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Turkey's Renewable Energy Sector from a Global Perspective

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Welcome

Over the past few years, policymakers in Turkey have realised the role that renewable energy can play in expanding power generation and diversifying the energy supply mix in an environmentally sustainable way.

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As Turkey's reliance on imported natural gas for power generation has given rise to concerns over supply security and the country's bulging current account deficit, support of domestic energy sources such as coal and renewables has gained a new urgency. In this regard, Turkey's new Renewable Energy Support Mechanism is an important step forward.

This publication is about Turkey's new Renewable Energy Support Mechanism and the state of play in its renewable energy sector. However, we also look at the policy environment and commercial developments around the world, as we believe that the renewable energy sector in Turkey cannot be evaluated in isolation. Setting up the right policy and regulatory framework for renewable energy has been a great experiment for policymakers all around the world, and there is still much to learn from local and international experience.

More steps need to be taken in a coordinated manner to improve the investment environment for renewable energy in Turkey. Firstly, regulatory uncertainties and bureaucratic inefficiencies in licensing and granting permits shall be eliminated. Secondly, an investment plan shall be made for the expansion of the power transmission network in a way that will enable the optimal mix of renewable energy power plants to be connected to the grid. More generally, policies that support the energy sector as a whole would also be beneficial for investors in renewable energy. As such, further liberalization of the energy markets would be key to attracting more investment to the energy sector.

We hope that the stakeholders in Turkey will find our report helpful in understanding the dynamics in the renewable energy sector – in Turkey and abroad.

Introduction

The starting point for this publication is to report the changes introduced by Turkey's new Renewable Energy Support Mechanism, which have gone into effect on 01 December 2011. However, the renewable energy sector in Turkey cannot be evaluated in isolation from developments in other countries. In Turkey and abroad, the renewable energy sector and government policies have interacted and changed at drastic speed over the last few years. Supporting renewable energy has been a great experiment for policymakers all around the world, and they still have much to learn from local and international experiences.

Several themes emerge from our report. The first is the interaction between government policy and the development of the renewable energy sector. Concerns with climate change and security of supply have spurred fiscal and regulatory support for renewable energy. Generous feed-in tariffs were introduced in European countries such as Germany, Italy and Spain, and the renewable energy sector emerged as one of the main recipients of stimulus spending in the US and in China. However, policymakers could not foresee the significant reductions in technology costs, which led to great expansion in project development and created an unexpected burden on already over-stretched European budgets. Policy reversals in the US, Germany, Italy and Spain have already started to reduce investment in project development in these countries.

Our second theme is the expansion of the Chinese manufacturing base for wind turbines and solar photovoltaic cells in particular. According to the Renewables 2011 Global Status Report prepared by the Renewable Energy Policy Network for the 21st Century, ten of the top fifteen solar cell manufacturers were based in China in 2010, and Chinese and Taiwanese companies produced 59% of all solar cells in 2010. Chinese wind turbine manufacturers are also growing rapidly, with Sinovel having acquired the second largest market share behind Denmark's Vestas in 2010, and closing the technology gap with their European and American counterparts. Political support has played a large role in the success of the Chinese industry, and protectionist measures are now being introduced in places like the US, Italy and Turkey.

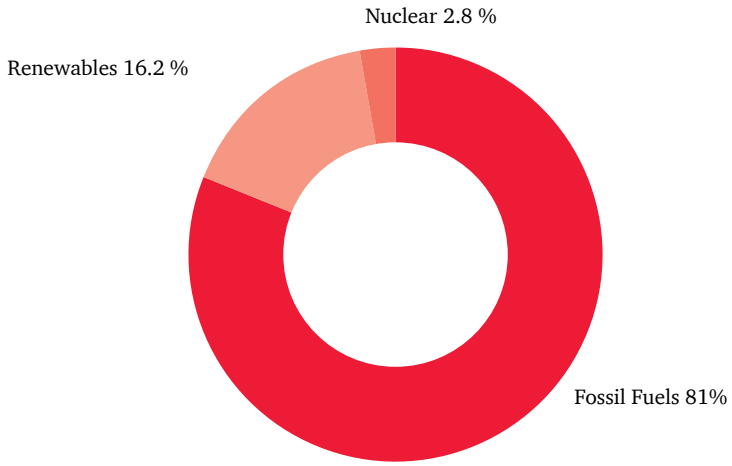
Finally, limitations of the power transmission networks constitute a significant problem for many countries including China and Germany. Public resources required for the promotion of renewable energy are not limited to fiscal incentives and feed-in tariffs, but significant investment in transmission networks may be necessary. These costs may be reduced, however, by smart grid controls and intelligent load management systems as well as planning the geographic distribution of renewable energy project sites and increasing the diversity of the renewables portfolio. A separate power control centre for renewable energy has been established in Spain to monitor and control renewable power generation. Taking account of the constraints in the transmission network, Turkey has announced the wind and solar capacity that can be connected to the grid and devised a special policy to discern between numerous license applications.

Section 1: Global trends in renewable energy

Market trends in renewable technology and power generation

Despite the global financial crisis, the renewable energy sector has achieved important advances in technology and power generation project development over the past few years. Strong government support played a big role in shielding the sector from the crisis and propelling its growth. In 2010, 195 GW of new power generation capacity was established globally and approximately half of this capacity is based on renewables. Renewables constitute nearly 25% of the global installed capacity, whereas in power generation the share of renewables is around 20%.

Chart 1: Renewable Energy Share of Global Final Energy Consumption, 2009



Source: Renewables 2011 Global Status Report

In 2010 wind power capacity installations tripled the capacity installed in 2005 throughout the globe. However, much of this growth occurred between 2005 and 2009 while market growth in 2010 was minimal. Political uncertainty and low prices for natural gas in the United States and Europe led to slower growth but developments in China helped the sector.

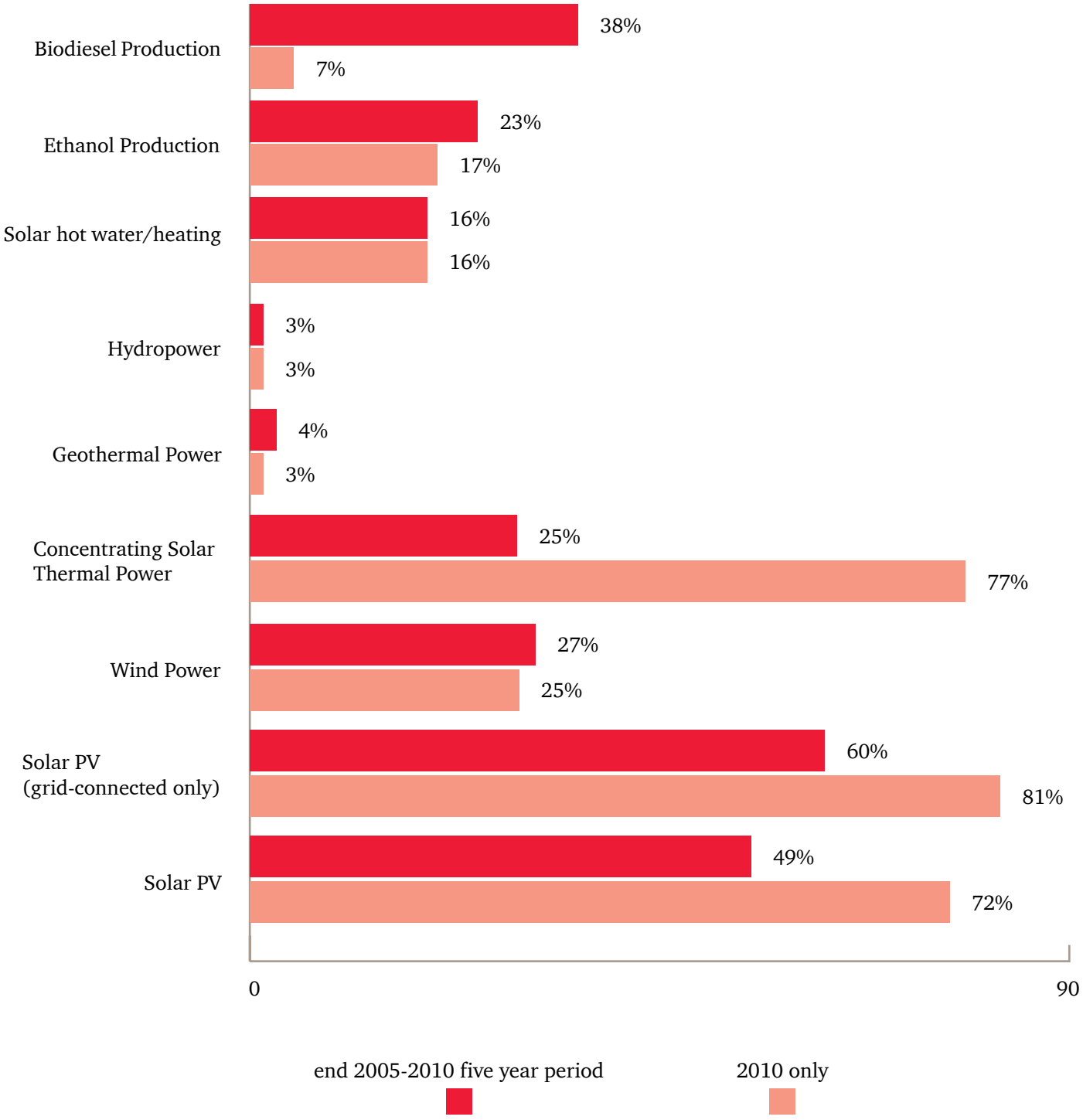
The global installed capacity of hydropower reached 1,010 GW in 2010. 150 countries in the world utilise hydropower for electricity production. Renovation of existing plants and new construction are attracting investment. The hydropower equipment industry is the most developed among the renewables equipment industries, especially in developed markets such as the United States and the European Union.

The solar photovoltaics industry experienced astonishing growth on the back of supportive feed-in tariff policies in Europe and the declining cost of solar technology. 17 GW solar photovoltaic capacity was added in 2010 worldwide, increasing the installed solar PV capacity by 70%. In the wake of feed-in tariff cuts in Germany, Spain and Italy, investment in solar power has already started to decline in Europe. The manufacturing industry continues to shift to Asia, where market growth has been supported by cost reductions, new applications, increasing interest and policy support.

Biomass continues to increase its share in electricity production. As of the end of 2010, 62 GW of installed biomass power is in operation around the world. Especially in Europe, the United States and China, power production from biomass experienced rapid growth in 2010. New global trends include conversion of many existing coal and gas-fired power plants to “co-firing” biomass with fossil fuels. Most of the biomass equipment industry is based in Europe. In the biomass industry, energy generation is taking precedence over waste treatment and management.

As of 2010, geothermal power plants were operating in 24 countries throughout the globe. Power capacity installation slightly decreased in 2010. In the upcoming years technological improvements may lead to significant development. New drilling technologies are expected to trigger capacity installations in new countries.

Chart 2: Average Annual Growth Rates of Renewable Energy Capacity and Biofuels Production, 2005-2010



Source: Renewables 2011 Global Status Report

The impact of gas prices

Low natural gas prices were sustained over 2010 and 2011 due to advances in technology that enabled the extraction of significant new reserves. The prices are likely to stay low as new supplies come online from shale gas drilling in North America and Europe. The competitiveness of renewable energy has deteriorated due to the low cost of natural gas. Project developers and equipment manufacturers in the wind power industry faced challenges in particular. Consequently, natural gas-fired generation emerged as the leading candidate to close the gap that may arise from popular opposition to nuclear energy in the wake of the Fukushima tragedy.

Despite the low level of natural gas prices, the security and environmental risks associated with over-reliance on fossil fuels remain, especially given the price and supply volatility that may arise from the "Arab Spring."

Policies like the Renewable Portfolio Standard, which are imposed on power utilities by many countries including the US, Canada, India and Australia, will ensure that the effects of low gas prices on renewable generation investment is limited. Natural gas may also emerge as a reliable complementary resource for solar and wind power in hybrid power plants. Moreover, improvements in renewable technology will improve cost competitiveness for renewable energy.

According to the Clean Energy Trends 2011 Report by market research company Clean Edge, distributed solar PV systems will be cost competitive for residential retail customers and commercial customers in most of the US states by 2020. Onshore wind power plants are already cost-competitive with fossil fuel-fired power plants in many markets including the US.

Table 1: Status of Renewable Energy Power Generation Technologies – Characteristics and Costs

Technology	Typical Characteristics		Typical Energy Costs (US cents/ kilowatt-hour)
Large Hydro	Plant size	10 MW-18,000 MW	3-5
Small Hydro	Plant size	1-10 MW	5-12
On-Shore Wind	Turbine size	1.5-3.5 MW; Rotor diameter: 60-100 meters	5-9
Off-Shore Wind	Turbine size	1.5-5 MW; Rotor diameter: 70-125 meters	10-20
Biomass Power	Plant size	1-20 MW	5-12
Geothermal Power	Plant size	1-100 MW	4-7
	Types	binary, single-and double-flash, natural steam	
Solar PV (module)	Efficiency	crystalline 12-19%; thin film 4-13%	-
Solar PV (concentrating)	Efficiency	25%	-
Rooftop Solar PV	Peak capacity	2-5 kWpeak	17-34
Utility-Scale Solar PV	Peak capacity	200 kW to 100 MW	15-30
Concentrating Solar Thermal Power	Plant size	50-500 MW (trough), 10-20 MW (tower)	14-18 (trough)

Source: Renewables 2011 Global Status Report

The effects of Fukushima

After the 9.0-magnitude earthquake in Japan, a crisis emerged at the Fukushima Daiichi nuclear power plant. The crisis created a question mark for the nuclear energy sector in several countries, especially in Europe. However, the nuclear energy market is still attractive for developing countries.

The most significant response to Fukushima has been in Germany and Italy. In 2010, the German government declared that the life span of the country's 17 nuclear power plants, which originally had to be closed by 2021 at the latest, was going to be extended for 12 years on average. However, the Fukushima crisis introduced a change in plans. First the German government temporarily closed the nuclear reactors built before 1980. The German public demanded more than this temporary solution, and the German coalition government declared to end nuclear energy by 2022. While 23% of German electricity comes from nuclear power, the country is expected to import electricity from France and Czech Republic to fill the gap. Meanwhile, energy companies will shift to fossil fuels such as coal and gas in the short term and renewables in the medium to long term.

Another unexpected development in Europe was the nuclear site explosion in France in mid-September. While causing one death, there was no radioactive leak according to the authorities. One of the world's most nuclear-dependent countries, France is not expected to change its energy policy in response to these events. Belgium, on the other hand, has announced the termination of 3 nuclear plants by 2015. Provided that alternative energy resources are sufficient to meet the electricity demand, the remaining 2 nuclear plants will be closed by 2025. Although the Fukushima crisis caused public fear in Italy, the energy market was intolerant to gear down its in nuclear power due to Italy's willingness to diversify away from North African coal. However, the Italian public did vote down Prime Minister Berlusconi's plans to start a big nuclear construction programme in a referendum. Italy is also likely to rely on electricity imports.

China, on the other hand, is unlikely to alter its current nuclear strategy. As China generates two-thirds of its electricity from coal-based power plants, nuclear power constitutes one of the main pillars of its carbon reduction strategy. Hence, the country is expected to continue its nuclear energy investments. Although concerns emerged due to Fukushima, the government is not expected to forgo nuclear power.

Regardless of Europe's strong reactions to Fukushima, the Turkish government is still determined to build nuclear power capacity in Akkuyu and in Sinop. Since Turkey and Japan have a strategic partnership for the construction of a nuclear power plant in Sinop, the Fukushima crisis slowed down the process and the negations were stopped for a while. However, the Japanese side declared their will to continue negotiations. The process for the Akkuyu plant, which is to be constructed by a Turkish-Russian partnership, is ongoing.

Without doubt the Fukushima crisis has resulted in more attention being paid to safety, however the strategic importance of nuclear energy is unchanged in China, the Gulf Cooperation Council (GCC) countries, India, Russia, Brazil, Turkey, South Korea, and South Africa. Following the halts due to concerns and safety reviews, these countries will probably proceed with their long-term nuclear plans.

Section 2: Government policy and renewable energy

Regulatory incentives and local content subsidies in a world of tighter public finances

United States

Various support mechanisms, obligations and incentives to promote renewable energy are in place at the state and federal levels in the US. At the federal level, the primary support mechanism for renewable energy has been investment and production tax credit programmes. Clean tech companies were able to sell these credits on tax equity markets to private players such as JP Morgan, Wells Fargo, GE, MetLife and Google. Because the demand for these tax credits disappeared in the wake of the financial crisis, a cash grant programme and a loan grant programme for renewable energy projects were introduced as an alternative to tax credits as part of the 2009 stimulus package.

The loan grant programmes expired on 30 September 2011, whereas the cash grant programme was not extended beyond 2011. The bankruptcy of a large-scale recipient of the loan grant programme, solar technology supplier Solyndra, has created doubts over the effectiveness of President Obama's clean energy strategy.

The return to the prior tax credit scheme means that renewable energy companies will face a narrower scope of financing opportunities. Hence, riskier projects such as solar thermal, wave and tidal power and offshore wind will be less likely to receive financing. However, the negative effect of this development on overall growth of the renewables industry will be constrained by the presence of state-level "Renewable Portfolio Standards" (RPS) and feed-in tariffs.

Some 30 state governments in the US oblige utility companies to have a minimum share of either their installed capacity, electricity generated or electricity sold based on renewable resources. Similar to carbon emissions trading, such policies may be complemented with the trading of certificates. The RPS requirements are upgraded regularly as companies meet their obligations.

China

China's new 12th Five-Year Plan includes highly ambitious targets for installed power capacity based on all kinds of renewable energy resources, reflecting the government's energy goals of diversifying the supply mix and reducing carbon emissions. Targets for new installations of 10 GW of solar power and 70 GW of wind power by 2015 are quoted in various sources. The extent of policy tools, which will be used to meet these targets, is gradually becoming clearer.

Until now, the Chinese state's priority in renewable energy has been wind power. Supportive government policies in China enabled tremendous growth in the wind power sector as well as the wind turbine manufacturing base since 2005. The installed capacity of Chinese wind power plants reached almost 45 GW in 2010. Chinese policies to support the wind power sector include advantageous loans provided to demonstration wind projects with locally produced components as well as the Renewable Portfolio Standards imposed on power transmission and generation companies.

However, there were important stumbling blocks along the way. When reverse auctions to determine feed-in tariffs for 50 MW-plus wind power plants led to tariffs that were too low to cover investment costs, the Chinese state introduced regional feed-in tariffs in 2009. The difficulties faced by transmission companies to connect new wind power capacity to the grid present an important problem that remains to be solved. Large government-sponsored projects that involve transmission companies in project planning from an early stage are able to avoid difficulties in connecting to the system.

Faced by a legal challenge in the WTO by the US Trade Representative (USTR), China agreed to abolish its subsidy program for wind turbine equipment in June 2011. The lifting of protective measures for the domestic industry signals that Chinese manufacturers have matured and are looking to expand their exports to developed markets, particularly the US. However, China now faces a new challenge against its policy support for solar panel exports, as the US International Trade Commission has recently ruled that imports of Chinese solar panels are harmful to the domestic industry. The case is likely to lead to import duties on Chinese solar panels, and China would likely respond by launching a WTO case against the US federal incentives for renewable energy.

In August 2011, China introduced a new feed-in tariff for solar power at $0.15/kWh. The tariff may increase depending on the location and timing of the project. The policy aims not only to support new non-fossil fuel generation capacity, but also to spur local demand for Chinese solar technology providers. The installed capacity based on solar power was merely 860 MW in mid-2011. However, the growth of solar power generation is likely to be monitored very carefully due to limitations of the transmission grid.

Finally, China currently controls the global supply of rare earths, which are critical in the production of PV films as well as the permanent magnets and batteries used in wind turbines and electric vehicles. While only 36% of the world's deposits are located in China, the country produces 97% of the global supply. China's decision to limit rare earth exports by 72% in early 2010 (and a further 11% in the first half of 2011) led to price increases of 300-700% for some rare earth elements in

2010, forcing countries like Japan, the US, Canada, South Africa and Kazakhstan to explore other options. These include developing new reserves as well as supporting R&D programmes that seek to minimise the rare earth content of batteries and permanent magnets.

Germany

As Germany abandoned its life extension and capacity building plans for nuclear energy, natural gas plants in the short term and renewables in the long term are expected to close the resulting supply gap. The government has committed to increasing the share of renewable energy in power production from the current 17% to 35% by 2020. However, these ambitious targets require significant investment in the transmission grid, and Germany adopted an energy package in July 2011 that includes important measures for infrastructure development. Opposition parties the Greens and Social Democrats are also supporting more funding for renewable energy incentives and development of the transmission network. The Merkel government prioritises offshore wind in its renewable energy growth plan, but connecting offshore wind farms in the North Sea to demand centres in the south will be challenging.

Germany has also adopted a policy to gradually cut solar feed-in tariffs after the budgetary burden of supporting solar energy investments grew tremendously with the decline in the cost of PV technology. The tariffs were already cut by 40 to 50 percent by June 2011, when the government decided to cancel the scheduled cuts for 2011 and March 2012. However, the German environment minister has signalled that the cuts may be brought forward. The government targets new installations of 3.5 GW every year, far less than the 7.4 GW installed in 2010. Currently feed-in tariffs for solar power ranges between EUR0.21/kWh to just under EUR0.29/kWh.

Italy

Italy adopted a new policy to reduce the feed-in tariffs for solar power in May 2011. Large projects (over 1 MW for rooftops) connected to the grid after August 2011 and small projects that come online after May will be subject to the new regime. During a transition period from June 2011 until the end of 2012, incentive costs will be limited to EUR580 million and installed capacity to 2.69 GW. Tariffs will be reduced gradually during this time period in order not to exceed the overall cap on costs. After the transition period, tariffs will be reduced every six months based on a pre-determined schedule, costs of the incentive programme and efficiency gains in technology. According to the REN21 Report, the regime corresponds to tariff cuts of 22-30% in 2011, 23-45% in 2012 and 10-45% in 2013.

The decree also includes a 10% addition to the incentives when 60% of the equipment in a solar installation is produced in the EU. Chinese exporters of low-cost solar panels could suffer from this measure, especially if other EU states follow the Italian example and introduce subsidies for local production. If EU trade barriers grow further, countries like Japan, the US and Canada would also take the EU to the WTO.

As part of a broader set of austerity measures, the Mario Monti government issued a decree in late January that makes new ground-based solar panels in agricultural areas no longer eligible for feed-in tariffs. The policy's impact on new deployments may be limited, however, given the high electricity prices in Italy and the oversupply of solar PV panels.

Spain

Although Spain kept the EUR0.42/kWh feed-in tariff for solar PV, which was adopted in 2007, unchanged, new legislation capped the number of production hours receiving the subsidy. The policy aims for a 30% or EUR3 billion reduction in solar PV subsidies over the next three years. This means that the overall remuneration for existing solar PV projects has been retroactively cut. Spain adopted this policy to reduce the burden of solar PV support on the budget, as well as to prevent investors from repowering existing solar PV plants with cheaper PV modules.

The policy reversal sent shockwaves through the investment community and claims are likely to be heard in European courts in relation to PV installations. Although the government has underlined its continued support for reasonable returns to investors, a lack of attention to the impact of changes of control since initial licensing and the functioning of project financing packages has caused concern among secondary investors.

On 27 January, Spain announced that it would temporarily suspend providing incentives to new renewables projects. It is not clear how long the suspension will last.

Table 2: Renewable Energy Support Policies

	Regulatory Policies						Fiscal Incentives				Public Finances	
	Feed-in tariff (incl. premium payment)	*Electric utility quota obligation /RPS*	*Net Metering*	*Biofuels obligation / mandate*	*Heat obligation / mandate*	*Tradable REC*	*Capital subsidy, grant or rebate*	*Investment or production tax credits*	*Reduction in sales, energy, CO2, VAT or other taxes*	*Energy production payment*	*Public investment loans or grants*	*Competitive public bidding*
United States	o	o	o	x	o	x	x	x	x	x	x	x
China	x	x		x	x		x			x	x	x
Germany	x			x	x		x	x	x		x	
Italy	x	x	x	x	x	x	x	x	x		x	x
Spain [1]	x			x	x		o	x	x		x	
Turkey	x			x								

[1] *The VAT reduction is applicable for the 2010-2012 period.*

o *: some states* x *: whole country*

Source: Renewables 2011 Global Status Report

Renewable Energy Support Policies

Feed-in tariff: A policy that: (a) sets a fixed, guaranteed price over a stated fixed-term period at which small or large generators can sell renewable power into the electricity network, and (b) usually guarantees grid access to renewable electricity generators. Some policies provide a fixed tariff whereas others provide fixed Premium payments that are added to wholesale market- or cost-related tariffs. Other variations exist, and feed-in tariffs for heat are evolving.

Electric utility quota obligation/Renewable Portfolio Standard (RPS): A measure requiring that a minimum percentage of total electricity or heat sold, or generation capacity installed, be provided using renewable energy sources. Obligated utilities are required to ensure that the target is met; if it is not, a fine is usually levied.

Net metering: A power supply arrangement that allows a two-way flow of electricity between the electricity distribution grid and customers that have their own generation system. The customer pays only for the net electricity delivered from the utility (total consumption minus self production). A variation that employs two meters with differing tariffs for purchasing electricity or exporting excess electricity off-site is called “net billing”.

Mandate/obligation: A measure that requires designated parties (consumers, suppliers, generators) to meet a minimum, and often gradually increasing, target for renewable energy such as a percentage of total supply or a stated amount of capacity. Costs are generally borne by consumers. In addition to electricity mandates through renewable portfolio standards/ quotas, mandates can include building codes or obligations that require the installation of renewable heat or power technologies (often in combination with energy efficiency investments); renewable heat purchase mandates; and requirements for blending biofuels into transportation fuel.

Renewable energy certificate (REC): A certificate that is awarded to certify the generation of one unit of renewable energy (typically 1 MWh of electricity but also less commonly of heat). Certificates can be accumulated to meet renewable energy obligations and also provide a tool for trading among consumers and/or producers. They also are a means of enabling purchases of voluntary green energy.

Capital subsidy, grant or rebate: One-time payments by a government or utility to cover a percentage of the capital cost of an investment, such as a solar water heater or a solar PV system.

Investment or production tax credit: Investment tax credit is a taxation measure that allows investments in renewable energy to be fully or partially deducted from the tax obligations or income of a project developer, industry, building owner, etc. Production tax credit is a taxation measure that provides the investor or owner of a qualifying property or facility with an annual tax credit based on the amount of renewable energy (electricity, heat, or biofuel) generated by that facility.

Public competitive bidding: An approach under which public authorities organise tenders for a given quota of renewable supplies or capacity, and remunerate winning bids at prices that are typically above standard market levels.

Source: Renewables 2011 Global Status Report

Turkey's renewable energy support mechanism

Turkey's Renewable Energy Support (YEK) Mechanism is finally in place with the enactment of amendments to Law No. 5346. Accordingly, power plants that have come into operation since 18 May 2005 or will come into operation before 31 December 2015 will be eligible to receive the following feed-in tariffs for the first ten years of their operation. The Cabinet will decide on the incentives that will be given to power plants that come into operation after 31 December 2015.

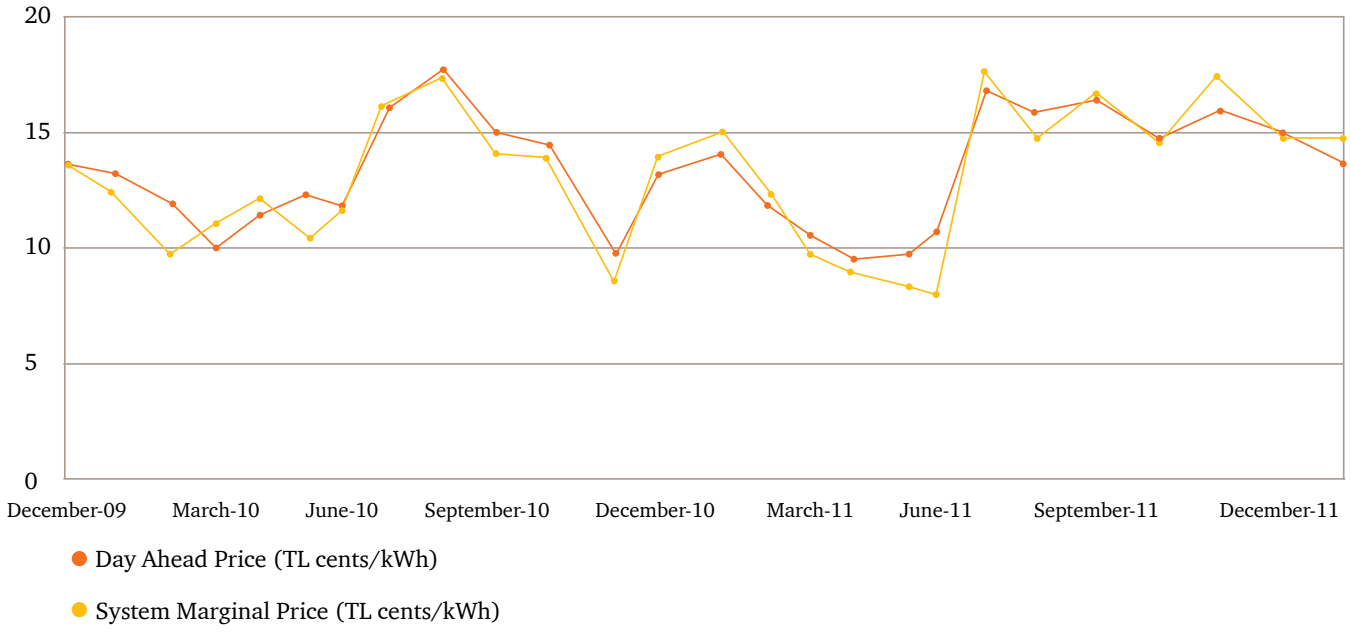
In addition, if the mechanical or electro-mechanical equipment of the power plant is produced locally, a premium shall be added to the feed-in tariffs during the first five years of operation.

Table 3: Feed-in Tariff Mechanism

Type of power plant facility	Feed-in tariff	Maximum local production premium	Maximum possible tariff
Hydroelectric PP	$7.3 cents/kWh	$2.3 cents/kWh	$9.6 cents/kWh
Wind PP	$7.3 cents/kWh	$3.7 cents/kWh	$11 cents/kWh
Geothermal PP	$10.5 cents/kWh	$2.7 cents/kWh	$13.2 cents/kWh
Biomass (including landfill)	$13.3 cents/kWh	$5.6 cents/kWh	$18.9 cents/kWh
Solar PV PP	$13.3 cents/kWh	$6.7 cents/kWh	$20 cents/kWh
Concentrating Solar PP	$13.3 cents/kWh	$9.2 cents/kWh	$22.5 cents/kWh

For hydro and wind investors, the premium for locally manufactured equipment is the element that gives the YEK mechanism an edge over the spot market, as the baseline feed-in tariffs do not exceed the spot market prices greatly. Consequently, the regulatory framework for the determination of this premium is very important.

Chart 3: Development of Prices on Spot Electricity Market



Source: Market Financial Settlement Centre (PMUM)

Local manufacturing is likely to remain limited to the assembly of more sophisticated, imported parts in the medium term. Taking this into account, the law assigns specific premiums to different parts of equipment. This will enable investors to receive premiums for mechanical assembly parts of the equipment, even when it is unrealistic for them to receive the maximum local production premiums.

Table 4: Premiums for local equipment

Type of PP facility	Type of equipment	Premium
HPP	Turbine	$1.3 cents/kWh
	Generator and power electronics	$1.0 cents/kWh
WPP	Blade	$0.8 cents/kWh
	Generator and power electronics	$1.0 cents/kWh
	Turbine tower	$0.6 cents/kWh
	Entire mechanical equipment in rotor and nose cone groups	$1.3 cents/kWh
Solar PV	PV panel integration and solar structure mechanics	$0.8 cents/kWh
	PV modules	$1.3 cents/kWh
	PV module cells	$3.5 cents/kWh
	Inverter	$0.6 cents/kWh
	Focusing materials to collect solar rays onto PV modules	$0.5 cents/kWh
Concentrating solar	Radiation collection tube	$2.4 cents/kWh
	Solar tracking system	$0.6 cents/kWh
	Reflective surface plate	$0.6 cents/kWh
	Mechanical equipment in thermal energy storage system	$1.3 cents/kWh
	Mechanical equipment in steam production system via collection of solar rays on roof	$2.4 cents/kWh
	Stirling engine	$1.3 cents/kWh
	Panel integration and solar structure mechanics	$0.6 cents/kWh
Biomass	Steam boiler with fluid bed	$0.8 cents/kWh
	Liquid-fired and gas-fired steam boiler	$0.4 cents/kWh
	Gasification and gas removal group	$0.6 cents/kWh
	Steam or gas turbines	$2.0 cents/kWh
	Internal combustion engine or stirling engine	$0.9 cents/kWh
	Generator and power electronics	$0.5 cents/kWh
	Cogeneration system	$0.4 cents/kWh
Geothermal	Steam or gas turbines	$1.3 cents/kWh
	Generator and power electronics	$0.7 cents/kWh
	Steam injector or vacuum compressor	$0.7 cents/kWh

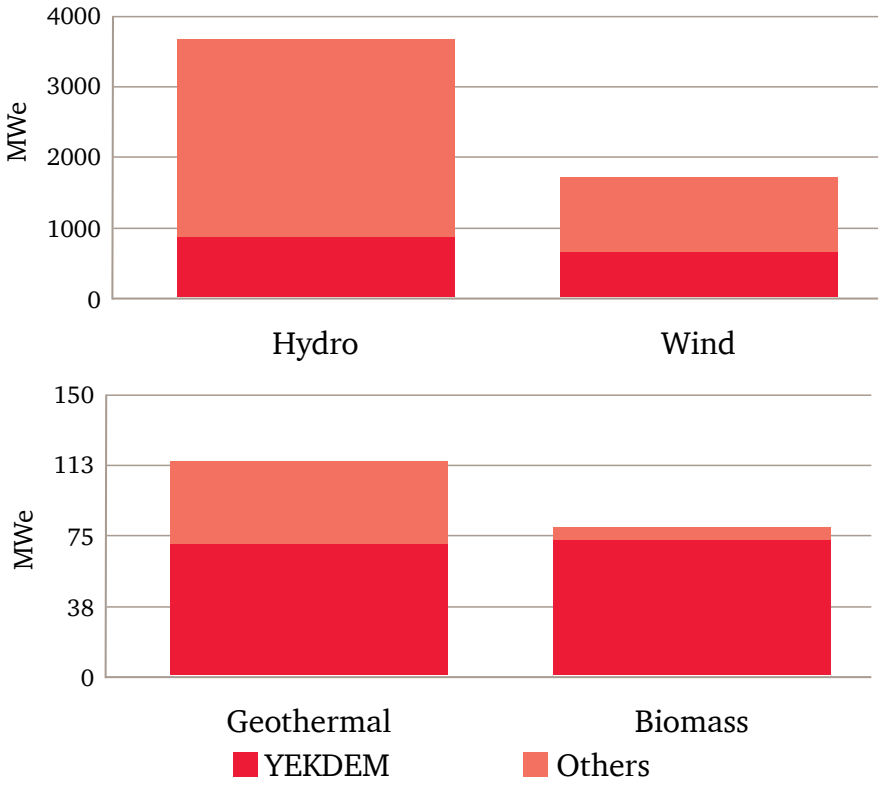
According to the regulation published in the Official Gazette on 19 June 2011, license holders will be required to present two documents to the Ministry of Energy and Natural Resources in order to qualify for a premium: 1) The Local Manufacture Status Certificate shall demonstrate that the equipment is produced locally. The certificate shall be prepared by a sworn financial advisor and certified by the Chamber of Industry and Commerce of the equipment supplier. 2) A product certificate that shows that the equipment complies with the relevant national and international standards. A national accreditation institution that has a mutual recognition agreement with the International Accreditation Forum (IAF) will prepare this document.

The Energy Market Regulatory Agency (EPDK) has released the Regulation on Documentation and Support for Renewable Energy Resources, detailing how the YEK Mechanism will be integrated into the Balancing and Settlement Market. Accordingly, market participants will no longer be required to obtain YEK certificates to participate in the YEK Mechanism. Instead, their licenses will be valid as YEK certificates. In order to participate in the YEK Mechanism in the following calendar year, power plants are required to apply to the EPDK by 31 October. The Market Financial Settlement Centre (PMUM) will establish a YEK portfolio registered within the Balancing and Settlement Market for the settlement of the energy within the YEK Mechanism, and it will be able to use the collaterals that are collected according to the Balancing and Settlement Market regulation (DUY).

PMUM shall act as an intermediary between mechanism participants and power suppliers in the YEK Mechanism, buying electricity from the participants of the mechanism and selling it on the Day Ahead Market on behalf of power suppliers. Power suppliers are then required to pay the difference between the purchase and sale amounts as well as any energy imbalance liabilities to PMUM. The purchase obligation of each power supplier is determined according to its market share.

EPDK has published the final list of the 78 power plants that will participate in the YEK Mechanism for the year 2012. Forty-four of these are hydroelectricity power plants (with a total capacity of 932.26 MWe), 22 are wind (684 MWe), 8 are biomass (73.4 MWe) and 4 are geothermal power plants (72.35 MWe). While almost all of biomass plants and most of geothermal plants have chosen to participate in the mechanism, the mechanism is far less popular for hydro and wind plants. Since the regulatory framework for the local content premium has not been fully established yet, the participants in the mechanism will only receive the basic feed-in tariffs in 2012.

Chart 4: Breakdown of private power plants in operation in terms of participation in YEK Mechanism in 2012



Source: EPDK

Unlicensed generation

Those renewable energy plants with an established capacity of less than 500 kWe are not required to receive a generation license or start a company. According to the Regulation on Unlicensed Production in the Electricity Market, such unlicensed producers should apply to the distribution company in their region. Distribution companies are required to offset the consumption and production amounts and buy the excess energy at the prices specified in the YEK Mechanism for 10 years. According to the Regulation on Documentation and Support for Renewable Energy Resources, distribution companies shall register the unlicensed production amounts within their territory with the EPDK at the same time as power generation companies. As the regulatory framework for unlicensed generation is being finalized only recently, the participation of unlicensed producers in the YEK mechanism is expected in 2013.

Table 5: Incentives other than feed-in tariffs for renewable energy investments

Incentives within the Renewable Energy Law (No. 5346)	Assigning of land belonging to the Treasury and "land at the disposal of the state" to renewable energy projects. 85% discount in easement, usufruct, permit or lease fees for the first 10 years of operation.
	Use of national parks, nature parks, natural protection areas, preservation forests, wildlife cultivation areas and special nature preservation areas with necessary permits.
	Exemption from the compulsory 1% turnover payment for operating business on immovable assets of the Treasury.
Incentives within the Electricity Market Licensing Regulation (No. 24836)	99% exemption from licensing fee and annual license fees for the first 8 years of operation
	Priority in system connection
Tax Incentives within the Cabinet Decree on State Aid Investments (No. 2009/15199)	VAT exemption for domestic equipment for Investment Support Certificate holders
	VAT, Customs Tax, Resource Support Utilisation Fund payment exemptions in imports for Investment Support Certificate holders
Incentives within the Law Regarding the Support of Research and Development Activities (No. 5746)	R&D deduction (deduction of R&D expenditures from corporate tax base at a rate of 100%)
	Income Tax exemption (80% of salary income for eligible R&D and support personnel), Social Security Premium support for 5 years, Stamp Tax exemption

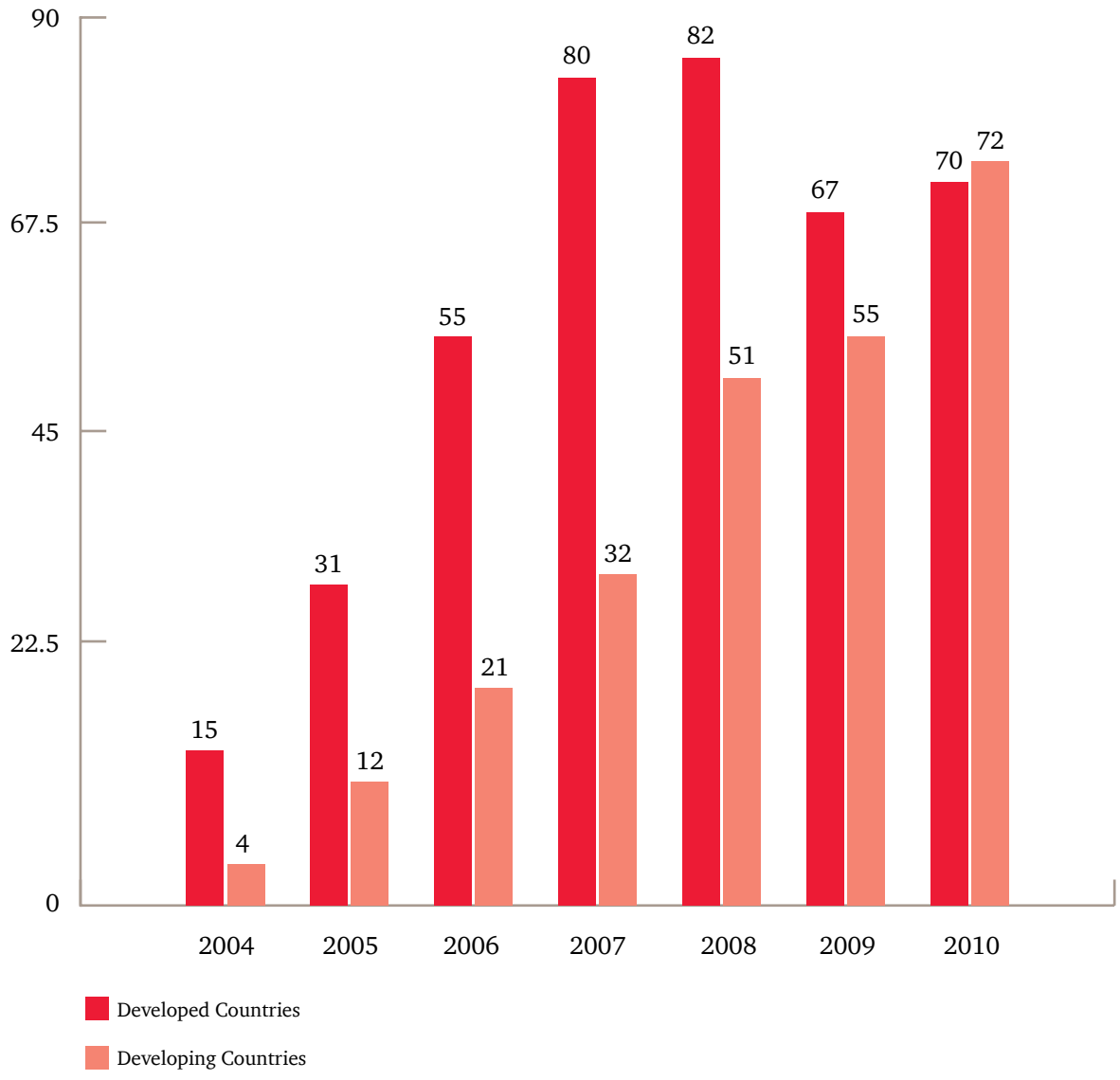
Section 3: Investment in renewable energy

Global investment in renewable energy

According to the Renewables 2011 Global Status Report, total investment for renewable energy reached $211 billion in 2010, up from $160 billion in 2009. The figure includes asset financing (both balance-sheet financing and non-recourse project financing), venture capital and private equity investment, stock purchases in public markets as well as corporate and government research and development. This figure excludes investment in large hydropower projects, which amounted to approximately $40-$45 billion.

For the first time financial investment in renewable energy, excluding investment in small-scale projects and R&D, was greater in developing countries than in developed countries. China attracted $49 billion of new financial investment in 2010, well ahead of the US, its closest runner-up, which received $25 billion. The wind power sector attracted the most investment in China. While Germany received $6.7 billion of financial new investment, investment in small-scale projects such as rooftop solar PV reached $34.3 billion.

Chart 5: New Financial Investment in Renewable Energy: Developed vs. Developing Countries, 2004-2010, $Billion



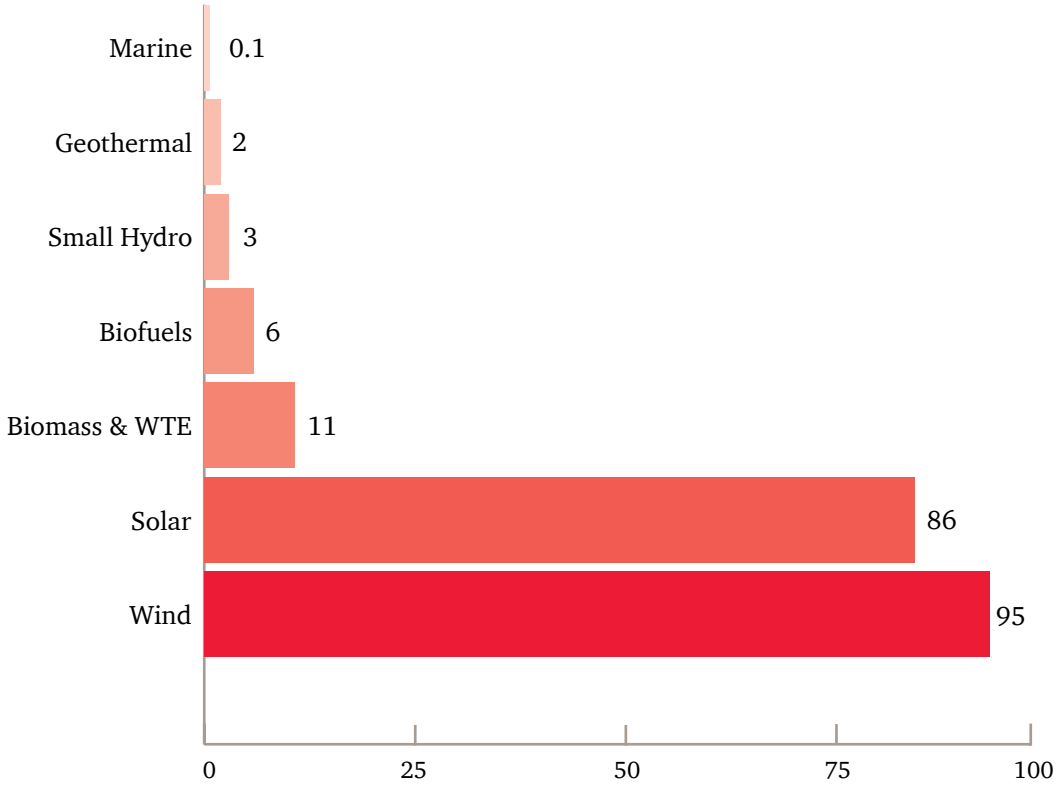
Source: Bloomberg New Energy Finance: Global Trends in Renewable Energy Investment 2011

Asset finance for new utility-scale renewable energy projects, which had declined by 6% in 2009 compared to 2008, grew by 20% in 2010 to $128 billion. Although balance-sheet financing continued to dominate non-recourse project financing in 2010, it declined to 68% of total asset financing from 76% in 2009. In 2008, balance-sheet financing constituted 59% of the total. This shows that lenders are more willing to provide non-recourse project financing to investors, but a full recovery to pre-crisis levels has not been achieved yet. The terms of non-recourse financing also improved, leading to a gradual reduction in spreads on loans for wind and solar projects in Europe and North America, a return to 15-year tenors in Europe and an ability for onshore wind and PV projects to secure debt equivalent to around 80% of total investment.

China took the lead in new-build asset financing. 70% of utility-scale asset finance in the world was devoted to wind power. Large-scale solar power plants received $19 billion. Financing for small-scale hydropower declined by 43% in 2010 due to European regulatory restrictions and concerns over the performance of these plants in the face of rainfall variations.

Small-scale distributed generation projects attracted $60 billion in 2010, a figure amounting to more than 25% of total renewable energy investment. Solar PV was the main recipient of investment in small-scale generation, and 86% of investment in small-scale solar projects targeted countries that have introduced feed-in tariffs. Germany, which remains the largest solar PV market in the world, attracted 57% of the investment.

Chart 6: Financial New Investment in Renewable Energy by Technology, 2010, $BN



Source: Bloomberg New Energy Finance: Global Trends in Renewable Energy Investment 2011

New financial investment was a mere $31 billion in the first quarter of 2011, down from $44 billion in the last quarter of 2010 and $32 billion in the first quarter of 2010. In the wake of reduced feed-in tariffs in Germany, Spain and Italy, investment in solar power declined in Europe. Wind power in the US also attracted lower investment compared to previous quarters.

Financing for renewable energy projects in Turkey

The electricity demand outlook and financial institutions' appetite for financing renewable energy projects may have improved dramatically since the global financial crisis, but financing conditions remain difficult for investors. The memory of the financial crisis is fresh on financiers' minds and volatile market conditions still constitute a risk. Consequently, financiers demand movable and immovable security, creditworthiness, completion and price guarantees from sponsors.

Financing for investors in the Turkish renewable energy market has never been easy. Even before the crisis, sponsors were not able to obtain non-recourse loans, which are secured by the project assets and paid back by the project's cash gain itself. During the crisis, however, conditions for financing became much stricter. Although banks still provided limited recourse project finance loans, all-encompassing price and completion guarantees made these loans very similar to full recourse corporate finance loans in all but name. Moreover, sponsors still had to complete costly technical and financial due diligence reports for their projects, which are required to obtain project finance loans. Although the conditions differ for each project, the overall financing environment has not improved greatly since the global financial crisis.

Turkish legislation provides "step-in rights" to financiers, but financiers do not consider this provision sufficient. According to Article 5 of the Electricity Market License Regulation, banks or financial institutions that provide project finance loans have the right to apply to the EPDK with valid grounds and request the license of the project to be transferred to another legal entity. However, especially foreign financiers have concerns about how this procedure would work in practice.

Especially for hydro and wind plants, the new YEK Mechanism is unlikely to improve the terms of financing considerably. In fact, the premium for locally produced equipment may complicate the financing process rather than ease it. The type, brand and technology of the project equipment have always been important to financiers, but these considerations came second to the general reputation of the project sponsors. Now, however, European banks and financing institutions such as the European Bank of Reconstruction and Development (EBRD) are saying that they will require an additional due diligence report to prove that locally manufactured equipment is purchased at fair market value, and not at a higher price, following the introduction of the mechanism.

With the spot market prices considered too low due to a supply glut and the YEK Mechanism offering no attractive alternative, the ability to conclude longer-term bilateral power purchase contracts will help project sponsors in their efforts to obtain financing. As such, generators who have the option of selling power to in-group companies will have a clear advantage over other projects.

Development and national banks are another source of financing for renewable energy projects. The International Finance Corporation (IFC), European Investment Bank (EIB), European Bank for Reconstruction and Development (EBRD) as well as the French Development Agency (AFD) have all provided project finance loans to renewable energy investments in Turkey or have teamed up with Turkish banks to do so.

The Industrial Development Bank of Turkey (TSKB) holds the leadership in financing renewable energy projects. The bank has financed 65 hydroelectricity projects with a total capacity of 2,150 MW; two wind power plants with a total capacity of 53 MW; two geothermal power plants of 58 MW total capacity; and one biomass power plant of 11 MW capacity. Among the listed projects: seven hydro plants (150 MW capacity), one wind plant (30 MW capacity), one geothermal plant (10 MW capacity) and the biomass plant have already started operation.

Prospects for carbon emissions trading in Turkey

Turkey became a party to the United Nations Convention on Climate Change in 2004 and ratified the Kyoto Protocol in 2009. Having no quantitative carbon emission reduction commitment during the protocol's first commitment period between 2008 and 2012, Turkey is not allowed to participate in the flexible mechanisms created by the protocol. Consequently, Turkish players can only sell carbon credits on voluntary carbon markets. Although the specifics of the post-Kyoto regime and Turkey's role in it are far from clear, Turkey could assume a more active role by taking on emission reduction obligations and obtaining the right to trade on compliance-based emissions trading markets. The international negotiations in the second half of 2011 will shape the post-2012 regime.

Within the scope of the Kyoto Protocol, "flexible mechanisms" were created to help countries with emissions reduction commitments meet their targets. International Emissions Trading enables Annex B (Annex I excluding Turkey and Belarus) countries to trade amongst each other, whereas the Joint Implementation Mechanism allows Annex B countries to claim emissions reductions by investing in projects in other Annex B countries. The Clean Development Mechanism makes it possible for emission reduction projects in non-Annex I countries to sell their reductions to Annex B countries.

Although Turkey cannot participate in the flexible mechanisms, it is quite active in the voluntary carbon markets. As of January 2011, 109 projects were registered in these markets. While the overwhelming majority of these projects are hydro and wind plants, there are several landfill gas, geothermal and biomass projects. The CO2-equivalent units expected to be generated from the 109 projects is ca. 8 million tonnes. Most of the projects possess the Gold Standard, but a few projects have VER+ and VCS standards.

Regulators are showing greater awareness about the need to support investors' participation in emissions markets. According to a new regulation on the YEK Mechanism, the EPDK shall publish the amount of power produced by each license holder in April every year. Non-licensed facilities may receive "generation resource certificates" to demonstrate the amount of electricity they produced during the preceding year.

The Ministry of Environment and Forestry released the Communiqué for the Registration of Projects Providing Carbon Emission Reduction in August 2010. The communiqué aims to register the projects that have or have applied to obtain carbon certificates from institutions like the Gold Standard Foundation. Within the framework of the communiqué, the projects are legally registered and double counting is prevented. Starting a registry for carbon emissions projects is just the first step in the long process of setting up the regulatory and institutional framework ahead of the post-Kyoto regime.

Looking forward, participation in voluntary markets can constitute valuable experience for Turkey's greater involvement in carbon markets. If bilateral arrangements gain greater prominence in the post-Kyoto regime, Turkey may conclude bilateral agreements with the EU and even the US. In that case the renewable energy producers will have more space to trade their carbon certificates.

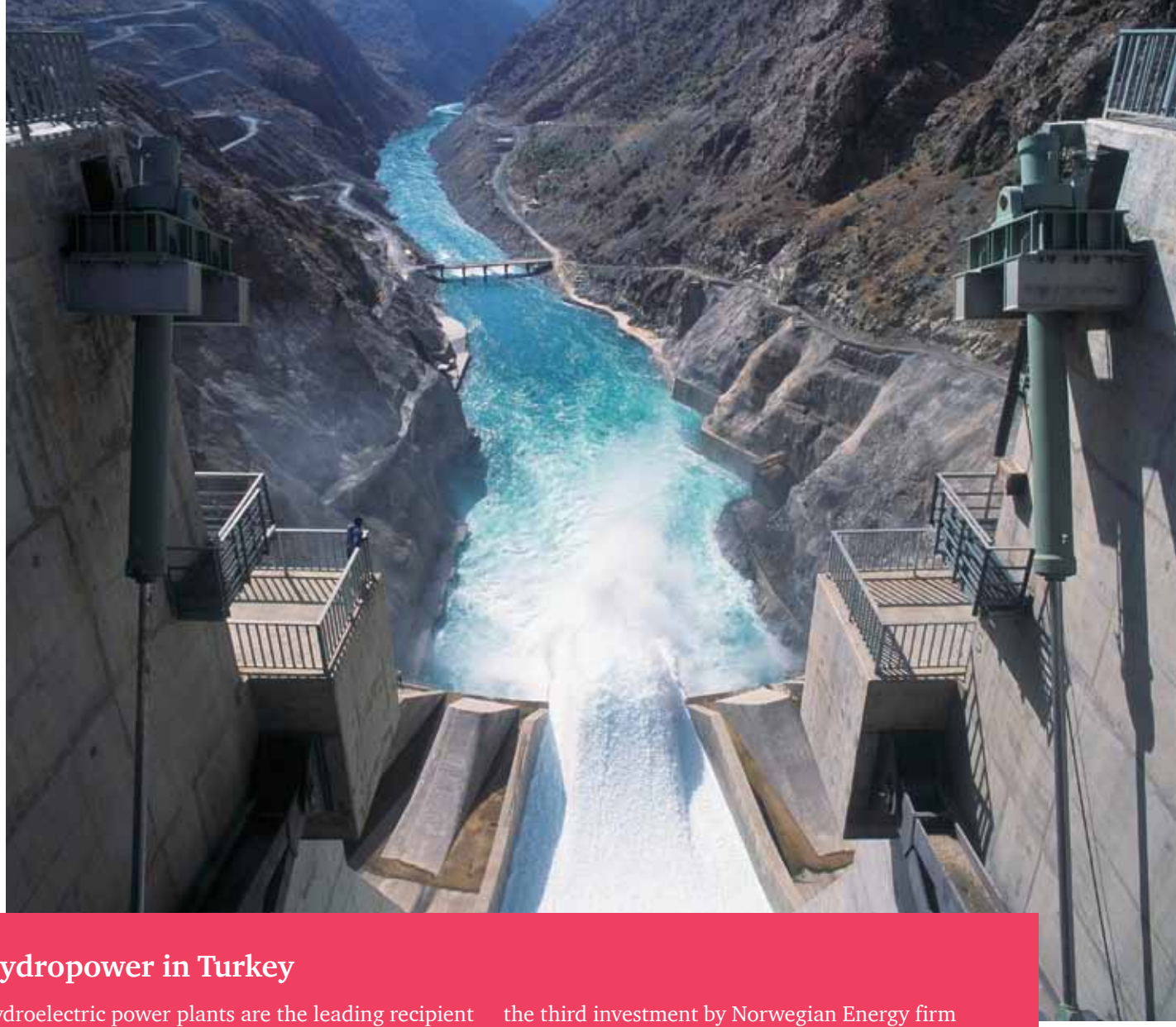
In a difficult financing environment where the YEK Mechanism is not considered a sufficient incentive to encourage investment in renewable energy, carbon finance may play a significant role in attracting investment. While industries with high carbon emissions are likely to show resistance to emissions reduction obligations, renewable energy-based power plants will have much to gain from obtaining access to compliance-based markets. Power plants will also have the opportunity to trade their carbon emissions reductions domestically. As for the large groups that are active in multiple sectors including renewable energy, they will have the opportunity to compensate for their carbon emissions with the credits from their renewable power plants.

Hydropower

New installations of 30 GW brought global hydropower capacity to 1,010 GW in 2010. 16% of global electricity production is generated by hydroelectric plants. China, which already leads the world with the greatest hydropower capacity and generation, added 16 GW of additional capacity to reach a capacity of 213 GW, and this capacity is expected to grow by an additional 140 GW over the next five years.

Brazil, Canada, Russia and the US have the most hydropower capacity after China. Hydropower is particularly important for Brazil and Canada, which produce 80% and 61% of their electricity from hydropower respectively. In North America and Europe, modernization of existing facilities and the construction of pumped storage also constitute an important area of activity, whereas emerging markets focus on construction of new capacity. Pumped storage involves the pumping of water from a lower to a higher reservoir to store energy for later use, especially during times of peak demand. Pumped storage capacity reached 136 GW by the end of 2010. Europe's small-hydro industry is facing the challenge of regulatory uncertainty due to conflicting implementation demands of the Renewable Energy Directive and the Water Framework Directive at the national level.

China hosts the most extensive hydropower industry, whereas India has 20 active domestic manufacturers of small-scale hydropower equipment. Chinese equipment manufacturers Harbin Electric Machinery and Zhejiang Machinery & Equipment are gaining global prominence. Global players such as Alstom, Andritz, IMPSA and Voith control approximately 40-50% of the global market. Regional players such as American Hydro, Bharat Heavy Electrical, CK Blansko Holding, Energomashexport, Hitachi and Toshiba account for the remaining 50-60%.



Hydropower in Turkey

Hydroelectric power plants are the leading recipient of renewable energy investments in Turkey. As of January 2012 there are 832 licenses entitled by the EPDK, with a total capacity of 29,570 MW. While approximately 15,275 MW of this capacity is in operation, 14,295 MW is under construction.

11,629 MW of the installed hydropower belongs to the Turkish Electricity Production Company (EUAS). Some of these power plants, including Karakaya (1,800 MW), Ataturk (2,405 MW) and Keban (1,330 MW), will remain outside the government's privatisation portfolio. Big private holding companies are also active in this sector. Dogus Holding, Akenerji and Aksa all have hydroelectricity investments.

The biggest hydropower project under construction now is the Boyabat Hydro Electricity Plant. The project is owned by a consortium of big investors in Turkey: Dogus and Dogan holdings as well as Unit Investment. The 528 MW capacity project is financed with a project finance loan amounting to $750 million.

Another large project is the Cetin Project to be constructed on the Dicle River. The project is the third investment by Norwegian Energy firm Statkraft in Turkey. The Cetin project, which will have a capacity of 517 MW, is expected to start operation in 2015. This project will bring Statkraft's total installed capacity to 639 MW.

Akenerji, being the first auto producer company group in Turkey, is one of the main players in the hydroelectricity sector. Most recently, the company acquired İckale Enerji, which has a 163 MW hydropower plant in its portfolio. Now the company holds 8 hydropower plant licenses with a total capacity of 298 MW. 81 MW of this capacity is in operation while 217 MW is still under construction. TSKB has provided EUR84 million of project finance to the portfolio of the company.

As for hydropower plant equipment, the government has made an initiative for production. The Turkish Electromechanic Industry Company, which is an affiliate of the Ministry of Energy and Natural Resources, manufactures all turbines, generators and electro mechanic system equipment for hydropower plants. The company has research and development studies also for solar and wind power plant equipment.

Environmental issues in hydropower

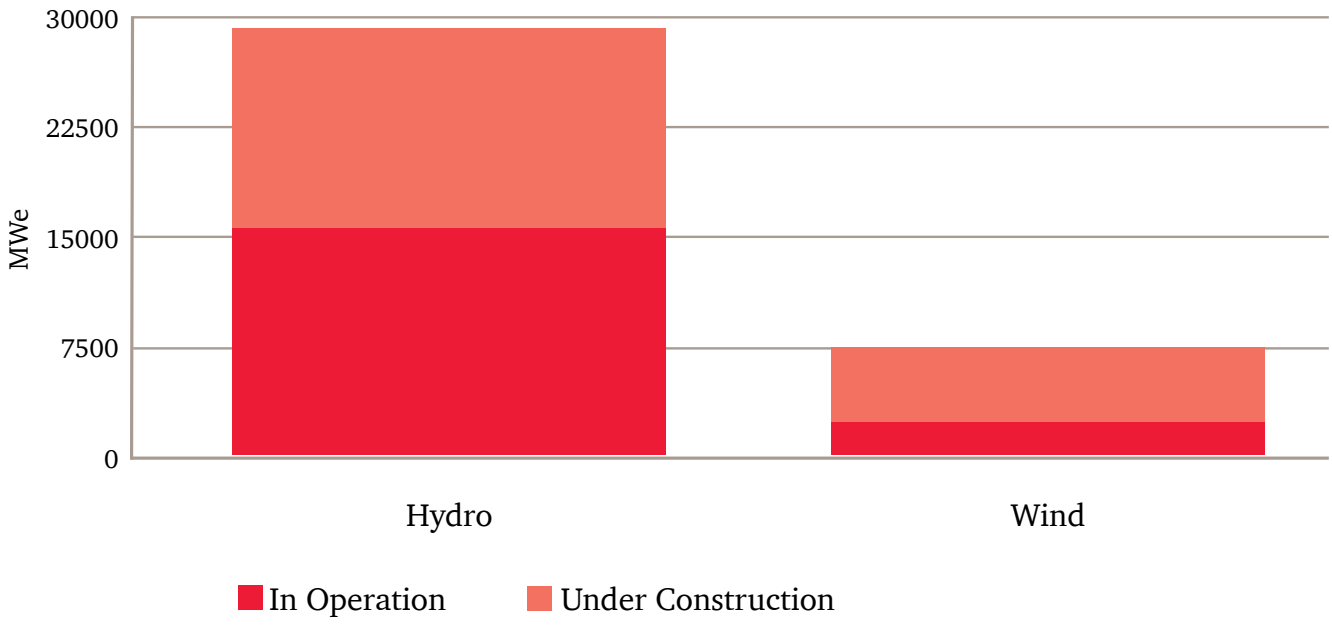
Hydropower projects have been subject to much public and legal scrutiny over the past few years. The efforts to capture the high hydroelectric capacity of the Eastern Black Sea region were obstructed by local initiatives organised around concerns about the environmental impact of the projects as well as effects on local tourism and agriculture. Local associations took most of the projects to court, seeking stays of execution and invalidation decisions for either the Environmental Impact Assessments (EIAs) or for decisions that had eliminated the requirement for an EIA. Due to the success of these initiatives in blocking projects and the public attention they receive, these legal cases are no longer limited to the Black Sea region.

Under the Environmental Impact Assessment Regulation, only plants with an established capacity of 25 MW or more are required to obtain an EIA as part of the licensing process. For smaller plants, the provincial environmental directorates decide whether an EIA is required. Consequently, either the decision of the provincial environmental directorate that no EIA is necessary, or the favourable EIA report, can come under legal scrutiny depending on the case. Local courts err on the side of caution and grant stays of execution in almost every case that comes before them on the grounds that the project may cause irreversible damage. Legal cases can last several years before the final verdict is granted. Investors, who conclude financing and equipment supply agreements based on the project schedule registered on their licenses, suffer from significant material losses due to these lengthy legal delays.

The environmental concerns that give rise to legal action should not be dismissed as groundless. There is a widespread perception that the current regulatory regime is not sufficient to grasp the full extent of environmental impact of hydropower projects. Critics argue that under the current regime projects are required to release too little water to the river basin, and this endangers species in and along the river. The felling of too many trees can increase the risk of landslide, and excavation waste is often disposed back into the river basin. Moreover, there is not sufficient supervision and monitoring during the construction period to make sure that the investors follow through on their environmental commitments.

The assessment of environmental impacts and feasibility studies would have been much healthier had a river basin planning study for each river basin been carried out in advance of licensing. Multiple projects along the same river receive licenses, but the environmental impact of each project is evaluated on a singular basis without regard to the collective effect of all the projects and the interconnection system. The same issue complicates feasibility studies, obliging investors to revise their original feasibility studies after licensing and creating delays. The absence of river basin planning also prevents power plants along the same river to be connected to the system in the most efficient way.

Chart 7: Breakdown of licensed hydro and wind projects

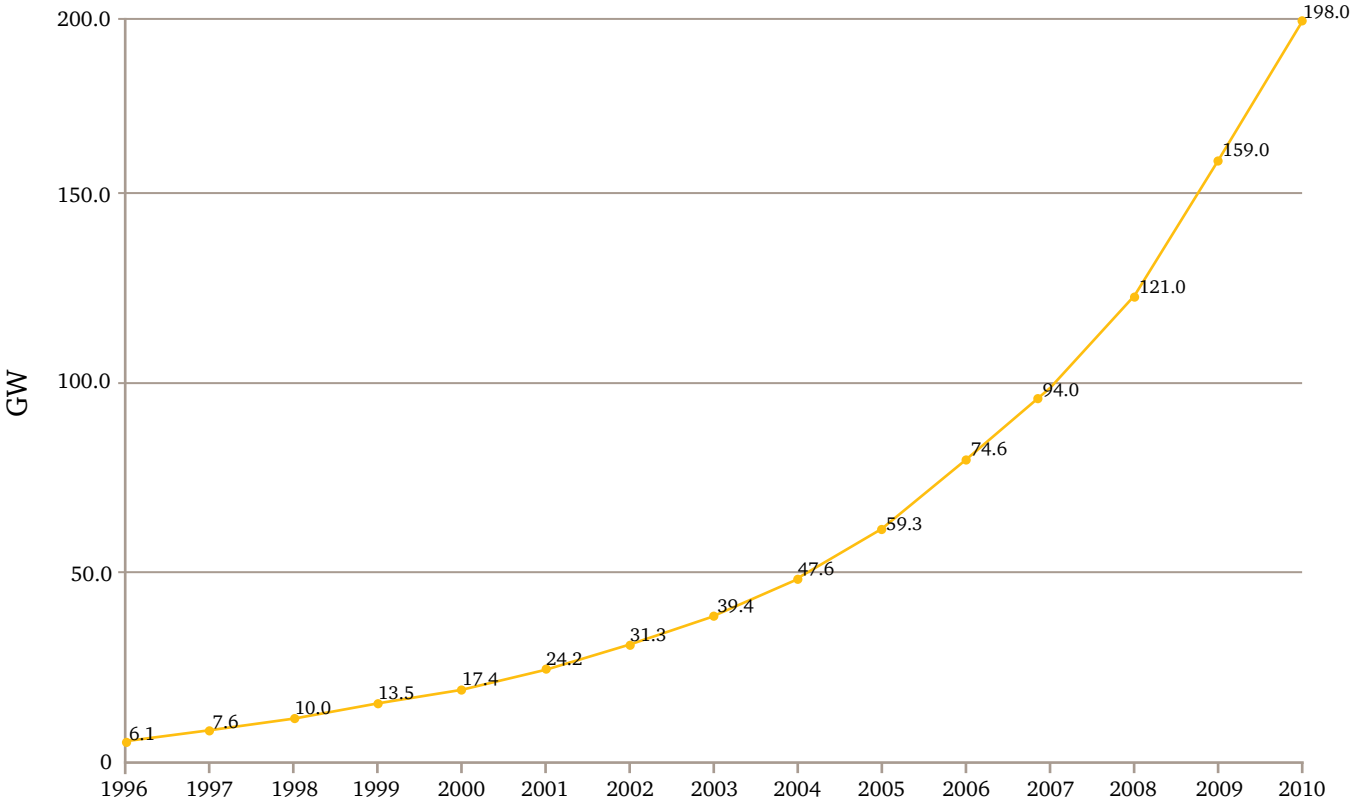


Source: EPDK

Wind

New wind power capacity of 39 GW was added during 2010, making wind power the leader of all renewable technologies in new installations. Total global capacity reached 198 GW at the end of 2010, increasing by more than 24%. The annual growth rate in 2010 only slightly exceeded the growth rate in 2009 when policy uncertainty and the economic crisis slowed growth in Europe and the US. Wind power met 2-2.5% of the global power demand by the end of 2010, and this ratio was much higher in some states such as Spain (15.4%) and Germany (6%). While the size of individual wind projects is getting larger, community wind power projects using small-scale turbines are also becoming more common.

Chart 8: Wind Power, Existing World Capacity (1996-2010)



Source: Renewables 2011 Global Status Report

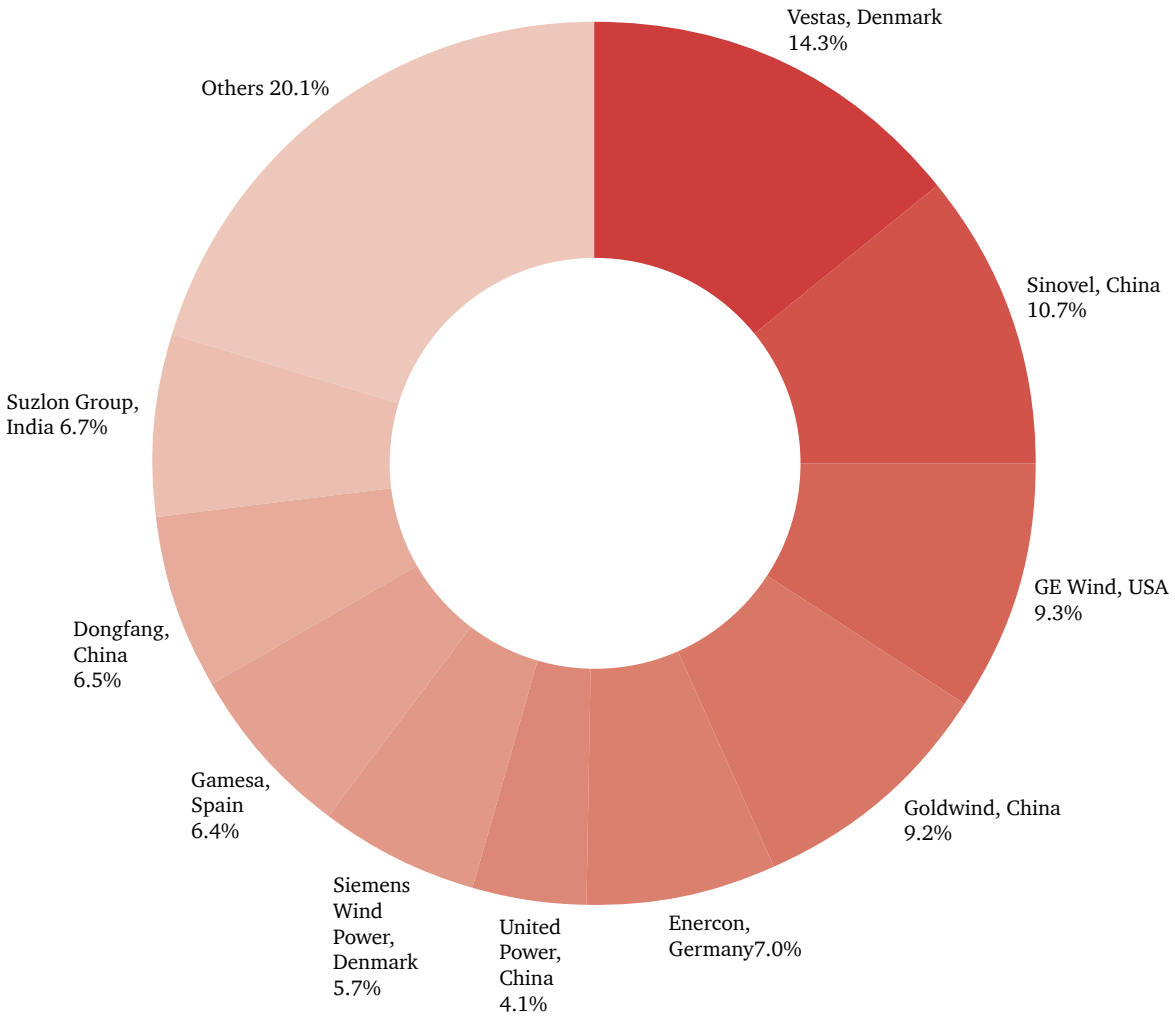
In stark contrast with a mere 4.4% in 2005, China attracted 50% of the new global capacity additions in 2005, bringing the total installed capacity for wind power in China to 44.7 GW. China plans to invest in more than 30 GW during 2011 and 2012. The wind power capacity of the US reached 40.2 GW with the addition of new capacity worth 5 GW. Additional wind capacity of 5.6 GW and 1.9 GW is under construction in the US and in the UK respectively.

9.5 GW wind power capacity was installed in the European Union in 2010 and the total installed capacity reached 84 GW. Wind power, which was the leader in new capacity additions since 2007, now came in third behind natural gas and solar PV. Germany was the leader within the EU with 27.2 GW of installed wind power capacity. Spain added 1.8 GW and became the world's fourth largest wind power installations market with an installed capacity of 20.7 GW.

Offshore wind power capacity is still small, but 1.2 GW of new installations were made during 2010 and the total global capacity reached 3.1 GW. Most of the offshore capacity is located in Europe (30 GW). The first big offshore wind power plant was installed in China in 2010.

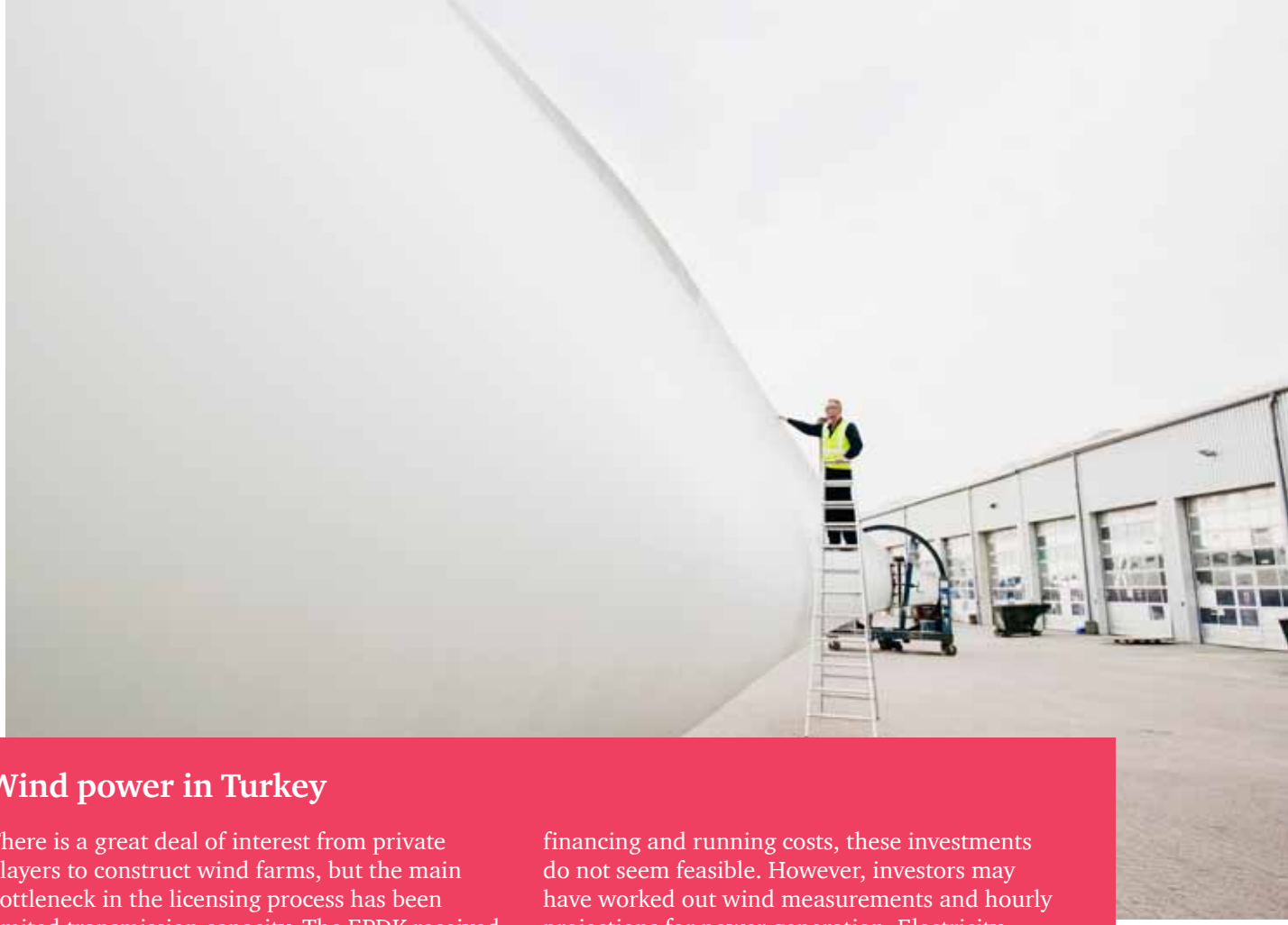
While wind power manufacturing volumes stayed constant in 2010, manufacturing capacity grew substantially. However, major manufacturing companies such as Vestas, Gamesa, Hansen Transmissions and GE Wind were not immune to market troubles. They lowered sales forecasts during 2010 due to limits on transmission systems, low natural gas prices and difficulties with obtaining project finance.

Chart 9: Market Shares of Top 10 Wind Turbine Manufacturers, 2010



Source: Renewables 2011 Global Status Report

Emerging markets like China and Brazil attracted most of the new investments in wind technology, and Chinese technology providers also grew significantly thanks to lower employment costs as well as political and regulatory support. Consolidation among the Chinese players is expected going forward. In Europe, technology companies focused on offshore wind technology and transmission systems to link offshore wind farms in the North Sea to Germany by 2013.



Wind power in Turkey

There is a great deal of interest from private players to construct wind farms, but the main bottleneck in the licensing process has been limited transmission capacity. The EPDK received an overwhelming number of wind power license applications following the elimination of a requirement to obtain a survey of the potential of the wind power sites, forcing it to suspend applications in mid-2006. EPDK then announced that it would accept applications on 1 November 2007; it received 715 applications with an overall capacity of 78 GW. (To put this figure into perspective, it is important to point out that Turkey's total generation capacity in 2007 was 40.8 GW.)

EPDK started to award licenses to "1 November applicants" in December 2010. Since 2007 the Energy Ministry and the EPDK had been searching for the best policy to discern between these applications. The necessary regulations have finally been issued and the Turkish Electricity Transmission Company (TEIAS) organised tenders for applicants who applied for the same substation capacity or location. These tenders took place in an aggressive competition environment. As per the results of the tenders, several investors will pay contribution fees over TL0.04 ($0.023) per kWh and this amount even reaches TL0.0652 ($0.037) per kWh. The current spot market prices and feed-in tariff amounts within the YEK Mechanism are evident. The feed-in tariff for wind power plants is $0.073 per kWh and this amount can only reach $0.11 cents with the addition of maximum local production premium. The highest spot market price ever was TL0.18/kWh and 2011 average prices did not exceed TL0.13/kWh. With financing and running costs, these investments do not seem feasible. However, investors may have worked out wind measurements and hourly projections for power generation. Electricity produced in peak hours can be sold at higher rates. Besides, the location of the nearest substation plays an important role. Electricity given to the system through busy substations can be sold at higher rates. Construction costs and financing alternatives also vary for different projects and influence the acceptable contribution fee for the investor. Beyond all of these, several investors are competing with each other to expand their presence in the energy sector.

The protocol between the Ministry of Energy, EPDK, the Scientific and Technological Research Council of Turkey (TUBITAK) and the Turkish General Staff dated 27 December 2010 required licensed wind power projects to obtain a Technical Interaction Analysis from TUBITAK and a Technical Interaction Approval from the General Staff before they can be approved by the Ministry of Energy. These approvals were required to ensure that wind farms do not interfere with communication, navigation and radar systems. However, the approval procedure has created a new bottleneck in the regulatory framework for wind farm projects.

A new survey requirement is expected to be introduced for wind power license applicants going forward. A survey circular has been released by the EPDK for this purpose. While this will increase the effectiveness of licensing, investors have viewed some of the technical requirements in the circular as too strenuous.

At the time of the writing of this report, EPDK had granted 209 licenses with a total capacity of 7,491 MW. 1,725 MW of this capacity is in operation while 5,765 MW is under construction. The largest producer is Zorlu Holding with their company Rotor located in Osmaniye with 135 MW installed capacity.

Another project with higher capacity is under construction. Al-Yel Electricity Production Company's 150 MW power plant will be constructed with 44 turbines in Kirsehir. The license is owned by French company Akuo Energy Sas. The company holds three other wind power licenses. Following the construction of these plants, Akuo will have 363 MW of installed wind power capacity and will probably become the biggest wind power producer in Turkey.

A Turkish construction company group, Agaoglu, has also declared interest in the renewable energy sector. The company currently has 2 wind power plants in operation with 126 MW of capacity and has 14 MW of capacity under construction.

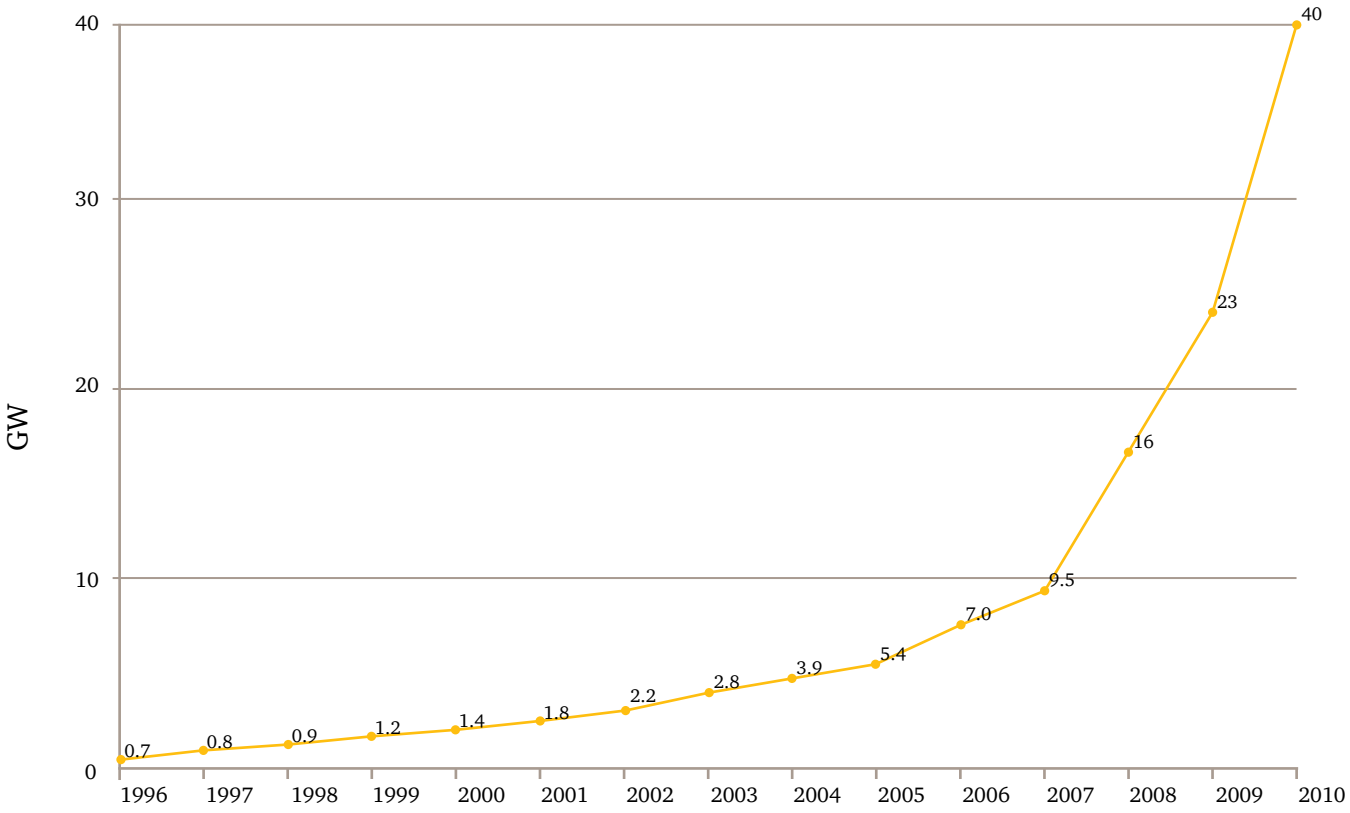
There are a few local technology providers in the sector. Enercon, the German turbine manufacturer, has production facilities in Turkey. The firm has a partnership with the Turkish holding company Demirer. Enercon Turkey carries out wind turbine manufacturing activities in the Aegean Free Zone. Up to date the firm provided wind turbines for approximately 500 MW of installed wind power capacity. Enercon also provides technical advisory services for installation and operation of wind power plants.

Model Enerji Company manufactures high capacity wind turbines with 1,650 kW capacity. The Company is also working on the production of 2,000 kW and 2,500 kW turbines. Soyut Wind produces accumulator wind turbines with capacity from 1 kW to 30 kW and network connection system wind turbines with capacity from 30 kW to 500 kW. The company conducts 100% of its production locally. GSR Enerji produces small-scale wind turbines.

Solar

The 17 GW added to solar PV capacity in 2010 brought the overall capacity to 40 GW. Declining costs of technology and strong policy support helped growth, but policy reversals in several countries are likely to change the picture. The European Union attracted 80% of the new installations at 13.2 GW in 2010, exceeding new installations in wind for the first time. Germany alone added 7.4 GW of additional capacity, reaching capacity of 17.3 GW. Italy's total installed capacity as of June 2011 was 5.8 GW. New installations in Spain were lower than their peak in 2008 with a mere 0.4 GW due to regulatory uncertainties. Total PV capacity reached 3.8 GW in Spain.

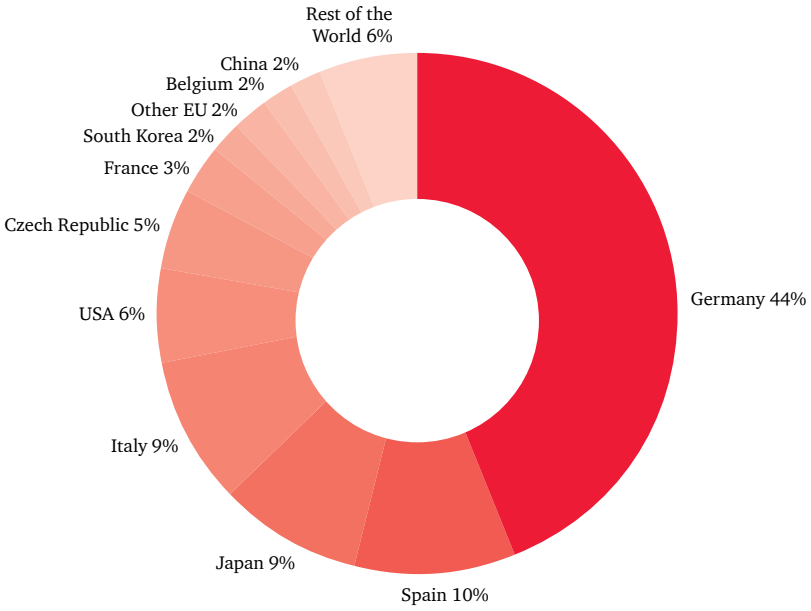
Chart-10: Solar PV, Existing World Capacity, 1995-2010



Source: Renewables 2011 Global Status Report

Similar to the trend in wind power, project size is growing for solar PV. Utility-scale (more than 200 kW) facilities are becoming more common around the world. There is a growing interest in concentrating PV (CPV), 0.02 GW was connected to the grid during 2010 and 2011. Projects or demonstrations are located in California, Australia, Egypt, France, Italy, Jordan, Mexico, Spain and South Africa. Building-integrated PV is also spreading from Europe to the world. While most of installed PV capacity is connected to the grid, small-scale off-grid systems are more widely utilised in both developed and developing world.

Chart 11: Solar PV Capacity, Top 10 Countries, 2010

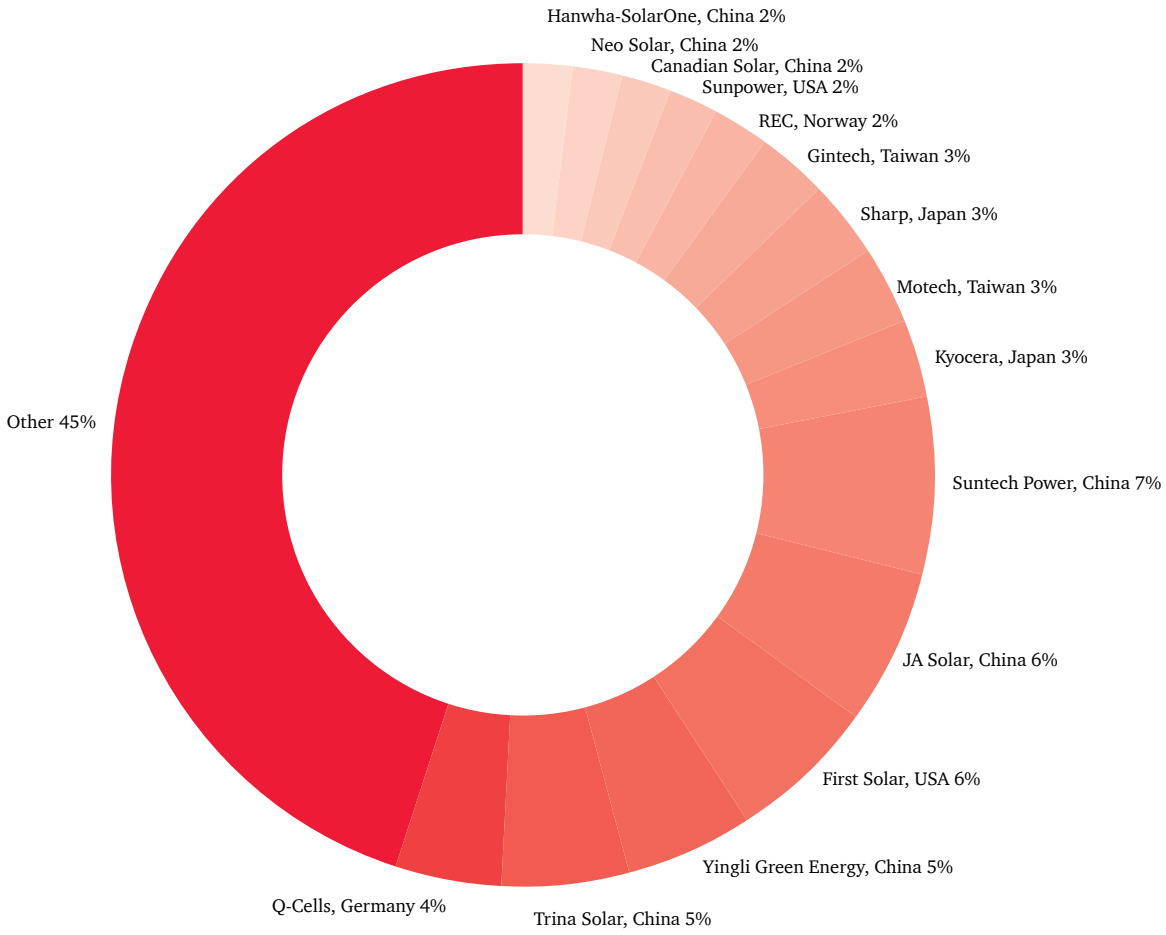


Source: Renewables 2011 Global Status Report

In 2010, the solar PV industry doubled in cell and module production, which amounted to 23.9 GW and 20 GW, respectively. Module prices, which declined by 38% in 2009, dropped a further 14% in 2010 due to the expansion of manufacturing capacity in China and other countries. Although the market share of thin film declined to 13% with respect to crystalline silicon, production of thin film increased and became more diversified. The solar PV manufacturing industry also experienced significant horizontal and vertical M&A activity in 2010. Many technology producers moved into project development.

Ten of the top fifteen solar cell manufacturers are based in China. Chinese and Taiwanese manufacturing firms alone accounted for 59% of global production, whereas the share of European and Japanese companies declined to 13% and 9%, respectively. Two Chinese companies, Suntech and JA Solar, became the largest two equipment producers in 2010, whereas prior market leader First Solar from the US dropped to third place. Some Chinese manufacturers started construction of factory buildings but refrained from installing the production equipment due to market uncertainties. India's solar manufacturing industry has also experienced strong growth with the launch of the National Solar Mission, which targets 20 GW of solar power capacity by 2022.

Chart 12: Market Share of Top 15 Solar PV Cell Manufacturers, 2010



Source: Renewables 2011 Global Status Report

Concentrating Solar Thermal power installations (CSP) are much less prevalent than PV technology, with about 1,095 MW of capacity added between 2007 and the end of 2010. Spain added 400 MW in 2010, becoming the world leader in CSP installations with 632 MW of capacity. Strong growth in this technology is expected in Spain, in the US as well as in North Africa and the Middle East. Several energy players such as Siemens, ABB and GE entered the market by acquiring CSP manufacturers. However, significant reductions in PV costs will continue to challenge CSP investments, especially in the US.

Solar power in Turkey

The EPDK has awarded no licenses to any solar power plant projects so far, and the regulatory framework has been absent. This delay was largely due to the commercial infeasibility of solar projects before the YEK Mechanism was introduced. Now that the new feed-in tariffs are in place, the EPDK has determined a regulatory roadmap for solar power licensing. The new regime builds upon the lessons learned from the chaos that ensued from an overwhelming number of wind applications.

By law, the total solar power capacity that will be connected to the network by the end of 2013 cannot exceed 600 MW. According to the Electricity Market Licensing Regulation, the established capacity of each solar power project shall not exceed 50 MW, and each project shall be connected to the nearest electrical substation. TEIAS has announced the electrical substations where the solar power plants may be connected to, as well as the available interconnection capacity until 31 December 2013. The Ministry published the radiation specifications and connection capacity distribution according to the technical advisory of TEIAS. The announced 600 MW of capacity is focused on the Central Anatolian region and Konya is the leading province with 92 MW. There will not be any solar capacity connections in the Marmara and Black Sea regions, while the solar capacity connection in the Southeastern region is only around 70 MW. TEIAS and the Ministry may have taken several parameters into account in their capacity determinations. Due to low altitude, the radiation specifications of the Southeastern region may be less than expected. Substation capacities and the distance from possible plant locations to substations may also have been important issues.

The EPDK has released a circular according to which investors will carry out site surveys before making their license applications. However, a date for solar power license applications has not been announced yet. Similar to the process for wind power plant applications, TEIAS will organise a tender for applicants, which have applied for the same land or electrical substation. The applicants who accept the greatest reduction from the feed-in tariffs will likely win the tenders.

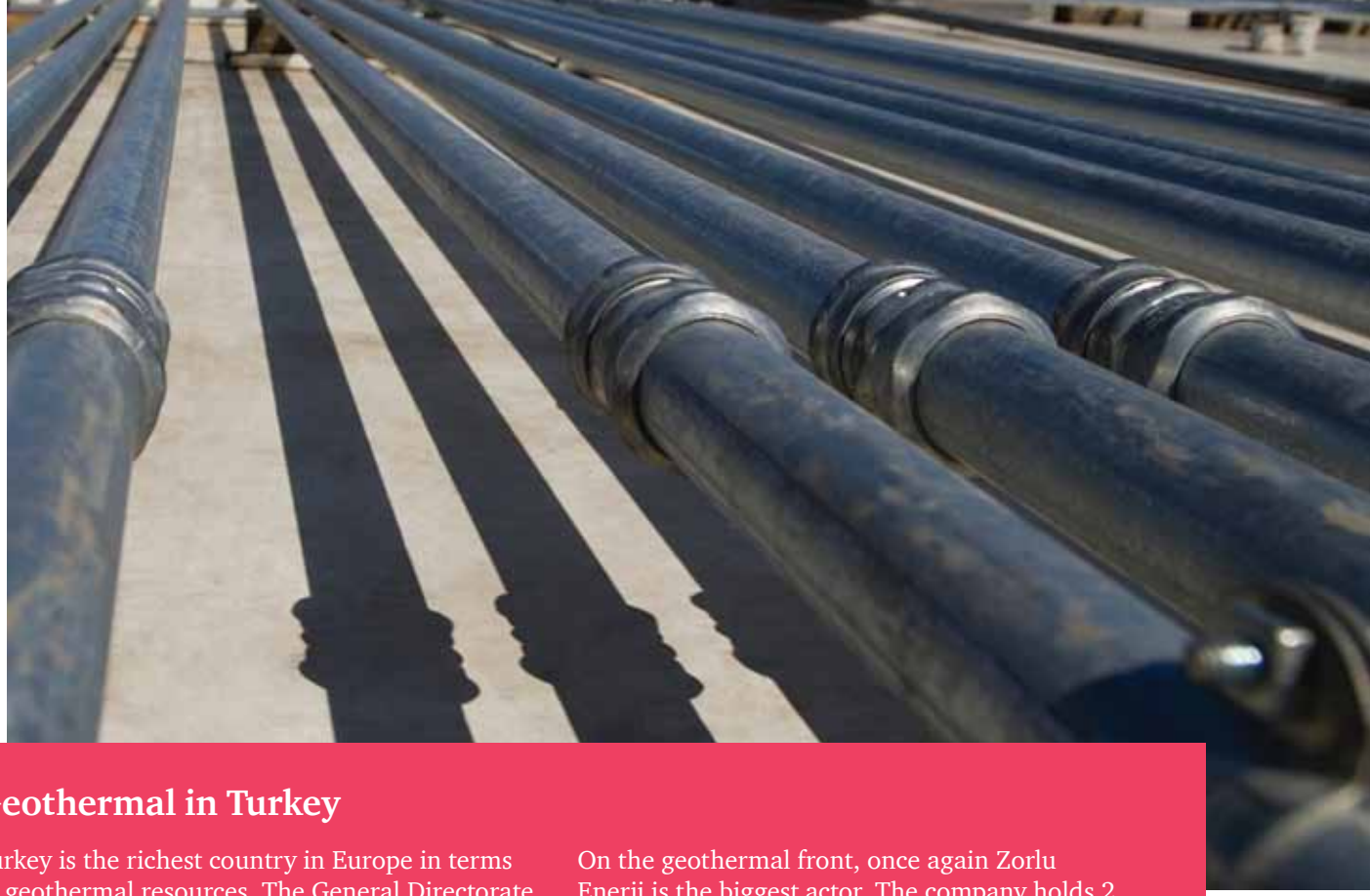
In the meantime, the Ministry of Energy and Natural Resources (MENR) has already issued a regulation that identifies the standards for equipment used in solar power plants and lays out the method for determining the electricity produced from solar energy in hybrid power plants.

On the industry front, there are two companies manufacturing solar PV cells. One of them is An-el Enerji. The Company also provides consulting to investors for solar scale tests. Antak Enerji produces solar PV cells in Antalya.

Geothermal

Global installations of geothermal plants exceeded 11 GW with an addition of 240 MW in 2010. Iceland, Indonesia, New Zealand, the US and Turkey have attracted important additions of power capacity from geothermal resources since 2005. Competition for available drilling rigs with the oil and gas industries slowed down new capacity installations. Iceland and the Philippines generated 26% and 18% of their electricity, respectively, from geothermal sources in 2010.

Growth in geothermal power will be significant over the coming years. Many projects are in the pipeline in Iceland, Germany and the US, which leads the sector with a capacity of 3.1 GW. The introduction of advanced technologies will enable the development of geothermal resources in new countries. Japanese companies Mitsubishi, Fuji Electric and Toshiba supply 70% of the steam turbines in the world.

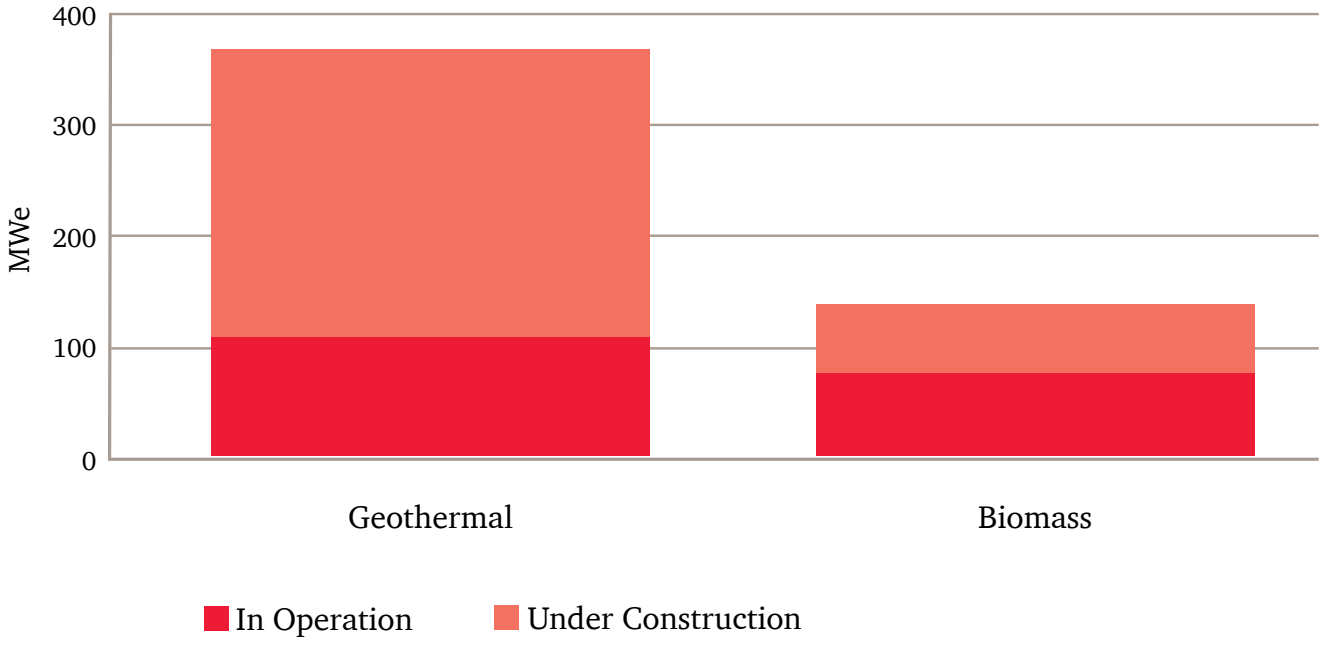


Geothermal in Turkey

Turkey is the richest country in Europe in terms of geothermal resources. The General Directorate of Electrical Power Resources Survey and Development Administration has said that the geothermal power capacity projection is 2,000 MW. EPDK has granted 17 licenses for a total capacity of 369 MW. 114 MW of this capacity is in operation while 255 MW is under construction. The new feed-in structure provides a $0.105 per kWh tariff for geothermal power plants.

On the geothermal front, once again Zorlu Enerji is the biggest actor. The company holds 2 licenses. 15 MW capacity of their 75 MW plant is in operation while the other 60 MW is under construction. Additionally the company has a 30 MW plant under construction in its wind hub Osmaniye. Bereket Enerji, a player in hydropower, has a 6.85 MW geothermal power plant in operation. The plant received project financing of $5.5 million from the TSKB.

Chart 13: Breakdown of Licensed Geothermal and Biomass Projects



Source: EPDK

Biomass

Especially in Europe, United States and China, power production from biomass experienced rapid growth in 2010. Global installed capacity reached 62 GW by the end of 2010. Power can be produced from biomass resources through the direct firing or co-firing of solid biomass, municipal organic waste, biogas and liquid biofuels.

The United States is the biggest producer of biomass power with a generation of 10.4 GW, followed by Germany, Sweden and the United Kingdom, Brazil, China and Japan. The United States biomass capacity is primarily based on wood, agricultural residue and increasingly landfill gas. China's biomass installed capacity increased 25% in 2010 and reached 4 GW.

Electricity produced from biomass resources increased by 10.2% from 2008 to 2009 in the European Union. Electricity production from both solid biomass and biogas has been growing quickly. Growth of biomass power in the EU has been supported by favourable policies, taxes on carbon dioxide emissions and fossil fuels, as well as the regulations that demand reductions in land filling of organic waste. Germany, Sweden and the UK lead the biomass sector in Europe, whereas future growth is expected in Italy, France, Spain and the UK. New biomass projects are underway in Africa and the Middle East supported partly by the Kyoto Protocol's Clean Development Mechanism. Countries like the US, Australia, Japan, the UK and Germany are converting some of their gas- and coal-fired power plants to enable co-firing with biomass.

Most of the manufacturers and project developers in the biomass sector are based in Europe. The region is the leader of wood pellet production. The production of biogas is also growing. Previously produced only in rural areas, biogas is now widely obtained from landfills, urban wastewater and effluent treatment plants and energy conversion methanisation plants that use slurry, crop residues, food processing waste, household and green waste as inputs. Germany leads manufacturing and project development in power generation from biogas, supported by a favourable feed-in tariff and domestic demand.

Biomass in Turkey

There have been 21 biomass plant licenses granted by EPDK, with a total capacity of 135 MW. 80 MW of this capacity is in operation while 55 MW is under construction. The biomass sector lacks adequate regulatory framework. Especially for landfill gas, investors are dependent on municipal administrations since they hold the authority to control landfills. However, waste management problems of municipal administrations are expected to lead to development in the biomass sector. The YEK Mechanism introduced a feed-in tariff of $0.133 per kWh for biomass.

One of the biggest players on the landfill gas front is Ortadogu Enerji, producing electricity from Istanbul's municipal waste. For now the company has nearly 23 MW of production capacity in operation and 13 MW under construction.

ITC-Ka holds 4 landfill gas licenses in Adana, Ankara and Konya. The company has 58.64 MW of total capacity; 38.17 MW of this is already in operation.

The role of Turkish universities in renewable R&D

Middle East Technical University has research and development centres for both wind and solar power technologies. Istanbul Technical University's Institute of Energy conducts research on all lines of renewable energy technology. Ege University's Solar Energy Institute focuses on wind, solar and other renewable hybrid electricity systems. Such academic institutes conduct their studies on the trial level for now. For example, Ege University Institute has manufactured solar photovoltaic cells and wind power turbines. Although the university uses this locally manufactured equipment to meet part of its own energy needs, there seems to be a long way to go before commercialisation. Ostim Renewable Energy and Environment Technologies Group works in collaboration with university institutes in order to promote Ostim Industrial District resident companies' involvement in this field.

Conclusion

As of the end of 2010, total renewable power capacity excluding hydropower was 135 GW in the EU. Germany and Spain had 49 GW and 26 GW of non-hydro renewable power capacity respectively, whereas Turkey's non-hydro renewable power capacity was a mere 1.92 GW as of January 2012.

Table 6: Renewable Energy Capacity as of end of 2010

Technology	World total	Developing countries	EU-27	USA	China	Germany	Spain	India	Turkey
				GW					
Wind power	198	61	84	40	45	27	21	13	1.73
Biomass power	62	27	20	10	4	5	1	3	0.08
Solar PV	40	n/a	29	3	1	17	4	-	0
Geothermal power	11	5	1	3	-	-	-	-	0.11
Solar thermal power (CSP)	1	-	1	1	-	-	1	-	0
Ocean (tidal) power	0	-	0	-	-	-	-	-	0
Total renewable power capacity (not including hydropower)	312	94	135	56	50	49	26	16	1.92
Hydropower	1,010	n/a	130	78	213	5	16	40	15.27
Total renewable power capacity (including hydropower)	1,320	n/a	265	134	263	54	42	56	17.19

Note: Turkey as of January 2012, remaining data as of end of 2010.

Source: Renewables 2011 Global Status Report, EPDK

Setting up the right policy and regulatory framework for renewable energy requires considerable effort and a clear political commitment. The foremost priority of Turkish policymakers in the energy sector has been the expansion of power generation capacity to keep up with increasing power demand, and policymakers did not view non-hydro renewables as a viable alternative for a long time. Power plants running on non-hydro renewable resources were considered too small and costly to make any significant contribution to generation capacity in a quick manner. Instead, natural gas-fired Build-Operate and Build-Operate-Transfer plants were constructed in the 1990s, and the government has been pushing for nuclear power more recently.

Renewable energy has become a priority for Turkish policymakers over the past few years as they realised the role that this energy source can play in expanding power generation and diversifying the energy supply mix in an environmentally sustainable way. Turkey's reliance on imported natural gas for power generation has given rise to concerns over both supply security and the country's bulging current account deficit. Consequently, support of domestic energy sources such as coal and renewables has gained a new urgency. In this regard Turkey's new renewable energy support mechanism is an important step forward, but more steps need to be taken in a coordinated manner to improve the investment environment for renewable energy.

There are still important uncertainties regarding the YEK Mechanism. The locally manufactured equipment premium can contribute to the feasibility of renewable energy projects as well as local technology development in a significant way. However, none of the participants in the YEK Mechanism could receive the premium in 2012 due to a disagreement between investors and the Energy Ministry regarding what qualifies as "locally manufactured equipment." Uncertainty regarding the implementation of this policy should be eliminated in order to be able to realise the potential benefits in a timely manner. Secondly, the regulation related to wind and solar power surveys has been released. The requirement for wind and solar surveys will increase the effectiveness of the licensing process, but the technical requirements have been viewed as too strenuous by some investors. Thirdly, the regulatory framework for unlicensed generation is currently being finalized. Unlicensed power generation can play an important role in utilizing Turkey's renewable energy potential and decentralizing power generation.

Currently, TEIAS organises tenders for license applicants in the wind power sector who have applied for the same location or electrical substation. A similar system is envisioned for solar power as well. Very high contribution fees for kWh of power produced have emerged from the wind power tenders, and there is uncertainty over whether these projects can be realized in the end. Wind power investors argue that the tenders should be organized to obtain the highest contribution fee for MW of established capacity, and applicants should be required to pay this amount before the license is granted. In this way, the sector can avoid license trading as well as delays in the utilisation of renewable resources. Going forward, a new requirement to provide wind measurements in license applications would also eliminate some of the potential applicants at an early stage.

The latest amendments to the Balancing and Settlement Regulation, which came into effect on 1 December, have further increased the system imbalance obligations of renewable energy companies by changing the calculation formula. Granted, renewable power plants can form groups with other generation and wholesale companies that will allow them to trade imbalance energy amounts within the group, wind power companies are still likely to incur significant costs from imbalances. Consequently, wind power companies would like to see either a reversal of the current policy or a mechanism that will allow them to revise their production plans until up to three hours in advance of delivery. The establishment of an intraday market would provide renewable energy producers a new venue to trade their output while minimising imbalance obligations.

In a difficult financing environment where the YEK Mechanism may not be considered a sufficient incentive to encourage investment in renewable energy, carbon finance may play a significant role in attracting investment. For this purpose, the options of establishing carbon markets domestically as well as obtaining access to flexible mechanisms in the post-Kyoto period should be given sufficient consideration. Another helpful policy would be the introduction of certificates that determine the amount of electricity generated from renewable sources and sold to eligible customers. If a certificate mechanism is established, eligible customers could credibly claim that the electricity they use is generated from renewable sources.

Policies that support the energy sector as a whole would also be beneficial for investors in renewable energy. Chief among these would be an effort to increase bureaucratic efficiency in licensing and granting permits. Power generation companies need to acquire numerous permits from various bodies before they can start operation. Bureaucratic efficiency should be achieved at each of these steps, but such decisions should also be given sufficient consideration to avoid subsequent judicial reversals.

Further liberalisation of the energy markets would be the key to attracting private investment to the energy sector. Greater market size as well as a greater number and diversity of market players would be achieved by liberalisation. Transparent price signals generated by the market via exchanges as well as the ability to manage risks from asset ownership are among the benefits of a liberalised framework for investors.

An investment plan for the expansion of the transmission system should be prepared. The costs of grid expansion may be moderated by smart grid controls and intelligent load management systems as well as planning the geographic distribution of renewable energy project sites and increasing the diversity of the renewables portfolio. For instance, a separate power control centre for renewable energy has been established in Spain to monitor and control renewable power generation.

Renewable energy provides countries the opportunity to expand their generation capacity and diversify their energy supply mix in an environmentally sustainable manner. While setting up the right regulatory and policy framework can prove difficult and costly, the benefits are worth the effort.

Notes

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