

KEY RENEWABLE ENERGY SECTORS

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No-one can predict with any certainty what the energy mix will look like in 2030, let alone 2050. Fossil fuel generation will undoubtedly still be a substantial part of the equation. However, it is clear that any future low carbon energy infrastructure will have to include a significant proportion of energy generated from renewable sources – most scenarios showing the proportion of primary energy having to reach 40-50% by 2050. Some of the leading technology contenders are emerging and, in some cases have begun to build significant experience.

In this article eight renewable energy technologies which look particularly promising in terms of two factors: abatement potential and current state of competitiveness. This Article will look at some of the other technologies – principally around the digital/smart grid, energy efficiency, power storage and carbon capture and sequestration – which will be required if low carbon energy is to fulfill its full potential within the future energy mix.

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Onshore Wind

The most mature of the renewable energy sectors, the onshore wind industry saw 21GW built in 2007, bringing installed capacity to over 100GW. In Germany, Spain and Denmark wind power now supplies 3%, 11% and 19% respectively of total electricity production during the course of the year, and in Denmark up to 43% of the country's electricity demand at times of peak wind supply. Electricity from onshore wind can be generated at prices of 9-13 c/kWh, making it only 32% more expensive than natural gas CCGT, even in the absence of a carbon price.

Offshore Wind

When the best sites for onshore wind have been snapped up, the next place to look for large quantities of renewable energy is offshore.

Offshore wind offers enormous potential, with stronger more predictable winds and almost unlimited space for turbines. Planning permission can be easier to obtain than onshore, farms can be built at scales impossible on land, and the availability of space is almost unlimited if deep waters are mastered. At present, the cost of electricity from offshore wind is high – around 16-21 c/kWh.

Solar Photovoltaic Power

Photovoltaic (PV) technology has made very rapid strides in the past four years, in terms of reducing the cost of crystalline silicon (its main component) and commercializing thin film technology, with investment volume growing to US\$ 50 billion in 2007-2008.

Although there has been a bottleneck in the production of solargrade silicon, new capacity is coming on line and costs are set to drop rapidly from US\$ 4/W to US\$ 2.60/W by the end of 2009, making unsubsidized solar PV generation costs comparable with daytime peak retail electricity prices in many sunny parts of the world.

Cellulosic and Next Generation Biofuels

The argument over food vs fuel is an emotive one. In most regions, there is sufficient land to increase biofuels production from the current 1% of transport fuel to 3% or even 5% without impacting on food availability (as long as we can quickly return to increasing annual agricultural productivity). But after that the only way to increase production of biofuels will be to source feedstock that does not compete with food. Luckily, the cost of producing biofuels from agricultural waste through cellulosic conversion and algae is coming down rapidly, and the future fuel system is likely to include a proportion of fuels from these sources. Future technologies could include artificial photosynthesis and synthetic genomics.

Geothermal

Geothermal power is particularly attractive as a renewable energy source because it can be used as predictable base-load power in a way that wind and solar power cannot be. Until now, geothermal power has been used only in limited regions, but a raft of new approaches has helped make it economically viable across a wider area. In addition, all countries can exploit geothermal resources for ground source heat pumps or district heating, if not for large-scale electricity generation. It is important to emphasize that these are by no means the only clean energy sectors of promise.

There are many other emerging technologies – a wide range of biomass based power generation approaches, wave and tidal power, ground source heat pumps, ocean thermal and osmotic power – each of which has substantial potential and its fervent admirers. Nuclear power is also set for a renaissance in many countries around the world. Nuclear energy's share of total electricity production has remained steady at around 16% since the 1980s, when 218 reactors were built around the world. However, nuclear power will clearly be part of any future energy system, although its contribution will be limited by issues of cost, storage, safety and public resistance.