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How to profit from the sun's rays

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As the relentless summer heat begins to descend on California, farmers in the region will be staring nervously at their crops. It's the irrigation systems they are worried about. With thousands of air conditioners being flicked on across the state, blackouts have become a regular scourge for farmers: their electrically-powered irrigation systems regularly cut out on the hot, dry days on which their crops need watering the most.

And it's the same story in China. Factories across the country often grind to a halt as the local grid struggles with surging electricity demand. In India, brand-new malls and offices are falling back on diesel generators after a spate of blackouts. Britain isn't immune either: only this week thousands of homes from London to Cheshire were left without power as the Sizewell B nuclear power station and the Longanett coal-fired power station in Fife went off-line at the same time.

This spate of global power cuts is not an easily solvable problem. With world electricity demand projected to double over the next two decades, and reserves of fossil fuels running thin, governments face the prospect of rolling blackouts if they don't find a new way to boost the supply of electricity. But how? Obviously, with an alternative of some kind. But which one?

The answer might just be **solar power**. It's clean, you don't have to look hard to find it, it doesn't place too much demand on already-stressed water and land reserves. And, best of all, it will soon be efficient and affordable enough to rival oil: solar technology is on the cusp of a breakthrough that will make it cheaper than oil, gas, and even nuclear power. All in all, it is about as close as we'll ever get to a silver bullet to deal with everything from global warming to energy security and peak oil.

Why it's different this time

You'll have heard this kind of talk about solar before – scientists long ago calculated that an hour's worth of the sunlight bathing the planet held more energy than the lot of us consume in an entire year. You'll also know that it has always ended in disappointment. The last time governments threw their weight behind solar was in the 1970s. Then a major breakthrough in the development of solar cells had dropped the price of making electricity from sunshine from $100 to $27 per watt. Overexcited governments, reeling from the oil shock, announced that it was to be the energy of the future – powering railroads, lighthouses and off-shore oil rigs, and a cheap way for the global economy to cut its dependence on the Middle East.

But it didn't quite work out like that. The solar panels turned out to be far too expensive and too unreliable, to say nothing of utterly useless at night. In the end, the only places that it took off were in remote regions – mountainous villages too far removed from civilisation to be supplied by national grids. The result? Despite the amazing potential of the sun, today it still accounts for under 1% of global electricity supply.

However, it might just be different this time. For starters, solar power has become an awful lot cheaper to produce and is very close to being genuinely competitive with carbon-generated electricity (which is more than you can say for, say, wind power). A brand new coal-burning plant today will typically deliver electricity at a price of $2 per watt. But advances in the use of silicon panels have seen the price of solar energy drop from $27 per watt in the 1970s to just $2.50 today – a 90% reduction in the space of 25 years.

So what's changed? The 1970 photovoltaic (PV) cell, the bit which converts light into electricity, only converted about 6% of the photons the sun beamed onto the panel. But today's paper-thin panels, gleaned from complex compounds of semiconductor material, can convert up to 25% of the sun's light into electricity – and the percentage is rising. American think-tank the Earth Policy Institute has estimated that if progress continues to go as forecast, production costs for PV cells will fall to just $1 per watt by 2012. That will make solar not just competitive with coal, but significantly cheaper (particularly if fossil fuel prices keep rising).

This doesn't seem to be a pipe dream. Recent developments in solar technology really are exciting. Solar scientists have found a number of energy-efficient metal compounds that will make all the difference. PV cells have traditionally been manufactured with silicon – layering the silicon sheets onto the glass of the solar panel. But by combining minor metals gallium, indium and germanium in the production of PV cells, you can produce solar cells with much thinner slices of material and at a fraction of the cost. These semiconductor materials can also be treated at much lower temperatures, requiring less energy and purity.

In fact, by simply "spattering" the semiconductor material on the panel, as Jim Mellon, author of *The Top Ten Investments for the Next Ten Years* puts it, the outlay of semiconductor material is reduced from 200 microns to less then ten per layer of film. The cost savings are immense, and the efficiencies should continue to rise more or less in line with Moore's Law – doubling every 18 months, says Mellon. And there's similar good news on another solar technology: thermal power plants. These aren't new – one was built in the Mojave Desert during the 1980s – but they could soon match coal and oil for price.

The plants work by using mirrors to heat oil in much the same way as you would use a magnifying glass to start a fire. The heat from the oil pipes is used to turn a steam turbine, which then generates electricity. The one in Mojave is twice the size of Central Park – a vast farm of mirrors that generates 354 megawatts of power as it tracks the sun across the sky. It costs eight to 12 cents to generate one kilowatt hour of electricity with thermal power, compared with about three to five cents to get the same amount by burning coal.

So it's still expensive – with the US government currently covering 45% of the development cost. But what could change this is scale. Thermal power plants are being spread over vast stretches of land – generating 100 megawatts of power where they used to produce one megawatt. As the power plants get bigger, the economies of scale will see the cost of thermal power drop considerably.

The only silver bullet we have

This is the bit that makes solar power our silver bullet. No other alternative energy source has a hope of matching the efficiency gains of solar and hence ending up so cheap. The problems with biofuels are well documented (as you increase your use of them, agricultural prices rise and so, as a result, do biofuel prices). Building hydro-electric dams is impractical – and countries such as China and India can hardly afford to flood vital farmland to build the dams, let alone the enforced urbanisation this would bring. And while we like the idea of nuclear power, the stations are expensive to build, waste is expensive to dispose of and public opposition is hard to overcome.

That leaves wind power, the only renewable energy source that has seen good efficiency gains in recent years. Wind towers with ten-metre-long turbines produced 200kWh-300kWh of energy in the 1970s. Today, those blades are likely to be 40 metres long, producing 2,500kWh at a cost of five to eight cents per kWh. But the problem is this: even now wind power is not cost competitive and, beyond increasing the size of turbines – which can't go on forever – the scope for a huge leap in efficiency is limited.

So how exactly will all this translate into powering our lives? Well, for starters, it means that it is already possible in many parts of the world to use solar to power your own house. In America, there are already as many as 350,000 households meeting their own energy needs, says Nick Rosen, author of *How to Live Off-Grid* – and it's growing at 30% a year. He estimates that there will be between four and five million Americans living off-grid within the next ten years. And even HSBC bowed to the promise of solar power this week, covering their tower in Canary Wharf with 617 square meters of solar panelling, insisting as they did so that it was not a publicity stunt but an investment, the return on which they are "happy" with.

At the same time huge, PV 'farms' have been springing up around the world. Germany has led the way, accounting for half of all the solar PV cells installed globally – 2.5 gigawatts (GW) of installed capacity. But

we can expect that to rise to 100-150 GWs over the next ten years, according to Jim Mellon, thanks to a generous system of subsidies.

The key to solar's popularity in Germany has been the aggressive subsidies that Berlin has poured into sector. In the late 1990s, Germany set up a feed-in tariff system, where anyone connected to the national grid can sell solar power to utilities at four times the market price. That's a guaranteed price of 55 cents to 57 cents per kWh, against the 8.4 cents made on wind power. No wonder then that German farmers have wasted no time buying into solar – barns were glazed with PV cells and cows cleared off the land to make way for gleaming rows of solar panelling.

In Japan, solar has also been heavily subsidised. Having offered residents generous sums to glaze their roofs with solar panels since the 1990s, the Japanese government is expecting 30% of all households to have panels installed by 2030. That's 14 million homes, producing 1.3 million kWh. Germany and Japan's example is being copied all around the world. Feed-in-tarriffs have now been adopted by 19 European Union countries and 47 worldwide.

And according to the US Energy Information Administration, grid connected solar power will increase thirty-fold to 1,800 megawatts by 2025. That should mean that the global market for PV cells will more than double over the next five years. Add it all up and the solar-power industry – already worth $12.9bn – is set to keep growing at around 15% a year.

Still, before we all get too excited, note that these run-away figures ignore a couple of problems that solar power will face in the next two years – ones that a careful investor should be very much aware of. While Germany has been happy to strong-arm utilities into buying solar power from farmers at four times the market price, they can't be that generous for too long. In 2009, Germany will start scaling back its subsidies. And Spain could soon follow.

The pace of growth in solar will also be stung by a shortage of silicon. Competition with the microchip industry for silicon has resulted in a serious supply crunch, and the margins of PV cell producers will be squeezed until polysilicon manufacturers catch up with demand. There is likely to be a serious shakeout in the next two year for those solar-panel makers who are heavily dependent on subsidies and silicon-based panels, warn analysts at Citigroup.

However, buying into bog-standard solar panel manufacturers is hardly the only way to invest in the sun. Here, we have a look at some of the firms driving the business forward.

The hottest stocks in the sector

Big solar stocks such as Suntech Power Holdings, Sharp and Q-Cells have had a formidable run in the last few years. But if they stick to producing silicon-based solar cells they are likely to lose ground to companies such as **First Solar** (Nasdaq:FSLR). The company is two years ahead of its peers in delivering a product that is cost-competitive with grid electricity. The technology has enabled its cost per watt to go from $1.60 in 2005 to $1.20 last year, and will likely be below $1 next year, say Citigroup analysts.

As a result, earnings per share (EPS) should increase from $3.34 this year to $11.29 in 2010. That puts the stock on a relatively expensive forward p/e of 24 for 2010, says Citigroup, but they note that this is the big player in thin-film technology and say they expect a 60% upside on the stock.

Another pure play on thin-film technology is **Daystar Technologies** (Nasdaq:DSTI). Daystar makes thin-film cells with copper, indium, gallium and selenium. The company has suffered a little over the past few years after an onerous financing deal in 2006 that hindered its ability to deliver its low-cost solar panels. It is not turning a profit as a result. Yet Daystar is one of the few firms at the forefront of the new semiconductor-produced solar cells, and could be poised for a serious rebound, say analysts at Northland Securities, as thin-film solar takes off and the company finds capital for its excellent product.

Another producer is **Trina Solar** (NYSE:TSL), which has cut long-term deals with its big partners and is still performing very strongly. In its most recent report, earnings jumped from $4.6m to $15.7m year-on-year on the back of a major production boost. EPS are expected to rise from $1.46 to $2.88 this year, and again to $4 in 2009. The company trades on a forward p/e of 11.3.

With the supply crunch in polysilicon eating into the margins of more traditional PV-cell producers, silicon is also a good bet. **MEMC Electronic Materials** (NYSE:WFR), the leading American producer of silicon wafers, has performed very strongly, with earnings growing at 25% to 30% a year. But it is ramping up production and has signed long-term agreements that will be worth $15bn to $18bn over the next seven years. So analysts at Lehman Brothers believe is still has a long way to go. The investment bank

maintains a target price of $90 on the stock – it currently trades on $67 and an attractive forward p/e of 12.9.

However, the best way to play solar is to invest in the materials themselves, says Jim Mellon. There a number of companies focusing on producing the metals that make up the thin-film technology that is replacing traditional PV cells. **Dowa Mining**, (JP:5714), for example, is the world's largest producer of gallium, while **Bluglass** (AX:BLG) is an Australian producer of gallium.

These metals are in short supply and the companies producing them will have a firm grip on developments in thin-film solar panels. As Jim Mellon pointed out in last week's Roundtable, you'll also be able to get good exposure across these metals when his Emerging Metals company lists on Aim in the coming months. For a broader exposure to the next revolution in solar power, there are two solar ETFs from **Claymore** (NYSE:TAN) and **VanEck** (AMEX:KWT).

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