



RENEWABLES 2011

GLOBAL STATUS REPORT

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2011



EXECUTIVE SUMMARY

Changes in renewable energy markets, investments, industries, and policies have been so rapid in recent years that perceptions of the status of renewable energy can lag years behind the reality. This report captures that reality and provides a unique overview of renewable energy worldwide as of early 2011. The report covers both current status and key trends; by design, it does not provide analysis or forecast the future.

Global energy consumption rebounded in 2010 after an overall downturn in 2009. Renewable energy, which experienced no downturn in 2009, continued to grow strongly in all end-use sectors – power, heat and transport – and supplied an estimated 16% of global final energy consumption. Renewable energy accounted for approximately half of the estimated 194 gigawatts (GW) of new electric capacity added globally during the year. Renewables delivered close to 20% of global electricity supply in 2010, and by early 2011 they comprised one-quarter of global power capacity from all sources.

In several countries, renewables represent a rapidly growing share of total energy supply, including heat and transport. For example:

- In the United States, renewable energy accounted for about 10.9% of domestic primary energy production (compared with nuclear's 11.3%), an increase of 5.6% relative to 2009.
- China added an estimated 29 GW of grid-connected renewable capacity, for a total of 263 GW, an increase of 12% compared with 2009. Renewables accounted for about 26% of China's total installed electric capacity, 18% of generation, and more than 9% of final energy consumption in 2010.
- Germany met 11% of its total final energy consumption with renewable sources, which accounted for 16.8% of electricity consumption, 9.8% of heat production (mostly from biomass), and 5.8% of transport fuel consumption. Wind power accounted for nearly 36% of renewable generation, followed by biomass, hydropower, and solar photovoltaics (PV).
- Several countries met higher shares of their electricity demand with wind power in 2010, including Denmark (22%), Portugal (21%), Spain (15.4%), and Ireland (10.1%).

Trends reflect strong growth and investment across all market sectors. During the period from the end of 2005 through 2010, total global capacity of many renewable energy technologies – including solar PV, wind power, concentrating solar thermal power (CSP), solar water heating systems, and biofuels – grew at average rates ranging from around 15% to nearly 50% annually. Biomass and geothermal for power and heat also grew strongly. Wind power added the most new capacity, followed by hydropower and solar PV.

Across most technologies, 2010 saw further growth in equipment manufacturing, sales, and installation. Technology cost reductions in solar PV in particular meant high growth rates in manufacturing. Cost reductions in wind turbines and biofuel processing technologies also contributed to growth. At the same time, there was further industry consolidation, notably in the biomass and biofuels industries, as traditional energy companies moved more strongly into the renewable energy space, and as manufacturing firms continued to move into project development.

By early 2011, at least 118 countries had some type of policy target or renewable support policy at the national level, up from 55 countries in early 2005. There is also a large diversity of policies in place at state/provincial and local levels. Developing countries, which now represent more than half of all countries with policy targets and half of all countries with renewable support policies, are playing an increasingly important role in advancing renewable energy.

As policies spread to more and more countries, the geography of renewable energy use is also changing. For example, commercial wind power existed in just a handful of countries in the 1990s but now exists in at least 83 countries. Solar PV capacity was added in more than 100 countries during 2010. Outside of Europe and the United States, developed countries like Australia, Canada, and Japan are experiencing gains and broader technology diversification, while (collectively) developing countries have more than half of global renewable power capacity.

China now leads in several indicators of market growth: in 2010, it was the top installer of wind turbines and solar thermal systems and was the top hydropower producer. India is fifth worldwide in total existing wind power capacity and is rapidly expanding many forms of rural renewables such as biogas and solar PV. Brazil produces virtually all of the world's sugar-derived ethanol and has been adding new hydropower, biomass, and wind power plants, as well as solar heating systems.

At least 20 countries in the Middle East, North Africa, and sub-Saharan Africa have active renewable energy markets. Manufacturing leadership continues to shift from Europe to Asia as countries like China, India, and South Korea increase their commitments to renewable energy. The increasing geographic diversity in markets and manufacturing is boosting confidence that renewables are less vulnerable to policy or market dislocations in any specific country.

One of the forces propelling renewable energy policies and development is the potential to create new industries and generate new jobs. Jobs from renewables number in the hundreds of thousands in several countries. Globally, there are more than 3.5 million direct jobs

in renewable energy industries, about half of them in the biofuels industry, with additional indirect jobs well beyond this figure.

Also driving renewables development are state-owned multilateral and bilateral development banks, which have been pillars of investment in renewable energy during recent, troubled years for the world economy. More public money went to the renewable energy sector through development banks than through government stimulus packages during 2010.

Total investment in renewable energy reached \$211 billion in 2010, up from \$160 billion in 2009, continuing the steady annual increase seen since tracking first began in 2004. Including the unreported \$15 billion (estimated) invested in solar hot water collectors, total investment exceeded \$226 billion. An additional \$40–45 billion was invested in large hydropower.

Asset finance of new utility-scale projects (wind farms, solar parks, and biofuel and solar thermal plants) accounted for almost 60% of the total and was the largest investment asset class. Investment in small-scale distributed generation projects (mainly solar PV) amounted to \$60 billion and accounted for more than 25% of total investment in renewable energy. For the first time, investment in renewable energy companies and utility-scale generation and biofuel projects in developing countries surpassed that in developed economies. China attracted more than a third of global investment during 2010, making it the leader for the second year in a row.



■ 2010 Market and Industry Highlights and Ongoing Trends

WIND POWER. The market maintained its 2009 level, with 38 GW added for a total of about 198 GW. For the first time, the majority of new wind power capacity was added in developing countries and emerging markets, driven primarily by China, which accounted for half the global market. Trends include continued offshore development, the growing popularity of community-based projects and distributed, small-scale grid-connected turbines, and the development of wind projects in a wider variety of geographical locations. Average turbine sizes continued to increase in 2010, with some manufacturers launching 5 MW and larger machines, and direct-drive turbine designs captured 18% of the global market.

SOLAR PHOTOVOLTAICS (PV). The PV industry had an extraordinary year, with global production and markets more than doubling in 2010. An estimated 17 GW of capacity was added worldwide (compared with just under 7.3 GW in 2009), bringing the global total to about 40 GW – more than seven times the capacity in place five years earlier. The EU dominated the global PV market, led by Italy and particularly Germany, which installed more PV in 2010 than the entire world did the previous year. The trend toward utility-scale PV plants continued, with the number of such systems exceeding 5,000 and accounting for almost 25% of total global PV capacity. Cell manufacturing continued its shift to Asia, with 10 of the top 15 manufacturers located in the region. Industry responded to price declines and rapidly changing market conditions by consolidating, scaling up, and moving into project development.

CONCENTRATING SOLAR THERMAL POWER (CSP). After years of inactivity, the CSP market has come back to life with nearly 740 MW added between 2007 and the end of 2010. More than half of this capacity was installed during 2010. Parabolic trough plants continued to dominate the market. Dramatic reductions in PV costs are challenging the growing market for CSP, at least in the United States, where several planned projects were redesigned to use utility-scale PV technologies. At the same time, project development is moving beyond the U.S. southwest and Spain to other regions and countries, particularly the MENA region.

SOLAR HOT WATER/HEATING. Solar heating capacity increased by an estimated 25 GW_{th} in 2010 to reach approximately 185 GW_{th}, excluding unglazed swimming pool heating. China continues to dominate the world market for solar hot water collectors. Europe's market shrank during 2010 due to the economic recession, despite the emergence of some new players, but it continued to rank a distant second. While virtually all installations in China are for hot water only, there is a trend in Europe toward larger combined systems that

provide both water and space heating. A number of solar industrial process heat installations came online during 2009 and 2010 in China, Europe, the United States, and elsewhere.

BIOMASS POWER AND HEAT. Biomass supplies an increasing share of electricity and heat and continues to provide the majority of heating produced with renewable sources. An estimated 62 GW of biomass power capacity was in operation by the end of 2010. Biomass heat markets are expanding steadily, particularly in Europe but also in the United States, China, India, and elsewhere. Trends include increasing consumption of solid biomass pellets (for heat and power) and use of biomass in combined heat and power (CHP) plants and in centralized district heating systems. China leads the world in the number of household biogas plants, and gasifiers are used increasingly for heat applications in small and large enterprises in India and elsewhere. Biomethane (purified biogas) is increasingly injected into pipelines (particularly in Europe) to replace natural gas in power and CHP plants.

BIOFUELS. Liquid biofuels provided about 2.7% of global road transport fuels in 2010. The global ethanol industry recovered in response to rising oil prices, with production increasing 17% in 2010, and some previously bankrupt firms returned to the market. The United States and Brazil accounted for 88% of global ethanol production; after several years as a net importer, the United States overtook Brazil to become the world's leading ethanol exporter. The EU remained the center of biodiesel production, but due to increased competition with relatively cheap imports, growth in the region continued to slow. The diversity of players in the advanced biofuels industry continued to increase with the participation of young, rapidly growing firms, major aviation companies, and traditional oil companies.

GEOTHERMAL POWER AND HEAT. Geothermal power plants operated in at least 24 countries in 2010, and geothermal energy was used directly for heat in at least 78 countries. Although power development slowed in 2010, with global capacity reaching just over 11 GW, a significant acceleration in the rate of deployment is expected as advanced technologies allow for development in new countries. Heat output from geothermal sources increased by an average rate of almost 9% annually over the past decade, due mainly to rapid growth in the use of ground-source heat pumps. Use of geothermal energy for combined heat and power is also on the rise.

HYDROPOWER. Global hydropower production represented about 16% of global electricity production in 2010. An estimated 30 GW of capacity was added during the year, with existing global capacity reaching an estimated 1,010 GW. Asia (led by China) and Latin America (led by Brazil) are the most active regions for new hydro development.

OCEAN ENERGY. At least 25 countries are involved in ocean energy development, and wave and tidal technologies saw significant progress toward commercial generation during 2010. At year's end, an estimated total of 6 MW of wave (2 MW) and tidal stream (4 MW) capacity had been installed, with most of this capacity in Europe.

Continued strong growth is expected in all renewable energy sectors in the coming years, with projects at various stages of development around the world. China alone plans to install more than 30 GW of wind power capacity during 2011 and 2012, and significant additional capacity is under construction in India, the United States, United Kingdom, and other countries. At least 5.4 GW of solar PV capacity was under contract in the United States by the end of 2010. Globally, nearly 2.6 GW of additional CSP capacity was under construction by year's end, with all plants expected to be operational by 2014. Significant geothermal power capacity (and CHP) was in project pipelines around the globe by year-end, with 46 countries forecast to have new geothermal capacity installed within the next five years. Major developments are under way for hydropower, ocean energy, and other renewable technologies as well.

For more 2010 data and country rankings, see the Selected Indicators and Top Five Countries tables on page 15.

■ A Dynamic Policy Landscape

Renewable energy support policies continued to be a driving force behind the increasing shares of renewable energy, despite some setbacks due to the lack of long-term policy certainty and stability around the world in 2010.

National targets now exist in at least 96 countries. These targets represent commitments to shares of electricity production (typically 10–30%), total primary or final energy, heat supply, installed capacities of specific technologies, and shares of biofuels in road transport fuels. Many targets also exist at the state, provincial, and local levels. Although some targets were not met or were scaled back, many countries achieved or exceeded their targets set for 2010, while Sweden passed its target for 2020. Existing targets were raised in a number of countries including Finland, Germany, Spain, and Taiwan, and entirely new targets were adopted in South Africa, Guatemala, and India, among others.

Renewable power generation policies have been implemented in 96 countries and represent the most common type of renewables support policy. The feed-in tariff (FIT) remains the most widely implemented policy, in place in at least 61 countries and 26 states/provinces worldwide. Most FIT-related activity in 2010 focused on revisions to existing policies in response to strong markets that exceeded expectations, particularly in the

case of PV. New FIT policies were implemented in several developing/transition countries in 2010 and early 2011. Renewable portfolio standard (RPS)/quota policies have been enacted at the national level in 10 countries and in at least 50 other jurisdictions, including 30 U.S. states (plus Washington, D.C.) and the Canadian province of British Columbia, which requires that 93% of new power capacity be renewable.

Many additional types of policies are being implemented to support renewable power generation, including direct capital investment subsidies, grants, or rebates; tax incentives; energy production payments or credits; and public financing. Net metering, or “net billing,” policies exist in at least 14 countries, including Italy, Japan, Jordan, and Mexico, and in almost all U.S. states. Green energy purchasing and labeling programs are growing with more than 6 million green power consumers in Europe, the United States, Australia, Japan, and Canada.

Although enacted less aggressively than policies to promote renewable electricity or biofuels, many policies to support renewable heating and cooling have emerged in recent years. New policies introduced since the beginning of 2010 include the United Kingdom’s innovative Renewable Heat Incentive and a grant program in South Africa. Governments have traditionally relied on direct capital grants and tax credits to spur investment in renewable heating systems, but new policies providing public budget neutrality have been gaining favor. Solar hot water mandates for new construction projects represent a growing trend at both national and local levels.

Mandates for blending biofuels exist in 31 countries at the national level and in 29 states/provinces. Subsidies and tax exemptions are also used to promote biofuels. Finland, Ethiopia, Thailand, and Spain all revised existing biofuels policy legislation in 2010, and South Korea and Jamaica implemented new blending mandates.

City and local governments continue to become increasingly important players in promoting the local generation and use of renewable energy. Local support policies include renewable energy targets; urban planning that incorporates renewable energy; building codes that mandate or promote renewable energy; tax credits and exemptions; investment in renewable energy for municipal buildings and transit; subsidies, grants, or loans; as well as a variety of informal, voluntary actions to promote renewable energy at the community level.

■ Rural Renewable Energy

In even the most remote areas, renewable energy is increasing access to basic energy services – including lighting and communications, cooking, heating and cooling, and water pumping – and generating economic growth. PV household systems, wind turbines, micro-hydro powered or hybrid mini-grids, biomass-based systems or solar pumps, and other renewable technologies are being employed in homes, schools, hospitals, agriculture, and small industry in rural and off-grid areas of the developing world.

The number of rural households served by renewable energy is difficult to estimate as the sector becomes driven increasingly by individual project promoters or private companies, but it runs into the hundreds of millions. Small solar PV systems provide power to a few million households, and micro-hydro configured into village- or county-scale mini-grids serves many more. Over 44 million households use biogas made in household-scale digesters for lighting and/or cooking, and more than 166 million households now rely on a new generation of more-efficient biomass cookstoves.

Off-grid renewable solutions are increasingly acknowledged to be the cheapest and most sustainable options for rural areas in much of the developing world. This will have an impact on market development in the long term, especially if the barriers to accessing information and financing products are addressed.