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**ENEL GREEN POWER:
IS CHINA AN ATTRACTIVE MARKET
FOR ENTRY?**

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*"A chi mi ha trasmesso l'umiltà e la curiosità,
sorgenti prime per la sete del sapere.
A chi mi ha sempre smosso dagli allori,
forgiandomi di una continua motivazione,
perché il vincente è colui che non si ferma,
ma imperterritito, già guarda oltre.
A chi mi ha insegnato la costanza e
la precisione, onniscienti linee guida
nel raggiungimento di ogni traguardo.
A chi mi ha mostrato la forza della tenacia,
arma imprescindibile per lottare senza
tregua e non mollare mai.
Ed infine a colui che, onnipresente,
accompagna ogni mio passo, senza far rumore."*

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INTRODUCTION

“We're reaching the point where the Earth will have to end the burden we've placed on her, if we don't lift the burden ourselves.” - Steven M. Greer

The paper's aim is to figure out a hypothetical strategy to enter the biggest and quite closed energy market around the world, looking from an Enel Green Power perspective.

Air pollution, CO₂ emissions, fossil-fuel reserves, unexploited garbage, compromised environment, industrial evolution, economic growth and country development. What these different words have in common is all about one thing: the energy production. Human being made huge walk on the technological bridge, starting from nature fire until to arrive in the space. Unfortunately, the biggest mistake was to link and base his infinite progress run to something that can bring to a drastic end. World's pollution has reached critical levels, as a cancer that are affecting the Earth, and as all diseases has its big causes and roots: the world's factory, it is China. In 2009, China has become both the largest energy consumer and CO₂ emitting country in the world. Along with high-speed economic development and increasing energy consumption, the Chinese Government faces a growing pressure to maintain the balance between energy supply and demand, showing a long-term sustainable solution need. China has understood that its following evolution is strictly linked to new energies, as stated in its 12th Five Years Plan, extremely focused on very high green targets and on a higher degree of openness to the West World. Global Renewable companies and utilities can make this change easier, through operations and know-hows, because their technical engineering can be the essential line forwards the green evolution inside a new economic eve. The “Red Dragon” has already become the biggest renewable market in the world, and is going to get the first position in the global economy as well, a result achievable just running on the renewable and sustainable bridge.

The process will follow a drill-down approach, from general to details. Starting from an overview of the renewable sector, the focus will move around its huge investment trends, observed in both historical and planned terms, through a deep

breakdown by country, technology and type. After, the attention will turn on competition field, entering the huge renewable M&A segment, accounting latest results, the different flow directions and the principal issues and sentiment affecting the industry. A special focus on Chinese perspective will characterize all the previous arguments. In the second part, there will be a complete shift on Chinese electricity market. There will be displayed its structure, its historical and actual regulation, trying to describe all active or passive players that take a role inside this industry, with a big attention to the foreign ones.

The following part will give a snapshot about Enel Green Power, looking at its actual and planned operational diversification, both technological and geographic, its financial milestones and its sources of competitive advantage respect the competition.

In the end, a strategy will come to life, analysing all viable actions, in an attempt to understand the hypothetical attractiveness of such risky and fragmented operation.

CHAPTER 1

“AN OVERVIEW OF THE RENEWABLE SECTOR”

1.1. RENEWABLE ENERGY

Renewable energy flows involve natural phenomena such as sunlight, wind, tides, plant growth, and geothermal heat, as the International Energy Agency explains:

“Renewable energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly from the sun, or from heat generated deep within the earth. Included in the definition is electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, and biofuels and hydrogen derived from renewable resources¹.”

Renewable energy resources and significant opportunities for energy efficiency exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency, and technological diversification of energy sources, would result in significant energy security and economic benefits².

Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services:

- *Power generation.* Renewable energy provides 19% of electricity generation worldwide. Renewable power generators are spread across many countries, and wind power alone already provides a significant share of electricity in some areas: for example, 14% in the U.S. state of Iowa, 40% in the northern German state of Schleswig-Holstein, and 49% in Denmark. Some countries get most of their power from renewables, including Iceland

¹ IEA Renewable Energy Working Party (2002)

² International Energy Agency – “Energy Technology Perspectives 2012”

(100%), Norway (98%), Brazil (86%), Austria (62%), New Zealand (65%), and Sweden (54%).

- *Heating.* Solar hot water makes an important contribution to renewable heat in many countries, most notably in China, which now has 70% of the global total (180 GWh). Most of these systems are installed on multi-family apartment buildings and meet a portion of the hot water needs of an estimated 50–60 million households in China. Worldwide, total installed solar water heating systems meet a portion of the water heating needs of over 70 million households. The use of biomass for heating continues to grow as well. In Sweden, national use of biomass energy has surpassed that of oil. Direct geothermal for heating is also growing rapidly.
- *Transport fuels.* Renewable biofuels have contributed to a significant decline in oil consumption in the United States since 2006. The 93 billion liters of biofuels produced worldwide in 2009 displaced the equivalent of an estimated 68 billion liters of gasoline, equal to about 5% of world gasoline production³.

At the national level, at least 30 nations around the world already have renewable energy contributing more than 20% of energy supply. National renewable energy markets are projected to continue to grow strongly in the coming decade and beyond, and some 120 countries have various policy targets for longer-term shares of renewable energy, including a 20% target of all electricity generated for the European Union by 2020. Some countries have much higher long-term policy targets of up to 100% renewables. Outside Europe, a diverse group of 20 or more other countries target renewable energy shares in the 2020–2030 time frame that range from 10% to 50%. In international public opinion surveys there is strong support for promoting renewable sources such as solar power and wind power, requiring utilities to use more renewable energy (even if this increases the cost), and providing tax incentives to encourage the development and use of such technologies. There is substantial optimism that renewable energy investments will pay off economically in the long term⁴.

³ REN21 – Renewable 2010 Global Status Report

⁴ REN21 – Renewable Global futures report 2013

1.1.1. History

Before coal development in the 19th century, all energy used was renewable. The oldest renewable energy, in the form of traditional biomass to fuel fires, dates from 790,000 years ago. Probably, the second oldest usage of renewable energy is the wind for driving ships over water⁵.

Moving around history, the primary sources of traditional renewable energy were human labour, animal power, waterpower, wind, in grain crushing windmills, and firewood, a traditional biomass. By 1873, concerns of running out of coal prompted experiments with using solar energy. Development of solar engines continued until the outbreak of World War I⁶. In the 1970s, environmentalists promoted the development of renewable energy both as a replacement for the eventual depletion of oil, as well as for an escape from dependence on oil, and the first electricity generating wind turbines appeared. Solar had been used for heating and cooling, but solar panels were too costly to build solar farms until 1980.

According to the OECD Fact book 2011-2012, for all OECD countries taken as a whole, the contribution of renewables to total energy supply increased from 4.8% in 1971 to 7.6% in 2010⁷.

1.1.2. Wind Power

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships.

Airflows can run wind turbines. Modern utility-scale wind turbines range from around 600 kW to 5 MW. The power available from the wind is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically up to the maximum output for the particular turbine. Areas where winds are stronger and more constant, such as offshore and high altitude sites are

⁵ "The Encyclopaedia of Alternative Energy and Sustainable Living". Retrieved 15 January 2013.

⁶ "The surprising history of sustainable energy". Sustainablehistory.wordpress.com.

⁷ "OECD Fact book 2011-2012: Economic, Environmental and Social Statistics" Retrieved 2013/08.

preferred locations for wind farms. Typical capacity factors are 20-40%, with values at the upper end of the range in particularly favourable sites⁸.

This would require wind turbines to be installed over large areas, particularly in areas of higher wind resources, such as offshore. As offshore wind speeds average ~90% greater than that of land, so offshore resources can contribute substantially more energy than land stationed turbines.

During 2012, almost 45 GW of wind power capacity began operation, increasing global wind capacity 19% to almost 283 GW⁹. It was another record year for wind power, which again added more capacity than any other renewable technology despite policy uncertainty in key markets.

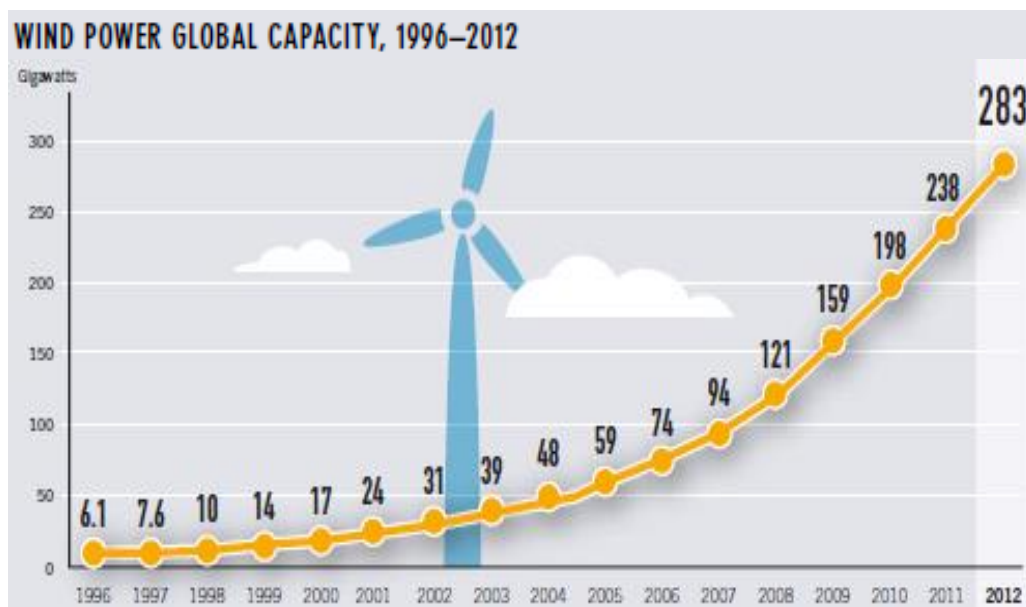


Figure 1.1.

The top 10 countries accounted for more than 85% of year-end global capacity, but the market continued to broaden. Around 44 countries added capacity during 2012, at least 64 had more than 10 MW of reported capacity by year's end, and 24 had more than 1 GW in operation. From the end of 2007 through 2012, annual growth rates of cumulative wind power capacity averaged 25%¹⁰.

⁸ "Wind Power: Capacity Factor, Intermittency, and what happens when the wind doesn't blow?."

⁹ "Global Wind Report – Annual Market Update 2012", GWEC.

¹⁰ "World Wind Energy Report 2012" (Brussels: May 2013), WWEA.

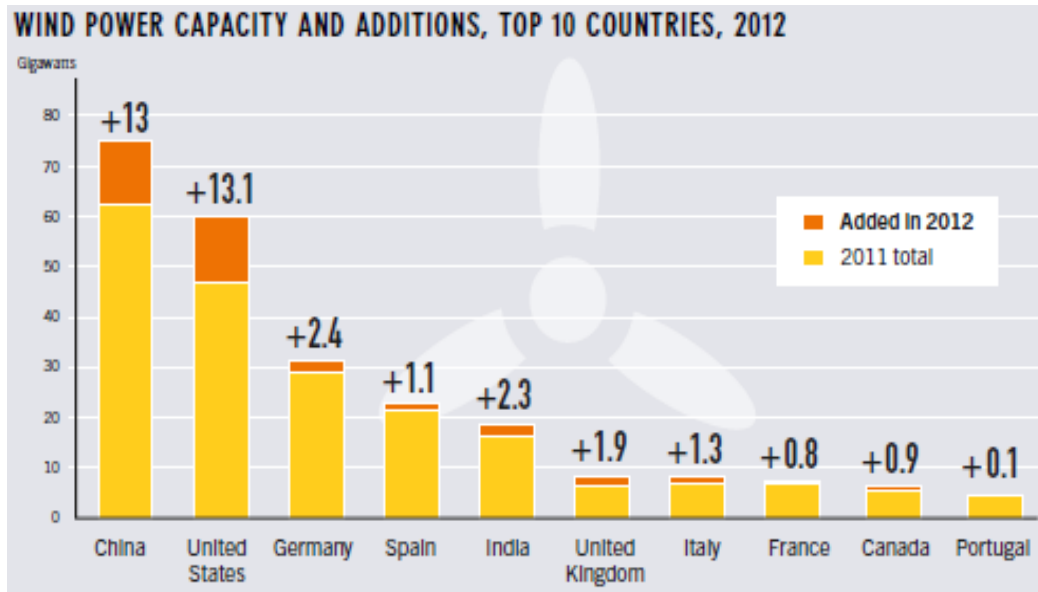


Figure 1.2.

1.1.3. Hydropower

Hydropower or waterpower is power derived from the energy of falling water and running water, which may be employed for useful purposes. Since ancient times, hydropower has been used for irrigation and the operation of various mechanical devices, such as watermills, sawmills, textile mills, dock cranes, domestic lifts, powerhouses and paint making.

Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy. There are many forms of water energy:

- *Hydroelectric energy* is a term usually reserved for large-scale hydroelectric dams. The largest of which is the Three Gorges Dam in China and a smaller example is the Akosombo Dam in Ghana.
- *Micro hydro systems* are hydroelectric power installations that typically produce up to 100 kW of power. They are often used in water rich areas as a remote-area power supply (RAPS).
- *Run-of-the-river hydroelectricity systems* derive kinetic energy from rivers and oceans without the creation of a large reservoir¹¹.

¹¹ "Hydroelectric Power". Water Encyclopaedia.

In 2012, an estimated 30 GW of new hydropower capacity came on line increasing global installed capacity by about 3% to an estimated 990 GW¹². The top countries for hydro capacity are China, Brazil, the United States, Canada, and Russia, which together account for 52% of total installed capacity.

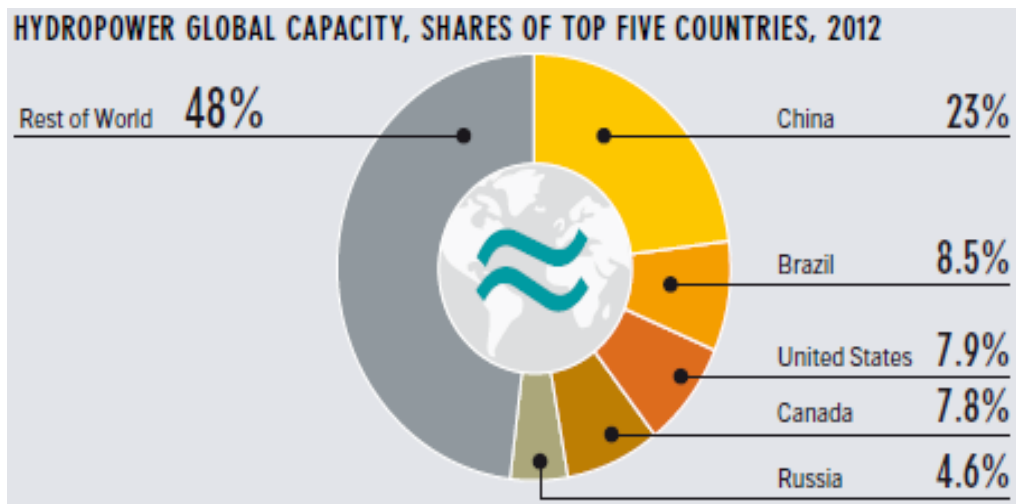


Figure 1.3.

Globally, hydropower generated an estimated 3,700 TWh of electricity during 2012, including approximately 864 TWh in China, followed by Brazil (441 TWh), Canada (376 TWh), the United States (277 TWh), Russia (155 TWh), Norway (143 TWh), and India (>116 TWh)¹³.

1.1.4. Solar Power

Solar energy applies energy from the sun in the form of solar radiation for heating or generating electricity. Solar electricity generation can use either photovoltaic or heat engines (concentrated solar power). Other solar applications include space heating and cooling through solar architecture, day lighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes.

Technologies are classified as either passive or active, depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the sun, selecting materials with

¹² "Hydropower & Dams World Atlas 2012" (Wellington, Surrey, U.K.: 2012), IJHD.

¹³ "Statistical Review of World Energy 2012" (London: 2012), BP.

favourable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. Solar energy capture is also being linked to research involving water splitting and carbon dioxide reduction for the development of artificial photosynthesis or solar fuels¹⁴.

During 2012, the solar photovoltaic (PV) market saw another strong year, with total global operating capacity reaching the 100 GW milestone. The market was fairly stable relative to 2011, with slightly less capacity brought on line but likely higher shipment levels, and the more than 29.4 GW added represented nearly one-third of total global capacity in operation at year's end¹⁵.

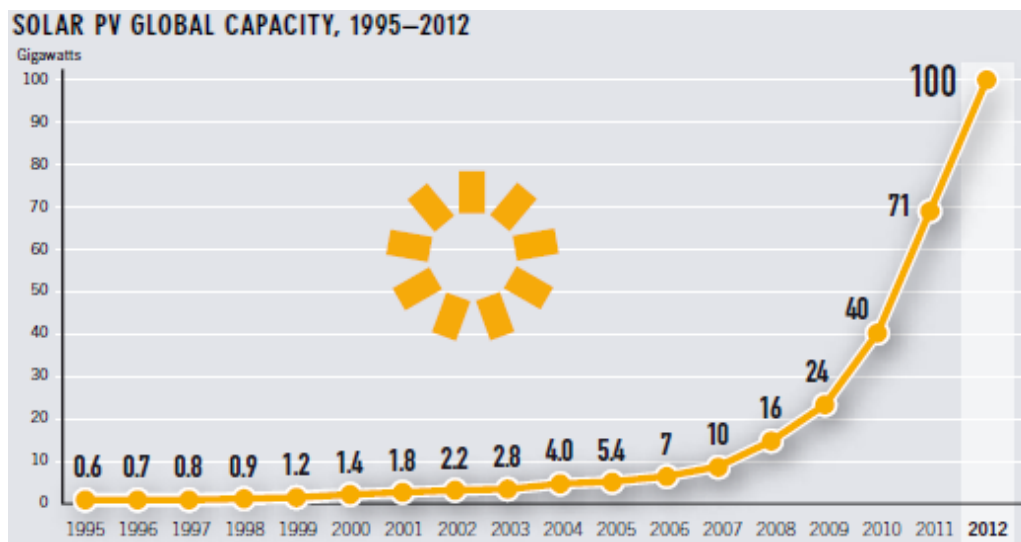


Figure 1.4.

Eight countries added more than 1 GW of solar PV to their grids in 2012, and the distribution of new installations continued to broaden.

The top markets – Germany, Italy, China, the United States, and Japan – were also the leaders for total capacity. By year's end, eight countries in Europe, three in Asia, the United States, and Australia had at least 1 GW of total capacity. The leaders for solar PV per inhabitant were Germany, Italy, Belgium, the Czech Republic, Greece, and Australia¹⁶.

¹⁴ "Solar Chimney, Natural Ventilation; Passive Downdraught Evaporative Cooling, Passive Cooling". ICAX. 2007.

¹⁵ "PVPS Report: A Snapshot of Global PV 1992-2012" (Paris: April 2013), IEA.

¹⁶ "Clean Energy Trends 2013" (March 2013), Clean Edge.

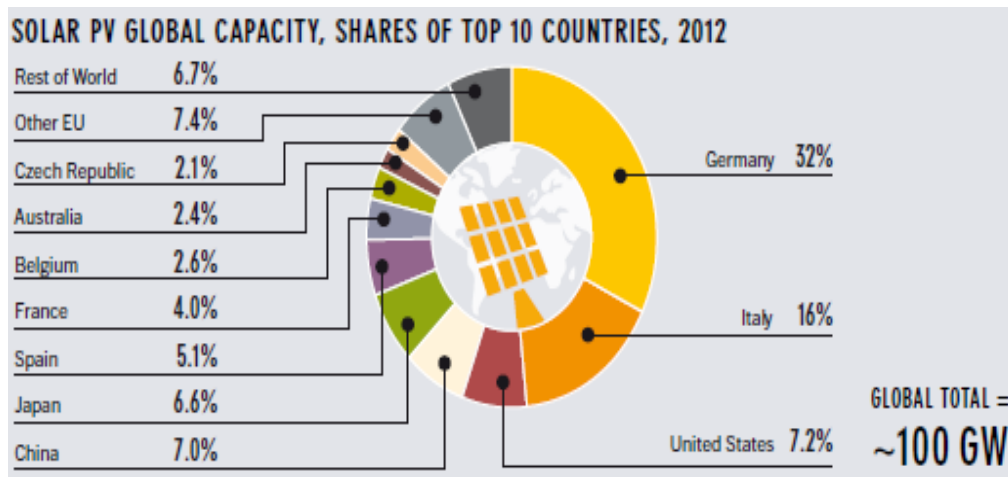


Figure 1.5.

1.1.5. Biomass Power

Biomass, as a renewable energy source, is biological material from living, or recently living organisms. In the first sense, biomass is plant matter used to generate electricity with steam turbines & gasifiers or produce heat, usually by direct combustion. Examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste. In the second sense, biomass includes plant or animal matter that can be converted into fibres or other industrial chemicals, including biofuels.

A range of chemical processes may be used to convert biomass into other forms:

- *Thermal conversion processes*, such as combustion, Torre-faction, pyrolysis, gasification, hydrothermal upgrading (HTU) and hydro processing.
- *Chemical conversion processes*, such as Fisher-Tropsch synthesis.
- *Biochemical conversion processes*, such as anaerobic digestion, fermentation and trans-esterification¹⁷.

Total primary energy supplied from biomass increased 2–3% in 2012 to reach approximately 55 EJ.

Heating accounted for the vast majority of biomass use (46 EJ), including heat produced from modern biomass and the traditional, inefficient use of animal dung,

¹⁷ "Biomass Energy Center", Biomassenergycentre.org.uk., Retrieved on 2012-02-28.

fuelwood, charcoal, and crop residues for domestic cooking and heating of dwellings and water in developing countries. Biomass of around 4.5 EJ of primary energy was consumed for electricity generation, and a similar amount for biofuels. Traditional biomass heating contributed an estimated 6–7% of total global primary energy demand in 2012¹⁸.

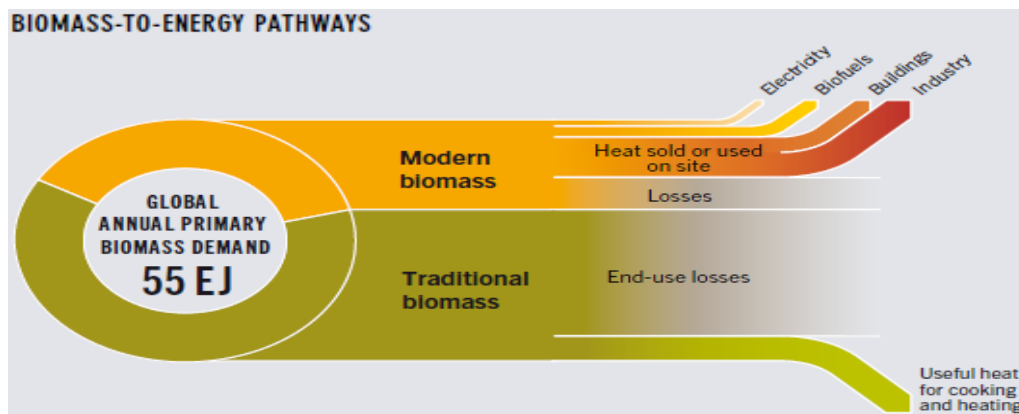


Figure 1.6.

1.1.6. Geothermal Power

Geothermal energy is from thermal energy generated and stored in the Earth. This energy originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%). The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface. The heat comes from deep within the Earth, about 4,000 miles (6,400 km) down. At the core, temperatures may reach over 9,000 °F (5,000 °C). Extremely high temperature and pressure cause some rock to melt, commonly known as magma. Magma convects upward since it is lighter than the solid rock, heating them and water in the crust, with a temperature up to 700 °F (371 °C)¹⁹.

In 2012, geothermal resources provide energy in the form of direct heat and electricity, totalling an estimated 805 PJ (223 TWh). Two-thirds of this output was delivered as direct heat, and the remaining one-third was delivered as electricity.

¹⁸ "Special Report on Renewable Energy Resources and Climate Change Mitigation" (2011), IPCC.

¹⁹ "Geothermal heating and cooling", Nemzer, J.

Although there are limited data available on recent growth in direct use of geothermal energy, output is known to have grown by an average of 10% annually from 2005 through 2010; much of that growth was attributed to ground-source heat pumps, which experienced an average annual growth of 20%. Assuming that these growth rates have persisted in the last two years, global geothermal heat capacity reached an estimated 66 GWh in 2012, delivering as much as 548 PJ of heat²⁰.

1.2. GLOBAL MARKET OVERVIEW

Global demand for renewable energy continued to rise during 2011 and 2012, despite the international economic crisis, trade disputes, and policy uncertainty and declining support in some key markets. Renewable energy supplied an estimated 19% of global final energy consumption by the end of 2011²¹. Of this total, approximately 9.3% came from traditional biomass, which is used primarily for cooking and heating in rural areas of developing countries. Useful heat energy from modern renewable sources accounted for an estimated 4.1% of total final energy use; hydropower made up about 3.7%; and an estimated 1.9% was provided by power from wind, solar, geothermal, and biomass, and by biofuels²².

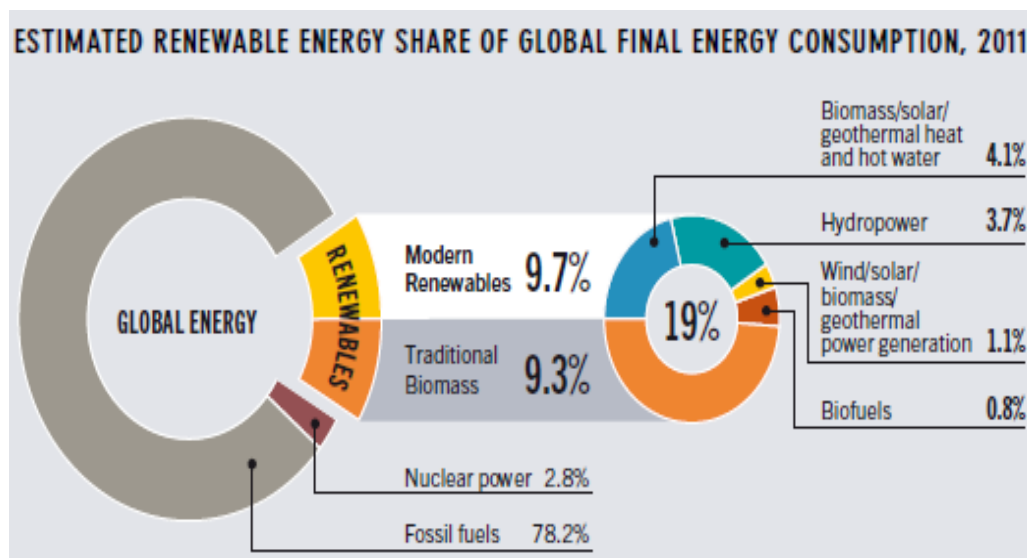


Figure 1.7.

²⁰ "Direct Utilization of Geothermal Energy: 2010 Worldwide Review", Geo-Heat Center - REN21.

²¹ "Renewables 2013: Global Status Report", REN21.

²² "World Energy Statistics 2012", IEA (Paris: OECD/IEA, 2012)

During the five-year period 2008–2012, renewable energy installed capacity grew quickly. Total capacity of solar photovoltaic (PV) increased with an average annual rate of about 60%²³.

Concentrating solar thermal power (CSP) capacity increased more than 40% per year on average, and wind power rose 25% annually over this period²⁴.

Hydropower and geothermal power are more mature technologies and their growth rates have been more moderate, between 3–4% per year. Bio-power is also mature but with steady growth in solid and gaseous biomass capacity, increasing at an average 8% annually.

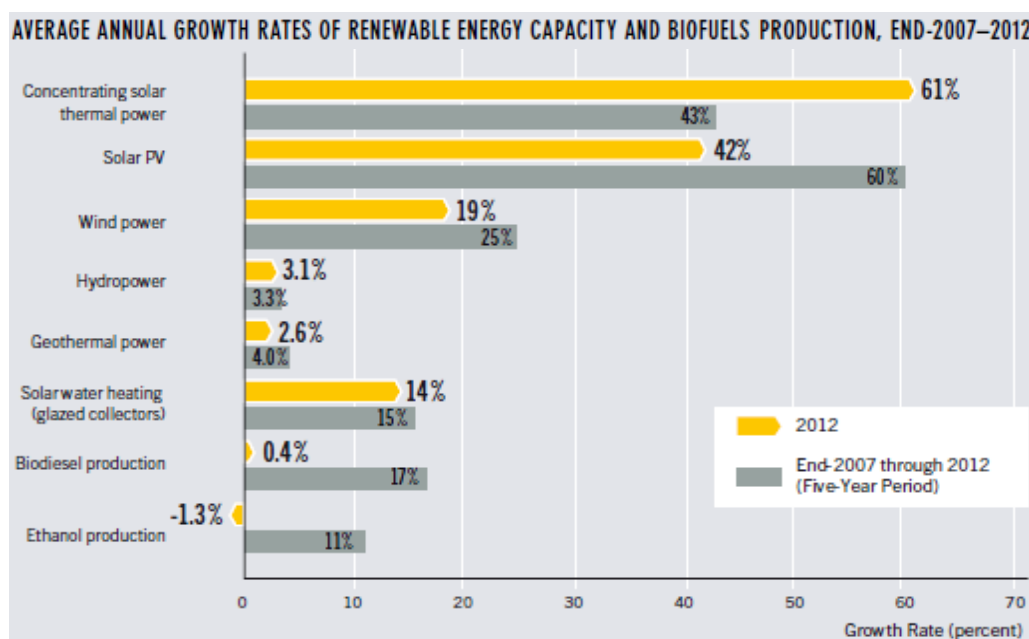


Figure 1.8.

Demand has risen rapidly as well, particularly for solar thermal systems, geothermal and some bioenergy fuels and systems. Capacity of glazed solar water heaters has grown with an average 15%, over the past five years. Ground-source heat pumps and bio-heat continue to grow by an average 20% annually and steadily, respectively. Wood pellet consumption (for both heat and power) is rising by about 20% per year. The average annual growth rate over the period from the end of 2007 through 2012 was nearly 11% for ethanol and 17% for biodiesel. Although biodiesel

²³ “Market Report 2012”, EPIA (Brussels: February 2013)

²⁴ “Global Wind Report – Annual Market Update 2012”, GWEC (Brussels: April 2013).

production continued to increase in 2012, it was at a much slower rate of growth, whereas ethanol production peaked in 2010 and has since declined²⁵.

Most technologies continued to see expansion in both manufacturing and global demand. However, global market growth slowed for most technologies in 2012 relative to the previous few years. Uncertain policy environments and declining policy support – such as policy reversals and retroactive changes – affected investment climates in a number of established markets, and slowed momentum in Europe, China, and India.

Solar PV and onshore wind power experienced new price reductions in 2012, due to economies of scale and technology advances, but due to a production surplus of modules and turbines as well. These developments, together with the international economic crisis (which has helped drive policy changes) and ongoing tensions in international trade, have created new challenges for some renewable energy industries and, particularly, equipment manufacturers.

Consequently, industry consolidation went on among both large and small players, especially in solar, wind and biofuel sectors, experiencing many high-profile bankruptcies during the year²⁶. In order to increase product value and reduce costs, manufacturers vertically integrated their supply chains and diversified products, moving into project development and ownership as well.

Many manufacturers have found new opportunities, even though falling prices hurting. Companies have looked for new markets, because of oversupply and slowing growth in the traditional ones. Falling prices and innovations in financing are making renewables more affordable for a broader range of consumers in developed and developing countries alike²⁷. Lower prices made 2012 a good year for installers and consumers.

As a result, new markets in Asia, Latin America, the Middle East, and Africa are gaining momentum, with new investment seen in all renewable technologies and end-use sectors. Markets, manufacturing, and investment shifted increasingly towards developing countries during 2012.

²⁵ “Worldwide Electricity Production from Renewable Energy Sources: Stats and Figures Series”, 2012 edition (Paris: 2012).

²⁶ “Renewable Energy Country Attractiveness Indices 2012”, Ernst & Young.

²⁷ Renewable Energy Finance Tracking Initiative (REFTI), RenewableEnergyWorld.com.

Renewables are moving into new applications and industries, such as desalination and the mining industry, whose operations are energy intensive and often in remote locations²⁸.

1.2.1. Power Sector

Total renewable power capacity worldwide exceeded 1,470 (GW) in 2012, up about 8.5% from 2011. Hydropower rose to an estimated 990 GW, while other renewables grew 21.5% to exceed 480 GW. Globally, wind power accounted for about 39% of renewable power capacity added in 2012, followed by hydropower and solar PV, each accounting for approximately 26%.

Table 1.1.

GLOBAL RENEWABLE ENERGY CAPACITY AND BIOFUEL PRODUCTION, 2012	Added During 2012	Existing at End-2012
Power Generation	(GW)	
Bio-power	+ 9	83
Geothermal power	+ 0.3	11.7
Hydropower	+ 30	990
Ocean power	~ 0	0.5
Solar PV	+ 29	100
Concentrating solar thermal power (CSP)	+ 1	2.5
Wind power	+ 45	283

Solar PV capacity reached the 100 GW milestone to pass bio-power and become the third largest renewable technology in terms of capacity (but not generation), after hydro and wind.

Renewables have still represented a growing share of electric added capacity worldwide yearly: in 2012, they made up just over half of net additions to electric generating capacity.

Actually, renewables accounts more than 26% of total global power generating capacity and supplies an estimated 21.7% of global electricity, with 16.5% of total electricity provided by hydropower²⁹.

²⁸ "Global Trends in Renewable Energy Investment 2012", BNEF (Paris: 2012)

²⁹ "World Energy Outlook 2012", IEA

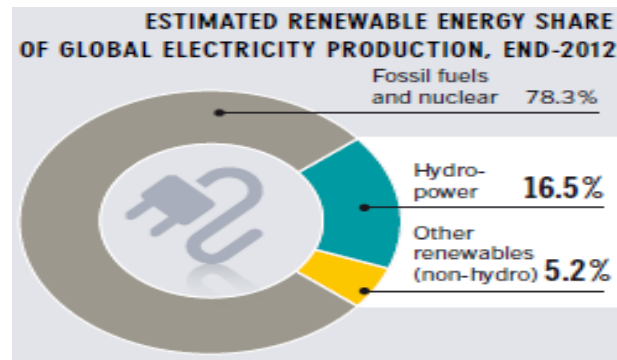


Figure 1.9.

Wind and solar power are achieving high levels of penetration in countries like Denmark and Italy, which generated 30% of electricity with wind and 5.6% with solar PV, respectively, during 2012. In an increasing number of regions, such as Australia, Germany, India, and the United States, the electricity generation share from variable resources has recorded impressive peaks, temporarily meeting high shares of power demand, while often driving down spot market prices.

In addition, the levelised costs of generation from onshore wind and solar PV have fallen, while average global costs from coal and natural gas generation have increased, due to higher capital costs. As prices for many renewable energy technologies continue to fall, a growing number of renewables are achieving grid parity in more and more areas around the world.

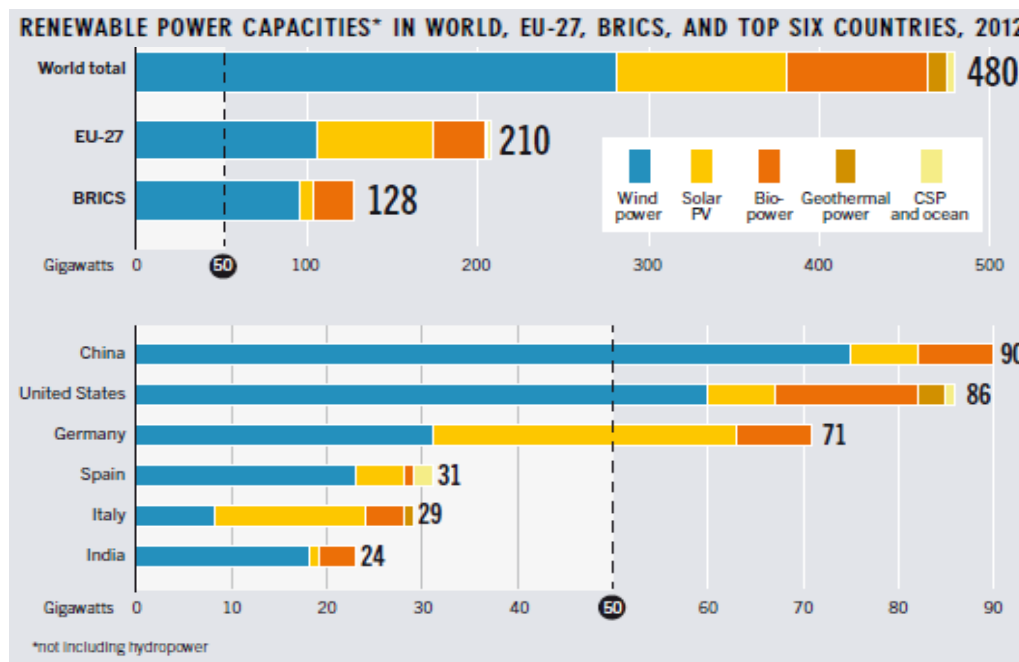


Figure 1.10.

China, the United States, Brazil, Canada, and Germany remained the top countries for total renewable electric capacity by the end of 2012. The top countries for non-hydro renewable power capacity were China, the United States, and Germany, followed by Spain, Italy, and India. The ranking on a per capita basis for non-hydro renewable energy capacity in use puts Germany first, followed by Sweden, Spain, Italy, Canada, the United States, the United Kingdom, France, Japan, China, Brazil, and India. In total, these 12 countries accounted for almost 84% of global non-hydro renewable capacity, and the top five countries accounted for 64%³⁰.

China accounts to about one-fifth of the world's renewable power capacity, with an estimated 229 GW of hydropower capacity plus about 90 GW of other renewables (mostly wind) at the end of 2012. Of the 88 GW of electric capacity added in 2012, hydropower represented more than 17% and other renewables for about 19%. Renewables met nearly 20% of China's electricity demand in 2012, with hydropower accounting for 17.4%. Relative to 2011, electricity output in 2012 was up 35.5% from wind, and 400% from solar PV, with wind generation increasing more than generation from coal and passing nuclear power output for the first time³¹.

In the United States, renewables accounted for 12.2% of net electricity generation in 2012, and for more than 15% of total capacity. Hydropower output was down 13.4%, while net generation from other renewables rose from 4.7% in 2011 to 5.4% in 2012. For the first time, wind represented the largest source of electric capacity added, accounting for as much as 45%, and all renewables made up about half of U.S. electric capacity additions during the year³².

Renewables accounted for 22.9% of Germany's electricity consumption (up from 20.5% in 2011), generating more electricity than the country's nuclear, gas-fired, or hard coal power plants (but not lignite plants). Total renewable electricity generation (136 TWh) was more than 10% above 2011 output, with wind energy representing a 33.8% share, followed by biomass with 30% (more than half from

³⁰ "Annual Report 2012", IEA.

³¹ "China renewables and non-fossil energy utilization", CNREC.

³² "Energy Review March 2013", EIA.

biogas), solar PV 20.6%, and hydropower 15.6%. Renewables met 12.6% of Germany's total final energy needs (up from 12.1% in 2011)³³.

Spain has experienced a slowdown in renewable capacity additions resulting from the economic recession and recent policy changes. However, globally it still ranked fourth for non-hydro renewable power capacity, with an estimated 30.8 GW in operation, plus 17 GW of hydro. Renewable energy provided 32% of Spain's electricity needs in 2012 (down from 33% in 2011), with wind contributing the largest share, followed by solar power³⁴. Italy remained in fifth place with 29 GW of non-hydro renewables and 18 GW of hydropower by the end of 2012. Renewables met 27% of the country's electricity demand, up from 24% in 2011, with non-hydro renewables accounting for 15%. About 4.2 GW of renewable power capacity was added in India during 2012, including about 0.7 GW of hydropower and 3.5 GW of other renewables (mostly wind), for a year-end total exceeding 66 GW. Renewables accounted for more than 31% of total installed capacity at year's end, with non-hydro renewables representing over 11% (24 GW).

The BRICS nations accounted for 36% of total global renewable power capacity and almost 27% of non-hydro renewable capacity by the end of 2012. While Russia has a large capacity of hydropower, virtually all of the BRICS' non-hydro capacity is in Brazil, India, and particularly China. South Africa is also starting to gain momentum, with significant wind and CSP capacity under construction by year's end. While the BRICS countries led for capacity of all renewables, the European Union (EU) had the most non-hydro capacity at the end of 2012, with approximately 44% of the global total. Renewables accounted for more than half of all electric capacity added in the EU during the 2000–2012 period, and for almost 70% of additions in 2012, mostly from solar PV (37% of all 2012 additions) and wind (26.5%). At year's end, renewables made up more than one-third of the region's total generating capacity, with non-hydro renewables accounting for more than one-fifth. In 2011, renewables met 20.6% of the region's electricity consumption (up from 20% in 2010) and 13.4% of gross final energy consumption (compared to 12.5% in 2010). In the EU and elsewhere, an increasing number of

³³ "Bruttostromerzeugung in Deutschland von 1990 bis 2012 nach Energieträgern," 14-02-2013.

³⁴ "The Spanish Electricity System", REE.

households and businesses are making voluntary purchases of renewable energy. Voluntary purchases of heat and transport biofuels are options in some countries, but “green energy” purchasing remains most common for renewable electricity. The largest corporate users are reportedly in Japan, Germany, and Finland. Germany has become one of the world’s green power leaders. Its market grew from 0.8 million residential customers in 2006 to 4.3 million in 2011, or 10% of all private households in the country purchasing 13.1 TWh of renewable electricity; including commercial customers, purchases exceeded 21 TWh³⁵. Other major European green power markets include Austria, Belgium (Flanders), Finland, Italy, the Netherlands, Sweden, Switzerland, and the United Kingdom, although the market share in these countries remains below German levels. In the United States, more than half of electricity customers have the option to purchase green power directly from a retail electricity provider. In 2011, the U.S. green power market grew an estimated 20%, and Green-e Energy, the country’s leading certifier of voluntary green power, certified 27.8 TWh. By early 2013, the 50 largest purchasers (including municipalities and corporations) in the Environmental Protection Agency’s Green Power Partnership were buying more than 17 TWh annually from a variety of renewable sources, with 17 partners covering all of their electricity demand. Green power markets also exist in Australia, Canada, Japan, and South Africa³⁶.

Major industrial and commercial customers in Europe, India, the United States, and elsewhere continued to install and operate their own renewable power systems, while community-owned and cooperative projects increased in number during 2012. The year saw expanded installations of small-scale, distributed renewable systems for remote locations as well as grid-connected systems where consumers prefer to generate at least a portion of their electricity on-site. As consumers increasingly become producers of power, particularly in some European countries, some major utilities are losing market share, putting strains on current business models³⁷.

³⁵ “Annual Report 2012–2013”, MNRE – IEA – GWEC.

³⁶ “Market Brief: Status of the Voluntary Renewable Energy Certificate Market”, NREL.

³⁷ “Big business groups to push renewable energy space by raising capacity”, Economic Times.

CHAPTER 2

“ANALYSIS OF THE HISTORICAL AND PLANNED INVESTMENTS IN THE RENEWABLE SECTOR”

2.1. HISTORICAL TREND

2.1.1. Global Overview 2012

Global new investment in renewable power and fuels was USD 244 billion in 2012, down 12% from the previous year’s record amount of USD 279 billion³⁸. Despite the setback, the total in 2012 was the second highest ever and 8% above the 2010 level. The decline in investment—after several years of growth— resulted from uncertainty over support policies in Europe and the United States, as well as from actual retroactive reductions in support. On a more positive note, it also resulted from sharp reductions in technology costs³⁹.

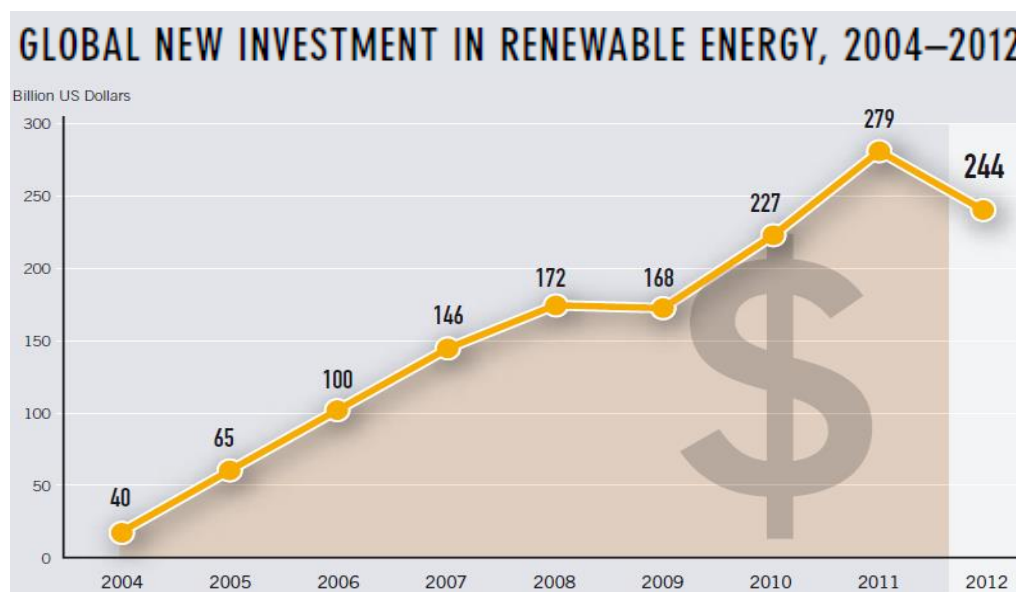


Figure 2.1.

A major theme of 2012 was a further movement in activity from developed to developing economies, although the former group still accounted for more than half of global investment. In 2007, developed economies invested two-and-a-half times

³⁸ “Renewables 2013: Global Status Report”, REN21.

³⁹ UNEP Collaborating Centre for Climate & Sustainable Energy Finance (FS-UNEP) and Bloomberg New Energy Finance (BNEF).

more in renewables (excluding large hydro) than developing countries did; in 2012, the difference was only 15%. China was once again the dominant country for renewable energy investment. The other major theme of 2012 was a further, significant reduction in the costs of solar PV technology. In fact, the continued improvements in cost-competitiveness for solar and wind power helped to support demand in many markets.

2.1.2. Investment Breakdown by Country

The year 2012 saw the most dramatic shift yet in the balance of renewable energy investment worldwide, with the dominance of developed countries waning and the importance of developing countries growing. In the developing world, renewable energy outlays reached USD 112 billion, up from USD 94 billion in 2011, and represented 46% of the world total (up from 34% in 2011 and 37% in 2010). By contrast, outlays by developed economies fell sharply (29%), from USD 186 billion in 2011 to USD 132 billion in 2012, the lowest level since 2009. This shift reflects three important trends: a reduction in subsidies for wind and solar project development in Europe and the United States; increasing investor interest in emerging markets that offer both rising power demand and attractive renewable energy resources; and falling technology costs of wind and solar PV.

Several regions of the world experienced a reduction in investment in 2012 relative to 2011; the exceptions were Asia and the Middle East, the Americas excluding the United States and Brazil, and Africa⁴⁰. (See Figure 2.2.) Europe and China continued to be the most significant investors; together, they accounted for 60% of the world total in 2012, even though it was Europe's weakest year since 2009. At the national level, the top investors included four developing countries (most of the BRICS countries) and six developed countries. China was in the lead with USD 64.7 billion invested, followed by the United States (USD 34.2 billion), Germany (USD 19.8 billion), Japan (USD 16.0 billion), and Italy (USD 14.1 billion). The next five were the United Kingdom (USD 8.8 billion), India (USD 6.4 billion), South Africa (USD 5.7 billion), Brazil (USD 5.3 billion), and France (USD 4.6

⁴⁰ "Special Report on Renewable Energy Sources and Climate Change Mitigation", IPCC.

billion). China accounted for USD 66.6 billion (including R&D) of renewable energy new investment, up 22% from 2011 levels. It was fuelled by strong growth in the solar power sector, including both utility-scale and small-scale projects (<1 MW).

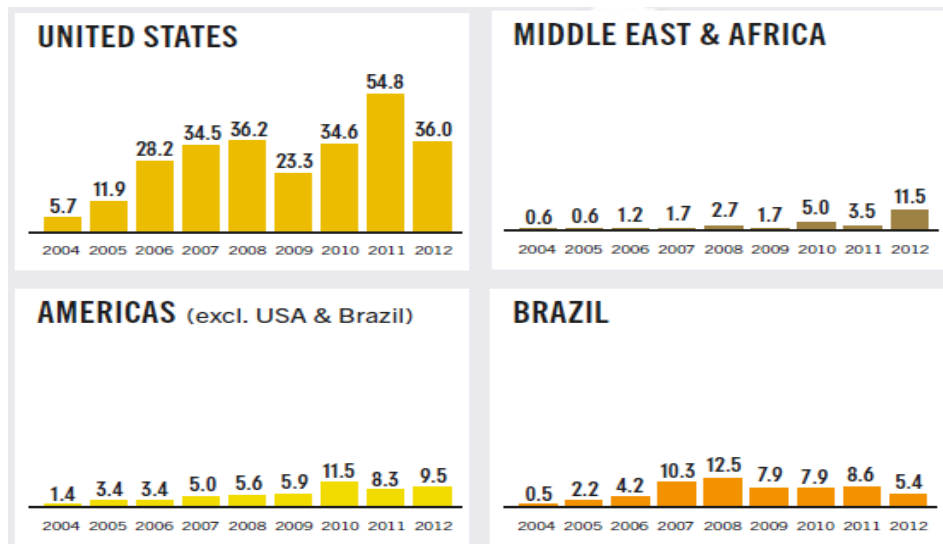


Figure 2.2.

In the United States, overall asset finance dropped to USD 23.4 billion, which is 49% below the 2011 total. This was due primarily to the decline in large solar project financing, from USD 26.7 billion to USD 6.9 billion, which resulted from the expiration of two renewable energy incentives in late 2011. There was a high level of wind asset finance in 2011, driven by a rush to install projects before expected expiration of the U.S. production tax credit at the end of 2012. Due to the time lag between financing and construction, this translated into record capacity additions in 2012; but the financing of wind rose only 5% in 2012, from USD 14.1 billion in 2011 to USD 14.8 billion. Although Germany's total investment in renewables slipped 35%, it remained the third largest investor, installing far more solar PV capacity than any other country, most of it small-scale.

The value of Germany's investment in small-scale solar PV projects fell by 15% to USD 15 billion, reflecting the sharp reductions in module prices during the year.

Germany invested more than any other country in small-scale renewables, but there was a fairly narrow gap between Germany's input and investments in Japan and

Italy. The United States and China took fourth and fifth places for investment in small-scale capacity.

Japan's utility-scale finance jumped 229% to USD 3 billion, and the country saw spectacular investment in small-scale projects, which grew 56% to USD 13.1 billion. These significant increases in both sectors reflect Japan's decision after the March 2011 Fukushima nuclear disaster to encourage renewable energy deployment more vigorously. Japan's feed-in tariff (FIT) for solar PV installations has been particularly attractive for investors.

In Italy, investment in renewable energy fell by 53% in 2012, to USD 14.1 billion. This was due to lower payments under Italy's feed-in tariff (FIT) and to the strict limits put on the amount of new wind and solar power capacity eligible for FIT support. Small-scale investment accounted for most of this total, at USD 13 billion.

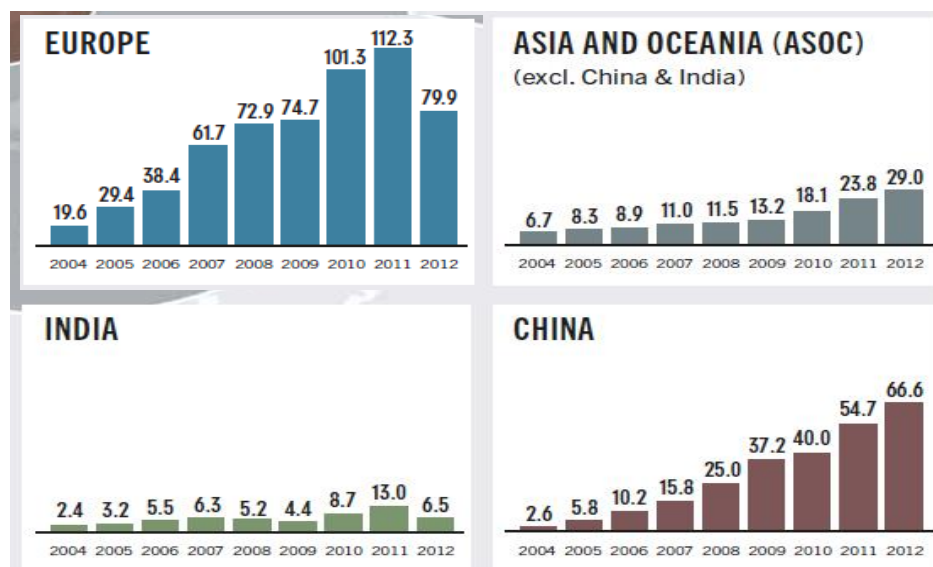


Figure 2.3.

While investment was down in most leading developed country markets, it increased substantially in a number of new markets around the world. There is striking momentum in the Middle East and Africa, where annual investment in renewable energy has risen from less than USD 1 billion in the middle of the last decade to USD 11.5 billion in 2012. South Africa experienced a stunning leap in 2012, increasing its investment in renewable energy from a few hundred million dollars to USD 5.7 billion. Elsewhere in Africa, Morocco saw a jump in outlays

from USD 297 million to USD 1.8 billion, while Kenya saw commitments rise from almost zero in 2011 to USD 1.1 billion in 2012.

In Latin America, Brazil continued to be the leading investor despite a 38% decline in 2012. But investment in renewable energy is growing rapidly elsewhere. Mexico's investment increased more than fivefold, from USD 352 million in 2011 to USD 2 billion in 2012, and Chile and Peru turned out to be attractive new markets.

2.1.3. Investment Breakdown by Sector

In 2012, solar power was the leading sector by far in terms of money committed; at USD 140.4 billion, solar accounted for more than 57% of total new investment in renewable energy.

Wind power was second with USD 80.3 billion, representing almost 33%. The remaining 10% of total new investment was made up of bio-power and waste-to-energy (USD 8.6 billion), small-scale hydropower (<50 MW) (USD 7.8 billion), biofuels (USD 5 billion), geothermal power (USD 2 billion), and ocean energy (USD 0.3 billion). With the exception of small-scale hydropower and ocean energy, investment in 2012 declined relative to 2011 in all renewable sectors tracked by Bloomberg New Energy Finance (BNEF)⁴¹.

Approximately 96% of investment in the solar sector went to solar PV (USD 135.1), with the remaining share going to concentrating solar thermal power (CSP) (USD 5.3 billion). Solar investment dropped in 2012, due primarily to a slump in financing of CSP projects in Spain and the United States (down USD 14 billion from 2011), as well as to sharply lower PV system prices. Solar power investment continued to be dominated by developed economies, which together accounted for 63% of the total (down from 80% in 2011)⁴². Germany, the United States, Japan, and Italy were four of the five largest investors in solar power capacity in 2012. Even so, China accounted for the largest share, at 22% of global investment. The USD 31.3 billion that China invested in 2012 was up sharply from USD 17.8 billion in 2011. Overall, solar power investment in developing countries rocketed up 72%

⁴¹ "Global Trends in Renewable Energy Investment 2013" (Frankfurt: 2013), BNEF.

⁴² "Global Trends in Renewable Energy Investment 2012" (Frankfurt: 2012), BNEF.

to USD 51.7 billion, while investment in developed markets fell by 31% to USD 88.7 billion.

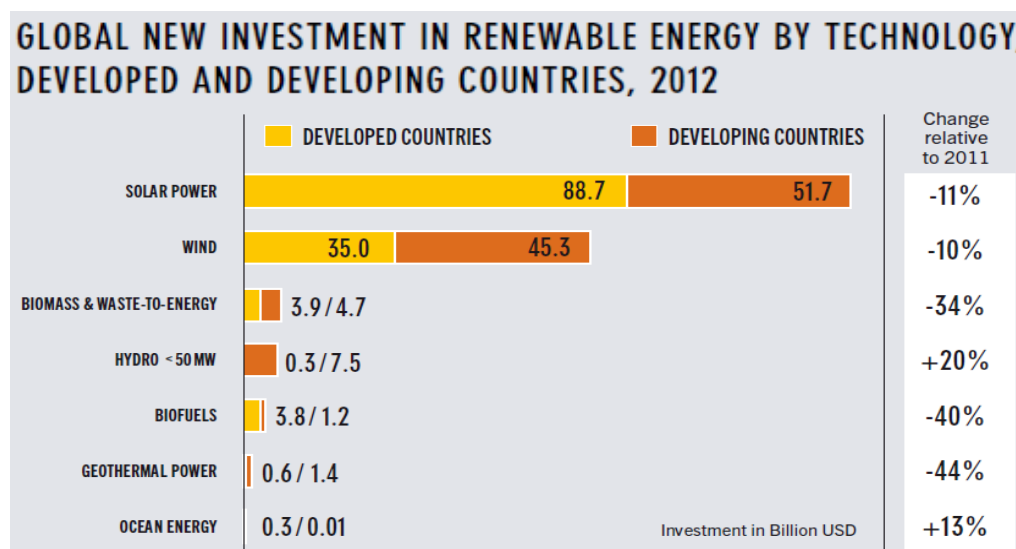


Figure 2.4.

Aside from solar energy, developed countries maintained a lead only in biofuels and the embryonic sector of ocean energy. In all other technologies – including wind power, small-scale hydro, biomass and waste-to-energy, and geothermal power – developing economies were at the forefront. This represents a dramatic break from previous years; in 2011, developing countries were the major investors only in small-scale hydropower⁴³.

Detailed statistics are not available for solar water heating (SWH) technologies or large hydropower projects over 50 MW in size. It is estimated that about 55 GWh of solar collector capacity was added during 2012, with about 80% of this capacity installed in China⁴⁴. The value of this investment is hard to estimate, given the wide range of prices paid for different solar collector technologies, but it is likely to have exceeded USD 10 billion. Investment in large hydropower projects of more than 50 MW continued to be significant in 2012, exceeding all other renewable energy sectors except wind and solar power. Translating capacity additions into asset finance dollars per year is not straightforward because the average project takes four years to build, but it is estimated that asset financing for large hydro projects

⁴³ "Harnessing Variable Renewables – A Guide to the Balancing Challenge", IEA.

⁴⁴ "Solar Heat Worldwide: Markets and Contribution to the Energy Supply 2011", IEA.

commissioned in 2012 totalled at least USD 33 billion – over a fifth of the USD 148.5 billion value of asset finance excluding large hydro⁴⁵.

2.1.4. Investment Breakdown by Type

Global research and development (R&D) spending on renewable energy inched 1% higher to USD 9.6 billion in 2012, marking the eighth consecutive year rise. Global R&D investment has almost doubled since 2004 in absolute terms (up 93%); however, R&D spending by OECD governments as a proportion of GDP is scarcely a quarter of its level 30 years ago⁴⁶. Europe remained the largest centre for R&D in total, but China moved ahead on government spending. The United States was the only region to show positive, although modest, trends in both corporate and government outlays during 2012. Overall, government R&D spending rose 3% to USD 4.8 billion, while corporate R&D fell by 1% to just below USD 4.8 billion, making public and private spending broadly equal for the third year in a row. Solar power continued to dominate at USD 4.9 billion, claiming just over half (51%) of all research dollars spent, despite a 1% fall relative to 2011. It was followed by wind power (up 4% to USD 1.7 billion), and biofuels (up 2% to USD 1.7 billion).

Venture capital and private equity investment (VC/PE) in renewable energy fell by 30% to USD 3.6 billion, the lowest level since 2005, as VC/PE investors faced a bleak economic outlook in Europe, China, and the United States. Other factors driving the decline were overcapacity, plunging product prices, subsidy reductions, and continuing policy uncertainty. Three-quarters of the decline was in private equity expansion capital, and most of the remaining decrease was in early-stage venture capital. By contrast, seed funding, the earliest stage of VC, rose 146% over 2011. While solar remained the largest sector for VC/PE, it suffered the steepest decline, down 40% to USD 1.5 billion, followed by investment in biomass and waste-to-energy, which halved to USD 500 million.

Amid the economic gloom, new public market investment (in stock markets) in renewable energy slumped by more than 60% to just over USD 4 billion, scarcely a fifth of the peak level established in 2007. The main reasons for under-

⁴⁵ “Global Trends in Renewable Energy Investment 2013”, BNEF.

⁴⁶ Data are from the IEA, BNEF and IMF.

performance of renewables shares were distress in the wind and solar supply chains due to overcapacity and unease about policy developments in Europe and the United States. Wind suffered the most, down 72% to USD 1.3 billion. This left solar power as the biggest issuer of new stocks, at USD 2.3 billion, despite the fact that it was down 50% relative to 2011. Biofuels took third place with USD 400 million, but shrank 43%.

Asset finance of utility-scale projects again made up the lion's share (61%) of total new investment in renewable energy, totalling USD 148.5 billion in 2012. This was down 18% from the record USD 180.1 billion in 2011, but ahead of the USD 143.7 billion in 2010. The utility-scale share of all renewable energy investment was down four percentage points from 2011, reflecting the rising share of total investment going to small (<1 MW) residential and commercial solar projects. Small-scale distributed capacity was the renewable energy stalwart of the year. Investment in small-scale installations rose by 3% to USD 80 billion, compared with the 12% decline in total new investment in renewable energy. This means that projects of less than 1 MW capacity attracted almost a third of the total new investment – up from 28% in 2011 and 27% in 2010. Although the 3% rise was far below the 24% growth seen in 2011, it came despite a further significant drop in solar PV module prices. Even as global investment in this sector increased, it declined in every European country on the top 10 list for investment in small-scale projects, with the exception of Greece, as austerity-hit governments sought to limit pressure on electricity consumers by cutting renewable power subsidies. Greece, which ranked eighth for small-scale investment in 2012, saw a 195% increase, as did China. Investment in small-scale projects also rose in the United States and Japan.

A new mechanism has evolved in recent years to raise capital for projects from a large number of small investors. "Crowd funding" first developed in the United States, is now being applied to renewable energy and spreading through western Europe, and it is particularly well suited to small-scale projects.

Mergers and acquisition (M&A) activity – which is not counted as part of the USD 244 billion in new investment – fell sharply (29%) in 2012 to USD 52.3 billion, from an all-time high of USD 73.4 billion in 2011. The decline was almost entirely

due to a collapse in corporate mergers and acquisitions caused by the general economic slowdown.

2.1.5. Bank Finance

Development banks provided USD 79.1 billion of finance in 2012 to broad clean energy, including hydro and other renewable energy projects, manufacturers, research, energy efficiency, transmissions, and distribution. This was down just over 1% from 2011 levels. Of this amount, USD 50.8 billion of finance went to renewable energy projects, manufacturers, and research efforts, down slightly from the previous year⁴⁷. The largest player was once again Germany's KfW, which made USD 26 billion (EUR 20 billion) of finance available, down 10% on 2011 levels, followed by China Development Bank with USD 15 billion (up 1%), BNDES of Brazil (USD 11.9 billion), European Investment Bank (USD 6 billion) and World Bank Group (USD 5 billion). Looking at core renewable energy lending, the European investment Bank made some USD 5.6 billion (EUR 4.3 billion) available in 2012. One key new trend in 2012 was the increasing role of smaller and newer development banks in renewable energy financing.

These included the Development Bank of Southern Africa, which approved loan facilities totalling USD 1 billion earmarked for renewable energy projects, and the African Development Bank, which granted Morocco USD 800 millions in loans to support renewable energy programmes.

2.2. PLANNED INVESTMENT

2.2.1. Global Overview

Global investment in renewable energy has increased rapidly during last years, due to the increasing fossil fuel cost, new policies and climate change discussions, in order to develop green energy capacity. Green investments (excluding hydro) are expected to rise from USD 195bn in 2010 to USD 395bn in 2020 and to USD 460bn

⁴⁷ "Renewables 2013: Global Status Report", REN21.

by 2030, according to Bloomberg New Energy Finance analysis. Over the next 20 years, USD 7 trillion of new capital will be needed to sustaining this growth⁴⁸.

Renewable sources share of total primary energy production will increase from 12.6% in 2010 to 15.7% in 2030, from 10.3% to 13.2% over the same period for the non-hydro ones. In the next 10 years there will be a steep “big” climb in investment as countries try to meet their 2020 renewables targets. In addition, the more costly offshore wind projects will attract much of the investment in 2018-20, in particular in Germany and the UK. Expenditure on renewable energy projects is likely to dip temporarily in the early 2020s as countries review their longer-term objectives, as an effect of the huge expansion in renewables over the previous years.

2.2.2. Regional Outlook

Europe will continue to be the largest regional market for renewables up to 2014, with 25% of world investment, but will see a reduction over this period as the value of clean energy support mechanisms will be under revision by governments, due to the persisting sovereign debt problems. European market growth will resume brake post 2015 at an annual growth rate of 8% as investment is expected to meet the European renewable energy target by 2020.

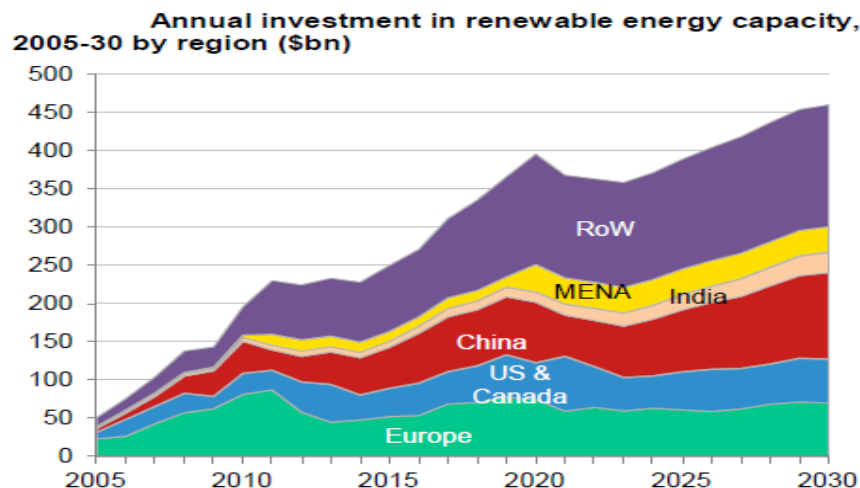


Figure 2.5.

The rest of the world will experience a minor impact of European economic downturn. In China, investment in renewable energy is expected to growth

⁴⁸ “Global Renewable Energy Market Outlook 2012”, BNEF.

continuously for all years, achieving by 2014, first position as the largest single market for renewable energy with an annual expenditure of about USD 50bn, accounting for 21% of the world market. The US and Canada are also expected to recover after lasting decrease in project building, together with USD 50bn of total investment by 2020.

The rapidly developing economies of India, the Middle East and North Africa (MENA), Africa and Latin America will experience the fastest growth, thanks to growth rates of 10-18% per year between 2010 and 2020. By 2020, the markets outside of the EU, US, Canada and China will reach a share of 50% on overall world investment.

2.2.3. Technological outlook

After 2020, new energy policies together with lower costs of renewable technologies will lead deployment of renewable energy technologies. In the decade to 2030, world investment in renewables will increase by a more modest 2.5% per year, as a consequence of a very significant development as the cost of technologies decrease. Cost reduction effects will influence the solar sector, where unit costs are expected to fall by 60% over the next 20 years. This will stimulate solar technologies around the world, so investment required for the same output will be less. Solar annual investment will go from USD 86bn in 2010 to USD 150bn in 2020 and then constant at USD 150bn per year from 2020 to 2030.

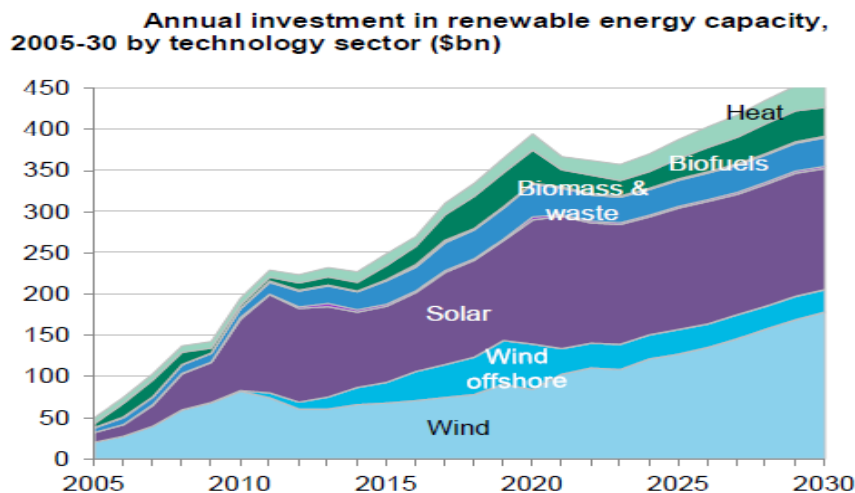


Figure 2.6.

The wind sector will have similar trend, growing from USD 71bn in 2010 to USD 140bn in 2020 and USD 82bn in 2030. The bioenergy sector will have new activity with the commercialisation of second-generation technologies and global supply chains developing in the movement of biomass fuels. Biofuels, biomass and waste-to-energy is expected to growth from USD 14bn in 2010 to USD 80bn in 2020 and then will follow the same trend in the following decade.

2.2.4. Power Generation

Net power production will growth by about 90% over the next 20 years, to 34,000 TWh worldwide. Electricity intensity has declined over the last 20 years and will continue to come down, due to correlation between economic growth and electricity demand. Clean electricity share (renewables, including hydro, and fossil-fuel plants with carbon capture and storage) will rise from 23% in 2010 to 29% in 2020, reaching 34% in 2030.

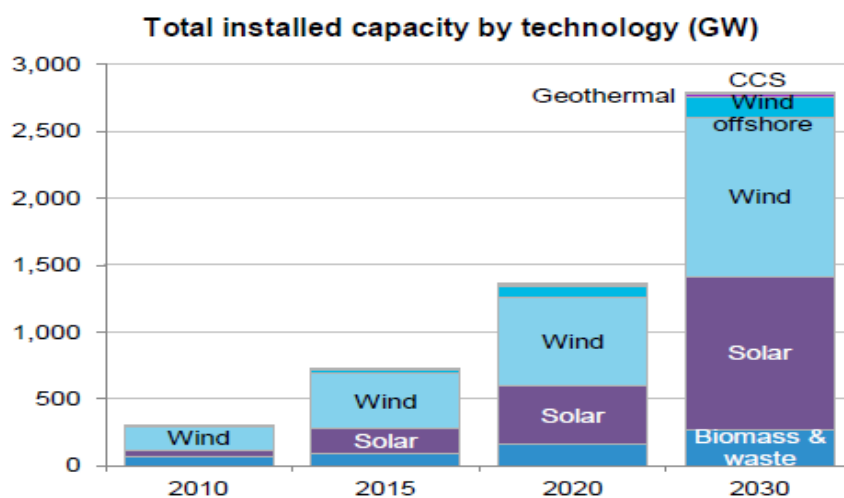


Figure 2.7.

The share of hydropower is expected to decline from some 19% in 2010 to 15% by 2020. Because of the overall increase in power production, hydro output will still growth by 2% a year, due to the overall increasing of power production. The aggregate share of other renewable technologies, such as wind, solar and geothermal, and CCS, will increase from 5% in 2010 to 19% in 2030, with a 10% compound annual growth rate. Total installed capacity of renewable power sources is also expected to rise, growing by 2.5 TW to 2030, with a 800% increase. Around 1.1 TW of new build, with 36% from solar and 46% onshore wind are expected to

be experienced, followed by 1.4 TW between 2021 and 2030, of which half will be new solar installations and 37% onshore wind.

Total clean energy investment is expected to reach a level just below USD 6 trillion over the next 20 years. An average USD 248bn will be spent each year, increasing to USD 350bn from 2021.

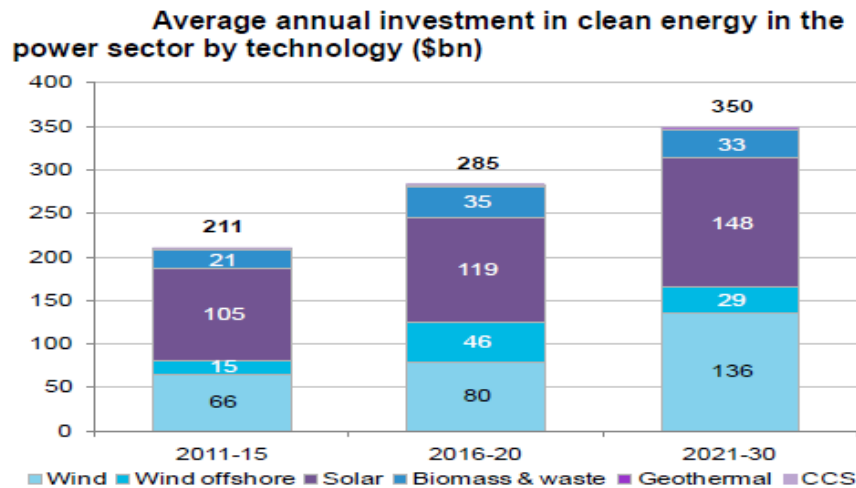


Figure 2.8.

Solar will attract around half of the spend, at USD 1.1 trillion between 2011 and 2020 and USD 1.5 trillion in the next decade. Wind (onshore and offshore) will follow, absorbing a little over one-third of total investment this decade and 41% over the next. The relatively high levels of investment in wind are due to the large number of new offshore installations in Europe, especially UK and Germany, before 2020 as well as the refurbishment of old wind farms in the EU, US and China over 2026-30.

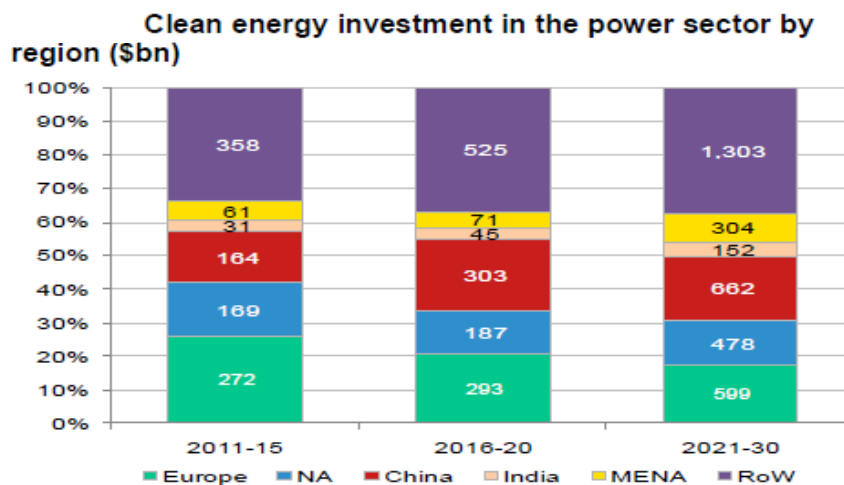


Figure 2.9.

The focus of the renewable power market is changing, outside the traditional mature markets of Europe and the US.

Smaller markets are growing more aggressively as their power demand goes up more quickly and – more importantly – there remains considerable unexploited potential for renewable power in these regions.

This creates a huge contrast to Europe, for example, where suitable sites for onshore wind are harder to be found.

Europe will be the biggest market for renewable power over the next five years, attracting 26% of the finance, but for the rest of the period, China will take pole position, with some 20% of new investment. The MENA market will also grow very quickly – about 400% over the next 20 years – with oil-fired power plants replaced by new investment in solar power.

2.3. FOCUS ON CHINA'S FUTURE INVESTMENT TREND

Renewables are scheduled to play a key part of China's strategy to meet its growing energy demand. Around 17% of the country's power comes from renewable energy, including hydro, and this figure will need to increase significantly to achieve the national non-fossil fuel policy targets⁴⁹.

2.3.1. Power demand

Economic growth has increased power demand in China to such an extent that power rationing has already been usual in some coastal and central provinces for years. The country's power generation reached 4,228 TWh in 2010, surpassing that of the US and making it the largest power producer in the world.

These trends show no signs of abating. GDP will remain the dominant driver of power demand. According to model, the electricity intensity of the Chinese economy will decrease by 3-4% per year this decade due to higher penetration of energy efficiency and structural changes of the economy.

Nevertheless, strong economic growth will continue to drive up power demand.

⁴⁹ "Global Renewable Energy Market Outlook 2012 – Specific Focus on China", BNEF.

2.3.2. Environmental targets

China has several policy targets that could have an impact on the energy sector and growth in the renewable market. A key of China is to reduce carbon emissions per unit of GDP (carbon intensity) by 40-45% by 2020 on 2005 levels. This target however is unlikely to be an important driver of renewable energy investment as structural changes in the Chinese economy (away from heavy industry) and the natural attrition and/or replacement of aging polluting factories by more modern facilities will most likely lower the carbon intensity of the economy enough for the country to meet this target. The more relevant target is the government's intention to increase the share of non-fossil fuel energy sources to 11.4% of primary energy consumption by 2015 and to 15% by 2020. Although non-fossil fuel includes both nuclear and renewable energy sources, the target will certainly require significant new investment in renewable energy technologies. By 2020, China aims to have at least 160 GW of wind capacity, 30 GW of biomass & waste-to-energy and 50 GW of solar. To incentivise this investment, China currently provides fixed feed-in tariffs for wind, biomass power, waste-to-energy and solar PV projects. In addition, China has introduced subsidies for rooftop and building integrated solar PV, and is considering to adopt a renewable portfolio standard for grid and power companies later this year.

2.3.3. Outlook

Our analysis shows that in China installed capacity of all types of power generation is forecast to increase by just under 150% over the next 20 years (*Figure 2.10.*). It will add approximately 35 GW of coal, 13 GW of nuclear, 12 GW of hydro and 26 GW of other renewables every year up to 2020 (average growth)⁵⁰. In the renewable sector China has historically favoured wind power, which accounted for 86% of renewables capacity in 2010. While wind (onshore and offshore) will retain the top spot by 2030 with 346 GW, solar installations are expected to grow at a far faster rate, reaching 194 GW by 2030 from 0.8 GW in 2010. The capacity of biomass

⁵⁰ "Global Renewable Energy Market Outlook 2012 – Specific Focus on China", BNEF.

and/or waste incineration plants will climb 2.5 GW a year this decade and 2 GW a year over the next.

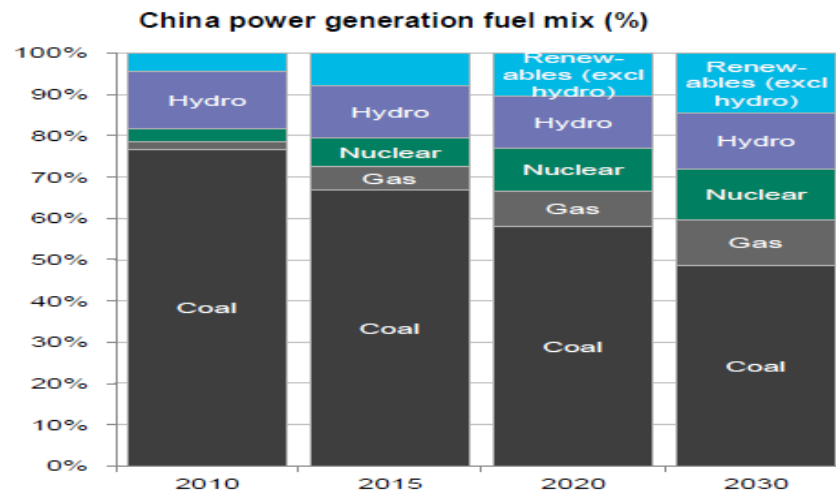


Figure 2.10.

Figure 2.11. shows the increasingly important role of renewable energy in the country's power generation fuel mix.

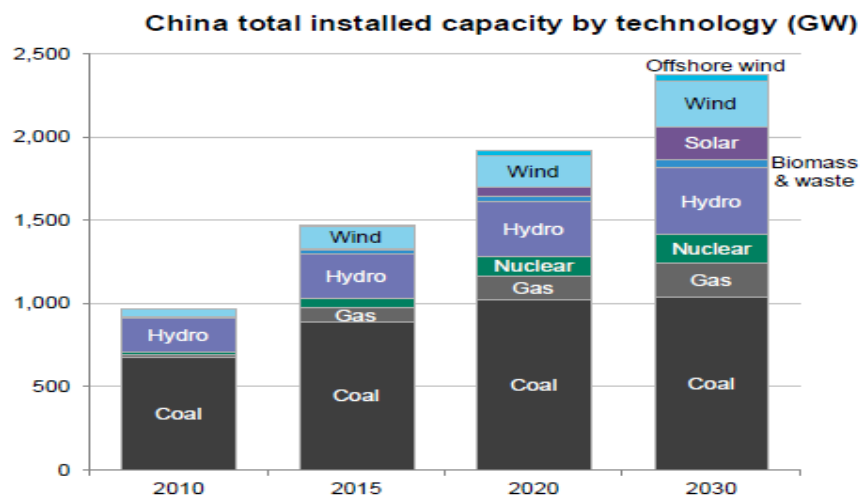


Figure 2.11.

In 2010 all renewable electricity accounted for 17% of total power generation. In less than five years we expect this fraction to rise to 21%, reaching 24% by 2020 and almost 30% in 2030. Including nuclear, the share of clean electricity increases from 22% in 2010 to 33% in 2020 and 40% in 2030. In addition, natural gas will boost its rather trivial share of 2% in 2010 to 8% of total generation in 2020 and 11% in 2030.

These developments will reduce the carbon intensity of the power generation sector by 33% by 2030: at the end of this decade, every MWh will generate 0.67 tCO₂e compared with 0.85 tCO₂e in 2010, declining to 0.57 tCO₂e by 2030.

In terms of investment dollars, China is projected to remain the world's largest market for clean energy investment worth USD1.4 trillion over the next 20 years, equivalent to 20% of the world market. Wind will secure approximately USD 240bn by 2020, of which USD 110bn will go to offshore projects. Between 2021 and 2030 the wind market will increase to just over USD 270bn but the share of offshore technologies will reduce to USD 50bn. This increase in the onshore market size will be driven as much by the refurbishment and/or repowering of existing aging wind farms as new capacity additions⁵¹.

The Chinese solar market will also grow significantly, but up to 2020 it will remain around half the size of the wind market. Some USD 112bn is expected to be spent on solar power generation technologies up to 2020 decade, half of which will go to small-scale installations. Over 2021-30 the solar market will increase more rapidly as costs continue to fall and fossil subsidies are phased out. Our central projection is that investment in solar capacity will increase to USD 241bn between 2021 and 2030 with solar PV projects taking the lion's share.

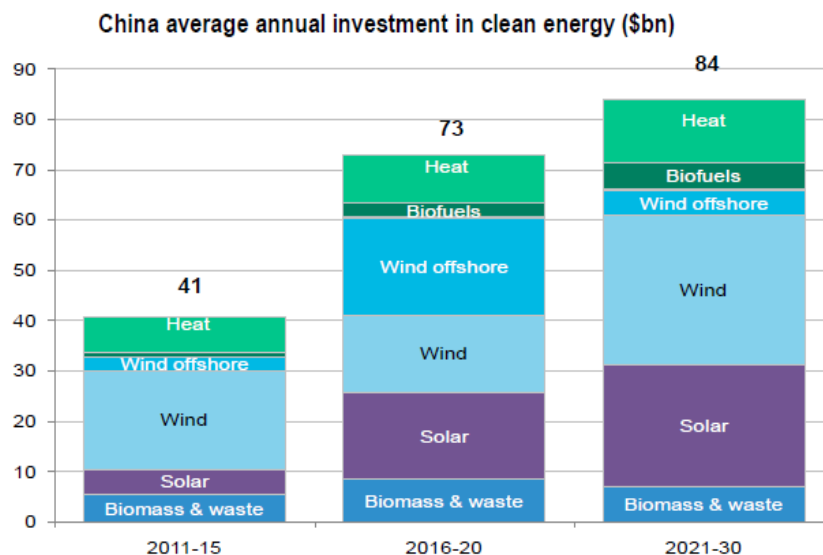


Figure 2.12.

⁵¹ "Global Renewable Energy Market Outlook 2012 – Specific Focus on China", BNEF.

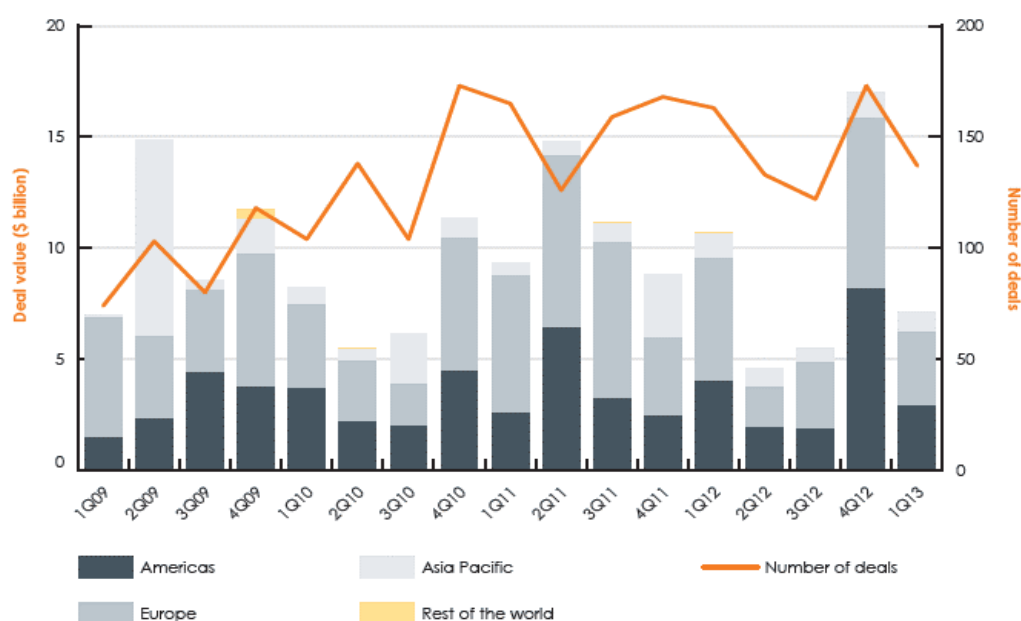
CHAPTER 3

“M&A TRENDS ACTIVITY IN THE RENEWABLE SECTOR”

3.1. GLOBAL OVERVIEW

Global renewable energy M&A activity has grown constantly during the past four years. A total of 591 acquisitions valued at USD 37.8 billion were announced in 2012, a 58% increase on the 375 deals, totalling USD 42.1 billion, announced in 2009. An absence of large deals resulted in the decline in the total value of announced transactions⁵².

Global renewable energy M&A activity



Source: Clean Energy Pipeline

Figure 3.1.

New renewable energy capacity continued to grow rapidly in 2012. A record 44.8 GW of wind capacity was installed in 2012, counting a 10% increase on the 40.6 GW in 2011. New solar PV capacity reached 30 GW in 2012, following a similar trend, reaching the record volumes achieved in 2011. From an M&A perspective,

⁵² “Green Energy 2013: Renewable Energy M&A Activity”, CohnReznick – Clean Energy Pipeline.

the sector was less active. After a 42% increase in activity value in 2011, the value of announced deals fell 14% to USD 37.8 billion in 2012, a 4% decline in the number of announced deals. Only five billionaire deals with a total combined value of USD 8.6 billion were announced in 2012, comparing with seven similar sized transactions (total value: USD 14.3 billion) in 2011. Last year's M&A activity followed historic trends – 591 acquisitions were announced in 2012, a 58% increase on the 375 deals announced in 2009.

Looking at 2013 and beyond, survey respondents are unanimous in predicting that M&A activity will continue to be lively – nine out of ten survey respondents believe that the number of sub-USD 500 million M&A transactions will increase or very likely remain stable during the next 18 months.

3.1.1. Principal issues

The ongoing decline in equipment and system costs will bring M&A activity to remain constant during the next 18 months. Costs for a number of renewable energy technologies continued to fall significantly in 2012. Solar PV crystalline modules are currently priced on the spot market at €1.02 per watt in Germany and €0.74 per watt in China (*Source: pvXchange*), totalling a 37% and 46% decline, respectively, on 12 months ago price. Costs have fallen to such an extent that renewable energy has now achieved grid parity in a number of emerging markets, due to big falling in costs. This means that, depending on the country, new built renewables can compete directly against fossil fuels ones without subsidies. In Brazil, wind has been so able to challenge with combined cycle gas turbine (CCGT) plants, bringing to a separation between wind and CCGT auctions this year.

Established markets, where there is often excess power supply, will experience a different situation. In these markets, there is usually a competition between new built renewable energy and operational fossil fuel projects, especially due to concerns about government support.

3.1.2. Subsidies retro activeness

Although renewable energy costs continued to decline in 2012, investment in a number of core markets was typified by retroactive changes to subsidies, even if

costs continued to decrease in 2012. A good example was in Spain, where the Government announced the introduction of a 7% tax on electricity sales in December 2012 to reduce its €24 billion-tariff deficit. The tax effectively functions as a retroactive cut to feed-in tariff subsidies by diminishing an asset-generated revenue over the course of its life and in turn reducing investors' rate of return. The tax followed the announcement in January 2012, that feed-in tariffs would be suspended for all new projects. Spain is not unique in introducing retroactive cuts. Both Bulgaria and Romania announced retroactive cuts in 2012. Even Germany proposed a one year 1.5% retroactive cut to subsidy payments for all operating renewable energy projects, although this plan has since been postponed.

Retroactive policies affect investor confidence on the countries, in which they are applied. Outside Europe and North America, subsidy frameworks and procurement processes are just beginning to be smoothed. Brazil was one of the first countries to actively encourage investment in renewable energy and has managed a series of regular renewable energy tender auctions since December 2009. South Africa allocated preferential bidder status to 28 renewable energy projects during the first renewable energy IPP procurement round. All 28 projects secured financing totalling USD 5.7 billion in November 2012.

European style feed-in tariffs to subsidise renewable energy investment has been left out by many emerging markets. A range of subsidies (as part of its climate change bill) has been introduced by Mexico in April 2012, bringing the country to a 50% cut in carbon emissions by 2050. This explains why these markets are grabbing the attention of international developers.

3.1.3. Project finance

According to survey respondents, the availability of acquisition finance (debt and equity) has the greatest impact on M&A activity. It is more important than the need to meet regulatory targets; the need for consolidation; or the need to improve green credentials. Unfortunately, the availability of acquisition finance has not improved during the last 18 months. The availability of project debt finance affected M&A activity strongly, as well. If project finance is restricted, small developers may need

to sell to larger developers with larger balance sheets, totalling higher M&A activity in the short term.

Project debt finance displayed also some cracks. Only USD 156 billion of project finance was directed to renewable energy assets globally in 2012, a 13% decrease on the USD 180 billion invested in 2011, meeting its first annual decrease. Only USD 24 billion of project finance was spent globally in 1Q13, the lowest quarterly level since the beginning of 2009.

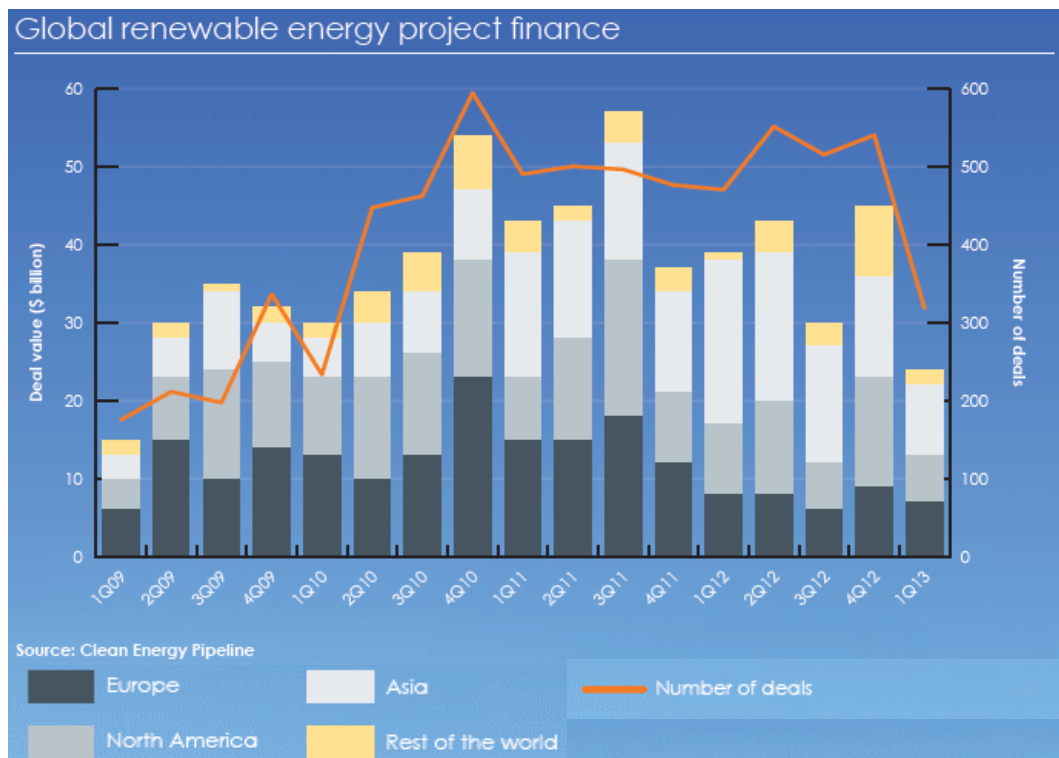


Figure 3.2.

3.1.4. Project Sponsorship

Eight of the ten most active project sponsors (measured by the number of projects financed) in 2012 were Chinese. China Guodian was the most active, securing USD 4.9 billion for 54 wind farms and 9 solar PV plants, all located in China⁵³. The most notable financed projects were the 250 MW Shanxi Qinyuan wind farm (USD 303 million), the 249 MW Hebei Shangyi Chaoligai wind farm (USD 247.8 million) and the 60 MW Phase II Wulanchabu Siziwangqi solar plant (USD 139 million).

⁵³ "Clean Energy League Table 2012", BNEF.

China Datang Corp Renewable Power was the second most active project sponsor in 2012, securing USD 4.2 billion for 53 onshore wind farms and 6 solar PV farms, all located in China. China Longyuan Power Group was third, securing USD 4.2 billion for 51 onshore wind farms, two solar PV plants and one offshore wind farm, while China Huadian New Energy Development was fourth, securing USD 3.9 billion for 40 onshore wind farms and nine solar PV plants.

Table 3.1.

Rank	Project Sponsors	Number of Deals	Deal Value (\$ million)
1	China Guodian Corp.	63	4,874
2	China Datang Corp. Renewable Power Co. Ltd	59	4,231
3	China Longyuan Power Group Corp Ltd.	54	4,180
4	China Huadian New Energy Development Co. Ltd	49	3,915
5	Huaneng Renewables Corp. Ltd.	47	4,727
6	China Guangdong Nuclear Power Group	37	2,776
7	Enel Green Power Spa	26	2,074
8	IKEA Group	22	110
9	Guohua Energy Investment Co. Ltd	21	1,694
10	China Power Investment Corp.	19	1,444

Enel Green Power and IKEA Group were the only non-Chinese project sponsors to feature in the top ten list. Enel Green Power secured USD 2.1 billion of project financing for 26 projects. Notable projects financed include a 410 MW portfolio of wind farms situated in Romania, the USA and Brazil and the 235 MW Chisholm wind farm that is being developed in conjunction with GE Capital.

IKEA Group makes it into the top ten list (by number of projects financed) by financing 22 small-scale projects in 2012, and it has recently doubled its planned spending on renewable to USD 2 billion by 2015 and USD 4 billion by 2020.

Another big profile example of investment include Google, which has already invested more than USD 1 billion in 12 renewable energy projects, mostly in wind and solar sectors across world, such as USD 200 million in a 161 MW wind farm in January 2013. Many other global corporates from multiple sectors have also started out on the renewable energy journey: Nike, HSBC, Volkswagen, Nestle, BT, PepsiCo, Cemex, Renault, BMW and Apple – are a few of the brands moving into this space⁵⁴.

⁵⁴ “Renewable energy country attractiveness indices” (2013), Ernst & Young.

3.1.5. Active players

The most active acquirers of renewable energy assets are financial investors. In 2012 private equity funds, infrastructure funds, pension funds and life insurance companies announced 124 acquisitions valued at USD9.7 billion, less than the 111 acquisitions totalling USD 12.6 billion announced in 2011, but higher of the USD 6.1 billion and USD 5.0 billion announced in 2010 and 2009, respectively. Last year they were ranked second behind independent power producers. As the sector's technology has matured and the volume of operating assets has increased, Infrastructure funds have become more active, especially thanks to technology maturity and bigger operating assets volume. Stable and inflation-linked returns offered by operational renewable assets, due to the current low bond yield environment, is an attraction for longer-term investors.

Table 3.2.

INVESTOR/ACQUIRER	STAKE	TARGET/FUNDING RECIPIENT	DATE ANNOUNCED	DEAL VALUE	DEAL TYPE
Friends Life Group	N/A	Drax – coal to biomass conversion project (UK)	April 2013	\$115 million	Corporate debt
Metal Industries Benefit Funds Administrators (MIBFA)	N/A	Mergence Renewable Energy Debt Fund (South Africa)	April 2013	\$109 million	Fund investment
Caisse de dépôt et placement du Québec*	25%	630MW London Array offshore wind farm – phase one (UK)	February 2013	\$786 million	Acquisition
Industriens Pensjonsforsikring A/S, PKA A/S	22.5% each	288MW Butendiek offshore wind farm (Germany)	February 2013	Undisclosed	Project equity investment
Caisse de dépôt et placement du Québec	Minority (exact stake undisclosed)	1.5GW portfolio of operational wind capacity (USA and Canada)	January 2013	\$500 million	Acquisition
PensionDanmark A/S	50%	433MW portfolio of three wind farms (USA)	October 2012	Undisclosed	Acquisition
Public Sector Pension Investment Board	N/A	Isolux Corsán (Spain)	July 2012	\$633 million	Equity investment
Caisse de dépôt et placement du Québec	10%	Innergex Renewable Energy (Canada)	July 2012	\$98 million	Private placement
PensionDanmark A/S	N/A	216MW Northwind offshore wind farm (Belgium)	June 2012	\$44 million	Project debt finance
PGGM	33.75%	396MW Marenas Renovables wind farm (Mexico)	February 2012	Undisclosed	Acquisition

Source: Clean Energy Pipeline

Pension funds are expected to increase their investment activity, starting to take construction-stage risks, as a new development respect to past years. Two Danish pension funds Industriens Pension and PKA A/S, for example, participated in the equity financing of the 288 MW Butendiek offshore wind farm situated in German waters in February 2013. This kind of investors are most attracted by mature renewable sectors - onshore wind, hydro and solar PV. To date, pension funds have

invested equity in renewable energy assets, following two strategies: investing in infrastructure funds and direct investment in large-scale projects.

3.1.6. Common strategies

Major utilities are divesting non-core renewable energy assets to rebuild their balance sheets and free up capital to invest in offshore wind assets.

In 2012, major utilities announced the sale of 32 renewable energy asset portfolios valued at USD 12.5 billion, more than double with respect to the USD 5.4 billion of asset sales announced in 2011. In the first quarter of 2013, utilities have announced disposals of 16 renewable energy asset portfolios valued at USD 2.0 billion. European utilities or subsidiaries of European utilities accounted for 87% of all assets divested by utilities (USD 10.9 billion in 2012). However, these utilities own renewable energy assets worldwide, generating a good deal-flow, due to divestment strategies. For example, French utility GDF Suez agreed to sell a 60% stake in its 680 MW Canadian renewable energy portfolio, valued at over CAD 2 billion (USD 2.03 billion), to Japanese conglomerate Mitsui & Co. and Canada-based asset management firm Fiera Axiom Infrastructure in December 2012.

Similarly, German utility company E.ON announced the sale in October 2012 of 50% stakes in three US wind farms totalling 433 MW to Danish pension fund PensionDanmark. Large-scale offshore wind farms are the major target of divestment proceeds, used as reinvestment source. For example, Danish state-owned power producer DONG Energy sold a 50% stake in its 277 MW Borkum Riffgrund I offshore wind farm in May 2012. Three months later, DONG acquired a portfolio of three offshore wind projects in Germany from PNE Wind AG for an upfront cash consideration of EUR 57 million and deferred payments of up to €100 million. Nevertheless, the USD 12.5 billion worth of divestments announced by utilities in 2012 represented a third of the total value of all M&A activity globally. Utilities are expected to be involved in new acquisitions as well. According to survey respondents, utilities are now ranked third most active acquirer behind

infrastructure funds and independent power producers. Two years ago they were ranked most likely active acquirer⁵⁵.

Table 3.3.

SELLER	ASSETS DIVESTED	STAKE DIVESTED	ENTERPRISE VALUE	ACQUIRER	DATE ANNOUNCED	MULTIPLE (OPERATIONAL PROJECT ONLY)
GDF Suez SA	680MW Canadian wind portfolio comprising 363MW of operational capacity and 317MW of planned capacity (Canada)	60%	\$2.00 billion	Mitsui & Co. Ltd., Fiera Axium Infrastructure Inc.	December 2012	n/a
DOING Energy A/S	277MW Borkum Riffgrund offshore wind farm (pre-construction) (Germany)	50%	\$1.70 billion	KIRKE A/S, Oficon Foundation	February 2012	n/a
EDP Renováveis S.A.	599MW portfolio of wind farms (USA)	49%	\$1.45 billion	Borealis Infrastructure	November 2012	\$2.4 million per MW
EDP Renováveis S.A.	644MW portfolio of wind projects comprising 615MW of operational capacity and 29MW of planned capacity (Portugal)	49%	\$1.34 billion	China Three Gorges	December 2012	\$2.2 million per MW, 6.7xEBITDA
E.ON AG	E.ON Energy from Waste (Germany)	51%	\$1.20 billion	EGT Infrastructure II	December 2012	1.8xRevenues
GDF Suez SA	IP Maestrale Investments Ltd (comprising 550MW installed wind capacity in Italy and 86MW installed wind capacity in Germany) (Italy & Germany)	80%	\$1.18 billion	ERG SpA	December 2012	\$1.9 million per MW, 5.2xEBITDA
NextEra Energy Resources LLC	White Pine Hydro Investments LLC (comprising 351MW operating hydro capacity in the USA) (USA)	100%	\$760 million	Brookfield Renewable Energy Partners	December 2012	\$2.2 million per MW
Iberdrola SA	Iberdrola Renovables France SAS (comprising 321.4MW of operational wind capacity) (France)	100%	\$529 million	GE Energy Financial Services, MEAG, EDF Energies Nouvelles	December 2012	\$1.4 million per MW
Iberdrola SA	IBERDROLA Renewables Polska (comprising 184.5MW of operational wind capacity and a wind project of undisclosed assets) (Poland)	75%	\$356 million	Energa SA, PGE Energia Odnawialna SA	February 2012	\$1.9 million per MW
Bectricity de France SA	150MW Massif du Sud wind farm (Canada)	50%	\$344 million	Enbridge Inc.	December 2012	\$2.3 million per MW
DOING Energy A/S	111.5MW portfolio of three operating wind farms and a 700MW development portfolio (Poland)	100%	\$319 million	Energa SA, PGE Energia Odnawialna SA	February 2013	n/a
Iberdrola SA	62.9MW of operational wind capacity (Germany)	100%	\$51.9 million	MVV Windenergie GmbH	December 2012	\$1.3 million per MW
E.ON AG	433MW US wind portfolio comprising the Papalote Creek I & II and the Stony Creek wind farms (USA)	50%	Undisclosed	PensionDanmark A/S	October 2012	n/a
Bectricity de France SA	205.5MW Lakefield wind farm (USA)	50%	Undisclosed	Abu Dhabi National Energy Company (TAQA)	January 2013	n/a
Bectricity de France SA	205.5MW Lakefield wind farm (USA)	50%	Undisclosed	Marubeni Corp.	October 2012	n/a

Source: Clean Energy Pipeline

⁵⁵ “Green Energy 2013: Renewable Energy M&A Activity”, CohnReznick – Clean Energy Pipeline.

3.1.7. Bank Activities

The cost of project finance debt varies significantly by region and technology. In Europe, solar PV farms, onshore wind farms and biomass plants are currently financed at an average of 320 bps above Libor. In North America similar projects expect to secure better terms by on average 40 bps. Rates are low in North America, because Life Insurance Companies are now allocating significant capital to renewables and the banking sector has rebounded more quickly than in Europe. Banks are obliged to offer more competitive rates, because of decreasing number of projects seeking financing. “Historically, a lot of the debt financing capacity in this market has come from European banks,” explained Lance Markowitz, Senior Vice President and Manager of the Leasing and Asset Finance Division of Union Bank. “Eighteen months ago their pricing was inhibited by what was going on in Greece and other countries. While pricing had momentarily tightened it once again increased reflecting funding difficulties of various market participants. Banks are now being much more aggressive on pricing and terms. The banks that are still in the market seem to be on a more solid footing. More importantly, there are not really a lot of projects in the US seeking debt financing right now. There is a dearth of quality deals and banks are eager to get their share. We were in the 275-325bps above Libor range 12-18 months ago with lots of mini-perm structures. Today the market is plus or minus 50 basis points below with much longer tenors being offered.” The expiration of the 1603 cash grant program is also inhibiting developers from raising project debt financing, since the equity requirement now needs to be financed through tax equity. There is limited scope for debt to be brought into tax equity-financed projects, since the cash flows are swallowed up by tax equity investors and are therefore unavailable to be used to repay debt. This is forcing banks to compete more aggressively to participate in transactions. “A lot of wind projects were financed utilising the cash grant, which has now expired, largely focused on projects that include PTCs as part of their economics,” continued Lance Markowitz, Senior Vice President and Manager of the Leasing and Asset Finance Division of Union Bank. “As a result, most wind projects are now being financed utilizing unlevered partnership flip structures, where the debt opportunity is more limited. In this structure, debt is limited to construction financing and possibly a

back leverage of the sponsor's investment. That is one reason why the banks are so aggressive when they do have an opportunity." Evidence suggests tax equity margins are also decreasing, due to a reduction in PPA prices. "The margins that tax equity players were working with are not sustainable now as energy prices in PPAs have dropped significantly", confirmed Alejandro Burgaleta, CFO of Gestamp Wind. "There is just less of the pie to share. Tax equity providers have adjusted their expectations as otherwise projects just would not have got built. With projects being so tight the returns that were available last year are not anymore".

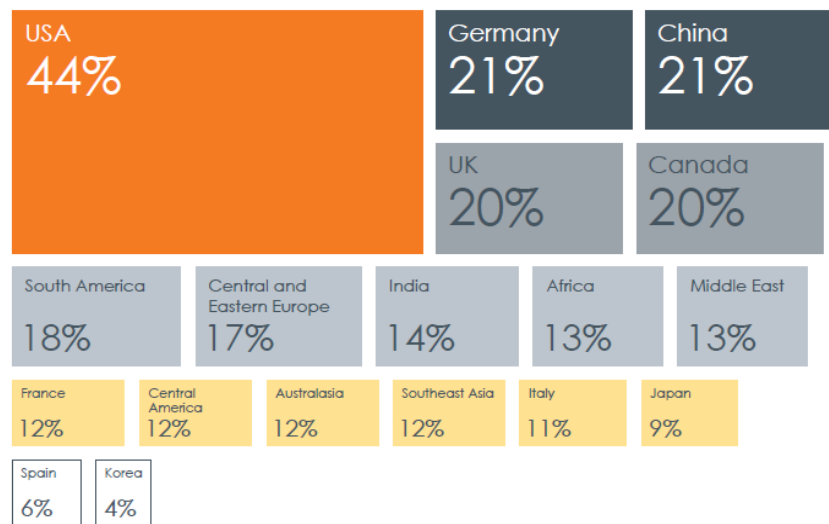
3.1.8. Valuation Differences

There is limited disparity in valuations around the world, except when it comes to pre-construction stage solar PV assets. According to survey respondents, in North America these assets are currently being acquired for USD 1.2 million per MW, 3x the USD 0.4 million per MW average valuation in Europe. This is essentially because the US solar investment tax credit, which provides investors with a 30% tax credit on residential and commercial projects, and is not due to expire until 2016. This has triggered a series of acquisitions of pre-construction stage assets. Most notably, MidAmerican Renewables acquired the planned 579 MW Antelope Valley Solar Projects (AVSP) from SunPower Corp in December 2012, for an undisclosed sum. The co-located projects, which are located in Kern and Los Angeles Counties, are the largest permitted projects in the world. Attraction for pre-construction stage solar PV has changed in Europe because subsidies are going to be eliminated. In March 2012, Germany enacted feed-in tariff cuts of 20% - 30% for sub-5 MW solar PV projects and removed subsidies entirely for new projects larger than 10 MW. In August, Italy cut subsidies for solar PV projects by an average of 35%, as its new Conto Energia V subsidy programme came into effect. This prompted a marked decrease in the valuation of planned projects, bringing valuations of pre-construction stage solar PV projects in Europe fell by an average of 8% in the last 18 months. Similar situation is experienced in the supply chain. According to survey respondents, EBITDA-positive European renewable energy companies are

currently being acquired for a multiple of 4.7x revenues, which is at a discount to exit multiples achieved by North American (5.1x) and Asian (5.2x) companies⁵⁶.

3.1.9. The country target list

The top five countries and regions for M&A and investment globally in the next 18 months are the USA, targeted by 44% of survey respondents, Germany (21%), China (21%), the UK (20%) and Canada (20%). The most significant growing market was the UK, selected by 12% of survey respondents in 2012, Canada (selected by 12% of respondents in 2012), Central America (selected by 12% of respondents in 2013, 3% last year) and South America (selected by 18% of respondents in 2013, 13% last year). The biggest decreasing market was India, targeted by just 14% of survey respondents, well below the 23% reached in 2012.



Source: Clean Energy Pipeline

Figure 3.3.

3.1.10. Top Renewable Transactions

In 2012, overall renewable M&A accounted for an amount of USD 37.8 billion, showing a 14% decrease respect to 2011, even if there was a growth in the number of announced deals until 591. This trend demonstrates a high focus on smaller deals respect to the past, as a consequence of continuous industry's assessment in these years. Looking in details, three of the four billionaires deals interested the solar

⁵⁶ "Renewable Energy M&A Activity", Clean Energy Pipeline.

sector, even if wind asset deals made up the largest M&A share, with 60% of total renewable deal value in 2012⁵⁷. In country terms, the hottest were USA and Canada, where there was a high domestic inbound activity, except for Canadian GDF Suez renewable portfolio that was acquired by Japanese Mitsui in collaboration with Canadian private equity firm. Important movements were registered in UK, where wind sector is fruitful field, targeted by a differentiated bidder base. European-based deals showed the most diversified activity in terms of technology, as showed by a billionaire Biomass deal in Netherlands, Hydro deal in Sweden and wind one in Germany⁵⁸.

Table 3.4.

Top Renewable Transaction by Deal Value (2012 -13)					
Target	Acquirer	Country	Sector	Year	Value (USD)
Antelope Valley Solar Project (579 MW)	MidAmerican Renewables, LLC.	USA	Solar	2012	2500 M
AVR Afvalverwerking BV	Power Assets Ltd., Cheung Kong Ltd., Li Ka Shing Foundation Ltd.	Netherlands	Biomass	2013	1250 M
GDF Suez - Wind farms and solar plants (680 MW)	Mitsui & Co Ltd., Fiera Axium Infrastructure Inc.	Canada	Wind, Solar	2012	1218 M
Power-One Inc.	ABB Group	USA	Solar	2013	1028 M
IP Maestrals Investment Ltd. (80% stake) - owned by GDF Suez	ERG SpA	UK	Wind	2012	898 M
Gamesa - Wind Power Stations (4X480 MW)	Algonquin Power & Utilities Corp.	USA	Wind	2012	880 M
Seajacks International Ltd.	Marubeni Corp., Innovation Network Corp. of Japan	UK	Wind	2012	850 M
Borkum Riffgrund Wind farm (277 MW)	KIRKBI A/S, Oticon Foundation	Germany	Wind	2012	836 M
Kraftgärden AB	Voimapiha AB	Sweden	Hydro	2013	670 M
BVP SA	CPFL Energias Renováveis S.A.	Brazil	Wind	2012	621 M
Alcoa Inc (351 MW Tapoca hydroelectric project)	Brookfield Asset Management Inc	USA	Hydro	2012	600 M
EDP Renováveis SA (49% Stake)	China Three Gorges Corp.	Spain	Wind	2012	476 M

⁵⁷ "Power transactions and trends 2012", Ernst & Young.

⁵⁸ "Clean Energy 2012-13", Clean Energy Pipeline – BNEF.

3.2. FOCUS ON ASIA-PACIFIC

In 2012, Asia-Pacific acquirers started to make significant investments abroad. Their companies participated in 38 acquisitions in 2012 (36 in 2011) valued at USD 6.0 billion (USD 1.9 billion in 2011) outside Asia.

Japanese acquirers, like Marubeni Corp., Innovation Network Corporation of Japan, Mitsui, Mitsubishi and Sumitomo all acquired renewable energy assets in North American and/or Europe in 2012. International acquisitions by Japanese firms represented 45% (USD 2.7 billion) of all Asian international M&A activity in 2012. Japan is not just a source of equity. Japanese banks allocated USD 2.3 billion of project debt finance to renewable energy projects in North America and Europe in 2012, over 3 times the volume invested in 2009. In North America, the landmark deal was the project financing of a portfolio of three Canadian wind farms totalling 248 MW and two Canadian solar PV farms totalling 20 MW by Japan Bank for International Cooperation and a group of Japanese commercial banks including The Bank of Tokyo-Mitsubishi UFJ, Ltd., Mizuho Corporate Bank and Sumitomo Mitsui Banking Corporation.

Chinese government appears to be encouraging renewable energy manufacturers and developers to seek growth opportunities abroad in an attempt to keep businesses alive in the face of supply chain consolidation, grid capacity constraints and protectionist measures from the West. It has, for example, awarded USD 4.8 billion of bank finance to China Guangdong Nuclear Power Corporation to advance plans to take its wind energy portfolio abroad. Such plans include an agreement with India's Suzlon to co-develop 800 MW of wind capacity in India, South Africa and Brazil. However, PRC's investment in international markets is not just about global project finance. The real innovation is in the fine print, with an increasing number of financing deals, stipulating conditions that all or some of the components are provided by Chinese suppliers. This "bundling" is enabling Chinese turbine and solar panel manufacturers to provide both components and financing to establish a foothold in the world's fastest-growing markets, while also offering foreign developers access to finance that is less expansive and easier to arrange than local bank loans. South America is already looking like a hotspot for some of this Chinese outbound activity. In November 2012, for example, the China Development Bank

agreed a USD 261 million loan to Spain's Grupo Isolux Corsan SA, toward its 200 MW Loma Blanca wind complex in Argentina, on the provision that it will use 100 MW of turbines from China-based XECM Windpower Co⁵⁹.

In traditional M&A terms, Chinese companies are still aggressive but less than before, due to two essential reasons: solar module manufacturers want to acquire pre-construction stage projects so they can deploy their equipment; and equipment manufacturers want to acquire distressed manufacturing assets to obtain a physical presence in Europe and North America.

3.2.1. Chinese Expansion into Europe

There has been a notable increase in cross-border deal activity between Chinese and European companies in 2012. Chinese companies have announced 12 acquisitions of European clean energy companies in 2012 thus far, more than the ten that were announced between 2009 and 2011. Following a period of dynamic growth, China's renewable energy sector is expected to slow during the next five years as a direct result of measures taken by the central government to curb the growth in new alternative installations. This, coupled with an increasingly competitive domestic renewable sector, is pushing Chinese energy companies to enter new markets. M&A is the fastest route into a new market. In addition, a large number of distressed European clean energy assets that have become available. It is also unsurprising that two of China's largest acquisition targets – EDP and REN – are based in Portugal, one of the Eurozone's sclerotic and most indebted economies.

Another reason why Chinese acquirers are increasingly focused on Europe is that they now consider the region more attractive than North America. The decreasing lure of North America can partly be explained by growing renewable policy uncertainty in the US, which has been exacerbated in the run up to the US presidential election. Chinese wind turbine manufacturers will have almost certainly have been turned off by the lack of clarity on a potential extension of the wind energy production tax credit. Solar subsidies in the US may be guaranteed

⁵⁹ "Renewable energy country attractiveness indices – Focus on China" (2013), Ernst & Young.

until 2016, but the industry is still very much in its infancy and is tiny by comparison with Europe⁶⁰.

Table 3.5.

Target	Sector	Country	Deal value (\$ million)	Date Announced	Acquirer
Energias de Portugal (EDP)	Diversified utility	Portugal	3,515	12-Dec-11	China Three Gorges Corp.
Thames Water Utilities Ltd.	Water utility	UK	1,100	20-Jan-12	China Investment Corp.
REN	Grid operator	Portugal	510	02-Feb-12	State Grid Corporation of China
Q-Cells SE	Solar	Germany	313	26-Aug-12	Hanwha Group
Vestas Wind Systems A/S (towers factory)	Wind	Denmark	19	14-Jun-12	Titan Wind Energy (Suzhou) Co Ltd.
Sunways AG	Solar	Germany	16	25-Apr-12	LDK Solar Co. Ltd.
10MW solar PV plant (Cornwall, UK)	Solar	UK	N/D	06-Nov-12	China Sunergy Co. Ltd
Lucas Est Srl	Solar	Romania	N/D	20-Sep-12	ReneSola Co. Ltd
13.5MW solar PV plant (Marche, Italy)	Solar	Italy	N/D	19-Sep-12	Jiangsu Zongyi Co. Ltd
Saab AB	Green Transportation	Sweden	N/D	13-Jun-12	National Electric Vehicle Sweden AB
Scheuten Solar Holding BV	Solar	Netherlands	N/D	12-Jun-12	Guangdong Aiko Solar Energy Technology Co. Ltd
Solibro AB	Solar	Sweden	N/D	05-Jun-12	Hanergy Holding Group
Another Recycling Company	Recycling & Waste	UK	N/D	03-May-12	New Oriental Energy & Chemical Corp.
Scheuten Solar Holding BV (certain assets)	Solar	Netherlands	N/D	03-Apr-12	Sunway Technology Investment Co. Ltd
Centre for Integrated Photonics Ltd	Solar	UK	N/D	25-Jan-12	Huawei Technologies Co. Ltd

This year there is a marked decline in interest in emerging European markets - only a small number of Chinese companies plan to invest and/or acquire in Central and Eastern Europe and Russia this year, a completely different way respect to last year. Reduced interest is a direct result of renewable energy subsidy cuts, planned or already implemented, in many Central & Eastern European countries.

Energy efficiency, solar and wind are the most attractive sectors to Chinese companies on the acquisition trail. In contrast the tidal, wave, biofuels and geothermal sectors are likely to be side-lined.

Chinese renewable energy equipment manufacturers want to acquire preconstruction stage projects, where they can deploy their products whereas

⁶⁰ “Chinese expansion in Europe’s clean energy sector – Drivers and Opportunities”, Clean Energy Pipeline.

Chinese utilities are interested in operational projects to accelerate their expansion internationally. The significant demand for energy efficiency acquisitions likely stems from China's emphasis on energy efficiency in its most recent five-year plan. Significant technology knowhow will have to be imported if China is to meet its ambitious energy efficiency targets. The most favoured method for European expansion is to secure exposure to construction-ready projects through strategic partnerships with project developers. Recent examples include Sinovel, which announced a partnership in May 2012 with Romanian companies C-Tech Ltd. and Rokura Ltd, to develop 1.2 GW of wind capacity in Romania. This followed the establishment in April 2012 of a partnership between Sinovel and Turkish construction group Ağaoğlu to develop a 600 MW wind farm in Turkey. With more Chinese pursuing this strategy in Europe than ever before, many are starting to provide earlier project development-stage financing in addition to construction project finance in order to forge ties with developers at an earlier stage.

Chinese wind turbine manufacturers have a natural advantage in forming these partnerships because they often have close ties with Chinese State banks capable of providing project finance, as well as utilities that may act as an eventual acquirer of a project. In recent months, the capacity of Chinese companies to offer financing to its European development partners has increased significantly. In many cases, the funding recipients can draw on these reserves to offer vendor financing to European project development partners.

Chinese energy companies are also starting to consider acquiring renewable energy equipment manufacturers, a number of transactions in 2012 indicate that there is genuine interest. In April 2012, Chinese solar polysilicon and wafer manufacturer LDK Solar acquired a 38% stake in Sunways AG, the German solar PV manufacturing and development company adding to the 33% stake it purchased earlier in the year. This was followed in June 2012 by Chinese renewable energy group Hanergy Holding Group's acquisition of Q-Cells' solar thin-film manufacturing subsidiary Solibro. Later the same month Titan Wind Energy Co Ltd, China's largest wind turbine tower manufacturer, announced the acquisition of Vestas' turbine tower manufacturing plant in Varde, Denmark.

3.2.2. European Opportunities in China

China is recognised as one of the world's fastest growing renewable energy markets. It overtook the USA as the world's largest wind market by installed capacity last year and has set ambitious targets for solar, biomass and energy efficiency. Strong market growth potential is an important driver behind Chinese expansion.

Strong incumbents limit opportunities: plugging supply chain gaps is the way.

The issue for European companies is that there are numerous Chinese project developers, which have already established a strong domestic market presence. European project developers have little chance of competing with Chinese project developers, many of which are subsidiaries of large state-owned enterprises.

A number of clean energy sectors are set to experience explosive growth in the coming years after being prioritised in China's most recent five year plan covering the period 2011- 2015. For example, the central government has called for accelerated deployment of smart grid technologies capable of connecting the vast quantities of planned renewable capacity to the grid. In addition, if target will be met, China is going to become the largest offshore wind market.

As these industries are all being built completely, there will likely be many opportunities for European companies to plug gaps in the local supply chain by providing essential technology and knowhow. With Europe being the world's most advanced offshore wind market, there should also be many opportunities for companies with core technology or services-based expertise. The only area in which European companies will find it difficult to access China's offshore wind sector is in turbine supply, due to the dominance of domestic manufacturers Sinovel and Goldwind.

Of course, technology is only one component of any supply chain. Chinese companies will also need to obtain process engineering and technology integration knowhow if they are to develop integrated supply chains capable of meeting the demands of the country's future high growth industries. Indeed some industry experts believe that the greatest opportunities for European firms in China lie in exporting process engineering expertise and knowhow, rather than technology itself. "There is no shortage of technology in China, but what they don't have is the

process engineering skill set to actually take the mechanical engineers, take the electricians and glue a process together,” explained Nicolas Holmes, Managing Director of Quatraflow.

Cross-border project financing hindered by local market dynamics

To date European banks have been relatively apprehensive about providing debt to Chinese renewable energy projects. From the perspective of European banks the main issue surrounds the way in which projects are developed in China, which puts more risk on the developer and financier in comparison to Europe. “It is a relatively open market, although the major challenge is that the business practises and attitudes towards risk management are very different. In Europe, you know what the feed-in tariff is before you start developing. This is hard for foreign developers and investors to accept. We are aware of a number of Chinese projects for which foreign project debt and equity is very welcome. However, foreign banks are not yet satisfied with the level of due diligence on technology, equipment, feedstock and EPC contracting that Chinese counterparts are used to. Over time we will see a convergence in the attitudes towards risk from Chinese and European banks, which will result in more lending between the two regions.” stated Simon Parker, CEO of the biomass solutions provider DP Cleantech⁶¹.

IP protection remains a major concern

Licensing – the greatest opportunity but fears remain over IP protection Technology transfer represents the greatest opportunity for European companies to tap into China’s burgeoning renewable energy market. The conventional licensing approach offers tremendous advantages, particularly to relatively early-stage European technology developers. European respondents will seek to facilitate European expansion through technology licensing. Chinese renewable companies have historically focused on scaling manufacturing operations as rapidly as possible, investing minimally in technology development.

Although China represents a huge market opportunity for European clean energy technology companies, significant concerns remain over IP protection. The age-old

⁶¹ “Enter the dragon: How China will impact Europe’s renewable energy landscape”(2011), Taylor Wessing.

concern for European licensors surrounds the loss of control of IP, of which there have been many instances in the past. However, the growing maturation of China's renewable energy industry means that multinational, and in many cases state-owned companies, are seeking to license European technology. These entities appear less likely to exploit IP than smaller private corporations.

The perceived lack of protection of western IP in Chinese courts has had a significant impact on the willingness of European companies to license to China. "The Chinese patent law is quite advanced. Some years ago China adopted very advanced patent laws. But China is a place where it seems more difficult to get relevant patent protection in place if you do not have a presence there. So if you are just exporting to China that can be difficult. Also, while they have very good patent law, enforcement is always the big challenge. China is a very big country and enforcing your rights in a city that is very far away can often seem like a daunting task if you are not a large organisation"⁶², explained Michael Fredskov, Regional President at Novozymes China.

"They don't understand why we do not manufacture in Europe. The way to get technology into China is through entering into a joint venture with a local partner, where the technology provider contributes IP and the manufacturing partner contributes capital" said Carl Griffiths.

Joint ventures of this kind offer other advantages. As Carl Griffiths explains: "There are many local incentives to set up manufacturing operations. The municipal government will cover 50%-70% of capital expenditure and 50% of electricity bills for a number of years. It will also assist with land acquisition and employment. The central government is very concerned about keeping employment high. Licensing technology doesn't help with that but manufacturing certainly does."

⁶² Crouching the Tiger: How China will impact Europe's renewable energy landscape" (2012), Taylor Wessing.

CHAPTER 4

“CHINESE ELECTRICITY MARKET OVERVIEW”

4.1. THE PEOPLE’S REPUBLIC OF CHINA (PRC)

The People's Republic of China (PRC), commonly known as China, is the most populous state in the world, with over 1.3 billion citizens. Located in East Asia, it is a single-party state governed by the Communist Party of China (CPC). The PRC exercises jurisdiction over 22 provinces, five autonomous regions, four directly administered municipalities, and two highly autonomous special administrative regions (SARs) – Hong Kong and Macau. Its capital city is Beijing. At about 9.6 million square kilometres (3.7 million square miles), the PRC is the world's third- or fourth-largest country by total area, depending on the definition of what is included in that total, and the second largest by land area.

4.2. ECONOMIC BACKGROUND

China is the world's most populous country and the largest energy consumer in the world. Rapidly increasing energy demand has made China extremely influential in world energy markets.

China is the world's most populous country and has a rapidly growing economy, which has driven the country's high overall energy demand and the quest for securing energy resources. According to the International Monetary Fund, China's real gross domestic product (GDP) grew at an estimated 9.2 percent in 2011 and 7.8 percent in the first half of 2012, after registering an average growth rate of 10 percent between 2000 and 2011. Economic growth continues to slow in 2012 as the global financial crises unfolds, industrial production and exports decrease, and the government attempts to curb economic inflation and excessive investment in some markets. China mitigated the 2008 global financial crisis with a massive \$586 billion (4 trillion yuan) stimulus package spread over two years. The recent global

downturn in 2012 has spurred China's government to begin incremental monetary easing measures and consider a second smaller fiscal stimulus package⁶³.

Table 4.1.

KEY Data (2012)	
Population (Mln)	1,347
GDP (USDbn)	5,930
GDP growth rate (2011)	9.2%
Electricity demand (TWh)	4,343
Electricity demand pro-capita (MWh)	3.2
Electricity Intensity (TWh/USDbn)	0.73
Electricity Demand growth rate 2000-2011 (p.a.)	11.9%
Electricity Demand growth rate 2012-2022 (p.a.)	7.2%

4.3. STRUCTURE OF THE CHINESE ELECTRICITY MARKET

The structure of the Chinese Electricity Market (CEM) is divided in 3 layers: the national, regional and provincial electricity markets. To ensure the proper interoperability of these three layers, and, in turn, their correct functioning, the regional and provincial markets need to be aligned at all levels (policies, regulations, technologies, etc.) with the national grid. The main functions of the national electricity market consist in coordinating the electricity trading between different regions and ensuring the security and stability of the national power grid. On a regional level, the main functions are complying with the national electricity market, participating in the electricity market trading and optimizing the utilization of energy sources within the region. The functions of provincial electricity markets account participating in both the regional and national electricity markets, lining up with the market scheduling and optimizing the utilization of energy sources within the provincial area⁶⁴.

Each of the above layers can be segmented into three different phases: Generation, Transmission and Distribution. When it comes to renewable energy, the storage of

⁶³ "Country Focus: China", EIA – U.S. Energy Information Administration – IMF.

⁶⁴ "Brief Description and Analysis of the Chinese Electricity Market", European Union – Trade Section.

electricity could be considered as an independent phase, between generation and transmission, but it has no major role related to conventional power. Thus, storage is not yet a paramount concern for the CEM, but it will nevertheless become inevitable as renewable energies are becoming a priority.

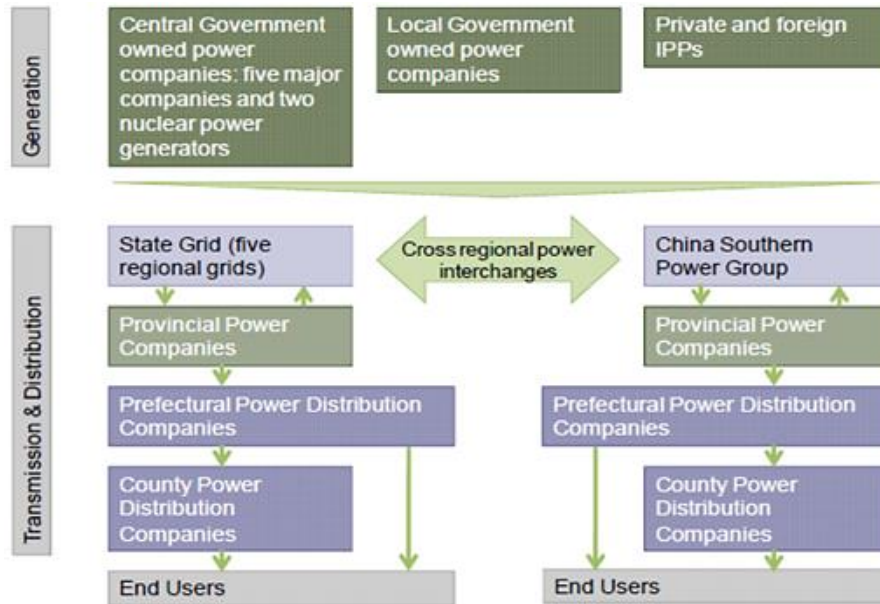


Figure 4.1.

4.3.1. Generation

Electric generation is the process of creating an electric power - concretely an electric current - from other forms of energy. According to the source, there are two main types of power generation methods, namely from conventional and renewable energy sources.

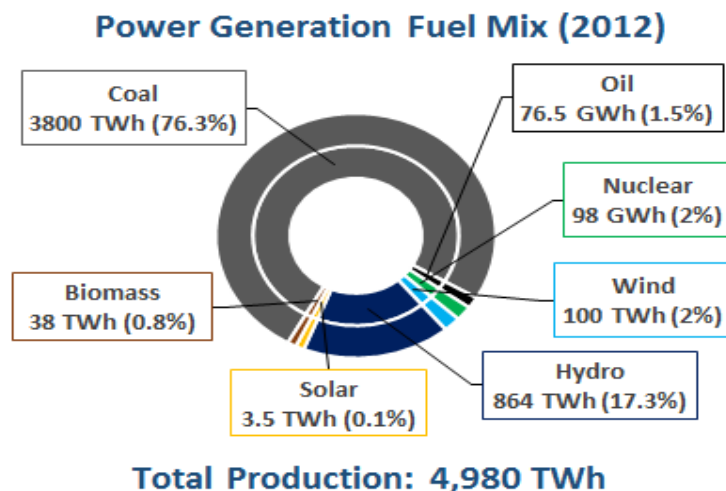


Figure 4.2.

China's electricity generation relies heavily on fossil fuel, mainly coal-fired. However, as sustainable development is a key concern, renewable energy gradually becomes a higher investment priority.

4.3.2. Transmission

The transmission lines carry electricity from the power plant to demand centres. China is actually improving its transmission network. In fact, under the 12th Five-year Plan (5YP) investments in the grid are up to 68% compared to the 11th 5YP. China's energy resources are distributed highly unevenly. Coal mines are mainly sited in the North of the country, and hydro power is predominantly located in the West. However, currently the large economic and load centres are in the East and South. This means it is impossible to fuel national economic development by using only local energy resources, and transmitting electricity is cheaper and more environmentally attractive than transporting coal. Therefore, along with the increased generating capacity, also the electricity transmission network had to expand. In order to create a unified national grid, long-distance transmission is a key developing point. Smart grids and Ultra High Voltage (UHV) grids are being built to increase transmission efficiency, as a key part of economic development policy made by the government.

4.3.3. Distribution, wholesale and retail markets

Electric power distribution consists in the delivery of electricity, which is classically organized in two phases (which several times are merged into one):

- On a first stage, the electricity is delivered from generators to retailers: this transaction is known as the wholesale electricity market;
- On a second stage, it is delivered from retailers to end-consumers (industry, households, etc.), which is also known as retail market.

Typically, a distribution system network would carry electricity from the transmission system and deliver it to the end-consumers, through the two described stages. However, recently the wholesale market is opening to large end-users and

China is running some pilot experiences allowing generators to make transactions directly with large consumers⁶⁵.

4.4. ELECTRICITY CONSUMPTION

Electricity consumption is mainly concentrated on the industry sector, far ahead of the residential and tertiary sectors. The share of the transport sector is very low (2%), on the one hand due to the limited development of the road transport system, and on the other hand because part of the transport activities are accounted for the industrial sector. Nevertheless, the share of transport is expected to grow rapidly over the coming years. The residential sector is also developing rapidly based on nation-wide household's electrification programs⁶⁶.

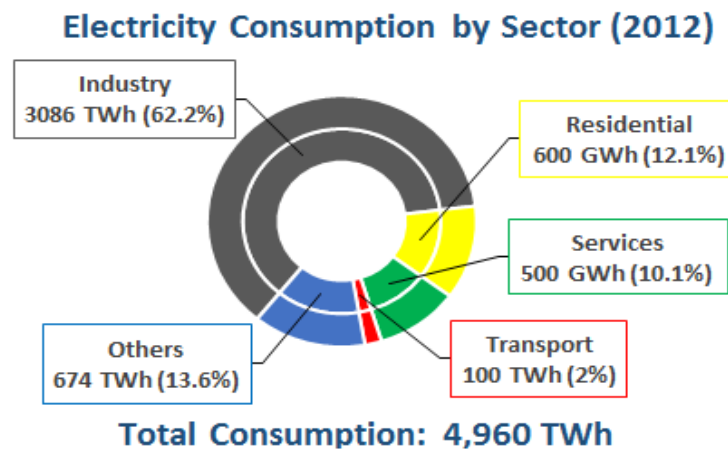


Figure 4.3.

Electricity consumption has been increasing strongly in the past decade, with a 12% average per year between 2000 and 2010 (compared to 8% average per year between 1990 and 2000). Then, according to the National Energy Administration (NEA), the growth should continue at a rate of 10% in the coming years.

4.5. THE REFORM OF THE CHINESE ELECTRICITY MARKET

4.5.1. Before the 2002 Reform Policy

When the People's Republic of China (PRC) came into power in 1949, the electricity market was nationalized and put under the control of the Ministry of

⁶⁵ "PRC Energy Report", Enerdate.

⁶⁶ "Country Focus: China", EIA – U.S. Energy Information Administration.

Electric Power (MEP). To avoid the power shortages, before the 1978 reform and early after, the Chinese government promulgated in 1985 the "Interim Provisions on Promoting Fund Raising for Electricity Investment and Implementing Multiple Electricity Prices", launching the liberalization of China's power industry. Although the State would continue to control most of the power generation across the country, the reform allowed new capacity investments by regional and local governments, as well as by domestic and foreign independent power producers (IPPs). These incentives met the objective of attracting new investments into the power industry, but also brought new complications related to monopolistic tendencies (as the State still owned the grid) and huge disparities of market access between the different actors. This situation contributed to an inefficient power industry with the consequent sharp increase of prices in the 1990s. China State Power Corporation (CSPC) was then created in 1997 based on the policy of "separation of the functions of administration and business". Hence, the CSPC controlled 46% of China's electricity generation and 90% of its grid operations. However, China still kept finding problems in balancing electric supply and demand, and the strategy wasn't successful in igniting market competition. Therefore, five years after its creation, the CSPC was dismantled, as China decreed in 2002 the separation of power generation from transmission and distribution.

4.5.2. The 2002 Reform Policy

China's 2002 Reform Policy was in fact fully consistent with the broad strategy of vertical separation and the creation of "upstream" competition that has nowadays become a sort of standard, even a "default" strategy, for the restructuring of natural monopolies around the world. Thus, in April 2002 the State Council issued the "Plan for the Reform of Electric Power System" marking the very beginning of a deep restructuring of the CEM. The main objective was the desegregation of the market by the separation of the distribution, transmission and generation activities. Concretely, the 2002 Reform Policy included:

- separation of generation assets from grid companies;

- restructuring of power regulatory bodies and establishment of an independent regulatory authority, the State Electricity Regulatory Commission (SERC);
- establishment of a competitive market in the generation segment, implementation of power tariff reform and formulation of environmental cost standards and surcharges for emissions; and
- formulation of a pilot program where generators directly supply power to large subscribers..

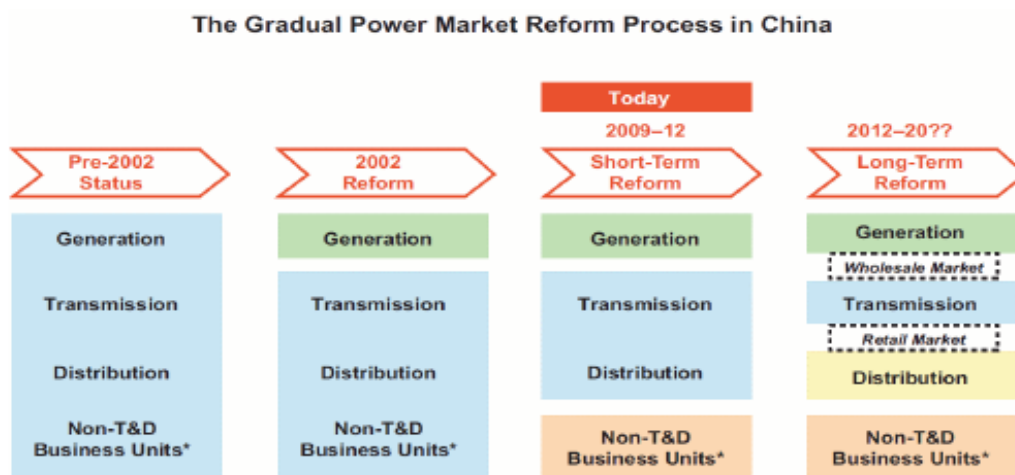


Figure 4.4.

The Plan aimed at introducing elements of competition with a view to increasing the efficiency. However, at the same time it aimed at creating an integrated electricity market network under the supervision of the government, which would legitimate the pricing mechanism in transmission and distribution, as retail prices should be the result of market demand and supply. However, since these initial reforms, the process has slowed down, in part due to the uncertainty generated by the power sector crisis abroad, in part due to domestic issues⁶⁷.

4.5.3. Generation industry: the establishment of the 5 Gencos

The CSPC's power generation assets were restructured into the following five power generation companies, each of which is limited to no more than 20% of the generating capacity in each regional network: China Huaneng Group (CHNG),

⁶⁷ "Balancing Supply Security and Affordability, Energy Price Reforms in PRC", IHS CERA Inc.

China Datang Corporation (CDT), China Huadian Corporation (CHD), China Guodian Corporation (CGDC), and China Power Investment Corporation (CPI). Each of these generation companies has one or more China - or Hong Kong-listed companies. However, these companies remain ultimately controlled by the State.

4.5.4. Transmission industry: two grid giants taking over the network

The CSPC's grid assets were restructured into the China State Grid Corporation (SGCC), and the China Southern Power Grid Company (CSG), both State-Owned Enterprises (SOEs). The SGCC established five regional companies, which cover mostly North and Central China – *the North China Power Grid Company* (green area), *the Northeast Power Grid Company* (purple area), *the East China Power Grid Company* (light blue area), *the Central China Power Grid Company* (intense blue area) and *the Northwest Power Grid Company* (yellow area). Moreover, SGCC also manages on a temporary basis *the Tibet Power Grid Co.* (pink area), which is an independent transmission operator. Its overall operational area actually includes 26 provinces, autonomous districts and cities, representing 88% of the national coverage, and serving electricity to over 1 billion people. In contrast, the CSG's scope covers South and Southwest China – Yunnan, Guizhou, Guangxi, Guangdong and Hainan provinces (the light green area at the bottom)⁶⁸.

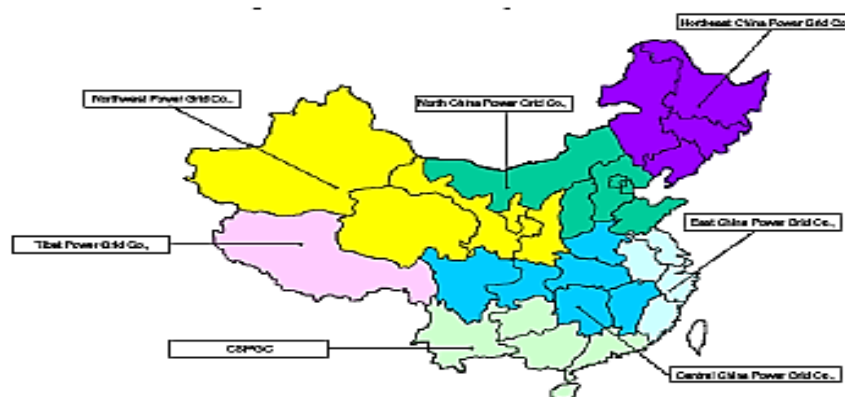


Figure 4.5.

4.5.5. Distribution industry: under the control of the two grid giants

Chinese distribution is mostly controlled by the two large monopolistic transmission companies: SGCC and CSG. Therefore, transmission and distribution

⁶⁸ "The China Power Generation Market Report 2012-2021", John Loffman Review.

constitute de facto one single market. These two activities are expected to generate by themselves around USD 469.1 billion in 2012, representing an increase of 5.9% from the previous year. Although the 2002 Reform Policy had planned the further creation of an original and unique retail market, China has initially decided to condition the liberalization of the electricity retail market on the direct transaction between large users and generation companies. This ambitious program is divided in two phases: firstly, they would create the possibility to choose a supply company for large end-users; secondly, the right to wholesale would also be established for generators. Despite the 2002 Reform Policy, some independent distribution companies continued operating their private owned small-scale generation plants, or purchasing electricity directly from the national grid. Furthermore, the fragmented heritage of the national transmission grid has made, and might continue to make, the integration of regional markets a challenge for the government.

4.6. MAIN PLAYERS

4.6.1. Supra-ministerial level: The State Council

Created in 1954 with the Constitution establishing the People's Republic of China (PRC), the State Council is at the same time the highest executive organ and the highest organ of the State administration.

It is composed by the heads of the different ministries and exercises an effective leadership over the different components of the Chinese administration. As the highest executive organ, the State Council is responsible for undertaking the principles and policies issued by the Party (i.e. the 2002 Reform Policy, all the 5YP, etc.), as well as the laws and regulations adopted by the National People's Congress (including the legislative framework of the CEM).

4.6.2. Ministerial level

The National and Development Reform Commission

The National Development and Reform Commission (NDRC) is the government's primary economic policymaking and planning agency. With regard to the CEM, it is the institution in charge with the formulation of strategic and long-term plans for development of the electricity sector, planning the spatial distribution of major

electricity investment projects, and arranging state investment funds for infrastructure. It also examines electricity prices and formulates, monitors, and enforces the government's pricing policy.

National Energy Commission

The National Energy Commission (NEC) was created in 2010 to coordinate the overall energy policies spread among different agencies.

Hence it includes members from diverse agencies such as environment, finance, central bank, NDRC, etc. NEC's role is to determine the national energy development strategy; it addresses any significant issues concerning energy security and coordinates major domestic, as well as global cooperation programs.

4.6.3. Under-ministerial level

National Energy Administration

The main functions and responsibilities of National Energy Administration (NEA) have been delegated in 2008 by the NDRC, which supervises the former, especially on the administration level of the energy industry, which include:

- working out energy development strategies,
- planning future policies and making suggestions on structural reform;
- administering energy resources such as petroleum, natural gas,, nuclear power, coal and electric power, and the petroleum reserve of the state;
- proposing policy measures for developing new energy resources and energy conservation in the energy industry;
- conducting international energy cooperation.

State Electricity Regulatory Commission

The State Council directly supervises the electricity sector through the SERC. Since its creation, this organ has been in charge of the regulation for the power sector implementing the government's objective to unbundle the electricity market. Furthermore, it is the first regulatory commission in the public utilities sector, and it is also in the process of helping the seven state run operators (five generation companies and two grid operators) to adopt modern corporate governance practices.














State-owned Assets Supervision Administration Commission

The SASAC was established in 2003 directly under the supervision of the State Council. It is the representative of the State for managing SOEs, including appointing top executives and approving any mergers or sales of stocks or assets, as well as drafting laws related to this kind of enterprises⁶⁹.

4.6.4. THE SOEs – State Owned Enterprises

CSPC was created in 1997 and assumed the commercial activities and the assets of the former MEP. The reorganisation of CSPC, which was announced in January 2003, led to the split of its production capacities into 5 companies: *China Huaneng Group, China Datang Corporation, China Huadian Corporation, China Guodian Corporation and China Power Investment Corporation*⁷⁰.

Table 4.2.

		China Installed Capacity GW	Renewable Technology
National Gencos	China Huaneng (Parent Comp. of Huaneng Renewable Corp.)	113	 
	China Datang (Parent Company of China Datang Corp. Renewable Power Company)	106	 
	China Guodian (Parent Company of China Longyuan)	85	  
	China Huadian	77	
	China Power Investment	77	  
IPPs	Three Gorges Corporation	25	 
	TOTAL	483 GW (43% of Total Installed Capacity)	

4.6.5. Independent Power Producers (IPPs)

Besides SOEs, there are also IPPs involved in the electricity generation market. There are three key factors affecting all independent generation companies in China, foreign or domestic:

⁶⁹ "Reform in PRC's Electric Power Industry - A case study of Eat PRC's wholesale Electric Power Market", (May 2006), by Chun Chun NI, IEEJ.

⁷⁰ "China Electricity Market Overview 2012", Enel Green Power.

- *The supply-demand situation.* Given China's still relatively poor inter-provincial grid connection, the local supply-demand situation is extremely significant in determining the number of utilization hours and the amount of generation output, which bear on revenues of IPPs.
- *Regulation of tariffs,* particularly challenging for foreigners, can be subdivided in three issues:
 - *administrative tariff review:* the provincial pricing bureau - upon the developer's submission of a "tariff proposal" - reviews and approves annually the different costs of the average tariff for each plant. As a consequence, the purchaser of electricity has no real obligation to honour tariff provisions agreed in the Power Purchase Agreements (PPA) signed with IPPs;
 - *provisional tariff review:* after a plant starts operation, but before it reaches COD (i.e. during the testing periods), it obtains "provisional tariffs" which are of a low level and sufficient to cover operating costs alone. This is a system that can be easily abused, since the local power bureau may delay the declaration of COD and/or the approval process for tariffs as the tariffs are lower at that stage;
 - *excess tariffs:* electricity output beyond the "planned" quantity is charged under this kind of tariffs, hence requiring the approval from the authorities and are typically lower in level. This administrative framework provides a lot of flexibility in tariff reductions and can potentially open the door to arbitrary charges, which may affect the performances of foreign and domestic IPPs.
 - *Increasing costs,* particularly sharp for coal and coal transportation, put enormous pressure on profit margins, especially for local IPPs⁷¹.

⁷¹ "The Experience of Independent Power Producers in Developing Countries", Seminar at Stanford University (June 2005).

4.7. CHINESE RENEWABLE ENERGY

The use of renewable energy is an increasingly hot topic and important issue in China. There are three key drivers behind the continued interest in renewable:

1. Increasing demand for electricity.
2. Need to reduce its reliance on coal for energy production
3. Need to reduce its greenhouse gas emissions.

“In the face of the problems of climate change, greenhouse gas emissions and oil prices rising, the public has come to realize the importance of developing renewable energy. More and more people opt for green travel or low-carbon lifestyles and the public media has been increasing its coverage and publicity of the development of low carbon technology and renewable energy.” – Liu Mingliang, Analyst, China Wind Energy Association.

Driven by China’s well-documented rapid economic growth over the past 30 years, China’s energy consumption has more than doubled in less than 10 years. It is now the world’s greatest consumer of energy and as the Chinese government continues to invest in moving Chinese manufacturers away from low-cost manufacturing and higher up the value chain into greater value added activities, China’s demand for energy shows no signs of easing. China produced 1/5 of the world’s total electricity in 2010, officially overtaking the USA for the first time to become the world’s largest generator of electricity. Its demand for energy as well as its capabilities and capacity for energy production are now positioning China to seize the opportunity to take the lead in the development of sustainable energy technologies, in order to cement its position as an international leader in renewable energies. Chinese government is quickly realising that coal will no longer be able to support the growth of its economy. Considering the logistical aspects of using coal, China has to either import it or have it removed from mines. This is very difficult, and as a matter of fact, it is now rapidly using up its coal capacity. China is now recognising that it is unable to get more coal as quickly as it is needed, so it will have to switch to something else. In the future, the effectiveness of China’s industrial evolution will no longer be judged on the speed of development alone. Instead, the application of smarter, more sustainable energy sourcing techniques will serve as a stronger indicator of China’s next generation of successful growth in the coming 10-15

years. The country now faces significant pressure from international organisations to reduce its carbon dioxide emissions. In November 2009, just before the United Nations Climate Change Conference in Copenhagen, Chinese Premier Wen Jiabao pledged to reduce China's carbon dioxide emissions by 40-45% from 2005 levels by 2020. In order to do this, the Chinese government will need to continue heavily investing in renewable energies and increase the use of sustainable energy sources in its overall energy mix. China targets to increase the use of renewable energies from around 9% of its current total energy mix, to 15% by 2020. Whether or not these targets will be successfully met remains to be seen. There are still serious doubts as to whether or not China will be able to successfully reduce its dependence on coal generated power, as Qiao Liming, China's Director of the Global Wind Energy Council acknowledges, "the Chinese energy mix is still quite heavily reliant on coal and I don't see that this situation will ever fundamentally change". Despite this uncertainty, the Chinese government is investing heavily in renewable energy in a bid to meet its self-prescribed targets⁷².

4.7.1. Legislative and Policy Framework

The 2006 Renewable Energy Law

The China Renewable Energy Law was accepted on 1 January 2006 and was China's first state-supported mandate to help develop the use of renewable energy in China. The law is still a key driver of renewable energy development in China. The 2006 Renewable Energy Law not only encourages the continued construction of renewable energy facilities, but also puts pressure on the Chinese grid operators to purchase the power generated by approved renewable facilities.

The excess cost between the lower cost traditional power and the higher cost renewable energy is subsidised by the government and collected through a surcharge on the price of consumer electricity, collected from all customers on the grid. This surcharge was doubled in December 2011, increasing from 0.04 RMB per kWh of electricity to 0.08 RMB per kWh, creating a total subsidy fund of around 50 billion RMB, all of which is used to further develop the use of renewable energy

⁷² "Statistical Review of World Energy June 2012", BP

in China. However, despite the implementation of legal obligations at a national level, provincial and industrial level infrastructure problems still create challenges for the future of renewable energy growth in China, thus more specific targets and schemes must still be developed during each of China's five year planning periods.

China's Five-Year-Plans

The 12th Five Year Plan focuses heavily on adjusting the economic growth model. Sustainability is highlighted as key for future development of the economy during this planning period. Three areas for focused investment have been identified for the planning period, namely clean energy, energy conservation and clean energy cars. Energy use is targeted to be reduced by 15% per unit of GDP, with carbon dioxide emissions to be reduced by 17% by the end of the planning period. There will be a minimum investment of RMB 5.3 trillion (around USD 830 billion) into the power industry, with hydro power, wind, solar, biomass and grid development as key targets for this investment. The 12th Five Year Plan marks a turning point for Chinese development and demonstrates the Chinese government's dedication to create a sustainable growth model to help propel China into the next stage of its development.

Table 4.3.

Energy	Target by 2015
Reduction in Energy Use	Reduce by 16% per unit of GDP
Reduction in Carbon Dioxide Emissions	Reduce by 17% per unit of GDP
Use of Non-Fossil Fuels as % of Total Energy Use	11.4% - 2015 / 15% - 2020
Investment in Power Industry	Minimum RMB 5.3 Trillion

Despite having set very ambitious targets for the increased utilisation of renewable energy by the end of the 12th Five Year Planning period, questions still remain as to how effective these strategic targets will be at developing the supporting industries. To help meet the energy and carbon dioxide emission reduction targets during the 11th Five Year Plan period (2006-2010), factories were shut down periodically during peak season. This suggests a lack of systematic planning of how to develop renewable energy systems along with the relevant supporting industries as part of the government's push to reduce China's carbon dioxide emissions in line with their self-imposed targets. Highlighting the discrepancy between the planned targets and the implementation roadmap, a Senior Diplomat from the Department

of Energy at the US Embassy in Beijing explains that government targets cannot be met without explicit instructions on how to achieve them. “The Five Year Plan is a strategic plan of where the government wants to go, but they don’t specify how they will get there. The 12th Five Year Plan has been out there for a year or so, but is not in a position of serious implementation. They are only now beginning to look at it from an industrial level and trying to figure out how they can get to where they want to go, they are only now finalising the ‘how’ part of their strategy”.

This raises questions as to how well government targets at a national level are coordinated with the development of renewable energy technology and industry. To examine this further, it is necessary to explore key renewable sectors at different stages of development in focus:

- Hydro – Approaching Decline: with fewer suitable locations for the installation of hydro power, the industry is experiencing a ‘final push’ before the final slowdown. The well-established industry is past its peak and now moving towards decline.
- Wind – Approaching Maturity: with well-established distribution channels and product standards maturing, the industry is seeing slowed growth after a period of rapid expansion, with recovery rates uncertain.
- Solar PV – Entering Growth: with a large number of competitors in the market, industry players are seeking to differentiate themselves, regularly creating product innovations and receiving increased levels of investment.
- Biomass/Biofuels – Introduction Stage: with technical issues still being resolved, industry players are now beginning to show an interest in the sector. The infant industry is being investigated for future investment, with rapid future growth expected⁷³.

4.7.2. Current Overview

China’s investment in renewables has grown at around 80% per annum since 2004, clearly demonstrating China’s commitment to pursuing global leadership in renewable energies and building a sustainable support structure for the continued

⁷³ “China’s Renewable Energy Sector: An Overview of Key Growth Sectors”(2012), Solidiance.

growth and development of its national economy. China is the world leading renewable energy producer, with an installed capacity of 321 GW (28.1% of overall country's power installed capacity of 1144 GW). Since 2005, the overall renewable energy growth rate has been about 11%. Despite hydropower still represents almost 77% of total installed capacity, huge increases have been recognized in wind and solar sector, increased of 32% and 48% respectively.

In terms of electricity generation, renewable energy has growth by 30%, showing increasing focus about grid connectivity, which has always represented a big weakness for wind and solar sector, accounted for a growth of 35% and 400% respectively. With about 5,000 TWh, renewables actually accounts for 20% of overall electricity generation⁷⁴.

Table 4.4.

Source	U	2005	2006	2007	2008	2009	2010	2011	2012	Δ(%)
Installed Capacity										
Renewable Energy	GW	120	135	155	184	219	251	288	321	11%
Hydropower	GW	117	130	148	173	196	216	233	249	6.8%
Wind on-grid	GW	1	2	4	8	18	30	46	61	32%
Biomass	GW	2	3	3	3	5	6	7	8	14%
Solar on-grid	GW	0	0	0	0	0.03	0.26	2.22	3.28	48%
Geothermal	GW	0.025	0.025	0.025	0.028	0.03	0.03	0.03	0.03	0.0%
Electricity Generation										
Renewable Energy	GWh	403K	425K	487K	593K	620K	761K	775K	1006K	30%
Hydropower	GWh	396K	415K	471K	565K	572K	687K	668K	864K	29%
Wind on-grid	GWh	2K	3K	6K	13K	28K	49K	74K	100K	35%
Biomass	GWh	5K	7K	10K	15K	21K	25K	31K	38K	21%
Solar on-grid	GWh	0	0	0	0	0	0,1K	0,7K	3K	400%
Geothermal	GWh	0,1K	0,1K	0,1K	0,1K	0,1K	0,1K	0,1K	0,1K	0.0%
Ratio of electricity generation										
Total installed capacity	GW	517	624	718	792	874	966	1056	1144	8.4%
Gross power generation	GWh	2497K	2850K	3264K	3451K	3681K	4228K	4722K	4980K	5.5%
Capacity ratio of renewables	%	23%	22%	22%	23%	25%	26%	27.3%	28.1%	0.7%
Generation ratio of ren.	%	16%	15%	15%	17%	17%	18%	16%	20%	3.8%

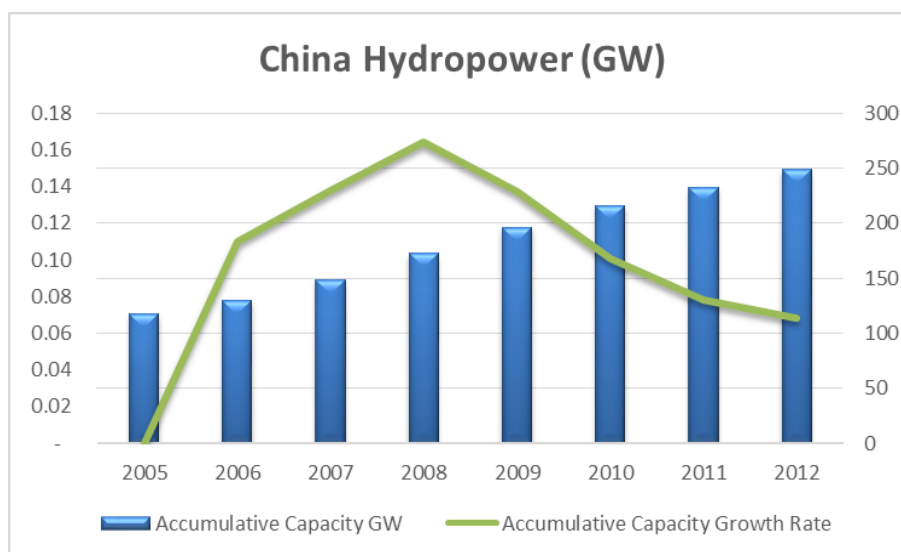
⁷⁴ State Electricity Regulatory Commission(SERC) - China National Renewable Energy Centre.

4.7.3. Chinese Hydropower

Hydro power remains China's most well developed form of renewable energy, with nearly 5 times more installed capacity than wind power in 2012, making up around 15% of China's generating capacity, compared to less than 5% for wind and solar combined. Installations of hydropower continued to raise in the period up to 2012, with China accounting for 22% of the total global installed hydropower capacity, almost 3 times higher than its nearest rival, the USA. In 2012, installed capacity reached about 250 GW, slowing its growth pace respect to previous years, even if its CAGR is about 11% on year-base.

Table 4.5.

HYDROPOWER	2005	2006	2007	2008	2009	2010	2011	2012
<i>Accumulative Installed capacity (GW)</i>	117.3	130.2	148.2	172.6	196.2	216.0	232.9	248.9
<i>Accumulative Capacity Growth Rate</i>	-	11%	14%	16%	14%	10%	8%	7%



With government targets for hydro power installations of around 325 GW by 2015 and a newly revised target of 430 GW (up from 380 GW) by 2020, China's love affair with hydro power looks set to continue over the next decade as investment in hydro power becomes one of China's key focuses⁷⁵.

Government subsidies for hydropower are set with feed-in tariffs of 0.2-0.3 RMB per kWh. Although hydropower is the most cost effective method of creating energy

⁷⁵ New Scientist, Xinhua, China Global Times, Deutsche Bank.

from a renewable source, challenges such as the long development periods, associated social displacement and environmental concerns as well as the increasing difficulty in accessing potential development sites suggest that China's investment in hydropower will decline after 2020.

The Chinese hydropower sector is dominated by SOEs, in both operation and construction. In the operation of Chinese hydropower facilities, the top 10 players, occupying almost half of the market in terms of installed capacity, are many of the top 10 state owned firms. In terms of the construction of Chinese hydropower facilities, the three dominant market leaders belong to the State Owned Assets Supervision and Administration Commission (SASAC) and the Chinese Armed Police Force. This demonstrates not only the government's keen interest in developing and assisting the construction of large hydro power facilities, but it also shows clearly the dominance of Chinese players within the market. Whilst it is possible for foreign firms to invest in the sector, their capacity is largely limited to a supporting role, with the government firmly controlling the development of this carefully crafted sector.

4.7.4. Chinese Wind Power

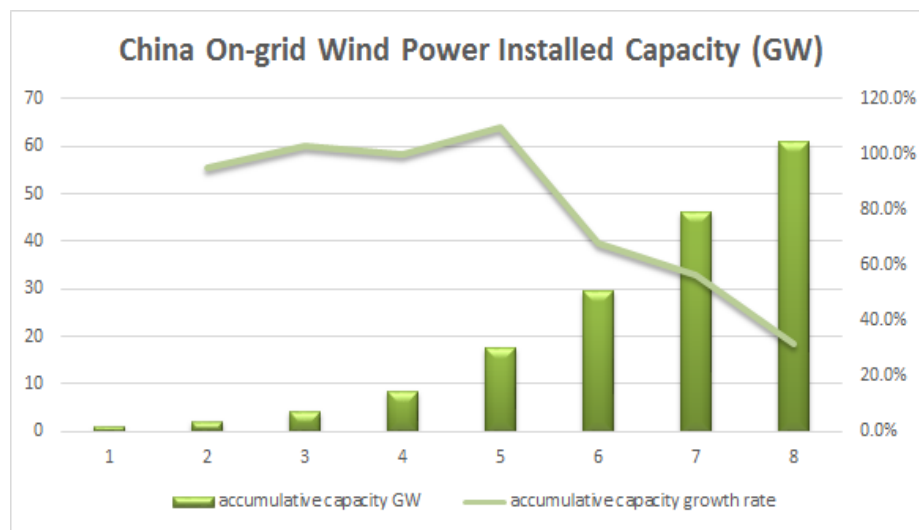
In 2011, there was a period of adjustment in the Chinese wind power industry as government regulations and requirements increase, the market has begun to consolidate and power grid capabilities take time to catch up to meet the unharnessed production output of current installed capacity. With key industry trends including consolidation and internationalisation, the Chinese wind power market is taking the opportunity to mature. While long term market growth is still likely, the unpredictable outcome of this adjustment phase makes short term growth patterns uncertain. While government targets and subsidies are financially suitable to help support industry development, the Global Wind Energy Council believe that the government now needs to become more involved in setting policy for standardisation of wind power regulations.

Although newly installed wind capacity continued to grow in China in 2012, it was at a slower overall rate than previous years. However, China still dominates the global wind energy market with 25% of total global installed wind capacity and

leading global growth, installing almost half of the world's total new wind power installations in 2012. Actually, installed capacity has reached about 60 GW, following a CAGR of about 80%, despite the decline in new installation pace during 2012.

Table 4.6.

WIND POWER		2005	2006	2007	2008	2009	2010	2011	2012
<i>Accumulative Installed Capacity (GW)</i>		1.06	2.07	4.2	8.39	17.6	29.58	46.23	60.83
<i>Accumulative Capacity Growth Rate</i>		-	95%	103%	100%	110%	68%	56%	32%



The slower pace of new installations in China marks a new period of adjustment for the industry, which has, until now, undergone almost a decade of unchecked, unassisted and uncoordinated growth. In terms of government subsidies, feed-in tariffs vary according to installation region: windy areas of Inner Mongolia and Xinjiang – RMB 0.51/kWh; other parts of Inner Mongolia and Hebei – RMB 0.54/kWh; Jilin, Heilongjiang, Gansu, Ningxia and remaining parts of Xinjiang – 0.58/kWh; all other areas – RMB 0.61/kWh.

Despite the government's ambitious growth plans by 2015 (100 GW of total installed capacity), the Chinese wind power market is now expected to plateau, although it is uncertain how long for. There are two key reasons for the slowdown in newly installed capacity – the need for more regulated growth and the need to improve grid connectivity⁷⁶.

⁷⁶ Global Wind Energy Council.

Regulating Growth

Before 2011, the wind power industry was poorly regulated, with no coordination between local governments, the national government and the industry. Wind power facility installations were approved at provincial level, often by unscrupulous local officials eager to meet and exceed their local economic development targets, which meant permits were obtained quickly and easily.

With subsidies arranged according to installed capacity figures rather than grid connected capacity, wind power facilities were erected without being grid connected.

The Chinese government is now attempting to restrain this kind of growth. In order to have access to national subsidies or feed in tariffs, new wind power facilities must now receive approval from the central government, slowing the approval process, resulting in the decline in domestic installations.

However, according to Qiao Liming, the Director for China at the Global Wind Energy Council, this slowdown should be perceived as a positive step, building a more solid platform from which the industry can continue to grow in future.

Improving Grid Connectivity

Currently, at least 30% of the installed wind power capacity in China is not connected to the grid and due to problems with the old fashioned electric grid system in China, the power that is connected to the grid suffers from curtailment and transmission problems. This critical oversight in the rapid establishment of wind power in China has rendered its capabilities fruitless. The fact remains that a meagre 1% of China's electricity is generated by wind power. The latest Five Year Plan seeks to address these problems, shifting policy away from targeting just capacity and towards grid connectivity.

Transmission –The Chinese grid system is very outdated and the transmission lines are not suitable to handle the long distance transfer at present. Until China's transmission lines are able to cope with the extra power transmission requirements created by wind energy as well as other renewables, many projects will be stalled and remain unconnected.

Curtailment – Energy supply and energy demand coming onto and off from the grid must be exactly equal on a second by second basis. The majority of wind power is

produced at night, when the demand for energy is lowest, which means other power generating plants must be turned off from the grid to compensate for this. In China, this usually means that a coal power plant will have to be turned off, in order to allow the wind power to be accepted onto the grid. However, as coal power does not cycle well, turning these plants off is not efficient and is rarely done. Instead wind power is simply not accepted by the grid

Industrial trend- consolidation and internationalization

During China's period of slowed, more coordinated growth in the wind sector, firms have gone through significant restructuring and resizing, resulting in some cases, obsolete. Industry consolidation is not only limited to small and medium-sized domestic firms, but is also visible at a higher level. International firms such as Vestas and Suzlon are consolidating their efforts in the China market, with Vestas selling a factory in Hohhot, Mongolia and Suzlon selling its Tianjin factory. This shows that at all levels, competition is high and the slowdown in China is beginning to affect strategies and operations. While China remains the largest wind power market in the world, the domestic slowdown in installations has caused all the large domestic companies to try and expand their operations abroad. Many firms in China are using the current European crisis as a chance to expand into the European market and gain market share as well as technological capabilities. Now that these companies have reached a certain level of maturity, it is logical that they would begin to expand overseas. However, Chinese firms are now going to adjust to international local content rules, similar problems that foreign firms had when entering China. The Chinese firms are going to expand their international capabilities quickly and learn how to adapt to heavily politicised and regulated markets⁷⁷.

4.7.5. Chinese Solar Power

During 2011 and 2012, solar PV installations increased by nearly 10 times in China, following the government's increased commitment to the development of the industry. Whilst installations are expected to continue a rapid ascent, the starting

⁷⁷ "China Wind Energy Development Roadmap 2050", IEA Technology Roadmap.

point of this growth is low. The overcrowded industry is pushing the weaker firms out of the picture, with strong firms suffering from problems of overcapacity, troublesome technological development processes and an international slowdown and struggle for survival. Long term market growth potential is significant, but coordination issues and grid capacity problems will need to be resolved to ensure the continued development in the short term.

Solar PV installation targets have been revised again in June 2012, to 21 GW by 2015, and to 50 GW by 2020. This not only shows the determination of the Chinese government to aggressively meet the overall renewable targets, but also demonstrates their belief that the solar industry is ready for growth and a suitable target for investment. Following the Fukushima disaster in Japan, China's investment in nuclear energy has been reduced and offset by an increase in solar PV investment. Subsidies count national Feed-in tariff (Approved after 1 July 2011, Operating after 31 December 2011 RMB 1/kWh) and Provincial ones (Shandong RMB 1.2/kWh; Zhejiang RMB 1.43/kWh). Another important government initiative is *The Golden Sun Programme*, started in 2009, focused on rural electrification and building projects to assist development of integrated solar PV. The national feed in tariff (FiT) has stabilised the Chinese solar sector, no longer allowing large SOEs to dominate in the former auction style scheme. The new national system eliminates such consequences and creating greater and true market competition and dynamism within the sector⁷⁸.

Current Overview

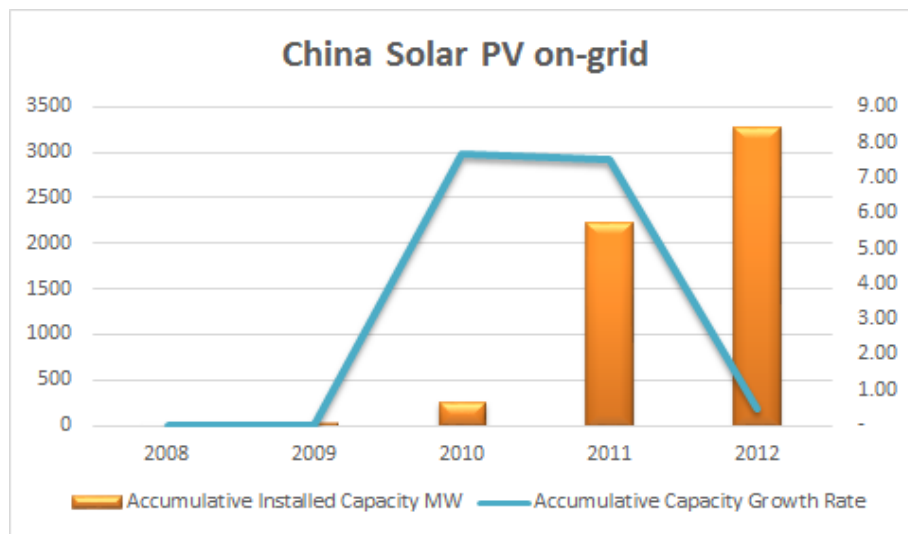
China is now a multi-gigawatt market, with over 3 GW of newly installed solar PV capacity in the last two years. It is also the fastest growing solar PV market in the world, with cumulative capacity expected to continue climbing over the next few years. Despite China's impressive investment volumes and consistent growth, the global solar PV market is still dominated by Europe with around 75% of the world's total capacity. However, the EU financial crisis and changing EU regulations and installation policies mean European demand for PV is falling and the industry is diversifying across countries, paving the way for China's sustained growth.

⁷⁸ "Global Market Outlook for Photovoltaic Until 2016"(May 2012), EPIA.

The global value chain for solar PV is suffering from serious overcapacity, leading to increased competition and consolidation in the manufacturing market.

Table 4.7.

SOLAR POWER	2005	2006	2007	2008	2009	2010	2011	2012
<i>PV Cell Production (MW)</i>	200	400	1088	2600	4000	8000	20000	20000
<i>Accumulative Installed Capacity (MW)</i>	-	-	-	-	30	260	2219	3280
<i>Accumulative Capacity Growth Rate</i>	-	-	-	-	-	767%	753%	48%



Industry Trends

Whilst growth is expected in installed solar PV capacity in China, the manufacturing industry has been suffering from serious overcapacity and profit reduction. Industry consolidation is rampant, due to the consistent fall in the price of silicon and the increased availability of domestically produced silicon in China (at 70% in Q3 2012 according to the Solar PV Committee of the Renewable Energy Society of China), Small manufacturers who only focus on assembly are struggling to remain competitive and falling out of the market. According to a senior diplomat at the US China Embassy Department of Energy, this is now causing a large number of SOEs to enter the solar industry. Until now, the industry has been dominated by private firms, but following the consolidation of the solar market, combined with the Chinese government's push for increased solar PV installations, SOEs are becoming increasingly involved in the solar industry. This could increase

competition and serve to drive the market, but the long term impact remains uncertain⁷⁹.

Industry opportunities and challenges

Opportunities for growth and development exist within the solar PV industry. Three chief opportunities for growth can be identified within the Chinese solar PV sector: domestic development, new technology research and development and cost reduction. The change in EU subsidies for solar PV creates a huge opportunity to reinvest excessive capacity into the domestic market. China has an abundance of potential for solar PV installations, with 1 GW of installations in Qinghai province alone, a figure exceeding the entire solar installations of the UK and over half of the total installations of France in 2011. Qinghai is also home to the world's largest PV plant with 200 MW capacity, the equivalent of 6 times Brazil's cumulative installed capacity in 2011. Chinese companies have gained strength in terms of production quality and cost on a global scale in comparison to market developments of the last 2-3 years. Prices for solar module components are continuing to drop, allowing manufacturers to produce solar modules in greater volumes for more cost effective installations. The falling cost of silicon cells has also contributed greatly to the falling cost of solar modules, making lower cost, higher efficiency modules one of the leading market opportunities. However, despite being at a prime development stage ready for investment and rapid development, there are a number of challenges being faced by the Chinese solar PV market which cannot be ignored. Firstly, overcapacity issues within all stages of the solar PV value chain will present a short term challenge to the future development of key solar companies in China, creating a difficult operating environment for smaller, assembly-focused plants. These plants are mainly exiting the market or being bought by SOEs, which creates a new level of competition for the established, high level solar module manufacturers. Whilst the precise role of the SOEs in the market remains to be seen, it is clear that competition is building within the market.

High cost of technology – Solar PV technology remains comparatively more expensive than hydro or wind power, with many technologies dependent on

⁷⁹ "Renewable Global Status Report 2012", IEA.

subsidies and feed in tariffs for economically viable installation. If the solar industry is to witness continued growth and development, the technologies will have to rapidly fall in price and match grid parity. For Chinese firms, this is a unique challenge: they are required to adjust their business models away from international exports and toward domestic installations and technology development. Given the variability in energy production cycles of solar PV, the challenges facing the Chinese electricity grid will increasingly also serve to create difficulties for the development of the solar industry. However, the issue of grid connectivity is potentially less serious in the solar industry than in the wind power industry as solar power is much better at load following than wind. When the solar power generated is at its highest and supply is high, the electricity demand on the grid is equally high, which enables more power to be accepted by the grid⁸⁰

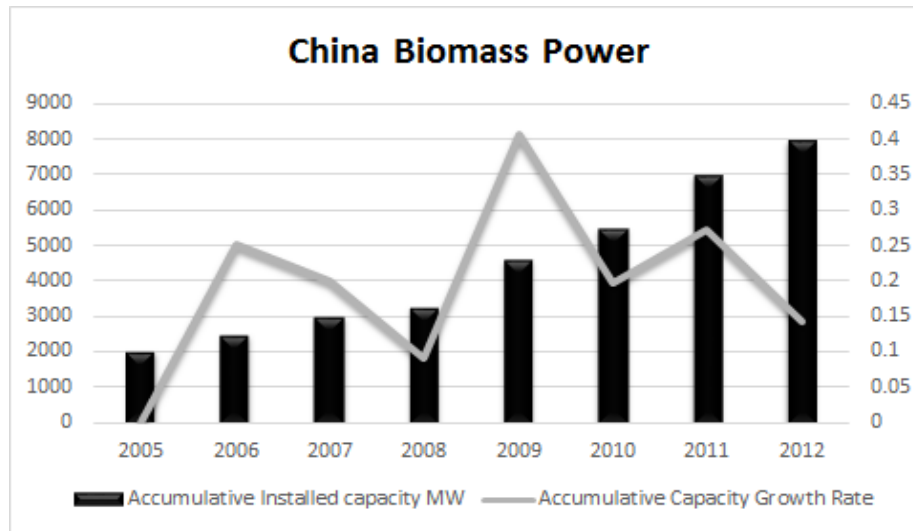
4.7.6. Chinese Biomass Power

Biomass and biofuels represent a key potential future growth area for renewables in China, with opportunities in second generation biofuels, ethanol and energy produce from feed stock sources. Despite their future potential, it is important to recognise that these areas are just getting started in China and currently have very poor supporting infrastructures. In biomass, China has strong existing understanding and knowledge of the required technologies as well as understanding of how to build and operate the power plants. The main restriction for development of biomass is currently the lack of supportive infrastructure. China is currently investing in a small number of test projects for biomass, which are expected to lead the way for further research and investment before 2015.

Table 4.8.

BIOMASS POWER	2005	2006	2007	2008	2009	2010	2011	2012
<i>Accumulative Installed capacity (MW)</i>	2000	2500	3000	3270	4600	5500	7000	8000
<i>Accumulative Capacity Growth Rate</i>	-	25%	20%	9%	41%	20%	27%	14%

⁸⁰ "China Greentech Initiative Renewable Energy Finance 2011", CAP.



The focus for Chinese biofuel development has been in two areas – ethanol production and second generation biofuels. Ethanol production remains a small area of investment for China, who lacks processors and matching infrastructure as well as knowledge on the right mixture to create a suitable power source. Second generation biofuels (non food sources that can be generated into biofuels) offer potential to China, who are now placing emphasis on the use of jet fuel in a bid to try and create a national source of price stable biofuels to reduce the impact of external geopolitical situations which could impact fuel security. According to China's Civil Aviation Administration, China is expected to use 12 million metric tons of aviation biofuels by 2020, accounting for around 30% of the country's total use of jet fuel. China is also beginning to invest in energy that can be produced from feed stock sources such as corn stocks, wheat stocks and gutter oil. Biofuels using algae are already more advanced than in other countries, according to the US Department of Energy at the US Embassy in Beijing, the scale of China's investment and existing capabilities are already greater than those of the US in this area. Sinopec and Sinoc, as well as other Chinese oil companies are beginning to recognize the potential value of this area for future development. They see that if they can generate aviation biofuels in China and export them globally, they would quickly rise to a position of global leadership. Which is why entities such as the China National Petroleum Corporation announced plans this year to build a refinery capable of producing 60,000 tons of biofuel annually by 2014.

Although these areas remain underdeveloped in China, compared to solar, wind or hydro technologies, biomass and biofuels could be described as the next generation of renewable energies in China and are the key growth markets to watch over the course of the 12th and 13th Five Year Planning periods⁸¹.

⁸¹ “China’s Renewable Energy Sector: An Overview of Key Growth Sectors” (2012), Solidiance.

CHAPTER 5

“FOREIGN PLAYERS IN CHINA RENEWABLE ENERGY”

5.1. FDI IN THE CHINESE POWER: HISTORICAL PERSPECTIVE

5.1.1. The growth of FDI

Private investment in electricity generation grew dramatically in developing countries during the 1990s, to heavily decrease at the end of that period, during the Asian financial crisis.

Negotiations for the first foreign-invested power project in China kicked off in the early 1980s between Guangdong provincial government and China Light and Power Co. Ltd (CLP) of Hong Kong for the joint development of a nuclear power plant: the joint venture agreements being signed in 1985. Deng Xiaoping economic policy in the first half of the 1990s allowed important commitments to foreign-invested projects, approving even those which envisaged full foreign control over the power plant. The boom period was specially noticed between 1994 and 1997, when the growth of FDI was tremendous, and the electric sector became especially attractive.

Hence, cumulative FDI in the power sector went from zero in 1985 to 13% of total investment in the Chinese power in 2002 (whereas in other sectors FDI stood at a 6% average). Just as remarkable is the precipitous drop-off later on: in 2005 foreign IPPs accounted for barely 9% of Chinese installed capacity, and the share was meant to decline further as remaining foreign IPP investors such as InterGen and AES planned already at that time to exit the market.

The once attractiveness of the Chinese market, based on its size and vertiginous growth, was in fact more like a mermaids' song, as high amounts of potential customers did not automatically translate into profits for foreigners given that individual Chinese in the 1990s were at the lower level of spare income. As a consequence, investments that may have been very profitable on a first stage (mainly on the equipment supply stage or EPC - Engineering, Procurement and

Construction- contracts), later on revealed themselves as largely unsustainable in the long-term⁸².

5.1.2. The Chinese need for foreign IPPs in the 1990s

The need for foreign participation in the power sector in the '90s was motivated by three main factors:

- mainly the need for foreign capital, which was born out of the tight fiscal situation as the Chinese government was closely controlling credits to stop inflation;
- the necessity of technology transfer, with the principal objective of acquiring efficient power generation equipment;
- to a lesser extent, the need to introduce some degree of competition. This worldwide movement to increase economy efficiency by introducing competition was transposed in China by the introduction of IPPs selling to a single buyer in the province (i.e. the regional or provincial power bureau), strategy being considered as the least disruptive way of introducing competition as it would not change the basic structure of the vertically-integrated power market. However, this strategy has not always worked out efficiently as it is generally difficult for competition to occur without a functional separation of the different aforementioned segments (generation, transmission, distribution), especially when they are concentrated in the hands of government bodies and SOE and there is unfair or/and unequal grid access for local or foreign IPPs.

5.1.3. The foreign IPPs experience in China

In addition, some other specific factors affect primarily foreign IPPs. Those are based on the fact that these had entered the CEM with the expectation that it would be a regulated market of long term PPAs, cost pass-through mechanism and guaranteed returns. In reality, it turned out to be a merchant market distorted by

⁸² "Brief Description and Analysis of the Chinese Electricity Market", European Union – Trade Section.

local protectionism and changing government policies. In addition to the mismatch in expectations, foreign IPPs suffered more severely than locals of lack of competitiveness in terms of tariff levels as they typically require higher returns and incur higher costs. These challenges may be regrouped in three categories:

- *Information barriers.* Foreign industry tends to transplant their own business models into the Chinese market, creating the aforementioned mismatch. This tendency can be attributed to the lack of transparency and poor quality data of the domestic market available through official channels;
- *Weak rule of law and poor enforceability of contracts.* If the system is better nowadays than in 1978, when China lacked the basic laws that defined the market (no contract law, no corporate law, no Intellectual Property law, etc.), many issues remain since they are related to two Chinese intrinsic characteristics:
 - a) the notion of law and contract law is still very different from the West, hence judicial interpretation varies frequently and becomes unpredictable for foreign companies (and Chinese entities are pretty reluctant to foreign arbitration);
 - b) the subordination of the law to socialist dictates.
- *Gradual decrease of governmental support for foreign investment* in the CEM particularly enhanced with the current policies of betterment of domestic industry or the creation of local champions.

5.2. FOREIGN PLAYERS

This is an analysis of data regarding foreign renewable players in Chinese Energy Market. Due to lack of national level data, all information have been gathered from company websites and newspaper. Three different groups are recognized:

- *Actual Foreign Renewable Players:* companies that are actually involved in the market.
- *Last Exiting Foreign Renewable Players:* companies that had been involved in the market in the last years, but that have exited.
- *Further Incumbent Foreign Renewable Players:* companies that have already planned to enter the market.

- *Other Energy Related Big Foreign Players*: companies that are involved in other segment of the Chinese Electricity Market.

5.2.1. Actual Foreign Renewable Players

China Light & Power “CLP” (Hong Kong)

Found in 1901 as the China Light and Power Company Limited in Hong Kong, the CLP Group has grown from a Hong Kong-based power utility into a leading investor and operator in the Asia Pacific Region’s electricity market, with a portfolio of over 30 generation assets and retails operations in the Chinese mainland, Australia, India, Thailand and Taiwan.

Currently, CLP is one of the largest foreign investor in China’s electricity industry, with a presence in the country’s most vibrant economic regions, including the Bohai Gulf area, the Pearl River Delta and provinces of Guangxi, Shaanxi, Sichuan and Hebei. CLP’s diversified fuel mix covers coal, nuclear energy, hydro and wind power. Its Chinese operations count 18 wind farms, 3 hydro plants and one biomass plant. CLP’s Chinese overall installed wind capacity is about 1,098 MW. It has two wholly-owned wind farm in Penglai (Shandong) and Songyuan (Jilin), which account for a capacity of 148 MW. The remaining part is jointly-owned with some of the most important Chinese renewable energy companies, as showed into the table.

Table 5.1.

Project	Location	Capacity	Partner	CLP Equity	CLP Capacity
CGN Wind Portfolio	Different Regions	2000 MW	CGN Wind Energy Ltd.	32%	524 MW
Changdao Wind Farm	Yantai, Shandong	27.2 MW	China Huaneng Group	45%	12.2 MW
Changling II Wind Farm	Songyuan, Jilin	50 MW	Sinohydro New Energy Co.	45%	22 MW
Chongming Wind Farm	Shanghai	48 MW	SH Municipal Electric Pow Co.	29%	14 MW
Datong Wind Farm	Taonan, Jilin	49.5 MW	China Datang Corporation	49%	24 MW
Hekou Wind Farm	Dongying, Shandong	49.5 MW	China Shenhua Energy	49%	24 MW
Haifang Wind Farm	Binzhou, Shandong	49.5 MW	China Shenhua Energy	49%	24 MW
Lijin I & II Wind Farm	Dongying, Shandong	99 MW	China Shenhua Energy	49%	48.5 MW
Laizhou Wind Farm	Laizhou, Shandong	41 MW	China Huadian Corporation	45%	18 MW
Mazongshan Wind Farm	Fuxin, Liaoning	49.5 MW	Shanghai Shenhua	24.5%	12 MW
Qujiagou Wind Farm	Fuxin, Liaoning	49.5 MW	Shanghai Shenhua	24.5%	12 MW
Nanao II & III Wind Farm	Shantou, Guangdong	60 MW	Huaneng Renewable Co. Ltd.	25%	15 MW
Rongcheng I, II & III	Rongcheng, Shandong	147.8 MW	China Shenhua Energy	49%	72.4 MW
Shuangliao I & II	Shuangliao, Jilin	99 MW	China Datang Corporation	49%	48.5 MW
Weihai I & II	Weihai, Shandong	69 MW	China Huaneng Group	45%	31 MW
Zhanhua I & II	Binzhou, Shandong	99 MW	China Shenhua Energy	49%	48.5 MW

Then, CLP's overall hydro capacity is about 486 MW: it operates 2 wholly-owned hydro power stations in Dali (Yunnan) and Jiangbian (Sichuan), and another jointly-owned one in Huaiji, in which CLP owns a 85% stake.

CLP has also interest in a 15 MW biomass plant, located in Binzhao (Shandong), in which the company owns an 80% stake⁸³.

Hong Kong Energy "HKE" (Hong Kong)

Hong Kong Energy (Holdings) Limited is a subsidiary of HKC (Holdings) Limited, acting as HKC (Holdings) Limited's renewable energy business arm.

The Company's primary investment is in the Danjinghe Wind Farm and the adjacent Lunaobao Wind Farm in Hebei. HKE pursued also an investment in the Siziwang Qi Phase 2 Wind Farm in Inner Mongolia.

The assets, which involve 535 MW of gross power generation capacity (attributable capacity of 251 MW), held by the Group include:

- Danjinghe Wind Farm in Hebei with a total capacity of 200 MW. Phase 1 with a capacity of 40.5 MW commissioned in March 2009, while the 80.0 MW Phase 2 and 79.5 MW Phase 3 commenced operation in 2010;
- Changma Wind Farm in Gansu. This 201 MW wind farm commenced commercial operation in the third quarter of 2010;
- Mudangjiang and Muling Wind farm in Heilongjiang. These 29.75 MW wind farms commenced full operations in September 2007 and has been making steady revenue contributions;
- Phase 1 of Siziwang Qi Wind Farm in Inner Mongolia. All wind turbines of this 49.5 MW wind farm have been hoisted and are currently under grid interconnection.
- A 25 MW waste-to-energy power plant at Linyi City in Shandong Province, which commenced full operations in 2007, and it is making steady revenue contributions.

Dr. Bruce Yung, chairman of HKE, said: "China presents an attractive business landscape to develop the alternative energy businesses. Among the alternative power generation options, wind is the most cost-competitive and has attracted the

⁸³ China Light & Power – Company Website.

most investment. China has potential wind power resources of 700 GW to 1,200 GW nationwide and the government is planning to raise the wind installed capacity to 150 GW by 2020. HKE wants to increase market share in this growing market and build a solid foundation for its future business expansion in China”⁸⁴.

KEPCO (South-Korea)

KEPCO’s entry into renewable energy business is driven by the imperative to penetrate into overseas renewable market and to reduce greenhouse gas emissions. In September 2005, KEPCO started wind power business for the first time by establishing a joint venture with China Datang Corporation (Sino-Japan or Chifeng) in Gansu Province, the region known for abundant wind power. KEPCO expanded wind power business to Inner Mongolia and completed phase one project (140 MW) in June 2007 followed by phase two expansion project. KEPCO is also involved in phase 3 ~ phase 7 projects in Inner Mongolia carried out as follow-up. In April 2010, KEPCO signed an agreement to develop 500 MW wind farm with Liaoning province and is continuously expanding investment into wind power business. It formed a joint venture, Gemeng International Co., Ltd. in Shanxi province, together with China’s SIE, one of the super large provincial SOEs, and Japan’s J-Power and Chugoku. As of late 2012, KEPCO is the largest overseas power supplier in China operating 919 MW wind power plants in Inner Mongolia, Gansu province and Liaoning province with another 396 MW project to be added soon⁸⁵.

KEPCO’s Performance(China)

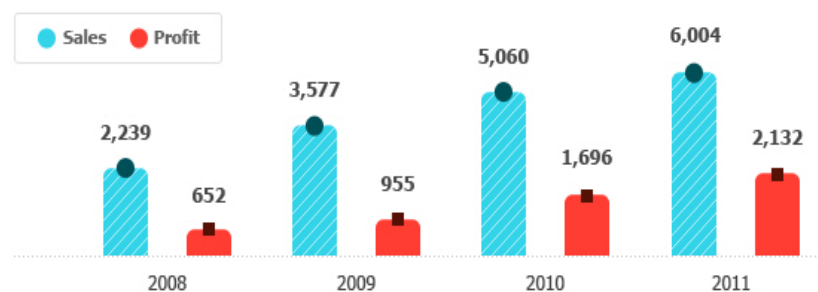


Figure 5.1.

⁸⁴ www.todayIR.com

⁸⁵ KEPCO – Company Website.

UPC (United States)

The UPC Group was co-founded by Brian Caffyn in early 1996 after leaving UPC Group's predecessor company where he was President since 1994. Since that time Mr. Caffyn has successfully grown the various UPC Group businesses. The other partners of UPC Group have all been active in the business since as early as 1998. The initial four partners are active in the management of the various businesses, with Mr. Caffyn being based in Hong Kong managing the China business, David Sutton based in the Philippines co-managing the Philippines business, Mark Instance based in Europe co-managing the Philippines and Peter Gish based in Boston managing the North African businesses.

The UPC Group formed the predecessor company to UPC Renewables China in early 2006 with the introduction of the China Renewable Energy Law on the 1st January 2006. Initially, the business had an office in Hong Kong and in late 2006, UPC Renewables China opened its Beijing office. By 2007, under the direction of Wilson Guo (COO) UPC was rapidly growing the management and staff, beginning to obtain initial development rights. The company has since gone on to acquire over 11,000 MW of development rights in 18 provinces in China. As of mid-2012, UPC Renewables China has three projects in operation and two projects in construction with 4 wholly owned projects and 9 JV projects approved by the NEA. It expects to enter into construction on the majority of these.



Figure 5.2.

UPC Renewables China is an owner and operator of wind farms and it is one of, if not the largest international wind farm developer in China, and is active on over 60 wind farm sites in the majority of Chinese Provinces. UPC Renewables China currently has sites as indicated in the above map of China. It develops, builds and

owns its wind farm projects. In certain cases this is accomplished through entering into joint ventures with local Chinese companies⁸⁶.

Nuon (Netherland)

Nuon, part of Vattenfall, is an energy company that generates electricity and produces gas, heating and cooling, and supplies these to approximately 2.3 million households, companies and organisations in the Netherlands. Nuon also offers its customers energy-saving products and services, and operates wind farms, hydro, solar and biomass plants. In China, Nuon entered into a BOT agreement with the local utility on Nan 'Ao Island to build and operate a 24 MW wind farm (which became operational in June 1998) for 20 years. The power purchase agreement (PPA) was structured so that the price of energy will be indexed 3% annually. This is the first time the Chinese government has allowed a utility to enter into a PPA for a wind farm that stipulates payment in hard currency and indexing of the price of energy to a foreign entity⁸⁷.

InfraVest (Germany)

InnoVent/InfraVest Group puts its emphasis on the development and investment in the wind energy, covering regions such as Germany, Spain and Turkey. Furthermore, the Company has committed itself to the Far Eastern, especially in Greater China. It operates 13 wind projects: 8 in Taiwan, 2 in Germany, 1 in China, Brasil and Turkey. Its Chinese wind farm started operation in December 2003, thanks to a partnership with Nordex, which provided wind turbines. It is a 16.5 MW wind farm, located in Shandong Province (Community of Qingdao / Daqiao), which required € 20 million investment with an annual energy yield of 36 GWh⁸⁸.

NBT AS (Norway)

NBT AS is a Norwegian renewable energy development company with operations in Norway, China, Cyprus, Hong Kong and Pakistan. NBT has been working in the Chinese wind power market since 2004. NBT is currently developing 200 MW of

⁸⁶ UPC Renewable – Company Website.

⁸⁷ "Renewable Energy Markets in China: An Analysis..." (1999), NREL – US Department.

⁸⁸ InfraVest – Company Website.

wind farms in China with a pipeline of another 1000 MW, a 60 MW biomass power plant in Jilin Province, China and 100 MW of wind farms in Pakistan, trading Certified Emission Reduction (CERs) rights. It has a long-term USD 400 million strategic plan for wind farm development in China and aims to build 8-12 wind farms, each with a capacity of 49.5 MW⁸⁹. It entered in a Sino-Norwegian JV, together with Guodian Longyuan Power Co.Ltd. and Shengyang Electricity Company, forming *NBT (Baicheng) New Energy Development* (aka Ao Lu Jia New Energy Development). NBT Baicheng entered into a long-term PPA with local distribution companies under the renewable energy law and associated framework that provides for feed-in tariffs. First project is the 49.5 MW first phase of a 200 MW wind farm in Baicheng, Jilin Province, China. As of April 2010, NBT (Baicheng) New Energy Development Co., Ltd. operates as a subsidiary of AEI China Power Limited. NBT holds also a 25% stake in Sanhe Green, a private company developing and operating biomass power plants in China, which had development rights for the first 50 MW combined heat and power plant with targeted production start in October 2009⁹⁰.

AEI - Ashmore Energy International (United States)

AEI owns and operates interests in power generation assets in the world's emerging markets. Through an Electric power generation of 1,283 MW, it operates in nine markets in Asia, Central and South America and the Caribbean.

In April 2010, AEI's wholly-owned subsidiary, AEI China Power Limited, acquired 67% of NBT (Baicheng) New Energy Development Company, Ltd., a formed in China. AEI also closed a long-term project finance loan for RMB 397 million (approximately USD 58 million), which was provided by HSBC and Bank of Communications. The bank financing was the first non-recourse project financing successfully closed for a wind farm project in China under the framework of the Chinese Renewable Energy Law and was also the first renminbi-denominated long-term project finance loan for HSBC. "AEI is excited to be developing its first wind farm in China and is pleased to be working with a strong group of partners and

⁸⁹ "Prepared to ride the Green Dragon?" (2008) – WWF.

⁹⁰ "Wind Farm Development in China" (2008), Bent Bugge – NBT AS.

stakeholders that includes NBT, HSBC, Bank of Communications, Suzlon, Baicheng City, and Taobei District,” said Colin Tam, CEO of AEI Asia Ltd⁹¹.

ASIA POWER CORPORATION Ltd (Singapore)

Asia Power is principally involved in the ownership, management and operation of power plants in China. It was incorporated in Singapore in March 1997 and later converted to a public company in October 1999. Its Chinese operation counts:

- *Asia Power (Neijiang) Hydroelectricity Co., Ltd ("Neijiang")* was incorporated in Neijiang City, Sichuan Province, China in February 1998 with a registered capital of USD 5 million. The company was then a wholly-owned subsidiary of Asia Power. In September 2002, Asia Power disposed of 40% equity interest in Neijiang to Neijiang Xingyuan Electric Power Co., Ltd ("Neijiang Xinyuan"). As a result, the company is now 60% owned by Asia Power. Neijiang owns and operates a 13.5 MW hydropower station in Zizhong County, Neijiang City, Sichuan Province. The hydropower station was commissioned in January 1991, and it comprises 3 generating units with an installed capacity of 4.5 MW each. Neijiang has invested RMB 15m in exchange for a 35% stake in Sichuan Anning River Energy Development Co., Ltd. Neijiang also owns 14.25% equity shares in Asia Power (Leibo) Hydroelectricity Co. Ltd.
- *Sichuan Anning River Energy Development Co., Ltd ("Anning River")* was incorporated in July 2002 with a registered capital of RMB 50m. The company is 35% owned by Neijiang and 30% owned by Asia Power (Chengdu) Investment Management Co., Ltd, a wholly-owned subsidiary of Asia Power. Asia Power's effective interest in Anning River is 51%. Anning River has undertaken to build hydropower stations along Anning River. The Sankeshu hydropower station operates at a total installed capacity of 52 MW (2 generating units at 26 MW each) and has commenced operation in January 2005.
- *Asia Power (Leibo) Hydroelectricity Co., Ltd ("Leibo")* was incorporated in March 2006. The Group owns total effective equity interest of 62% in Leibo

⁹¹ www.businesswire.com

through its subsidiaries. The principal activities of Leibo are mainly to develop and operate hydropower electricity generation plants with 40 MW installation capacity in Leibo County Sichuan, PRC⁹².

- *Fu Da Xin Holdings Ltd ("Fudaxin")* invests in hydro power plants and wind power resource in Shangxi province through Xi'an Kaixin Energy Development Co. Ltd. Asia Power owns 20% stake in Fudaxin.

5.2.2. Last Exiting Foreign Renewable Players

AES Corporation (USA)

The AES Corporation is a diversified power generation and distribution company dedicated to improving lives by providing safe, reliable and sustainable energy solutions in every market we serve. Founded in 1981 as one of the first Independent Power Producers in the U.S., we pioneered private investment in power generation and distribution in many countries. Today, it is one of the world's leading power companies concentrated in both stable and high growth markets with operating capabilities across diverse fuel types and technologies. Since the beginning of 90', AES has been one of the first foreign IPP to enter the Chinese market. Its Chinese operations have covered coal, hydro, gas and wind sector. Until 2012, AES Corp. has been jointly-owner of about 10 power plants in China, with an overall installed capacity of 2.8 GW:

- Hydro – 2 power plants accounted for about 400 MW of capacity.
- Coal - 1 power plant of 2,100 MW.
- Gas – 1 power plant of 50 MW.
- Wind – 5 power plants for an amount of 250 MW⁹³.

In May 2012, it entered in a purchase agreement with Sembcorp (Singapore), a leading energy and water player serving industrial and municipal customers, with an overall power capacity of 5,800 MW, generated from different sources. The sale, valued at USD 85.5million, includes a 49% stake in each of the five wind farms jointly owned by AES with China's Guohua Energy Investment, as well as a 25% stake in a coal-fired power plant. The Virginia-based company sold also its 25

⁹² Asian Power – Company Website.

⁹³ AES Corp. – Company Website.

percent equity interest in the coal-fired Yangcheng plant and its 49 percent interest in Jianghe Rural Electrification Development Company Ltd to its joint venture partner China Three Gorges New Energy Corp for USD 48 million⁹⁴.

Roaring 40s JV (Australia – Hong Kong)

Roaring 40s Renewable Energy Pty Ltd is a renewable energy development company. The company was a result of joint venture between Hydro Tasmania and China Light & Power (CLP) Group. Since the beginning in 2005, Roaring 40s' had 13 sites in operation or in planning in Australia, India, Hong Kong and mainland China. Cathedral Rocks, Woolnorth, Waterloo Wind Farm and Musselroe are four notable power plants that the company owns. It was engaged in ten Chinese wind farms, jointly-owned with China Datang Corporation and China Shenhua Energy, which are located in Shandong and Jilin provinces. The company owned a 49% stake in each of these projects, resulting in an overall equity capacity of about 250 MW. During 2011, Roaring40s was split, with all Chinese projects floated to JV partner CLP, while Tasmanian ones came to Hydro Tasmania⁹⁵.

Honiton Energy (United Kingdom)

Established in 2005, Honiton, a London-based company, was engaged in the operation and development of wind farms in China.

During 2000s, Honiton developed a substantial portfolio of wind farms, both operational and under development, located in China's Inner Mongolia, a region which benefits from among the highest quality of exploitable wind in China.

By 2009, Honiton has been owner of three wind farms in Bailingmiao Town, Inner Mongolia region, for an overall installed capacity of 150 MW, with other five projects in pipeline. Through further development, Honiton aimed to be among the leading wind farm operators in China, and it expected to expand its portfolio of wind farms to a capacity of 1,650 MW.

Being 100% foreign-owned allows the company to raise investor capital from international markets and to list on any overseas stock exchange without China's

⁹⁴ www.globaltimes.cn

⁹⁵ www.asian-power.com

regulatory approvals⁹⁶. In 2008, Honiton was acquired by a JV between Arcapita Bank, a Middle East PE, and Tanti Group, a family-owned Indian corporation that owns a majority of Suzlon, one of the world's leading suppliers of wind turbines. In last years, the ownership encountered different bankruptcy problems, and Honiton has been dissolved in 2012, without information about who would own its existing Chinese wind farms.

Meiva Power Co. Ltd. (United States)

One company active in the hydro sector was Meiva Power Co. Ltd. Originally, established in Hong Kong in 1994 as a regional office of PSEG Global to develop power generation investment opportunities in Asia, Meiya was 50% owned by New York-listed Public Service Enterprise Group (PSEG), which operates power plants totalling 16,000 MW in the US and worldwide. Meiya's two other shareholders were the Asian Infrastructure Fund with 30%, whose co-sponsors include the Asian Development Bank and the World Bank's International Finance Corporation, and Hydro-Quebec International with 20%. Until 2010, MPC was the leading foreign-owned independent power producer in North Asia, developing, owning and operating electric power and steam generation facilities in the People's Republic of China (PRC) and South Korea. MPC had a diverse and sizeable portfolio of high quality assets in the most developed economies in the region. It had grown significantly through greenfield developments and acquisitions in PRC and Korea. The Company had invested in over 20 power projects (including projects under construction) with a total installed capacity of about 15,000 MW. Almost half of all its projects were in renewable field, with 9 hydropower plants and one wind farm actually owned in China. Even if Meiya's track record had always been very good, it was interested by wrong ownership. In 2004, Meiya was acquired by BTU Group, a US private equity, which encountered bad management decision and sold its stake to Standard Chartered. In 2010, Meiya went in Chinese hands, being acquiring by China Guangdong Nuclear Power Corporation (CGNPC), which earned important

⁹⁶ www.economicstimes.com

synergies, buying the ex-leading foreign-owned IPP in renewable Chinese market⁹⁷.

5.2.3. Further Incumbent Foreign Renewable Players

Solaria (Spain)

Solaria Energia & Medio Ambiente SA, founded and based in Madrid in 2002, manufactures photovoltaic modules and cells in its two production facilities located in Spain, with a production capacity of 250 MW. Additionally, the company also develops turnkey projects for large facilities, for both own and third parties, generating power through its own photovoltaic plants all over the world, with a total generation capacity of 45 MW. In September 2011, Solaria signed up an agreement with the Chinese company Dongfang Electric Corporation (DEC). Through this agreement both companies established the baselines for commercial cooperation and development in Asia. Also, Solaria obtained a purchasing Credit Line of USD 30 million from DEC to purchase solar cells and other turnkey projects components. In addition, both companies, DEC and Solaria, will co-invest worldwide with a target pipeline of 100 MW per year⁹⁸.

Enfinity N.V. (Belgium)

Enfinity N.V. is established in Waregem (Belgium), and is a fast-growing and ambitious company with international activities in renewable energy. As a project specialist, Enfinity ensures the implementation of solar energy power plants, and is already present in twelve countries including Belgium, Italy, Spain, France, Greece, the US, Canada and Germany.

Enfinity has a total installed capacity of over 390 MW and is firmly established as one of the top 10 companies in the world in the field of solar energy development. Enfinity's annual total production capacity equates to the electricity consumption of 115,000 families and reduces CO2 emissions by 296,400 tonnes a year⁹⁹. In March 2009, Enfinity enters China through a joint venture with Energy Group CGNPC

⁹⁷ www.dynabondpowertech.com

⁹⁸ www.bloomberg.com - Manuel Baigorri.

⁹⁹ Enfinity – Company website.

nuclear and a contract for the development of a solar plant with a system size of 10 MW, with a production of 18,045 MWh in the Dunhuang, Gansu province. After, Enfinity signed a framework agreement with Huaneng New Energy Industrial Co. Ltd., for the development of 2 GW PV projects.

"Winning this bid is an important milestone for Enfinity's international expansion strategy and it will act as an entrance ticket towards the high potential Asian market," said Enfinity founder Gino Van Neer¹⁰⁰.

Electrobras (Brazil)

Brazilian company Furnas, of the Eletrobras group, signed a cooperation agreement with Chinese counterpart China Three Gorges Project Corporation (CTGPC) to seek out business opportunities in the renewable energy business. Negotiations are still continuing between them about their Jiangsu province offshore wind joint venture. The project involves three possible arrays of turbines, according to CTGC: 100 units of 2 MW turbines, 80 units of 2.5 MW turbines or 67 units of 3 MW turbines. The site of the wind farm has already been chosen by CTGC based on studies of wind speed, distance to the grid connection, environmental conditions and financial issues. The two companies hope to develop further joint ventures in the offshore wind sector but nothing concrete will be decided until this initial venture has been fully agreed and its development is underway, according to Furnas. "Being the first project of its sort, naturally it will take longer to develop," said Motta. Construction was originally scheduled to begin in the second half of 2012, following the signing of a memorandum of understanding by the two countries late last year¹⁰¹. On November '12, Furnas and China Three Gorges Corporation (CTGC) have invited EDP Renováveis (EDPR) to participate in their joint venture project. EDPR's participation makes sense given its presence in Furnas' home market of Brazil as well as CTGC's significant stake in the Portuguese company. EDPR would be able to bring technical expertise to the project "given the highly developed state of wind-power technology in Portugal",

¹⁰⁰ www.bloomberg.com

¹⁰¹ www.windpoweroffshore.com

to provide China with a clean and renewable source of energy within the region are under development. The company is also in negotiations to acquire an 80% interest in an existing Chinese 100 MW wind farm. This is an advanced phase wind energy project with significant expansion potential¹⁰⁴.

Abengoa SA (Spain)

Abengoa SA, Spanish company, applies innovative technology solutions for sustainability in the energy and environment sectors, generating electricity from renewable resources, converting biomass into biofuels and producing drinking water from sea water.

In January 2013, the company, which developed desalination plants from Algeria to India, said it has started commercial operations making salt water potable at the Qingdao facility in China. The plant at the second-largest port in northern China in Shandong province will produce 100,000 cubic meters of drinking water a day from seawater, enough to supply the needs of a half-million people.

Abengoa began building the plant in 2010 and will operate and maintain it for 25 years. During this time, the company is forecasting revenue of at least EUR 750 million (USD 1 billion) from the sale of water and a further EUR 25 million from technical support operations, according to the statement. The project, the first desalination one of its type carried out using a project-finance structure entirely financed by local Chinese banks, required a total investment of EUR 135 million¹⁰⁵.

TMO Renewables (United Kingdom)

TMO Renewables Limited, founded in 2002, produces chemicals and liquid fuels from biomass. It develops and engineers a process for the production of cellulosic bioethanol by utilizing a thermophilic organism. The company focuses on the production of bioethanol from agricultural residues and municipal solid waste.

In May 2011, it entered into two separate technology partnerships in China. One is with the Bio-energy and Bio-chemical Division of COFCO, China's largest diversified products and services supplier in the agribusiness and food industry. The

¹⁰⁴ www.energy-business-review.com – EBR.

¹⁰⁵ www.bloomberg.com - Reed Landberg.

other is with CNOOC New Energy Investment Co, a wholly owned subsidiary of the China National Offshore Oil Corporation (CNOOC), one of the largest state-owned oil companies, and the largest offshore oil and gas producer in China. Both agreements entailed TMO embarking on testing and producing programs jointly with each partner to develop the country's first fully commercial second-generation ethanol plants using cassava residue and cassava stalk.

Then in August 2012, TMO Renewables has selected Heilongjiang State Farm (HSF) to supply of biomass feedstock for its ethanol facilities to be constructed in Heilongjiang province. TMO CEO David Weaver said securing the supply contract was a step in building the first second-generation biofuel facility in China¹⁰⁶.

"Our network in China is growing and we look forward to announcing an offtake agreement for the ethanol produced, another key element that needs to be in place for the delivery of an operational plant in the province. Securing the supply contract was a step in building the first second-generation biofuel facility in China." TMO's CEO David Weaver said.

Lockheed (US)

Maryland-based Lockheed Martin Corp. and China's Reignwood Group will build a plant to generate electricity from differences in ocean temperatures, using technology the U.S. defence company previously worked on in the 1970s. The 10 MW facility powered by ocean thermal energy conversion, or OTEC, may spur use of a technology that has the potential for billions of dollars of projects. The plant will produce power for a Chinese resort being built by Reignwood.

"Benefits to generating power with OTEC are immense," Dan Heller, vice president of new ventures for Lockheed Martin mission systems and training, said. "Constructing a sea-based, multimegawatt pilot OTEC power plant for Reignwood is the final step in making it an economic option to meet growing needs for clean, reliable energy. The agreement with Reignwood may be the foundation to develop OTEC power plants from 10 MW to 100 MW. A commercial-scale plant would have the capability to power a small city"¹⁰⁷.

¹⁰⁶ www.renewable-technology.com

¹⁰⁷ www.bloomberg.com - Louise Downing.

METSO (Finland)

Metso Oyj, a Finnish engineering company, plans to expand its biomass business in China and India as growing urban populations drive up energy demand, while European governments cut back support for clean power.

“The growth of Asian cities adds to waste as well as energy consumption, offering opportunities to use that waste as biomass”, Martin Ridderheim, vice president of Helsinki-based Metso’s power business, said by e-mail. Power plants fueled by municipal waste, wood chips and straw can help utilities reduce consumption of coal to generate electricity. China, the world’s biggest coal user, has offered incentives to build clean-energy projects as it seeks to meet burgeoning power demand without adding to carbon emissions¹⁰⁸.

Orka Energy (Iceland)

Orka Energy is a geothermal development company specialized in harnessing geothermal resources for electricity production and district heating. With operations in Singapore, China, Philippines and Iceland, Orka Energy is founded on Iceland’s long history of geothermal utilization, advanced technologies and operational know-how.

In 2012, the company has started a joint venture with China’s Sinopec, named Shaanxi Green Energy Geothermal Development, which is expected to grow and expand the geothermal energy heating to at least 100m² of house floor in China by the year 2020. Sinopec owns 51% of the JV while Orka has 49% stake in the company, which has a registered capital of RMB 99m (USD 15.7 million)¹⁰⁹.

Both the partners are planning to make the JV a technology provider that integrates research, development and applications. In August, last year both the owners of the JV invested an additional USD 50 million in the company. The companies are also planning to develop electricity from the geothermal energy in high heat areas such as Tibet, which at present has a 25 MW geothermal power plant in operation at Yangbajian and some small-scale pilot projects.

¹⁰⁸ www.bloomberg.com

¹⁰⁹ www.businesswatch.com

Celanese Co. (United States)

In 2012, U.S. chemical firm Celanese Corp said it would start ethanol production in China by the middle of 2013, earlier than previously announced. The company earlier planned to open one to two ethanol production plants in China in the next 30 months. Now it would speed up its plans by 6 to 12 months ahead and expand its existing integrated acetyl facility in China with its TCX advanced technology to produce ethanol from hydrocarbon-sourced feedstock. “The modifications would lead to additional 200,000 tons of ethanol production capacity by the middle of 2013”, the company said¹¹⁰.

5.2.4. Other Energy Related Big Players

GDF Suez (France)

Active in China for more than 30 years, GDF SUEZ has strong positions in the environment, energy and services markets in mainland China, Hong Kong and Macao. As of 2011, the Group has approximately 7,000 employees in the country and revenues of €750 million¹¹¹.

Water production, distribution and treatment

Degrémont, a GDF SUEZ hydropower engineering subsidiary, has built 200 projects in China since it began operations there in the 1970s. In the 1980s, the Group teamed up with Hong Kong-based New World Group to found Sinofrench, a company specializing in water production, distribution and treatment. With 4,000 employees and operations in 16 Chinese cities, Sinofrench serves 14 million customers and recently launched a sludge treatment business.

Waste collection and treatment

The Group’s SITA subsidiary collects waste in several large cities in China.

- In Macao, SITA is responsible for collecting waste and incinerating hazardous waste. The company has also developed an underground pipeline network for collecting waste in order to avoid large numbers of trucks circulating in the city center.

¹¹⁰ China Briefing – www.china-briefing.com (2012).

¹¹¹ GDF Suez - Company Website.

- In Hong Kong, SITA transports nearly 80% of the city's waste to two of the world's largest covered landfills, NENT and WENT.
- In Shanghai, SITA is in charge of waste collection in the petrochemical zone.

Electricity and related activities

GDF SUEZ produces and distributes electricity in China through two projects:

- in Macao, Group employees manage CEM, an electricity production and distribution company with a total production capacity of 472 MW;
- in Zhenjiang, the Group holds a stake in the Hongshun plant, which has a total production capacity of 24 MW.

Throughout China, the Group has developed strong relationships with equipment manufacturers. For instance, some of the dam turbines, currently under construction at Jirau (Brazil), are manufactured by Dongfang Electric. Since 2008, GDF SUEZ has also established a portfolio of carbon credits with companies such as Guodian Huaneng and Shenhua. Credits are purchased to offset emissions from energy activities in Europe in order to meet EU requirements.

GDF SUEZ uses its expertise in this field to develop other Clean Development Mechanism projects throughout Asia.

Natural gas

GDF SUEZ has been working with Beijing Gas since the early 1990s and currently holds a 20% stake in the Beijing-based engineering joint venture BUGET. In 2010, GDF SUEZ signed a contract with China National Offshore Oil Corporation (CNOOC). Under this agreement, GDF SUEZ will sell CNOOC approximately 2.6 million tons of LNG over 4 years, starting in 2013.

Energy services

GDF SUEZ has been developing its energy services business in China since 2009. Operating predominately in the heating and cooling market, the Group is looking to broaden its offering.

- In September 2009, GDF SUEZ signed an energy services agreement with the municipality of Chongqing, a metropolitan area of 30 million. Under

this agreement, GDF SUEZ will design, build and manage the city's heating and cooling network.

- In May 2010, GDF SUEZ Energy Services signed a strategic partnership agreement with Tianjin New Finance Investment Co., Ltd, under which GDF SUEZ will finance, build, operate and manage an air conditioning services plant in the financial district of Yujiapu, south east of Beijing.

In Beijing, the Group holds a stake in a company that designs assembly lines for the automobile industry.

General Electric (United States)

GE has been involved in China since the early 1900s. With a full array of advanced power generation and energy delivery technologies, GE works collaboratively with customers to drive growth & progress, anticipate energy needs of the future, and power a cleaner, more productive world.

Evolving from a sales department to an operational company offering sales, engineering, research, and development. Actively involved in China's infrastructure construction, GE has helped build the country with 270 gas turbines, 70 steam turbines, 40 gasification licenses, and over 1000 wind turbines. Showing GE's commitment to the region, GE's China Technology Center in Shanghai is one of the company's four global research centers.

GE is at the heart of China's sustainable development, offering green solutions to address the country's energy needs, from cleaner power generation to multiple renewable energy solutions. For example, gasification technology plays a critical role in China's clean coal initiatives. In remote areas, Jenbacher gas engines use biowaste to generate power and heat for households.

GE's world leading gas turbine technology can help solve industrial waste gas issues, use them as fuel to generate power, while performing better emissions control. GE, a trusted long-term partner, strengthens the cooperation with many Chinese companies to meet the future requirement of energy in China¹¹².

In 2012, for example, GE acquired a 15% stake in Shanghai-listed China XD Electric Group, paying an amount of about USD 535 million, giving the largest U.S.

¹¹² GE – Company Website.

conglomerate a foothold in China's vast electrical infrastructure market and access to XD's technology. The two companies have also agreed to form a joint venture to distribute GE's electrical grid solutions to XD's local customers. XD will control 59 percent of the joint venture, with GE owning the rest. This represents a very historical milestones in the Chinese T&D sector, which has always been under state monopoly. Now all GE businesses have set up operations in China with 36 wholly owned entities and joint ventures in manufacturing, service and R&D. GE employs 14,000 people in China¹¹³.

Energies De France (France)

For almost 20 years, EDF group has been aggressively developing business in China, and established a China division in Beijing. The presence in Beijing and its purpose is to ensure that the Group becomes one of the big engineering players in the world's largest electricity program. The EDF Group has established an integration strategy based on long-term partnerships, contribute into new technological developments in nuclear power, thermal energy and hydroelectricity. EDF Group's China division department activities consists of:

- *Industrial Engineering department*: from design skills and network expertise, to manage the group's technical activities in China; monitoring the performance of EDF Group's subsidiaries in China, working close relationship with partners in the energy sector, so as to contribute to the Group industrial know-how in return.
- *Investment and development department*: developing EDF Group's possibilities of investment projects in China.
- *Nuclear department*: developing all forms of business in the EDF Group's nuclear activities in China, providing enquiries services and investments.
- *Support department*: management in China division's human resources, provides logistical support for China division's activities.

The company has five subsidiaries in China, interested in nuclear and fossil-fuel sector, with an overall capacity of about 5000 MW.

¹¹³ www.reuters.com (2012).

EDF Group owns also 20% stake in Beijing United Gas Engineering and Technology (BUGET), which designs, builds and provides consultancy services in gas heating systems. The other shareholders are Gaz de France (20%), USA Golden State Import Export Company Limited (20%) and Beijing Gas Group (40%)¹¹⁴.

¹¹⁴ EDF – Company Website.

CHAPTER 6

“ENEL GREEN POWER”

6.1. COMPANY OVERVIEW



“We contribute through our commitment to sustainable development. We believe that renewable sources are an important tool in promoting the competitiveness of the production system in various countries and also ensuring reliable procurement of energy sources: widespread generation of electricity from water, sun, wind and underground heat ensures greater energy autonomy for countries and at the same time helps safeguard the environment.”

Enel Green Power, established in December 2008, is the Enel Group company that develops and manages energy generation from renewable sources at a global level, with a presence in Europe and the Americas.

EGP is a major global operator in the field of energy generation from renewable sources, with an annual production of 22,5 TWh, mainly from water, wind, solar and the Earth’s heat, covering the energy consumption of more than 8 million clients and avoiding 16 million tonnes of CO₂ emissions per year. It has an installed capacity of 8,044 MW, produced by more than 700 plants in 16 countries and with a generation mix that includes wind, solar, hydro, geothermal and biomass. Its geographic diversification, minimizing regulatory and country-specific risks, ensures a good mix of growth strategies. Each country in which the Company operates offers different incentive schemes based on the resources used.

Enel Green Power’s daily net production first surpassed 100 GWh on 16 January 2013 with a peak of 103 GWh, thus confirming the substantial increase in installed capacity. This is a highly symbolic achievement and shows how the company has expanded over the last years with the help of all its components.

Enel Green Power’s main industrial activities include a factory for the production of multi junction thin-film photovoltaic panels with Sharp and STMicroelectronics. The factory, which supplies the Mediterranean Area, is the most important in Italy

and one of most in Europe. Enel Green Power is a founding partner of RES4MED - Renewable Energy Solutions for the Mediterranean, the association launched in May 2012 with the aim of contributing to the strategies of ongoing initiatives in the Mediterranean. The aim is to accelerate the development of multiple renewable energy solutions and the relevant electricity markets¹¹⁵.

6.1.1. Innovation Focus

50 million Euros
to be invested
in innovative
technologies
within 2015

Renewable energies are by definition a breeding ground for researching and developing new technologies able to produce clean energy. Innovation is one of the key element for the sustainable growth of the Group. Enel Green Power plays effectively his role in this process by developing advanced projects and exploring new territories where technological know-how and experience are very important. In 2012, Enel Green Power carried out activities for the development and demonstration of innovative technologies worth approximately 12 million Euros with a total commitment of approximately 50 million Euros by 2015.

Enel Green Power's efforts are concentrated along three lines:

- *improved performance* – increasing the performance of all of Enel Green Power's traditional technologies, improving availability and mitigating the effects of intermittency, also with the help of plants that allow different technologies to coexist;
- *integrating renewables into anthropic environments* – integrating the use of renewable resources in highly anthropic contexts thanks to the use of machines of small size and low visual impact as well as architectural integration performed, in particular, with thin-film photovoltaic panels which are easily adaptable to the needs of residential buildings;
- *use of new renewable resources* – using as yet untapped renewable resource (above all, marine energy) in order to ensure greater availability of electricity also in remote areas such as islands.

¹¹⁵ Enel Green Power – Company Website.

Enel Green Power relies on the contribution of research centres and universities in Italy and abroad working to promote technological innovation¹¹⁶.

6.1.2. Wind energy



“Wind power has seen exceptional development in recent years and has an expected average annual growth rate through to 2035 of about 8%, reaching a worldwide installed capacity of 1,098 GW.”

Enel Green Power plays a substantial role in the expansion of wind power on an international scale. In Italy, total installed capacity comes to 717 MW; the company enjoys significant presence and strong growth at international level with 2,599 MW from wind power in Spain, Portugal, Greece, France, Bulgaria and Romania, 832 MW in the USA and Canada and 168 MW in Latin America. Considerable attention is devoted to technological innovation, not least through studies concerning the reduction of possible impacts on the landscape. Huge focus is devoted to technological innovation, not just through studies on the landscape's impact reductions. In particular, in 2011 the company implemented a prototype mini-wind power blade designed by the architect Renzo Piano.

This is a new approach to the concept of wind power generation, which is more sensitive to low-altitude winds common throughout the area; it is based on research into innovative materials and new technological solutions. With a capacity of 55 kW, it ensures continuous generation of electricity since it is also capable of exploiting light breezes in the order of 2 metres/sec. The objective is also to ensure “natural” integration into the surrounding area thanks to reduced environmental impact. A twin-blade solution was consequently preferred to reduce visibility by one-third and to ensure, when there is absolutely no wind, a streamlined vertical profile of the tower and vertically aligned blades. Mass production for the Italian market will be developed at the end of the test stage. As regards distribution, the innovative generator will be used internationally for Enel Green Power plants and will also be sold in Italy through the Enel Green Power Retail franchising network.

¹¹⁶ “Leading the green change” (2013), EGP.

The mini-wind power blade designed by Renzo Piano is also intended for micro-generation use in other countries such as the United States, where mini-wind power boasts a long tradition, as well as France, Spain and Greece.

6.1.1. Solar Energy



“Solar energy is the most widespread source available anywhere in quantities that far outstrip energy needs. PV solar energy, according to WEO estimates, will experience strong growth in the near future from 22 GW in 2009 to about 500 GW in 2035.”*

Enel Green Power’s total installed solar capacity of 161 MW is distributed between Italy, North America, the Iberian Peninsula and Greece. Enel Green Power has inherited the great tradition of Enel in this segment with retail operations in the countries it is present in and intends to play a leading role in the global market, contributing to its growth and to the development of the associated know-how.

To this end the company believes it is important to establish technological partnerships and develop innovative business models such as franchising, which has led to a significant increase in generation capacity distributed on the retail and commercial markets in Italy. Enel Green Power is also involved in cutting edge photovoltaic technology manufacturing. The 3Sun factory in Sicily is producing innovative photovoltaic panels. In its initial phase the PV modules manufacturing plant employs approximately 300 skilled workers and has a production capacity of 160 MW of photovoltaic panels per year. This is the largest photovoltaic panel production complex in Italy and one of the largest in Europe. It produces thin-film photovoltaic panels to meet the demand for solar energy markets in Europe, the Middle East and Africa (EMEA). To this end, Enel Green Power has formed a second joint venture with Sharp named Enel Green Power & Sharp Solar Energy, ESSE, whose mission is to develop solar power plants mainly in Europe and MEA. In 2012 Enel Green Power concluded (through the joint venture with Sharp, ESSE) the construction of plants with a net installed capacity of 24 MW (4 in Greece and 20 in Italy) using the panels produced by the factory. In addition, aiming at geographical diversification, in March 2012 ESSE participated in the second tender

held by the South African Department of Energy for PV projects, for the construction of solar power plants in South Africa and was awarded a photovoltaic plant of about 10 MW (the Upington project).

6.1.2. Hydroelectric Energy



“Hydroelectricity is the oldest and most widespread renewable source. It covers a significant share of world electricity generation: More than 16% but with much higher peaks in certain geographical areas.”

The average annual growth rate through to 2035 is estimated at about 2% - a share that is particularly impressive when the already very broad installed base is taken into account. Enel Green Power - on the strength of the long tradition in which Enel's first power stations date back to the early 1900s - operates 397 hydroelectric power plants with a total installed capacity of 2,634 MW and an average annual production of 10 TWh. It manages an installed capacity of 1,513 MW in Italy and 1,121 MW distributed across Spain, Greece, the United States, Mexico, Guatemala, Costa Rica, Panama, Chile and Brazil. Enel Green Power aims to increase its presence in countries rich in this resource by selecting innovative projects and consolidating the power stations already in operation through restructuring and renovation of old elements. The 2013-2017 Enel Green Power business plan includes investments of over 1 billion Euros in the hydroelectric sector.

6.1.3. Geothermal Energy



“Geothermal energy is a response to the necessity to safeguard the environment and ensure sustainable development. This source “works” in a constant and predictable manner and does not cause CO2 emissions.”

Moreover, there is excellent scope for further growth, since it has not been exploited to the full yet. At the end of 2009, installed capacity worldwide totalled about 11 GW and is expected to reach 46 GW by 2035 thanks to an average annual growth

rate of more than 6%. Enel Green Power, with installed capacity of 769 MW, is among the world leaders in this area and is putting decades of expertise to the service of a major international development plan. In particular, Enel Green Power is the only operator in the world capable of covering the entire cycle from exploration through to construction and lastly, exploitation of plants themselves. Italy is the first country where underground heat was used on an industrial scale – the first such power station in the world was installed in 1913 at Larderello in Tuscany – and is still one of the main producers of geothermal electricity, with output of more than 5 TWh/year. In 2013 we celebrate the centenary of the opening of the first geothermal power plant in Larderello. In addition to Italy, Enel Green Power has geothermal plants in operation and under construction in the USA and at the exploration stage in Chile. Long-term experience in this sector also supports leadership in terms of innovation: over and above direct steam or flash technologies, Enel Green Power also conducts research into low enthalpy techniques ensuring optimal exploitation of geothermal resources otherwise still disadvantageous from an economic point of view. One example is the binary cycle that makes it possible to exploit lower temperature thermal resources, used by Enel Green Power at the Stillwater and Salt Wells geothermal power plants in Nevada (USA).

6.1.4. Biomass Energy



“Biomass is all biologically-produced matter based in carbon, hydrogen and oxygen. The estimated biomass production in the world is 146 billion tons a year, consisting of mostly wild plant growth.”

EGP’s installed biomass capacity in 2012 totals 44 MW of which 23 MW in Spain and 21 MW in Canada. It is expected to grow, mainly in Italy, to over 100 MW in 2013-2017. The business plan includes four lines of development with different characteristics:

- *mini biomass* – creation of a network of small and medium size biomass plants in Italy with a reference power of 200 to 500 kW, mainly fed using by-products (woody biomass, agricultural and agro-industrial residues) and established through joint ventures with agricultural partners;

- *hybrid plants* – integration of geothermal power plants in Tuscany, Italy with biomass plants, where technical conditions make it feasible. This type of plant is the first and only one of its kind in the world and could pave the way for a new way of producing energy, via the integration of a number of renewable energy sources, designed to maximise energy production, reducing waste and using local woody waste for generation;
- *conversion of former sugar mills* – the development of biomass plants conversion of former sugar mills and their sugar-beet supply chain through the development of big biomass plants (from 15 MW to 50 MW) using dedicated crops, waste from pruning, herbaceous biomass and by-products in short supply chain (within a radius of 70 km from the plant) in Italy;
- *international* – there are big prospects for the development of biomass at international level as horizons open toward new countries such as North Africa and Latin America, with full awareness of and willingness to comply with the environmental and social conditions of the host countries.

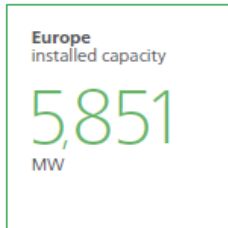
All of the plants are highly efficient, designed according to the BAT (Best Available Technology) and with a high level of flexibility in terms of the biomass used. The biomass needed to power the plants comes via long-term contracts in short chain (within 70 km of the plant) and includes dedicated woody and herbaceous crops, agricultural and agro-forestry residues and agro-industrial by-products. This approach enables the construction of plants with minimal environmental impact and the creation of local biomass supply chains strongly integrated into the local area, in terms of the virtuous use of local natural resources and the direct and indirect employment impact at local level. Particularly relevant is the "Energy Farm" project, created together with the University of Pisa, to improve the production process of plant oils and solid bio-fuels and the production of bio-ethanol from lignocelluloses biomass. In Québec, Canada, through Enel Green Power North America, it has developed a 23 MW plant that can produce energy from wood-processing waste¹¹⁷.

¹¹⁷ "World Energy Outlook 2012: New Policy Scenario", IEA.

6.2. ENEL GREEN POWER IN THE WORLD

Enel Green Power has an installed capacity of 8,207 MW, produced by more than 720 plants in 16 countries and with a generation mix, that includes wind, solar, hydro, geothermal and biomass.

6.2.1. Europe



In 2011, in line with the year before, Europe was the most important region in the world for production from wind and solar sources and second only to Asia for overall production of clean energy. Renewable energy provided about one quarter of total electricity generation in Europe in 2011.

Actually, Enel Green Power operates in Italy, Spain, Portugal, Greece, France, Romania and Bulgaria, with 5,851 MW installed as well as projects under development.

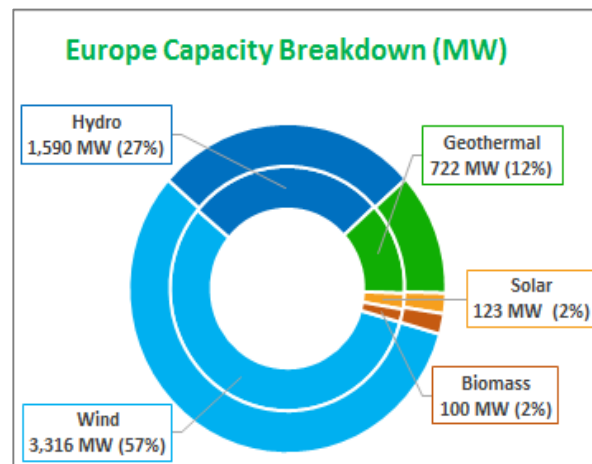


Figure 6.1.

Italy

With an installed capacity of 3,032 MW in Italy, Enel Green Power is a leader in three of the five technologies – geothermal, hydro and solar – and aims to boost total installed capacity over the coming years, consolidating its leadership position and developing its presence.

Enel Green Power has a strong tradition in hydroelectric power technology throughout Italy, with 1,513 MW of installed capacity. While ensuring minimal impact on the surrounding area, this kind of plant can also be managed by small

communities and allows a wide range of uses depending on the availability of hydro-resources.

Enel Green Power also has 34 geothermal plants in Tuscany, Italy, totalling 722 MW and ensuring an annual output of more than 5 TWh. Developed and refined in the Larderello area – which celebrates the centenary of its first power plant in 2013 – Italian geothermal technology is used by Enel Green Power all over the world. Enel Green Power also intends to give great impetus to the development of the solar sector by increasing its installed base and strengthening strategic partnerships with global technological leaders in the industry, such as Sharp and STMicroelectronics.

France

In France, Enel Green Power is based in Lyons and currently operates wind power plants for an installed capacity of 166 MW. Enel Green Power operates in the south of the country and will become a reference point for the sale and installation of high energy efficiency products and solutions – above all photovoltaic plants for installation on the roofs of buildings. The company's strategic approach is to expand its involvement in on-shore wind power significantly, while also continuing to evaluate possible investments in photovoltaic systems.

Greece and Bulgaria

Enel Green Power is present in Greece with an installed capacity of 249 MW and wind farms, mini-hydro and solar plants distributed nationwide. The based in Athens office oversees 2 wind power plants in Bulgaria with a capacity of 42 MW.

Romania

Enel Green Power began operation in Romania in 2007 and is based in Bucharest. The total capacity of the country's nine wind plants amounts to 498 MW.

Spain and Portugal

Enel Green Power operates on the Iberian Peninsula with total installed capacity of 1,864 MW. This is the outcome of integration of the operations of Enel and Endesa in the renewable sector. Enel Green Power boasts significant involvement in the wind power sector and manages 94 plants for a total installed capacity of 1,694 MW. The company also operates hydro plants with 57 MW produced by 9 plants, with cogeneration accounting for 77 MW and 17 plants. Three biomass plants that

produce 23 MW and 6 photovoltaic plants with a total output of 13 MW complete the balanced mix of generation on the Iberian Peninsula. Enel Green Power is the sector leader in terms of installed capacity and production in Spain and Portugal: in Portugal in particular, its total installed capacity is 184 MW from wind power and cogeneration.

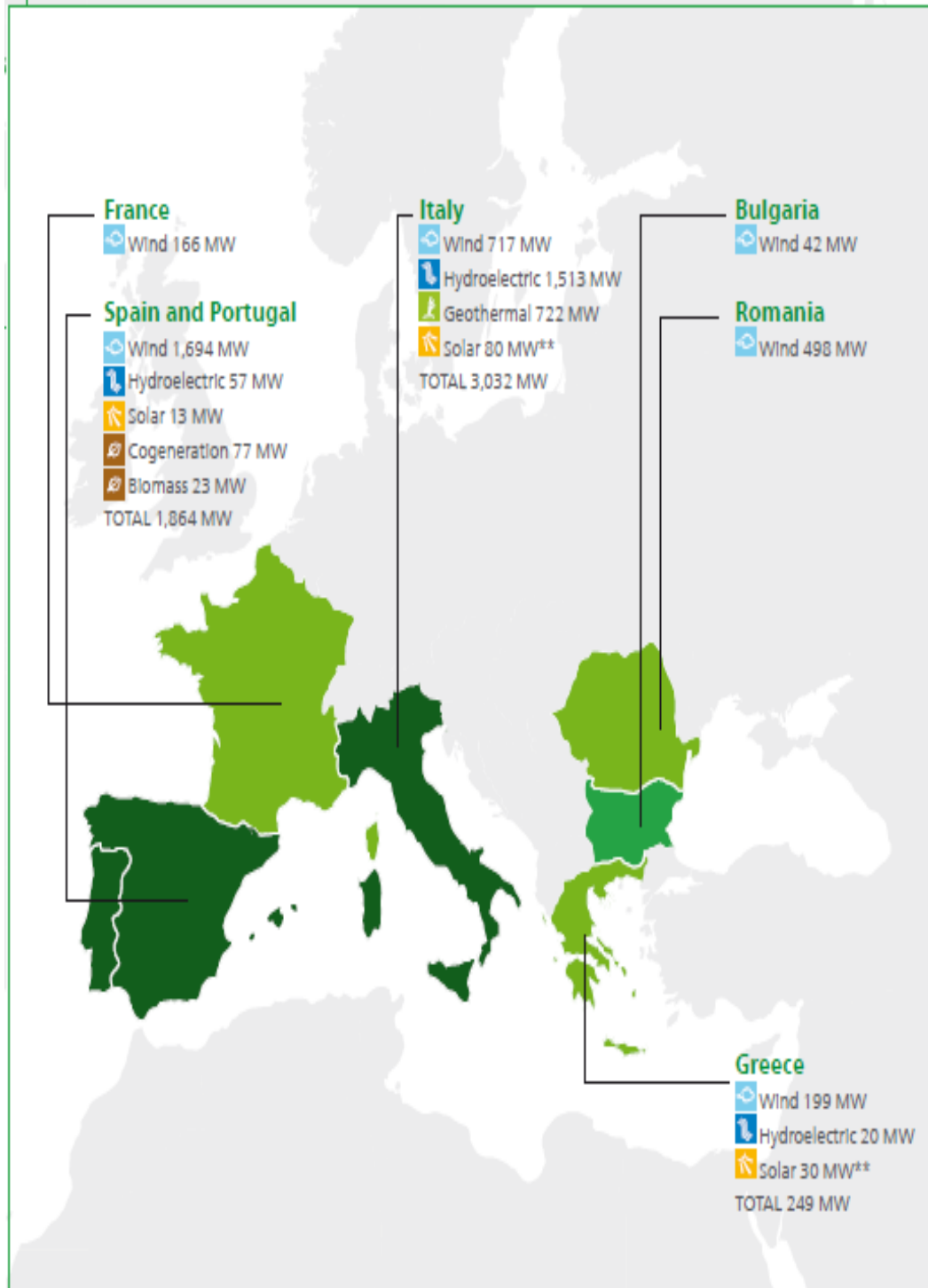
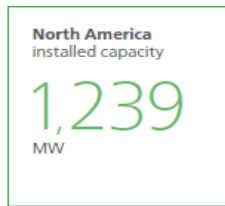


Figure 6.2.

6.2.2. North America



Enel Green Power operates in the United States and Canada through Enel Green Power North America, based near Boston in Andover, MA. The company develops and operates wind, geothermal, hydroelectric, solar, and biomass plants. Its first acquisition in North America was in 2000. Enel Green Power North America currently produces more than 3.8 TWh of electricity per year. With 91 plants and an installed capacity of 1,239 MW it is present in 21 U.S. states and 3 Canadian Provinces. It has a unique portfolio of plants diversified over the five main renewable technologies. Enel Green Power aims to grow by selecting the most significant projects in technological and financial terms, in States with high consumption and ample resources, particularly geothermal, wind and solar power. Thanks to its focus on technological innovation, Enel Green Power North America has completed the only hybrid plant in the world capable of combining the continuous generation capacity of binary cycle, medium enthalpy geothermal systems with the peak capacity of solar power, at the Stillwater solar geothermal hybrid power plant near Fallon, Nevada. The 26 MW photovoltaic capacity is connected and integrated with the existing 33 MW Stillwater geothermal plant located on the same site. The solar energy plant produces 40 million kWh of clean energy per year, avoiding approximately 28,000 tonnes per year of atmospheric carbon dioxide emissions.

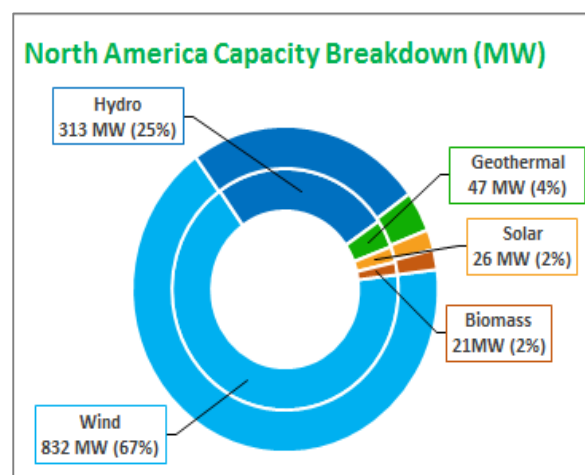
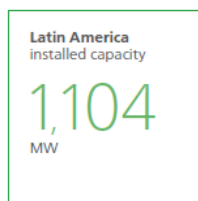


Figure 6.3.

The combination of the two technologies for power generation from renewable sources at the same site has increased the production of zero emission energy,

which, in this case, will exceed 200 million kilowatt hours per year, with 140,000 tons of carbon dioxide avoided each year. The hybrid plant also using the same infrastructure, such as the interconnecting power lines and thereby further reducing the environmental impact. Smoky Hills, in Kansas, is home to Enel Green Power's largest wind park in the world, with output of 250 MW. It is capable of generating sufficient energy to meet the consumption needs of 85,000 US families at the same time as avoiding emissions into the atmosphere of about 750,000 ton/year of CO₂.

6.2.3. Latin America



EGP operates in Central and South America through Enel Latin America, based in Santiago, Chile. It develops and operates 37 plants in Mexico, Costa Rica, Guatemala, Panama, Chile and Brazil. The company has achieved an important role in the region thanks to its diversified technologies with 900 MW of renewable capacity and minority holdings totalling a further 204 MW. Hydro energy is currently the main source EGP focuses its investments on with 33 plants in six countries for a total of 732 MW. In particular, EGP Latin America operates a 300 MW hydroelectric plant in Panama – the second biggest civil works project after the Canal – that generates 25% of the country's energy.

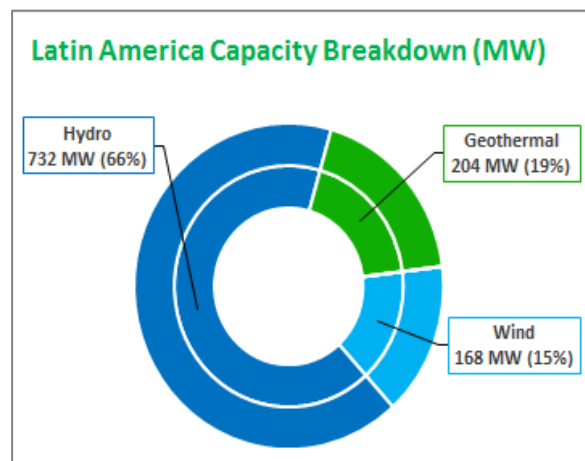


Figure 6.4.

The flowing water hydroelectric plant has been completed at Palo Viejo, Guatemala, with a capacity of 87 MW and it became operational in 2012. EGP also has wind turbines with an installed capacity of 24 MW in Movasa in Costa Rica. With a century of experience in the Italian geothermal energy industry, EGP is

exploring and developing new opportunities in this area. In particular, it has been awarded three licenses for geothermal exploration in Chile, confirming its position as market leader in the development of geothermal energy in the country. Geothermal del Norte (GDN), a subsidiary of EGP, will start construction of the first geothermal plant in South America at Cerro Pabellón in the Antofagasta region. Major projects are also underway in the wind sector in Brazil (Cristal 90 MW, 193 MW Leilao 2011), Chile (Talinay 90 MW, Valle de los Vientos 90 MW, Taltal 99 MW) and hydroelectric power in Costa Rica (Chucas 50 MW).

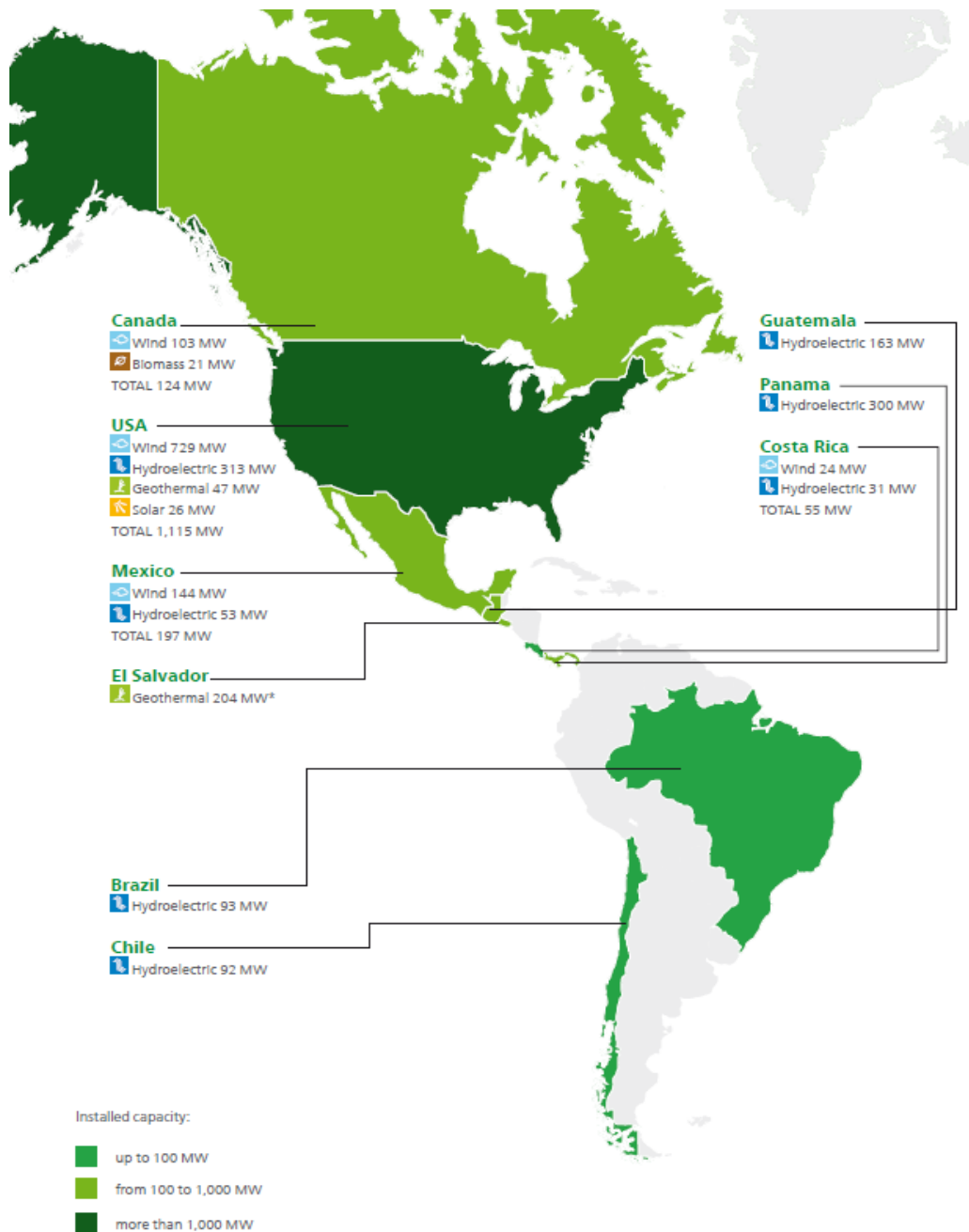


Figure 6.5.

6.3. STRATEGIC DEVELOPMENT

Enel Green Power has presented its BP on April 2013, showing its future strategic guidelines. Firstly, it has declared its best achievements in the past years:

- Global leadership in renewables
- Consistent delivery since IPO
- Increased geographical and technological diversification
- Strong set of projects in execution
- Solid capital and debt structure

The above points show that EGP has reached all of its key development targets, since it started operation in 2008. During years, different events have made precious EGP: Enel's acquisition of Spanish Endesa, thanks to that it has developed its operations over Iberia and Latham areas; EGP's IPO in November 2010, raising €2.6 billion and marking the largest initial public offering in Europe since that of Iberdrola Renovables in December 2007.

EGP has shown a very solid track record, especially in terms of installed capacity evolution, which has reached its IPO target one year in advance and is expected to growth up to 12.4 GW by 2017, with about 50% of additional target already in execution.

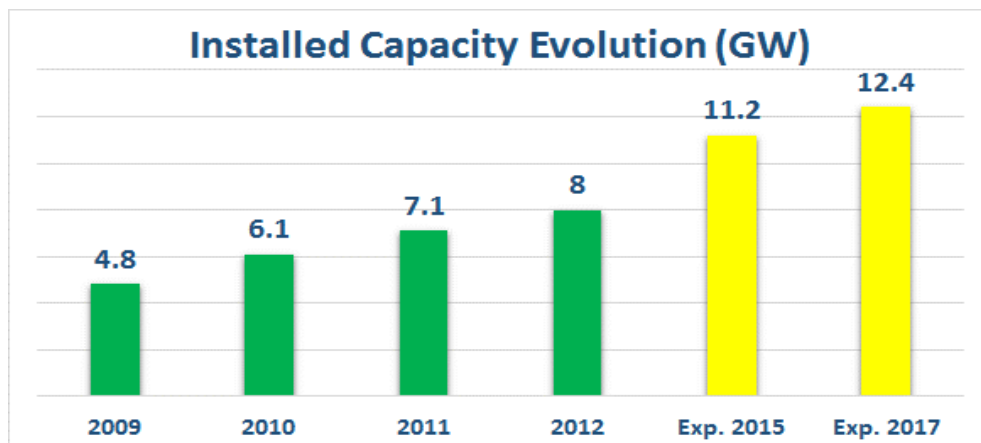


Figure 6.6.

In terms of diversification, EGP will increase its already good mix, thanks to a Capex plan confirmed of about EUR 6 billion, which will be allocated especially to Emerging markets (69%) as geography and to wind (45%) as technology. The below figure shows a comparison between actual mix and expected, in terms of both geography and technology.

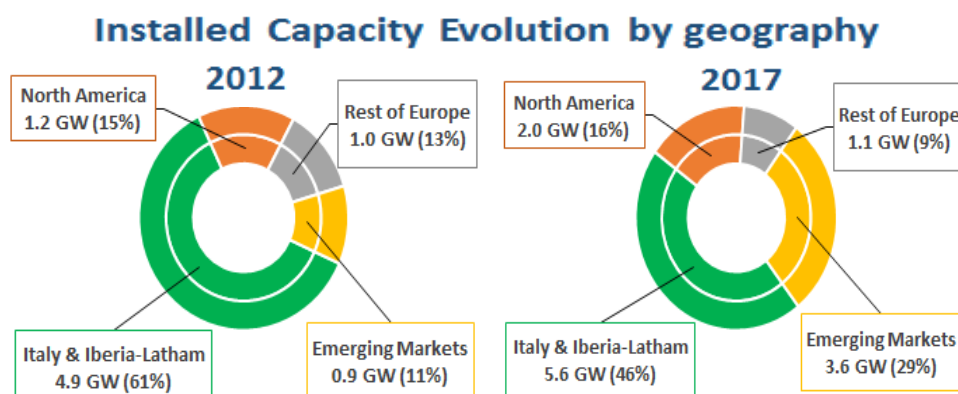


Figure 6.7.

As showed in Figure 6.7., the most important increase will regard Emerging markets, because their capacity is expected to grow for about 400% respect to 2012.

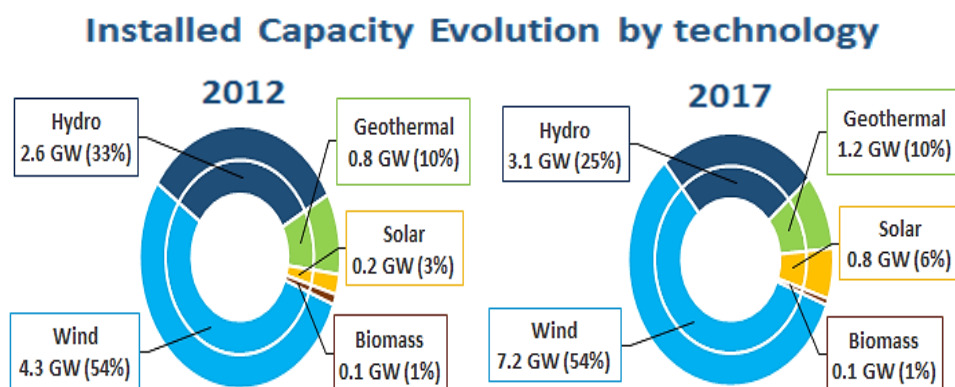


Figure 6.8.

Then, in technology terms, there will be a huge increase, regarding wind and solar, which are expected to grow for about 167% and 400%, respectively.

6.3.1. Financial Consideration

EGP's financial track record has showed important results since 2008.

Table 6.1.¹¹⁸

(EUR million)	2009	2010	2011	2012	Δ	CAGR
Revenues	1,777	2,271	2,527	2,688	911	14.8%
EBITDA	1,207	1,313	1,583	1,678	471	11.6%
Net Income	418	452	408	413	-5	-0.4%
Net Debt	5,345	3,092	4,075	4,614	-731	-4.8%

¹¹⁸ EGP Annual Reports.

Since 2009, Enel Green Power's revenues has increased of about 51% (+ EUR 911 million), with a CAGR of 14.8%, especially thanks to its strong international expansion and ability to innovate through new technologies. In addition, its EBITDA has showed a great increase of about 39% (+ EUR 471 million), with a CAGR of 11.6%, confirming its huge focus on cost efficiency, throughout production and operating optimization, economies of scale and R&D emphasis. Group Net Income has remained quite stable during years, recording a decrease after 2010, due to changes in taxation and dividend payout. Net Debt has been reduced for about 14% (- EUR 731 million) during these last 3 years, even if it has seen an increase in 2012, due to huge amount of new investments.

However, these figures show the solid capital and debt structure that characterizes EGP balance sheet. Its analysts expect EGP to improve this trend during the next 4 years, leveraging on:

- Self-funded growth thanks to a total CAPEX of EUR 6.1bn, entirely covered by Cash Flow From Operations.
- Maximization of asset value, with an average O&M/MW evolution (K€) reduction of 10%.
- 2013-2017 EBITDA-CAGR of about 10%, reaching EUR 2.7bn in 2017.
- Sustainable 11% overall IRR on new investment.

6.3.2. Diversification and Emerging markets

Emerging markets are considered a focus of growth, as stated by the future evolution of EGP's capital allocation.

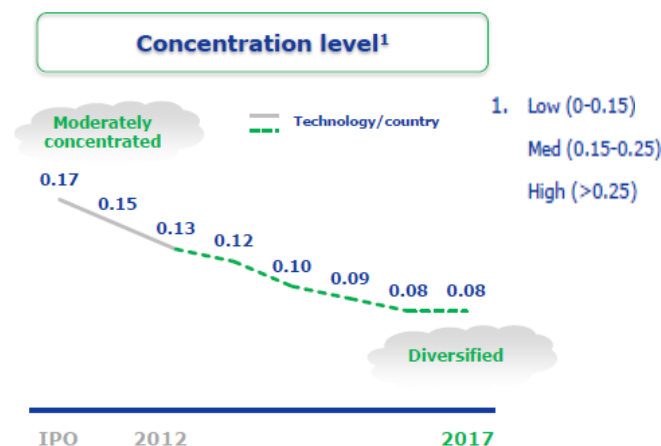


Figure 6.9.

Diversification is another important key element, resulting in a Concentration level of 0.13 from the initial 0.17 in 2009. EGP expects to reach a level of 0.08 by 2017, resulting from a well-managed mix in terms of both technology and geography, supported by Capex and Ebitda plans.

EGP follows a very structured process to select new growth markets, analysing and ranking them in terms of GDP growth, power-demand, energy dependency and easy of doing business. Availability of resources and cost roadmap (total capex, €/W) represent other key selective drivers as well.

In the new BP 2013-17, Enel Green Power has selected five new emerging markets in which it sees bases for operating.

Countries screening¹ (2012)				
Country	10-year GDP growth	10-year power demand growth	Power per capita (MWh)	Ease of doing business
Colombia	4.7%	3.0%	1.3	45
Morocco	4.6%	6.3%	0.9	97
Peru	6.5%	6.5%	1.3	43
South Africa	3.4%	1.3%	4.8	39
Turkey	5.0%	6.3%	3.1	71

Figure 6.10.

In these countries, there are different kinds of projects in pipeline, covering all different technologies of EGP's portfolio, from tender participation to multi-tech Greenfield projects.

Colombia	□ Small-hydro, wind and solar opportunities scouting
Morocco	□ Pre-qualification in 850MW wind tender; developing own PV and wind greenfield projects
Peru	□ Tenders to come in 2013; own multi-tech pipeline; 1 st geothermal exploration licences obtained
South Africa	□ Participation to 2013 PV tender; scouting of wind opportunities
Turkey	□ Multi-tech greenfield pipeline under development

Figure 6.11.

EGP's development is not going to end, because its experts continues to screen new areas for expanding operation, such as Africa and the Middle East¹¹⁹.

¹¹⁹ "Enel Green Power Business Plan 2013-2017", EGP.

6.3.3. Financial Market Position

On 29th October 2010, Enel Green Power successfully completed the €2.6bn (\$3.6bn) IPO. The offering terms were the following:

- The Enel Green Power listing was performed on the Italian and Spanish Stock Exchange.
- The operation regarded a 100% secondary offering, with an institutional offering under Rule 144A private placement in the US. The seller was Enel, the parent company which owned 100% of the equity capital.

As showed in the figure, after a normal debut under expectative, EGP's titles went up for 25% (until a price of 2,00€ per share), thanks to an increase in volume in the second quarter of 2011¹²⁰.



Figure 6.12.

In 2012, there was a huge decline in price until to EUR 1.1 per share, because of sovereign debt crisis in Europe. Fortunately, after the second quarter of 2012, EGP's title has started to recover, with a CAGR of 3% on monthly base.

In August 2013, the share price is in line with previous emission amount of EUR 1,66. Total Market Capitalization of EGP is about EUR 8,345 million, resulting in an Enterprise Value of about EUR 17 billion¹²¹.

¹²⁰ Yahoo Finance Data.

¹²¹ www.infinancials.com

6.3.4. Competitive Analysis

In this section, it is developed a comparison of EGP's value drivers with the main comparable global operator, as of end 2012. Iberdrola Renovables, EDF Energies Nouvelles, EDP Renovaveis and Acciona Energy are chosen as the most competitors of EGP, in terms of size, global presence and business mix.

Key drivers of comparison are the follows:

- Installed capacity and, therefore, the size of the company.
- Load factors, which give power production volumes.
- Profitability drivers, such as EBITDA.

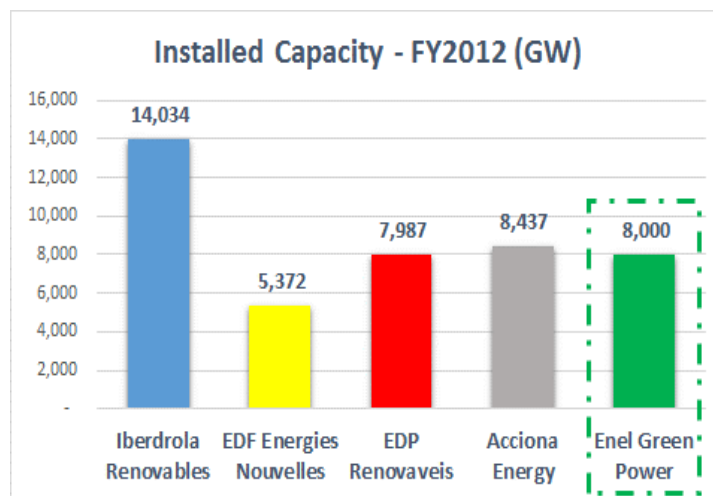


Figure 6.13.

As for installed capacity, it is seen that EGP is currently one of the major renewable power producers, globally.

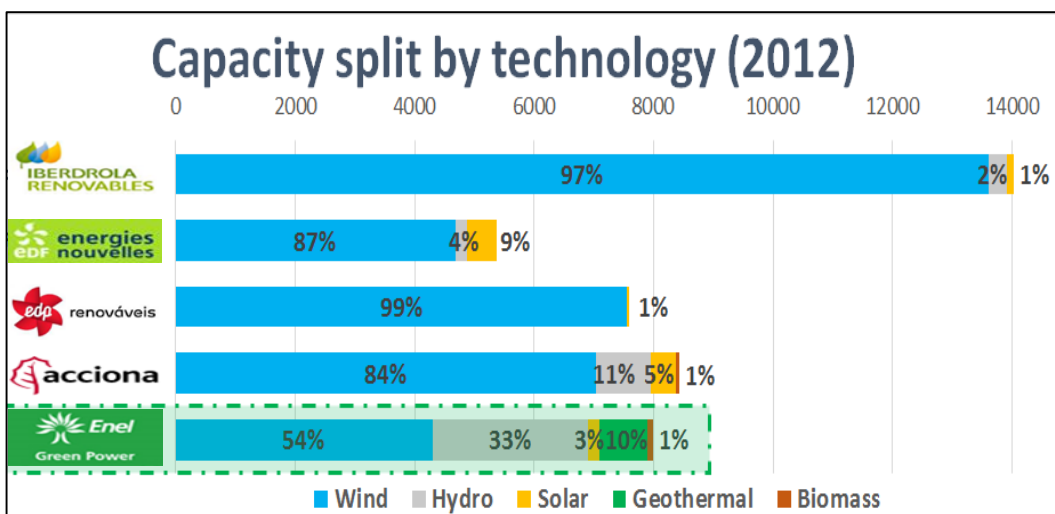


Figure 6.14.

In detail, analysing comparable capacity breakdown by technology, it is highlighted a much diversified production mix, which is the most important source of EGP's competitive advantage¹²².

Huge focus is deserved by Geothermal energy, in which EGP is among the best players, covering about 8% of overall global installed capacity (11 GW), and it is expected to record an excellent further growth, due to its actual unemployment.

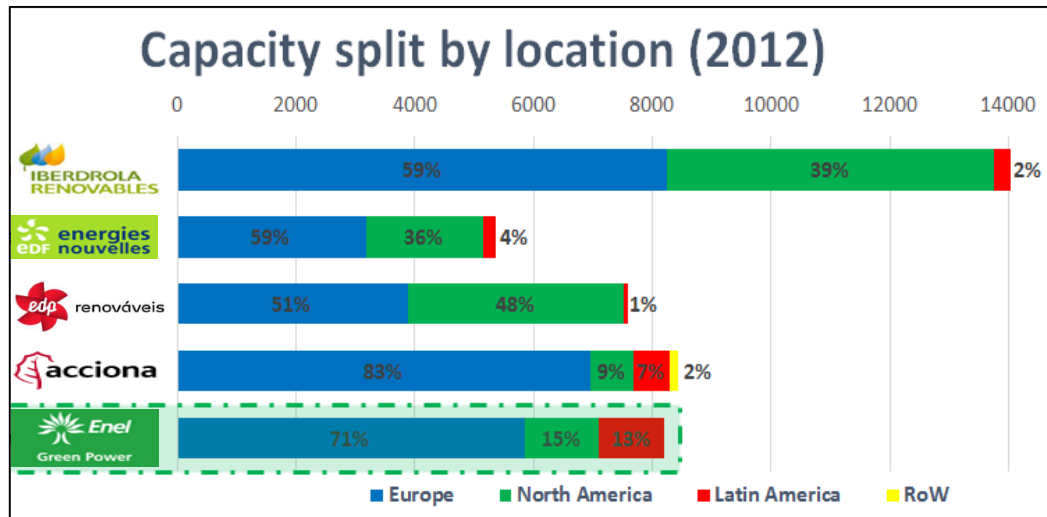


Figure 6.15.

In terms of geography mix, EGP shows again a good result respect to its peer, and the situation is expected to improve a lot, thanks to further plans to enter new emerging markets, especially in less discovered ones, such as Africa.

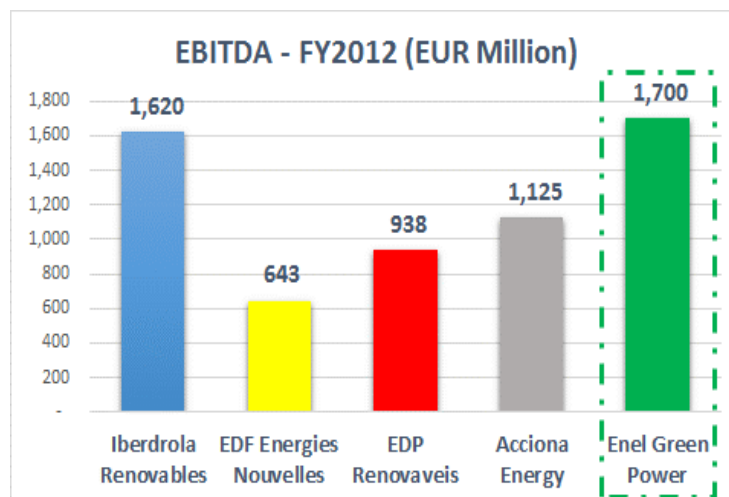


Figure 6.16.

¹²² Data from company website.

Leadership in profitability doesn't represent a surprise, as a consequence of EGP's world class expertise along all value chain, resulting in strong production and operating efficiency, cost reduction and better safety indexes. Solid capital and debt structure helps to reach a self-funded growth (Capex is entirely covered by Cash Flow), thanks to stringent profitability requirements for new investment.

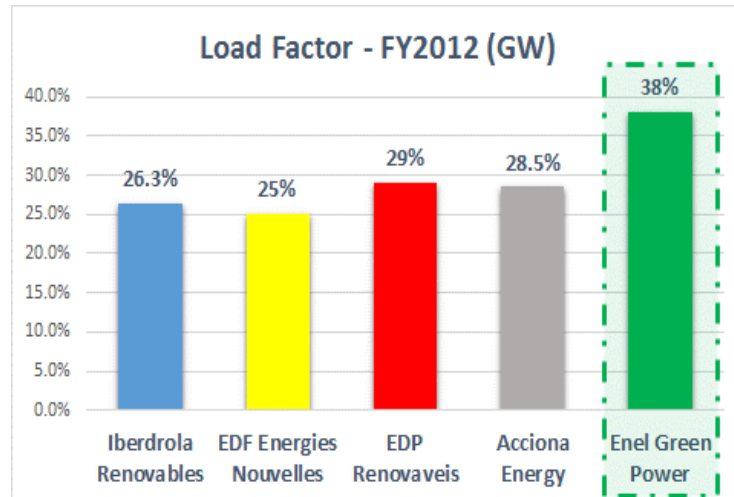


Figure 6.17.

Load factor is the percentage of hours that a power plant operates at its maximum capacity in a given time period. The greater the load factor, the more efficient the plant is in energy density, which is the energy stored in a region of space per unit volume. It is also defined as the ratio between net annual energy production and the theoretical productivity, and it allows comparing different technologies:

- Geothermal and biomass plants are placed in the base load category, typically with annual load factors exceeding 75%.
- Hydroelectric plants and offshore wind power are intermediate loaded power plants that have annual load factors ranging from 40% to 60%.
- The peak-load generation category operates at low annual load factors ranging from 5% to 15%, and this includes on land wind (20-30%), photovoltaic solar (12-20%), and concentrated solar (25-40%)¹²³.

EGP's load factor is completely higher respect to its competitors, as a consequence of a better generation mix, thanks to leadership in geothermal installation, while

¹²³ "Other Renewables Sources", Duke University – WordPress.

other companies are especially focused on wind. It is another key source of competitive advantage, allowing a higher profitability of carried investment.

6.3.5. EGP's SWOT Analysis

*Table 6.2.*¹²⁴

Strengths	Weakness
<ul style="list-style-type: none"> ■ Low exposure to incentive schemes. ■ Diversified geographical presence, therefore mitigated country risk. ■ Well balanced technology mix, therefore high capacity utilization. ■ Low debt-to-EBITDA ratio and high cash flow generation, resulting in self-funded growth. ■ Good track record on project development in renewables. 	<ul style="list-style-type: none"> ■ Authorisation process potentially affected by delays. ■ Financial volatility related to operating drivers (water flow and wind availability). ■ Financial volatility to oil/fossil fuel price scenario. ■ Grid development has to comply with power generation needs (avoid bottlenecks of project development).
Opportunities	Threats
<ul style="list-style-type: none"> ■ Distinctive and unique competencies in geothermal power generation, presumably to increase new opportunities globally. ■ Strong growth in the renewable power needs globally strong pipeline of new projects. ■ Government policies supporting capacity growth and prices for new capacity. ■ Innovation in renewable technologies. 	<ul style="list-style-type: none"> ■ Foreign currency volatility. ■ Government policy changes on the renewable sector, in terms of CO2 reduction programmes. ■ Government needs for debt reduction, cuts to incentive/tariff, changes to regulatory schemes. ■ Capacity growth from Chinese local operators, therefore risk of plant investment costs increase.

¹²⁴ Equity Company Note – Banca IMI.

CHAPTER 7

“HOW EGP COULD ENTER THE CHINESE RENEWABLE MARKET?”

7.1. LOOKING FORWARD CHINA

As demonstrated by previous chapters, Enel Green Power has emerged as one of the best renewable player around the world. On the other hand, following the analysis of the global renewable market, China represents the best host for further clean energy revolution, in both environmental and economic terms. Commonly, it is considered as a very hard target market for entry, due to its stringent regulation and lack of transparency, especially in a government-focused field like energy industry. Recently, Francesco Starace, CEO of EGP, has said: “Our focus will be on new areas of development, where incentives play a small role. Favouring, instead, new emerging and growing markets. For this reason, such areas like China and India have been excluded. The first is a market, very manned by local players, in which it is difficult to enter; the second, due to lack of infrastructures. At most, there could be an evolution, but for sure, not in the short-term”.

The aim of this chapter is to wear EGP’s clothes, and try to look forward a Chinese market entrance, analysing what would be the inside opportunities and barriers of a such quite-risky and fragmented strategy.

7.2. CHINA’S APPEAL

As stated in Chapter 6, EGP use a very structured process to select new growth markets, paying attention on different key drivers, such as GDP growth, energy demand, outstanding resource level and easy of doing business.

Table 7.1.

Country	GDP Growth Rate (%)	Power demand growth (%)	Demand per capita (MWh)	Easy of doing business
<i>China</i>	9.2	7.2	3.2	91
<i>Morocco</i>	4.6	6.3	0.9	97
<i>Turkey</i>	5.0	6.3	3.1	71
<i>Brazil</i>	3.5	5.0	2.2	130

As stated in Table 7.1. , China has leadership in terms of growth for both GDP and Power demand, respect to countries, in which EGP plans to operate (Morocco, Turkey) or already plays (Brazil). Another important element is the Easy of doing business (IMF ranking from 1 to 185), in which China results in a better position respect two target countries, especially regard to Brazil, the unique BRIC country in which EGP has already entered¹²⁵.

Table 7.2.

Potential renewable energy sources in China.

Renewable energy sources	Unit	Potential
Wind	TW h/yr	7644–24,700
Photo Voltaic	TW h/yr	1296–6480
Tidal energy	TW h/yr	>620
Wave	TW h/yr	>1500
Hydro power	TW h/yr	2474–6083
Total electricity	TW h/yr	13,434–39,383
Solar thermal	PJ/yr	6000–30,000
Geothermal	PJ/yr	1000
Total heat	PJ/yr	7000–31,000
Straw	PJ/yr	5561–6440
Wood	PJ/yr	4332–5210
Waste (combustible)	PJ/yr	1170–3454
Biogas	PJ/yr	1258–2517
Energy crops	PJ/yr	3660–10,500
Total biomass fuel	PJ/yr	15,981–28,121

Looking at the resource potential, China takes a primary position, even if it is already became the biggest country in terms of installed capacity. As showed into the Table 7.2., potential electricity can reach very impressive amount in a range between 90-95% of outstanding level, considering that until now renewable generation is about 1,006 TWh, especially thanks to new actual unemployed technologies and resource. Even if wind and solar are now quite established sector, their utilization is still accounted for just 1,15%, respect to their minimum potential¹²⁶. Wind (L) and Solar (R) energy distribution are showed in Figure 7.1.

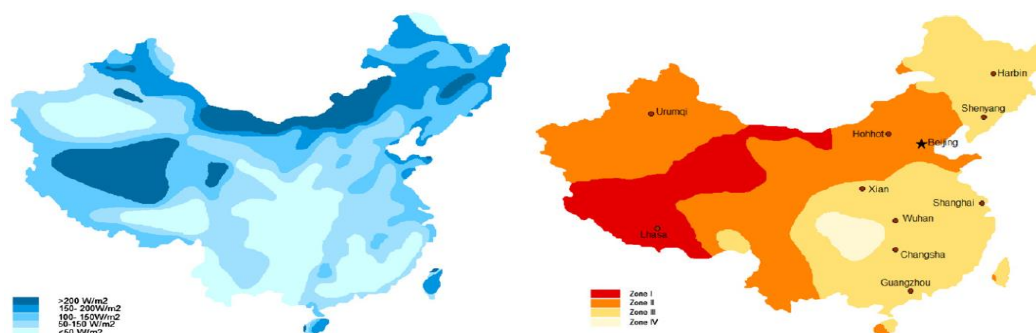


Figure 7.1.

¹²⁵ World Bank Database – Country Focus.

¹²⁶ "Potential of renewable energy systems in China", Applied Energy – Elsevier Journal.

7.3. FDI CATALOGUE

The 12th FYP will attempt to move the Chinese economy from its current focus on the manufacturing sector towards services; it will also seek to raise domestic wages, increase internal consumption and drive innovation. The plan promises new targets for the use of renewable energy and promotion of energy efficiency and looks at targeted investment in key sectors of the economy, including environmental protection. It is shaped by China's ambition to become a global leader in the green sector, while also addressing concerns about energy and food security, as well as its vulnerability to climate change.

The Catalogue for the Guidance of Foreign Investment Industries restricts FDI in certain clean-tech sectors. FDI in biofuels, for instance, is difficult to achieve, as it requires provincial or even central-government approval. By contrast, FDI in wind power, solar energy, pollution control, waste disposal, recycling and environmental-protection equipment requires the approval of only local or provincial authorities. As stated by the NDRC, the new 2011 Catalogue is intended to reflect the following changes:

- *Continued openness.* Continuous trend towards opening up of the economy, consistent with China's WTO commitments and the need to make use of advanced foreign technology.
- *Modernization and technical advance in the manufacturing sector.*
- *Promotion of strategic new industries.* A central goal of the 12th Five Year Plan is to move China beyond reliance on traditional manufacturing and onto strategic new industries that will mark the manufacturing world of the next several decades. The following seven such strategic industries have been identified:
 - 1) Alternative fuel cars: hybrid cars and electric cars as well as better fuel-cell batteries;
 - 2) Biotechnology: biomedicines, new vaccines, and advanced medical equipment;
 - 3) Environmental and energy-saving technologies: energy efficiency, pollution control, clean coal, waste recycling and seawater usage;

- 4) Alternative energy: next-generation nuclear power plants, solar power, wind power, smart grids and bioenergy;
- 5) Advanced materials: rare earths, special-usage glass, high-performance steel, fibres and composites, engineering plastic.
- 6) New-generation information technology: cloud computing technology, high-end software and virtual technology.
- 7) High-end equipment manufacturing: Aircraft, high-speed rail, satellites and offshore oil/gas equipment.

The intention of the Chinese government towards foreign investment is clear. Foreign investment is intended to support China's manufacturing sector by providing access to modern advanced technology. There is no longer a focus on job creation and there is little interest in foreign investment in any sector of the economy outside those areas, which will help China modernize. Potential foreign investors should take this into account. Investing against the trend in China seldom succeeds¹²⁷.

7.4. CORPORATE FORM OF FOREIGN INVESTED ENTERPRISE (FIE)

An FIE established in the People's Republic of China (PRC) will, in most cases, be regarded as a PRC legal person. There are five main types of FIE which may be established: *Wholly foreign-owned enterprises* (WFOE); *Sino-foreign joint ventures*, either equity joint ventures (EJV) or cooperative joint ventures (CJV); *Foreign-invested companies limited by shares* (FICLS); *Foreign-invested partnerships*. The vast majority of foreign investors establish either a WFOE (a wholly-owned subsidiary) or an EJV.

WFOE

A WFOE is a limited liability company which is wholly-owned by foreign investor(s). A WFOE may generally be set up by foreign investors where the type of business which will be carried out by the WFOE is not subject to any shareholding restrictions set out in the Catalogue or other PRC regulations. A

¹²⁷ "China's New Foreign Investment Catalogue" (2011), China Law Blog.

foreign investor is advised to check the Catalogue and other relevant regulations to determine whether the form of a WFOE is permitted for the relevant industry. WFOEs were originally conceived to encourage manufacturing activities that were either export orientated or introduced advanced technology to China.

However, with China's entry into the WTO, these conditions were gradually eroded and WFOEs are increasingly being used for a much wider range of activities including consulting and management services, as well as software development and trading.

Equity and Cooperative Joint Ventures

EJVs and CJVs are most commonly used in industries that are not currently open for foreign investment in the form of a WFOE or where a foreign investor depends on the local knowledge and resources of a Chinese partner.

Although EJVs and CJVs are both forms of joint venture vehicle, there are significant differences between them, particularly with respect to profit sharing arrangements.

An EJV must take the form of a limited liability company. The profits and losses of an EJV must be allocated according to the ratio of capital contributions made by the joint venture partners. An EJV is the most common form of FIE, especially in the manufacturing sector.

A CJV offers more flexibility to the parties involved because they can decide how the profits and losses will be allocated among themselves and this need not be in proportion to their respective capital contributions. It is also open for the parties to agree that one party should recover its investment through an accelerated repayment structure, whereas the other party will acquire specified assets of the CJV at the end of the joint venture's term. Therefore, the partners of a CJV are able to allocate the investment risk between them by agreement to a much greater extent than is possible using an EJV. A CJV (also sometimes referred to as a contractual joint venture) may take the form either of a limited liability company or of a non-legal person (which broadly equates to a partnership). In practice, the majority of CJVs do take the form of a limited liability company.

FICLS

Foreign investors may also establish a company limited by shares (or joint stock company) which has capital divided into shares. An FICLS must have a minimum of two (and less than two hundred) initial shareholders (or promoters), including at least one foreign investor, and a minimum registered capital of RMB30 million. Foreign investors rarely set up a new business in China using the form of an FICLS because of the more stringent capital and regulatory approval requirements applicable to setting up an FICLS. An FICLS more commonly arises where a foreign investor converts an EJV into an FICLS after successful expansion of its existing business. An FICLS is also the only form of FIE whose shares can be listed on one of the two stock exchanges in China.

Foreign-invested partnership

From 1 March 2010, foreign investors have been permitted to establish partnership enterprises in the PRC. Foreign investment made through a partnership will not require MOFCOM approval, but NDRC approval and any industry-specific approvals may still be required. Foreign investment made via a partnership structure will be subject to any limitations under the Catalogue, meaning the partnership can only engage in areas of business, for which no foreign shareholding restrictions are imposed under the Catalogue. Although the Administration of Industry and Commerce (AIC) (rather than MOFCOM) will be responsible for reviewing compliance with applicable foreign investment controls and all application documents submitted by the applicant. AIC shall report to local MOFCOM at the time of registering a new foreign invested partnership. There are no published requirements on the minimum amount of registered capital, the debt to equity ratio, or the time limit for making capital contributions to a foreign-invested partnership¹²⁸.

7.5. MARKET BARRIERS

The last round of reform, basically, lays down a legal framework allowing the foreign and private sectors to invest more freely in China's electricity industry, but

¹²⁸ "Establishing a foreign invested enterprise in China", Norton Rose.

some barriers are to be blamed. This makes for a challenging market environment where additional resources are required to ensure successful market entry. Barriers are not only originating from electricity sector regulation, but also from wider institutional arrangements. These increase the likely risk of successful entry and may also prolong the market entry process. In Figure 7.2., are showed the results of a EU Commission survey, aiming to analyse Chinese market barriers perception in energy sector¹²⁹.

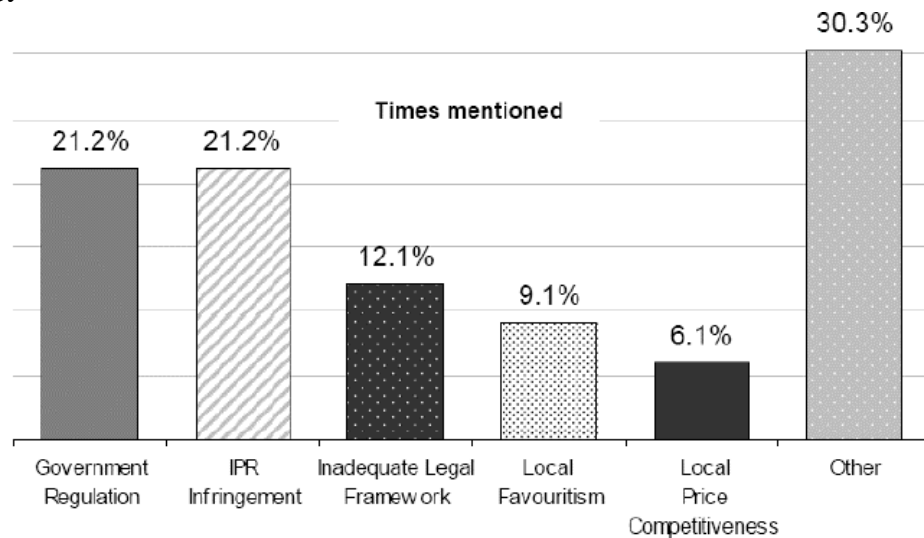


Figure 7.2.

Inadequate Legal Framework, Regulation and Price competitiveness

The fragmentation of the regulatory system is not only burdensome, but also more often than not, uncoordinated, resulting in very high levels of compliance costs for investors. To make things worse, the regulatory system is not rule-based, which gives too much discretion to the regulators. This creates many uncertainties for investors as they have to face unpredictable policy changes. In China, most investment permits in the electricity sector are issued by local governments who also serve as conduits for the submission of application of projects, which are subjected to central government approval, creating opportunities for rent-seeking. Lack of local connection and the intimacy of local governments with local SOEs in China may explain to some extent the decline in foreign investment in the electricity sector. Pricing regulation is another important factor impeding the entry of foreign and private investment. The 2002 reform set the goal to build a competitive

¹²⁹ "Prepared to ride the Green Dragon?", WWF.

electricity market which would determine the electricity price. The government, basically, uses the cost mark-up to set the price, to allow investors to recover their investment. However, due to a lack of reliable cost information and supervision, the price is more the result of negotiation and needs to be renewed every year, creating uncertainty.

Local favouritism

Despite its position among the biggest economies in the world, Chinese market continues to have a dark halo, due to some lacks of transparency in government action. China adopts a tendering system to award the project to the bidder who offered the lowest electricity price in the renewable energy sector. State-owned sector undercuts their private rivals by a very low bid price. One reason for the state-owned sector doing this, is because of the quota system for renewable energy. China's national, middle, and long term renewable development plans imposes 8% of renewable electricity quotas for power generation companies with an installed capacity of more than 5 million KW. If that requirement is not met, no new thermal plant could be allowed. The rapid expansion is mainly supported by debt increase or government "hidden" helps. In the past seven years, the debt ratio has increased by 20 percentage points. By the end of 2009, the asset-debt ratio of the Big Five reached 85.94%, above the upper limit set by SASAC and highest amongst all SASAC administrated big groups.

IPR infringement

The risk of IPR infringement is still agenda, even with approved Chinese patents, and this has kept many companies from entering the market as they are concerned of exposing their technology. One specific problem is the so-called 'first to file' principle, which means companies need to register trademarks before entering the Chinese market. One foreign embassy in China reportedly advises companies looking to enter China that they should register their trademarks two years before entering. Another embassy reports that 90% of the intellectual property rights (IPR) cases it deals with are trademark related. Issues also relate to production technologies protected by patents. Although some economic commentators believe

IPR issues are often exaggerated, it is widely agreed that they do add to the cost of doing business in China, particularly in the case of smaller enterprises. IPR problems can present more of a challenge to SMEs than larger enterprises, because typically they do not have in-house lawyers, making it necessary for them to outsource legal services¹³⁰.

7.6. TECHNOLOGICAL COLLABORATION

The selection of the strategic emerging industries and choices regarding national development policy set out in the FYPs must be understood not only as drivers of China's state-directed, capitalist economy but also as part of a domestic self-strengthening narrative. It has been a near constant during China's economic rise that foreign technology should be attracted, studied, and then deployed domestically for China's own economic advantage. This drive is manifested in China's quest to develop domestic "national champions," who are to be world leaders in their chosen industries. As stated in the SEI Decision:

"To hold an advantageous position in future international competition, we must accelerate the fostering and development of strategic emerging industries, control the key and core technologies and related intellectual property rights, and enhance our capability for independent development."

Echoing this sentiment last December, Liu Qi, Deputy Director of the National Energy Administration, stated that "in the initial stages of China's international renewable energy cooperation, China's main concern is access to foreign capital support and the introduction of international advanced technologies."

This remark points to the tremendous opportunity for foreign investors in the renewable energy sector to market their technology and services within China. To the extent that foreign capital support and technology can further China's own domestic development goals, foreign investors can expect to find willing partners among local businesses. As a result, regulatory approvals and preferential financing or tax treatment may be more readily available to spur investments within China.

¹³⁰ "Market Entry Barriers for FDI and Private Investors: Lesson from China's Electricity Market", NDRC.

At the same time, China's drive to create "national champions" and its continued insistence on "indigenous innovation" counsels caution for prospective market entrants. While potential SOE partners may bring advantageous relationships that promote joint business interests, these potential partners' other interests may not fully align with those of their international partners. Companies in many industries, including renewable energy, have reported misappropriation of intellectual property (IP) by SOEs and their affiliates. Indeed, intellectual property rights to innovative technologies remain a central concern in the Foreign-China bilateral trade relationship, while an unsettled regulatory environment and lack of government transparency continue to confront foreign companies operating in China. During the last thirty years of its economic development, China has perfected a highly efficient model, under which foreign capital and technology is fed and subsumed into the national economic engine. Development of the strategic emerging industries is likely to continue this trend; although, savvy foreign partners may also reap significant benefits along the way¹³¹.

Complexity of CDM and CERs

CDM was developed to encourage investment and transfer of technology that would help to reduce greenhouse gas emissions in developing countries worldwide. The prospect of additional income from the sale of CER quotas makes projects more attractive and doable from a financial point of view.

CDM projects in China are regulated by the Measures for the Operation and Management of CDM Projects in China, issued by the National Development and Reform Commission (NDCR) and other two ministries, which entered into force in October 2005. Some key points:

- *Three priority areas* have been set for CDM in China, in line with the more general national strategy for sustainable development: energy efficiency improvement, development and utilization of new and renewable energy, methane recovery and utilisation (article 4).
- *Differentiated project fees are established.* Projects in the priority areas are subjected to a 2% tax on their CER revenue. The tax raises to 65% for

¹³¹ "China Policy: Renewable Energy and China's Five Years Plan", CREIA – ACORE.

Hydrofluorocarbon (HFC) and Perfluorocarbon (PCF) projects and to 30% for Nitrous Oxide (N₂O) projects (Article 24).

- *Eligibility requirements for project ownership* are set, by introducing a 51% Chinese ownership rule. Article 11 provides that only “Chinese funded or enterprises with at least 51% of the equity share owned by Chinese entities within the territory of China are eligible to conduct CDM projects with foreign partners.” For this reason, a foreign company cannot directly benefit from the CER revenue since it cannot act as Project Owner, while it can participate as PDD Consultant and/or Credit Buyer and/or Technology Provider.

This is shown for instance by the local content requirement rules imposed by China, which have certainly constrained in a major way the strategies of foreign firms involved in CDM projects, obliged them to make a joint venture with a Chinese partner in order to receive CERs advantage¹³².

7.7. IS JOINT VENTURE THE RIGHT WAY?

Joint ventures (JVs), strategic alliances and minority stake deals have become increasingly attractive with companies pouring more money into such transactions. For many sectors, joint ventures (JVs) are the only practical way into new markets:

- JVs can help corporates mitigate risk and are a good way to optimize capital, particularly pertinent in the currently unstable economic environment.
- A successful JV will depend on a number of factors, including transparent governance, choosing the right partner, a shared purpose and adaptability to changing market conditions.

For companies looking to enter a new industry or geographic market, sharing knowledge and risk via a joint venture can be the way forward. This type of partnership is often considered by companies looking to expand their geographical footprint.

What made this the best option? “A joint venture is easier when both parties are bringing something relatively equal to the table,” explains John Trainer, Vice

¹³² “Global Corporation, CDM and Technology Transfer to China”, Bank of Italy – Sapienza University.

President, Business Development at MedImmune, which entered into a JV with China's Wuxi AppTec, in order to enter the Chinese pharmaceutical market. "WuXi had local market knowhow and facilities on the ground. AstraZeneca-MedImmune has products and global, as well as local, know-how. It was a good balance, and the quality of investment from both sides makes a difference for a successful long-term partnership."¹³³

In 2011, global deal values for JVs and strategic alliances rose by 75% to only USD 13.5 billion, while the value of minority stake transactions rose by 19% to USD 212.4 billion. JVs and minority stakes then fell back somewhat in 2012, compared with 2011, but this is in keeping with wider trends in the M&A market.

At a time when preserving and optimizing capital are of utmost importance, prematurely expanding into a new product or geographic market without advice can prove a costly mistake. JVs can be a great route to entry, allowing companies to gain insight into a given marketplace, while garnering a better understanding of the strategic fit and true value of a market from a partner.

Small stake deals are most commonplace in the energy, mining and utilities sector. Spreading risk throughout the supply chain and securing access to upstream assets is a key motivation for energy and resource corporates, national oil companies and industrial groups to undertake minority stake transactions. The sector, which saw 160 such deals worth USD 89 billion in 2011, has registered a three times increase in the last years.

Spreading the geographic footprint

With many companies looking outside national confines for growth, it is of little surprise that more than two out of five deals are cross-border transactions. Indeed, learning the ropes from local partners and successfully navigating unfamiliar regulatory frameworks is key to building a long-term future in a new market.

In countries such as India and China, which are burgeoning with opportunity, but carefully monitoring foreign investment, getting a small foothold in the market may be the best and only option available to investors. In 2011, China has registered an

¹³³ "Capital Insights: Q2 2013", Ernst & Young.

amount of USD 17 billion for cross-border minority interest transaction, recording a 365% increase yoy.

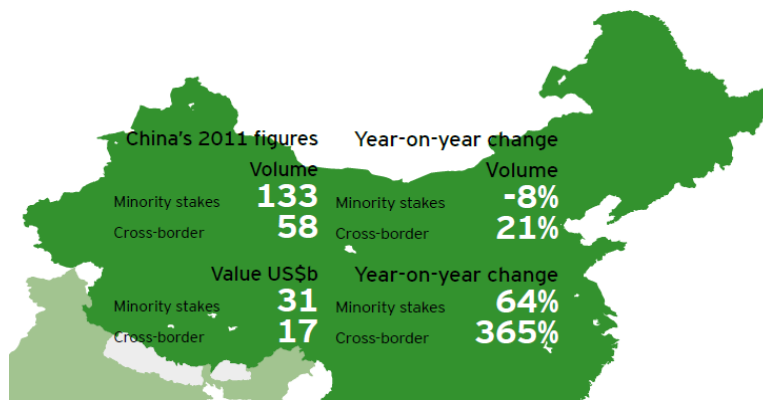


Figure 7.3.

A win-win solution

In order for a JV or strategic alliance to achieve synergies and optimize capital, partner firms should bring unique and complementary assets and competencies to the venture. In recent years, corporate deal-makers have become more comfortable and bold in undertaking larger JVs and strategic partnerships. The proportion of transactions valued at USD 250 million or more comprised half of such deals in 2011 and 60% in 2012 - over twice the average of 25% from the period 2005 to 2010¹³⁴.

Table 7.3.

Values for joint venture and strategic alliances from 2005 to 2012 (Q1/Q2)								
Value	2005	2006	2007	2008	2009	2010	2011	2012
<US\$15m	28%	29%	16%	31%	12%	0%	6%	20%
US\$15m-US\$100m	40%	48%	42%	33%	60%	30%	28%	20%
US\$101m-US\$250m	14%	9%	16%	14%	4%	20%	17%	0%
US\$251m-US\$500m	9%	7%	10%	12%	4%	0%	22%	0%
>US\$500m	8%	6%	16%	10%	20%	50%	28%	60%

EGP's experience with JVs and minority stakes

Enel Green Power has a good track record in terms of strategic alliances. The most important example is 3SUN S.r.l., a joint venture between EGP, Sharp and STMicroelectronics, which, founded in 2011, is actually the biggest Italian triple-junction thin-film photovoltaic panels facility.

¹³⁴ "Capital Insight: Q2 2012", Ernst & Young.

Enel Green Power and Sharp have signed an additional agreement aimed at the creation of an equal joint venture to develop solar farms, called ESSE. The goal is to install cumulative capacity at a level of 500 MW by the end of 2016, making use of the photovoltaic panels manufactured at the Catania factory. Up to date, the JV have develop different solar plant, in Italy and Greece, accounting for about 60 MW of installed capacity.

Other important JVs and minority stakes regard the wind sector:

- In Portugal and Spain, the company has significant minority stakes, such as Empreendimentos Eólicos do Vale do Minho and ENEOP - Eólicas de Portugal. The first one corresponds to a set of wind farms, that are already being operated (292 MW), in which Finerge (a wholly-owned subsidiaries of EGP) holds a 33% stake. The second one is the result of the union of 5 companies in the wind sector, including Finerge and TP, which jointly participate in the largest public tender launched by the Portuguese State. The winning bidder, ENEOP - Eólicas de Portugal, was awarded a license for 1,200 MW, in which Enel Green Power has a stake of 40%. Of this power, 652 MW were already in operation by May of 2011.
- In Greece, EGP has minority stakes (30%) in more than 30 wind projects, across the Maroussi area.
- In USA, EGP has 49% stake in different wind farms, across the Minnesota area, in collaboration with GE Capital, for more than 500 MW. Other collaborations result in the hydro sector, with two different jointly project across New York area, together with Hydro Development Group Ltd.
- In Latin America, important collaboration are registered in El Salvador, where EGP Latin America presently holds a 36.2% interest in a joint venture company, LaGeo, with the government of El Salvador. The company is currently a pure geothermal venture and operates two geothermal plants, the first in Ahuachapán with an installed capacity of 95 MW and a second one in Berlin with 109 MW. In Costa Rica, where it has 49% in MOVASA wind farm, and two hydro plants for a 35% stake respectively. In Panama, through 50% stake in Enel Fortuna SA, operating 300 MW of hydro. In Chile, EGP

has a 51% stake in Geotermica Del Norte SA, a EUR 53 billion company, in collaboration with Empresa Nacional De Geotermia SA¹³⁵.

7.8. HOW TO EXPLOIT EGP'S COMPETITIVE ADVANTAGE

Starting from all previous considerations, now, the focus will shift on what could be the hypothetical sources of strategic and technological competitive advantage for EGP, in an attempt to enter the Chinese renewable market, and in expectancy of what will be the further developments and evolutions of this continuously-under-consolidation market.

Geothermal leadership

China's geothermal energy resources amount to 860 trillion metric tons of coal equivalent, an amount 260,000 times greater than China's annual energy consumption, according to newly issued statistics from the Ministry of Land and Resources. The figure is based on a new evaluation of geothermal energy resources buried 3,000 to 10,000 meters below 287 cities, 12 sedimentary basins and 2,562 hot springs. The ministry said the country's shallow-lying geothermal energy resources add up to 9.5 billion tons of coal equivalent, with annually available resources amounting to 350 million tons of coal equivalent. Geothermal energy resources are abundant in China, although the country's ability to develop and utilize them is still in its infancy¹³⁶.

As stated in the previous chapter, EGP hold a global leader position in geothermal generation, a source of tangible competitive advantage respect to all its actual competitors around the world, that makes its generation mix an example for everyone and increase its already best-in-class load factor. Its focus of innovation represents a driver for all further goals, basing on a targeted and continuous technological development. EGP should exploit these well-known skills for attack the Chinese renewable market, conscious to count on first-mover advantage as well, inside an highly growth and unexploited industry.

¹³⁵ Enel Green Power – Company Website.

¹³⁶ www.chinadaily.com

Network, expertise and supply-chain holes

EGP, in collaboration with Sharp, has developed a great joint venture, engaged in both production, execution and owning of solar parks around the world. Sharp Solar Energy, one of the most important global solar companies, is present in China, since many years, with a well-positioned market share. Exploiting Sharp's expertise, know-how and network in the Chinese solar market, could be a good starting point for entering a very growth industry, which is characterized by a strong competition and investment appetite, being considered as government's "poster child" of renewable revolution.

In the wind sector, a good action could count a differentiated approach in both provincial and new unexploited rural areas. Foreign players entering the wind power will likely best be able to participate in projects organized on a provincial level, the BCG suggest in a recent study with analysis of market share among national SOEs, international players, provincial SOEs, national policy-motivated independent power producers (IPPs) and national financially motivated IPPs in provincial, national, and offshore project forecast. So far, international players have been barred from participation in projects on a national level, and the forecast for 2015 assumes this policy stance. Though the proportion of national level projects to provincial level projects is set to increase significantly to 2015, the total number of provincial level opportunities for foreign players is likely to increase based on what is known to be China's increase of renewable energy efforts overall¹³⁷.

Complementary Chinese collaboration for new target markets

As stated in the last EGP's business plan, the company has just entered the African renewable market, specifically in Morocco and South Africa, and it is already screening new areas of development in other 11 countries. The continent is endowed with ample solar, wind, hydropower and bio-energy resources. Africa thus presents a potentially vital niche in the global market for cleantech energy. China is already capitalising on this massive investment opportunity.

Companies, such as Sinohydro and Dongfang Electric, are key players in their construction, and they are financed by Chinese banks with support from the

¹³⁷ "Foreign Investment in China's Green Sector", China Briefing – BCG.

government in Beijing. The country's engineering and manufacturing giants have recently completed or are participating in at least USD 9.3 billion of hydropower projects in Zambia, Gabon, the Democratic Republic of Congo, and elsewhere on the continent, according to data compiled by Bloomberg and International Rivers, a Berkeley (Calif.) environmental group. A similar, if smaller, push is happening in newer renewable technologies. Chinese enterprises are now the top investors in African solar power, and China's government in June earmarked USD100 million for solar projects in 40 African countries. Chinese photovoltaic panels already power street lights in Sudan and sit atop schools and hospitals elsewhere¹³⁸.

Observing this situation, an hypothetical enter in the Chinese market, developing JVs and collaborations, could create a passable bridge to new African emerging markets, pushing on certified know-how, big network and impressive penetration of Chinese companies in the new frontier of renewable energies.

¹³⁸ www.businessweek.com – Bloomberg BusinessWeek Magazine.

CONCLUSION

The previous analysis has given us an overall view of what is the renewable energy, what are its investment trends, how has evolved its competitive and transaction landscape, focusing on Chinese distinctive elements, in terms of both players and regulation. All these things have been observed by Enel Green Power's perspective. As resulted, Chinese is a quite fragmented market, in which open market frictions are still at an immature stage, even if government is working forward a well-targeted direction, emphasizing an efficient competition. Foreign players do not act freely, because, differently from adopted regulation, a "hidden" favouritism continues to influence project approvals, tenders and contractions.

On the other hand, as showed by the last two Five-Years Plan, renewable energy revolution has likely changed card on table, pushed by technological and expertise needs. During last years, Chinese green sector has growth mostly in quantity terms, without paying great attention on quality and transparency, figuring out a huge and undisciplined market as a result of shortly-oriented strategy. Otherwise, actually, something is shifting, as a consequence of an approaching-maturity sector. Government has recognized the most likely weaknesses of an industry, historically, focused more on numbers than on needed standards. They understood that a just aggressively penetration in developed markets, through huge capital injection, is not enough, because its domestic base is dispersive and badly managed, so that a reverse flow is needed. Last developed policies demonstrate this trend, creating more entrance for international players, always characterized by a quality-focused behaviour. However, market remains still under a continuous and uncertain process of consolidation, which, despite all, can create important chances for foreign companies, especially for these pulled by a long-term strategy. Supply chain holes and tech-shortages open attractive fields of actions, even if a sapient caution should remain in company agendas. The "Green Dragon" knows impossibility to reach its amazing targets alone, turning its focus on a long-run and opening to international collaborations.

History has always taught that who acts well during changing and uncertain times, has more chances to obtain a leadership in following steps, most likely taking all returns from run risks. Global renewable top-companies, like EGP, should always

pay attention to these “greedy” competitive opportunities. Waiting too much could likely result in a wrong decision. China is going to change its policy and regulation, but not its own and traditional culture, which represents one of the most distinctive aspects. Experience shows that businesses need several years to build relations with business partners and government agencies before business will really take off and become profitable. Network (or *Guanxi* in Chinese) power and penetration are much more than most assume.

“When sustainability is viewed as being a matter of survival for your business, I believe you can create massive change.” – Cameron Sinclair

Enel Green Power has all needed skills for acting before the bell’s ring, and through its global well-known competitive advantages, it should pay great attention to the new “El Dorado” of sustainability revolution.

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