The roof of every home, office, retailer, school, hospital, government building and factory becomes an electricity generator – free power every day of the year.

What they are

Solar cell synthetic roofing slates or other similar products – clip fit, for rapid roofing / reroofing. Solar cells are part of the silicon revolution and prices are falling dramatically as techniques from the computer industry are applied to next-generation manufacturing.

How the work

Solar cells convert light into electricity. They produce some power even on cloudy days. The electricity is used to power the building, reducing the amount of electricity needed from the national grid. Surplus electricity can be sold back to the national grid.

Why they matter

It is easy to dismiss the collective power of solar cells but the future will see huge innovation in this area, because so much solar radiation is available, almost all wasted – and it is all free.

If used on a large scale, solar cells could significantly reduce carbon emissions. If a total land area 1% of the size of Texas was covered in solar cells with 30% efficiency, it would provide enough to power the whole of America. (National Renewable Energy Laboratory figures). Across the earth as a whole, ignoring clouds, every square metre of the earth receives 250 watts a day of solar power (insolation). Almost all this energy is lost back into space, while a tiny amount is used by plants to convert carbon dioxide into solid forms of carbon. Solar cells capture solar energy, push it down wires to energise electrical appliances. And when appliances are used, the energy is released once more as heat.

Challenges

Solar cells are still one of the most expensive ways to generate electricity. One reason is that high price means that few are sold, and manufacturers have not been able to create economies of scale. If a few more nations were to follow the lead of Germany and offer large subsidies, demand would increase rapidly and prices would fall.

Challenges

Paradoxically one of the challenges with solar cells has been lack of supply to meet rapidly growing demand, so retail prices have been far higher than one might expect given the falling costs of manufacture. As manufacturers catch up we can expect prices to fall even faster than would be the case with economies of scale and innovations.

Business potential

When solar cells are much more widely used, we can expect the cost of electricity generation to be similar to coal-fired power stations. Getting to that point will require government subsidies and regulatory changes, to force development of solar cell demand. Of course if coal-fired power stations are required to capture and store carbon dioxide emissions, then we will find almost overnight that solar cells become economically viable without additional subsidies.

We can see the impact of government action in Germany, where people installing solar cells are being offered 50 cents a unit for any electricity they wish to sell to the national grid – up to 5 times higher than the cost of electricity supplied normally. As a direct result in 2008 over half the entire global sales of solar cells were in Germany alone, and Germany's own solar cell industry was given a massive boost.

By the end of 2006, the solar generating capacity in Germany had already reached a theoretical maximum output of 2500 megawatts (bright sun shining on all panels at the same time), equivalent to the peak output of two or three medium sized coal-fired power stations.

Expect changes to happen very rapidly. For example, it is not hard to imagine a government passing new regulations requiring at least 25% of roof surface in new build homes and factories to be covered in solar panels. Expect every new roof of new homes in some regions to be at least partially covered by solar cells by 2020. Expect also that hundreds of millions of electrical devices and installations will be powered by their own solar cells – whether illuminated road signs, or robot lawn mowers or remote mobile phone transmitters. The global market could easily exceed £20bn a year by 2015 - four times the 2008 figure.

Solar cells are similar to computer chips: silicon-based, requiring high-tech large-scale manufacturing and strong patent protection. Expect global markets to be dominated by a

relatively small number of major manufacturers. Expect new technologies to produce solar panels which are much thinner and lighter than today, capturing more energy at lower cost. Expect fierce competition for supply / fit / servicing of solar panels.