Bloomberg NEW ENERGY FINANCE

The Business Council for Sustainable Energy®

SUSTAINABLE ENERGY in America 2013 Factbook

Executive Summary

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EXECUTIVE SUMMARY

A revolution is transforming how Americans produce, consume, and even think about energy. Traditional sources are in decline, while natural gas, renewables and energy efficiency are on the rise. These changes, which show no sign of abating, have far-reaching implications for US economic and national security interests. They are increasing the diversity of the country's energy mix, improving our energy security, and rapidly shrinking our 'carbon footprint' – a major positive development for addressing climate change.

Behind this revolution are a slew of new energy innovations, technologies, and applications. These include: newly applied techniques for extracting natural gas from shale rock formations; lower-cost and higher-efficiency photovoltaic panels for converting sunlight to electrons; highly efficient, natural gas end-use applications; vehicles fuelled by electricity and natural gas; and 'smart meters' that allow consumers to monitor, modulate, and cut electricity consumption.

This Factbook – researched and produced by Bloomberg New Energy Finance and commissioned by the Business Council for Sustainable Energy – offers a fresh look at the state of US energy along with the roles these new technologies and innovations now play. Its goal is to offer simple, easy-to-understand benchmarks on the contributions these new energy technologies are making today. It also provides information on finance and investment trends in clean energy resources.

What's unique about this Factbook

- First, the report is **quantitative and objective**, intended to arm policy-makers, journalists, and industry professionals with up-to-date, accurate market intelligence.
- Second, the report looks at **clean energy broadly defined**. The Factbook takes the pulse of the wide range of clean energy industries represented by the Council, including natural gas, renewable energy sources (including solar, wind, hydropower, geothermal, and biomass – but excluding liquid biofuels), distributed power, and energy efficiency.
- Third, the report **fills important data gaps**. For example, data sources and economic models of the US energy industry often fail to capture the full contribution of sectors such as distributed generation. This Factbook seeks to quantify accurately some sectors that are currently small but growing rapidly.

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The US energy sector is undergoing dramatic change

- Total energy use fell 6.4% between 2007 and 2012, according to preliminary estimates, driven largely by advances in energy efficiency.
- Use of natural gas and renewable energy have increased, while other major energy sources such as coal and oil have experienced significant declines. Natural gas provided the US with 27% of its total energy supply in 2012, and renewables (including hydropower) supplied 9.4%.
- In the electricity sector, lower- and zero-carbon power sources are growing. Natural gas-fired power plants provided 31% of US electricity in 2012, up from just 22% in 2007. Renewable energy generation has meanwhile grown from 8.3% to 12.1% over that period. These technologies, which include wind, solar, geothermal and hydropower, represented the largest single source of new capacity growth in 2012, with more than 17GW added.

Factbook highlights

- *The need for reliability will increasingly be met by the advantages of flexibility.* Ensuring ongoing reliability will become an even tougher challenge for electricity market operators and regulators, given the diminished role for coal and the increased presence of variable resources (ie, intermittent renewables). Yet other changes afoot – including reduced electricity demand through energy efficiency; the introduction of smart grid technologies for improved grid management; and the growing role for dispatchable resources such as natural gas plants, hydropower, and demand response – can help the electricity industry meet this challenge. Still, most market structures do not yet fully recognize the benefits of some of the technologies offering increased flexibility, such as energy storage.
- *The shift in the US energy sector is not just about technologies and fuels, but also about markets.* The country's power sector – long skewed towards large, centralized systems such as coal plants – is beginning to open up to a wide range of small, distributed power generators, including combined heat and power (CHP) generators (mainly fuelled with natural gas), and fuel cells, and small-scale renewables. In addition, electricity market structures are evolving: over the past decade, 40 states have passed policies that enable profits to be decoupled from the amount of energy (electricity, natural gas, or both) that private utilities sell, in order to encourage economical investment in improved efficiency.
- *Estimated total new investment in US clean energy was $44.2bn in 2012.* This amount, which includes investments in most renewable and energy efficiency technologies but excludes natural gas, is well above the $10.4bn figure from 2004, when Bloomberg New Energy Finance first started tracking these investments. However, it marks a 32% decline from 2011, largely due to uncertainty over the fate of certain federal incentives that support financing for renewables.
- *Total US installed capacity of natural gas (442GW) plus renewables (187GW) is now at 629GW (58% of the total power generating mix) – up from 605GW (56%) in 2011 and 548GW (54%) in 2007.* Between 2008 and 2012, the US nearly doubled its renewables capacity from 44GW to 86GW (excluding hydropower, which itself is the single largest source of renewable power, at 101GW as of 2012). Recent years have also seen rapid growth in digital energy controls (eg, smart grid deployments and demand response controls), and energy efficiency (eg, building

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retrofits). Some sectors have seen relatively low deployment thus far but have the potential to have a major impact: these include fuel cells and energy storage.

- *Natural gas is in the midst of a remarkable boom.* The emergence of new technologies has enabled the commercially viable extraction of unconventional natural gas resources including shale – a domestic, abundant, low-cost fuel (a mild winter in 2011-12 pushed prices down even further). Utility investments into natural gas infrastructure – such as pipelines, compressors, and meters – totalled $17bn in 2011.

- *Low natural gas prices can both complement and conflict with other energy sources.* For wind power in particular, cheaper gas has made it difficult to compete economically, though the one-year extension of the Production Tax Credit in 2013 has strengthened the business case for wind in the short term. Yet gas generators, which are inherently flexible technologies that can be easily ramped up and down to meet demand, are natural counterparts for variable resources such as wind and solar. Other options, such as combined heat and power (CHP), and fuel cell installations, which draw on natural gas for fuel, have become more competitive as natural gas prices decline.

- *The levelized costs of electricity for renewable technologies have plummeted.* For example, the cost of electricity generated by average large solar power plants has fallen from $0.31 per kilowatt-hour in 2009 to $0.14 per kilowatt-hour in 2012, according to our global benchmarking analysis based on already financed projects from around the world. (These figures exclude the effect of tax credits and other incentives, which would bring those costs down even lower.) Over the same period, the cost of power from a typical large wind farm has fallen from $0.09 in 2009 to $0.08 per kilowatt-hour.

- *Energy efficiency is making its mark on the grid and on buildings.* Since 1980, energy intensity of commercial buildings has decreased by over 40%, propelled by increasingly sophisticated approaches to financing for energy efficiency retrofits, as well as by standards, such as those that apply to heating and cooling units and to thermal performance (ie, insulation). Overall, US utility budgets for energy efficiency reached $7bn in 2011 (the latest available date for which data exists). Demand response capacity, which typically involves the curtailment of electricity consumption at times of peak usage, has grown by more than 250% between 2006 and 2011, allowing major power consumers such as manufacturers to cut their energy costs and utilities to scale back production from some of the costliest power plants. Some 46m smart meters have been deployed in the US, while spending on smart grid roll-outs hit $4.3bn in 2012, up from $1.3bn in 2008.

- *Policy is potent.* Though the levelized costs of electricity of many renewable generation technologies have fallen drastically, most of these technologies still rely on incentives to compete. State-level mandates have been important drivers for renewable growth in the US, though in the case of most states, quotas for the next several years have already been satisfied. Policy measures have also helped further the cause of energy efficiency: Energy Star-certified commercial building floor space has increased by 139% from 2008 to 2012, and the stringency of building air conditioning efficiency standards has increased by up to 34% since 2005. There are, however, some clean energy technologies which are ready (or on the brink of being ready) to operate in the marketplace without any incentives or policy directives at all.

- *Evolution of the transport sector mirrors that of power.* The country's ground transport sector is undergoing its own transition prompted by advances in technology and new fuel economy requirements. Corporate average fuel economy (CAFE) standards calling for the efficiency of US

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light-duty vehicles are scheduled to nearly double by 2025 compared with the 2011 average. Hybrids, plug-in electrics, and natural gas vehicles are growing in prominence; sales for the first two reached 488,000 vehicles in 2012 (3.25% of US passenger vehicle sales), and natural gas use in the transport sector (particularly among buses and light trucks) increased by 26% over 2008-11. In addition, a number of major automakers are aiming for commercial roll-out of fuel-cell electric vehicles by 2015. These developments, along with a growing role for biofuels, have driven gasoline consumption down 5.7% from its 2007 peak. These advanced vehicles largely still rely on incentives to be economical.

- *One winner from all of these developments is US air quality.* Reduced air pollution and emissions of greenhouse gases are a welcome consequence of the changes underway in the country's energy mix. The reductions in coal generation, ascendancy of gas, influx of renewables, expansion of CHP and other distributed power forms, adoption of demand-side efficiency technologies, rise of dispatchable demand response, and deployment of advanced vehicles are all contributing to the decline in carbon emissions from the energy sector (including transport), which peaked in 2007 at 6.02Gt and have dropped by an estimated 13% since. They are now at their lowest level since 1994.

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