme (UNEP), 2012).

By the end of 2012, the total installed capacity of wind energy had reached 282.5 GW. According to industry projections the total installed capacity is likely to surpass 322 GW by the end of 2013, and 536 GW by 2017. By 2011, 118 countries, more than half of which are developing countries, had put either renewable energy targets or policy frameworks in place.

Historically the development of renewable energy technologies is strongly driven by policy initiatives and the role of governments has been critical in developing adequate policy frameworks for attracting large investments to this sector. Decision makers in new and emerging markets may not be familiar with the long-term impact of policy choices. This includes the possible policy and regulatory solutions capable of creating new market opportunities, and accelerating the deployment of renewable energy technologies.

The choice of a policy framework is specific to a country. The design of the policy framework will drive a country's ability to successfully diversify its energy mix, to control its energy balance and to secure its energy supply. It follows therefore that the support mechanisms cost may be different depending on the country in question. In addition, the extent of local value creation (health benefits, improved energy access, employment and development) may differ significantly.

A summary analysis for each of the twelve national markets is presented in this chapter.



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COMMON ELEMENTS ACROSS THE TWELVE MARKETS:

Support schemes differ noticeably between different markets, and most of the countries studied in this report have experimented with several different support schemes over time. However, there are common elements across almost all the different markets, which may be replicated by other countries to develop their respective indigenous wind resource.

The elements of success from the studied markets were clarity in the design of their support scheme; an expression of long-term political commitment; and a sufficient level of remuneration to allow an acceptable level of profit for investors. The expected profit depends on the project risks, and is therefore linked to the stage of the technology and market development.

In all of the twelve markets, the governments identified either national or state-level targets and developed specific plans for renewable energy. These targets were an important aspect of raising public awareness, and sent a strong long-term and clear signal to investors.

It should be noted that support for renewable energy sources through an incentive or subsidy is often a necessary, but never a sufficient condition. The feed-in tariff in Greece was among the highest in Europe, but other external elements eventually slowed the pace of development in the country.

In some countries like India and the US, the legal frameworks looked to create a balance between the federal legislation and the state legislation. The main success factor here is the complementarity of the policy schemes over time.

In India, the State Electricity Regulatory Commissions define purchase obligations for renewable energy and tariffs, which are complemented by federal incentives such as the generation-based incentive (GBI). This arrangement has proved to be effective. However fluctuations in federal legislation have a direct influence on the domestic wind industry as demonstrated especially in the US market.

In some instances a dedicated ministry for renewable energy was created (in Germany the BMU, in India the

MNRE) and was responsible for streamlining the legislation and undertaking the role of an interlocutor on relevant renewable energy issues with other related ministries and departments. Alternatively, the creation of an energy agency or a single access point generally facilitates interactions with the market players.

The awareness and involvement of local communities in the development of a new technology is a factor of success in the deployment phase. For example, in the cases of Denmark, Germany, Greece and Scotland, local communities received tangible benefits from their local wind projects. This helped to transform the nature of the local communities' engagement from one of non-participation to a more proactive shareholder base, in some cases they even became direct project investors.

The early technology development in Denmark (cooperatives) and Germany started with the engagement of local farmers who were encouraged to produce their own electricity. This scheme significantly facilitated the creation of a basic industry prior to 1980, from which the modern wind industry grew. It also facilitated the adoption of the technology at a later stage, as long as the local communities were kept strongly involved.

Dedicated permitting and siting procedures for wind energy could be identified in eight of the twelve markets. Well-designed permitting and siting procedures for the installation of projects keeps costs down, allows for better returns on investment, and drastically reduces the likelihood of conflicts with local authorities and communities.

Different strategies are observed regarding the creation of local value. Tax incentives (Denmark), state-funded R&D programmes (Germany, India in partnership with the Danish Development Agency) stimulated the development and demand for renewable energy technology, especially during the early stages. In later periods, with a more mature technology, a mix of market incentives and local content requirements were used across markets as varied as China, Brazil, Portugal and Spain.

The main purpose of developing local manufacturing capacity is to maximise local benefits, but should ensure reasonable prices, which require a level of competition. To be successful in creating a local supply chain, the domestic demand and growth opportunities should be large and steady enough to ensure a sustained uptake of locally produced parts and machines. Long-term targets signaling significant market volumes may then be a contributing

Table 2: Range of major policy mechanisms and support schemes used over time in the 12 studied markets. The chart illustrates the large number of policy instruments available (rows), while the constant adaptations of the policy regimes in a single country (columns) correspond to a learning process in developing a policy framework for wind energy.

COUNTRY	INDICATIVE SUMMARY OF THE RANGE OF SUPPORT MECHANISMS USED HISTORICALLY											
	BRAZIL	CHINA	DENMARK	GERMANY	GREECE	INDIA	IRELAND	ITALY	PORTUGAL	SPAIN	UNITED KINGDOM	UNITED STATES
Remuneration	Feed-in tariff	✓	✓	✓	✓	✓		✓	✓	✓		
	Premium or Adder system		✓	✓					✓			
	Auction or tendering system	✓				✓			✓			
	Tax based (electricity) production incentives										✓	
	Spot market trading		✓	✓			✓		✓			
Target or Standard	Investment subsidy or tax credit		✓								✓	
	Tradable Green Certificate [e.g. REC / ROC]									✓	✓	
	Concessionary finance through government supported agencies	✓										✓
	Concession on import duty	✓										
	Renewables Purchase Obligation or Renewables Portfolio Standard											✓
Permitting	Federal or statewide targets (binding or indicative)	✓	✓	✓	✓	✓			✓	✓	✓	✓
	Project siting guidelines	✓	✓	✓	✓				✓	✓	✓	✓
	Project permitting process		✓		✓	✓			✓	✓	✓	✓
Grid Integration	Priority access to the grid	✓	✓	✓	✓	✓			✓	✓	✓	
	Grid code		✓	✓	✓							✓

success factor (e.g., in the recent auctions in Brazil). Local content requirements need specific conditions to add value including a firm long-term target for wind, access to Power Purchase Agreements, grid access priority, and a good wind resource base.

Ease of access to the electricity grid is another important aspect of a successful framework for the growth of wind energy. Today, across ten of the twelve surveyed markets, wind energy has priority access to the grid. This guarantees that the projects will effectively be connected and investors will be able to recover their investments.

Even at the early stages of development, the authorisation procedures to connect to the grid can be overwhelmed by large number of project applications, as in the case of China. Hence a strategy is needed to allocate the connection points to all projects. At an early stage of policy development, the planning exercise must consider the consequences of any national targets or forecasts of market growth. Inadequate planning can lead to costly delays and losses for both the project developers and utilities.

In Germany, a 2011 study conducted for the German Wind Energy Association by the consultancy company Ecofys found that 150 GWh of wind energy was lost in 2010, due to overproduction and grid operators having to disconnect turbines. This represents an increase of 69% compared to 2009 (Sewohl, A. 2012). Likewise in China in 2011, more than 10 billion kWh of wind energy could not be absorbed by the grid (Global Wind Energy Council (GWEC), 2012)

EVOLUTION OF MARKET DRIVERS

The development of wind energy has been motivated by diverse drivers, which have evolved over time. The early demonstration programmes initiated in the 1970s were mostly motivated by the oil crisis. At that time, countries realised that their economies were inordinately dependent on imported sources of energy with unpredictable costs. The vulnerability of countries to external energy supply constraints and the willingness to harness indigenous resources have remained a constant driver of renewable energy development.

After the oil market stabilised, wind policy development entered the next phase driven largely by environmental concerns, the desire for energy diversification, and energy security. The Chernobyl accident (1986) amplified public questioning of the role of nuclear energy, especially in some European countries, leading to alternative energy solutions being researched and developed.

Environmental concerns added to the public support for renewables during the 1980s and 1990s. The Kyoto Protocol (1997), which was driven by concerns over climate change, became an important instrument for the promotion of renewable energy projects globally. Its Clean Development Mechanism was particularly important in further development of wind energy in China and India.

In Europe, following a white paper on “Strategy and Action Plan for Renewable Energy” in 1997, the European Union defined EU-wide targets in both 2001¹ and 2009² which were divided into individual national renewable energy action plans. These targets were major drivers for the development of wind energy in the individual EU Member States. This development happened in parallel with the liberalisation of the energy market, which facilitated the emergence of independent power producers and private developers.

The need for energy supply diversification along with a desire for attaining energy security remained strong drivers across all markets, with some nuances. In the case of Brazil, the early developments came after a major energy supply crisis between 2000 and 2002, which initiated a reform of the energy sector including efforts to diversify the energy mix after a series of droughts affected hydropower generation.

Over the past few years, the cost of wind energy has declined significantly and in some locations, wind is now competitive with conventional sources including gas.

Under specific conditions, the drivers for wind energy development are increasingly becoming purely economical. The reasons for this include a technically advanced and mature supply chain at a global scale, which has reconciled the supply and the demand aspects, as well as reduced delivery delays, and more recently, the

¹ Directive 2001/77/EC: A target of 12% of overall energy consumption being produced from renewable energy in the EU in 2010. A share of electricity generated by renewable energy of 22% in 2010 for EU15 (compared with 14% in 2000); and a share of biofuels in diesel and petrol used for transport of 5.75% in 2010 (compared with 0.6% in 2002).

financial crisis, which has reduced the pace of growth, creating oversupply. In parallel, the price of fossil fuels grew significantly, with crude oil increasing from some USD 20 (USD₂₀₁₁ 26) per barrel in 2000, to often over USD 100 (USD₂₀₁₁ 104) per barrel post-December 2008. Gas prices increased in parallel, although the recent development of shale gas has significantly changed the energy landscape, especially in the North American markets.

An additional motivation for countries is the desire to create local economic value, in terms of jobs, additional income, health benefits and manufacturing. Those benefits vary significantly from market to market, and include localised installation and maintenance capacity, component supply or large-scale wind turbine manufacturing, local manpower development, and local investment opportunities.

For prospective wind markets, the main drivers are likely to be environmental and climate legislation, cost-competitiveness, energy independence, diversification of the energy supply, and creation of local value.

As determined in this report, policy and regulatory conditions are fundamental drivers across all major wind energy markets. They are further reinforced by the broader economic and financial conditions prevalent at any given point in time. They also determine the scale of investment – both public and private – over the long term.

However, there can be no “one size fits all” approach to designing a successful policy and regulatory framework for any country or market. Each country has its unique set of macro-economic conditions, historical and political constraints, all of which are key considerations for policy design and development.

HIGHLIGHTS: EVOLUTION OF POLICY AND REGULATORY SUPPORT FOR WIND ENERGY IN TWELVE IMPORTANT MARKETS

BRAZIL

The Programme of Incentives for Alternative Electricity Sources (PROINFA) was the major instrument which initiated the development of a wind market in Brazil. However, the Brazilian market only grew significantly in the last 5-6 years. The country has had a shorter experience curve in comparison to other important markets like Denmark, Germany and the USA. The use of a local content requirement for projects financed by the Brazilian Development Bank (BNDES) was instrumental in creating a supply chain. The main framework conditions favoring this development are (a) the availability of domestic concessionary finance (b) political support for grid access (c) a legal framework that is being continuously improved at the national and the state level.

Brazil benefits from unique climatic circumstances, with a good complementarity between hydropower and wind, which eases the integration of wind energy to the grid. High-wind seasons are drier and low-wind seasons are humid, while average wind speeds are higher and lead to high wind capacity factors. Although the economic crisis of 2008-09 created a lack of liquidity in the global markets, the support from BNDES allowed the wind industry to develop in Brazil. The success of the auctioning system was made possible inter alia due to the availability of cheaper and accessible domestic finance, and oversupply in the wind industry globally.

For detailed discussion see page 40

² Directive 2009/28/EC: A 20% share of energy from renewable sources and a 10% share of energy from renewable sources in transport in community energy consumption by 2020.

<p>CHINA</p>	<p>China's wind industry has seen one of the steepest learning and shortest experience curves in the wind industry. The growth of the wind industry started with the adoption of the comprehensive Renewable Energy Law passed in 2005. Thereafter, the policy frameworks were updated through the Five-Year Plans, allowing any deficiencies in the policy or incentives to be addressed on a regular basis. A series of auctions enabled to gain experience on the price of the electricity generated from wind power, and to define the level of feed-in tariffs (FIT).</p> <p>The government stimulated the strong existing industrial base, and enabled the creation of a strong domestic manufacturing capacity. China is today the market leader both in terms of cumulative installation and manufacturing capacity.</p> <p>For detailed discussion see page 48</p>
<p>DENMARK</p>	<p>Denmark is “the cradle” of modern wind energy technology and has had a historical role in the growth of this sector. The main driver for developing wind energy has been long-term commitment from the government to address climate change and achieve energy independence. The major framework conditions that helped in the expansion of the wind industry are the following:</p> <p>(a) Denmark is the earliest market to implement an industrial and export-driven strategy for commercial scale wind; (b) it has one of the most developed permitting and siting procedures, which were consistently improved over time; (c) wind energy has priority access to the grid; (d) long-term targets for wind development out to 2020 are in place. On average Denmark had one of the best policy regimes for wind energy between 1980 and 2012. The availability of large hydro resources in Norway and interconnectors with Germany helped greatly in increasing the share of wind power in the country's energy mix.</p> <p>For detailed discussion see page 58</p>
<p>GERMANY</p>	<p>Germany is among the early pioneers of wind energy in Europe, with one of the most consistent renewable energy policy frameworks since the late 1980s. The desire for energy independence combined with prominent public support for addressing climate change, led to a high level of commitment to developing renewable energy. The main conditions supporting the uptake of wind energy were (a) a clear and long-term price stability through the feed-in tariff mechanism; (b) priority grid access; (c) local and regional banks made financing available; (d) early and strong political commitment to renewable energy.</p> <p>Germany could be a reference case for similar markets, although the country had unique characteristics (a) a skilled workforce available to manufacture a complex technology; (b) the ability to finance R&D; (c) a high entrepreneurial drive from small stakeholders and farmers, who provided the initial investment for wind turbine installations.</p> <p>For detailed discussion see page 68</p>
<p>GREECE</p>	<p>Since Greece announced its National Renewable Energy Action Plan (2020 targets) the political establishment has been strongly supportive of its renewable energy targets. However, a difficult economic climate has led to a slowdown in reaching its expected annual targets.</p> <p>For detailed discussion see page 76</p>

<p>INDIA</p>	<p>Among the three developing country markets discussed in this report, India was the first to deploy commercial wind projects. The market is growing strongly, especially since 2003. Over the last two decades, India had a varied and complex policy and regulatory framework supporting wind energy, and has shown great flexibility in terms of the range of support mechanisms available over time.</p> <p>India developed wind energy in response to chronic electricity shortages and a desire for energy independence. The drivers differ from most western European markets, which were often motivated by anti-nuclear, environmental sustainability or climate change concerns. India has access to skilled manpower; and mechanical and engineering support was available to (a) undertake resource assessment; (b) create local jobs and a manufacturing capacity; (c) rapidly replicate the experience gained from pilot projects. One unique feature of the Indian market was that private sector investors and industry entrepreneurs, helped by the dedicated Ministry for New and Renewable Energy since the late 1990s, primarily drove the market growth.</p> <p>For detailed discussion see page 86</p>
<p>IRELAND</p>	<p>Ireland showed early political commitment to wind energy, driven by a desire to achieve energy independence. The strong political support helped to raise interest in using the large wind resources, and favoured a higher level of public acceptance than in neighboring England and Wales, for example. The European Commission supported the early developments of wind energy, and helped the Irish government to develop a long-term (2020) target for wind energy. The Irish wind market benefited significantly from increased exchanges with northern Ireland through an all-island grid, and increased interconnectors to the UK.</p> <p>For detailed discussion see page 98</p>
<p>ITALY</p>	<p>Until 2010, Italy had one of the most generous support schemes for wind and solar. Unlike in Germany, Italy's feed-in tariff does not reduce over time to reflect the technology learning rate. Therefore, the cost of renewables has remained high in comparison to similar European markets.</p> <p>Despite a generous support scheme, long permitting processes and imprecise guidance at regional level led to delays in project construction. The Italian government, like the UK, favored market-based mechanisms (tradable green certificates) for supporting renewables. The political support for addressing climate change, an anti-nuclear position, and a desire to achieve energy independence also helped develop strong support for developing renewable energy.</p> <p>For detailed discussion see page 105</p>
<p>PORTUGAL</p>	<p>Today Portugal has one of the highest penetration rates of wind energy as a percentage of its total electricity generation. Portugal, like Brazil, illustrates the complementarity between hydropower and wind energy. The country is also an excellent example of the benefits of the feed-in tariff system. Early political support for wind energy in Portugal was influenced by the high dependency on imported fossil fuels until the 1980s. Similarly to Spain, Portugal made use of local content requirements, which initiated the creation of a supply chain. However, the economic reforms and global financial crisis post-2008 have severely impacted the market.</p> <p>For detailed discussion see page 111</p>

<p>SPAIN</p>	<p>Spain's policy and regulatory support for wind energy is comparable to the successful support schemes in Denmark and Germany. From the early stages of development, the federal government and the provincial governments treated the development of policies and support as an "industrial and economic development" strategy, which was supported by local content requirements. The early introduction of a feed-in tariff allowed for a stable support, which places Spain among the markets with the highest wind penetration in the world. The ongoing economic crisis has, however, impacted on the short-term market outlook.</p> <p>For detailed discussion see page 118</p>
<p>UNITED KINGDOM</p>	<p>The UK has one of the richest offshore wind regimes in Europe. The support to wind energy has been supplemented by efforts to address climate change and to achieve energy independence. The UK has used market-based mechanisms to promote wind energy, unlike the German or Spanish support schemes. The initial support for wind energy under the National Fossil Fuel Obligation was related to the support provided to nuclear energy under the same scheme. Under the National Fossil Fuel Obligation, the development of wind projects remained low in comparison to that in Germany, Italy, Spain or Denmark during the same period. Due to disparities in the policy regimes across the UK, Northern Ireland and Scotland are exploiting their intense wind resources and creating local manufacturing capacity, while planning permissions in England and Wales are still difficult to obtain.</p> <p>For detailed discussion see page 125</p>
<p>UNITED STATES</p>	<p>In responding to the oil-shock of the 1970s, the United States became one of the earliest countries to promote wind energy, along with Denmark. This development was driven by a desire to achieve energy independence, and was initiated by the introduction of the Public Utility Regulatory Policies Act (PURPA) of 1978. However, this support was reduced drastically by the mid-1980s and the wind sector did not regain momentum until the early 1990s. Wind power generation has grown exponentially since the turn of the century.</p> <p>Since 2010 the individual states have implemented their respective plans for wind energy through Renewable Purchase Specifications, and states like California, Iowa and Texas are at the forefront of wind energy development. Today the US is the second-largest market globally, although a lack of long-term federal targets and short-term renewals of the federal production tax credit support continue to have a detrimental impact on investment plans for the sector.</p> <p>For detailed discussion see page 138</p>

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