



new energy finance MONTHLY BRIEFING

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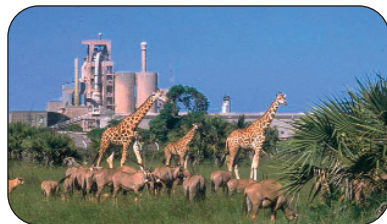
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SILICON BOTTLENECK: WHAT HAPPENS WHEN IT UNCLOGS?

MONTHLY VIP BRIEF



By Michael
Liebreich

Chairman & CEO,
New Energy Finance

Everyone knows that the solar sector's silicon bottleneck will unclog eventually but what will the resulting fall-out look like?

That's a question many within the industry, including all of us at New Energy Finance, have contemplated with increased frequency and urgency in the last 12 months. With new silicon refining facilities planned from China to Idaho and many points between, capacity is expected to rise rapidly over the next two years.

For some time now, we have argued that when the huge wave of new solar-grade silicon floods down the solar value chain, players at every stage will see their margins squeezed as they suddenly have to compete for market share (with the possible exception of installers, who might be capacity constrained by skill shortages). There have been no policy changes substantial enough to absorb the capacity coming online at current prices. This margin pressure looks set to hit the PV cell and module makers in the middle of the value chain - the Suntechs, SunPowers, and Q-Cells of the world - harder than many in the market are expecting. These happen to be the firms that have absorbed the most investor dollars via the public exchanges.

Today, it is no exaggeration to say that millions of investors of all stripes, from hedge fund managers to school teachers, have a stake in

the success of photovoltaic power. As of the end of August, the biggest single backer of publicly-traded PV companies was Boston-based mutual fund powerhouse Fidelity. The company held large stakes in Evergreen Solar (13.3%), Q-Cells (12.6%), Energy Conversion Devices (12.2%) and Suntech (12.1%), plus holdings in 10 other solar firms. Legg Mason, another major mutual fund player, held major stakes in a similar list of firms including SunPower (12.1%). If and when a major correction comes along for these stocks, the pain will be felt far and wide by the investors these mutual fund giants represent, and not just in their traditional brokerage accounts but in their retirement or pension plans.

The solar sector is, like all clean energy sectors, relatively young. Technology is still evolving, markets are still heavily subsidised, and companies have little or no profitability track record. One would expect such a sector to be volatile, but the level of volatility seen on the public markets in recent months has been extraordinary. Consider the one-week period of 5-12 November. Thin-film module maker First Solar announced strong earnings and a new supply deal, and watched its shares surge 33%.

The next week, solar shares across the board plummeted after the Solar Energy Industries Association warned that the current federal investment tax credit appeared unlikely to make it into the final version of the US Energy Bill being put before Congress. Chinese cell maker Yingli Energy was hardest hit, falling 17%. SunPower dropped 15% and the previous week's darling First Solar lost 14%. Little did it matter to investors that the US market accounted for just 9% of Yingli's

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sales in 2006, or that the federal credits are due to stay on the books until the end of 2008, giving Congress plenty of time to extend them, even if the current Energy Bill goes down in flames.

With volatility like this, it's not uncommon for a sell-side public equities analyst's upgrade of a solar stock to result immediately in a 5%-10% spike in its share price.

This in itself would not be too much of a worry, if at least the analysts had access to all of the information they would need in order to undertake a robust valuation. But they don't.

Although there is lots of information about the growth of the solar sector and of individual company sales, solar cell makers and their silicon suppliers almost never disclose details of the volume, duration, and most importantly, per-kilogram price of their long-term procurement agreements with silicon refiners.

This is no trivial matter, given the current shortage of silicon and the important role it plays in any cell producer's cost structure. As of 30 September, SunPower had \$2.3bn in total obligations related to supplier agreements lasting as long as 13 years. The company did not say how much of that is related to silicon procurement, but it's a safe bet that much of it involves feedstock. To put that in context, SunPower had \$1.5bn in assets on its books at that time.

For their part, cell makers say they do not provide full details about their deals because they are looking to maintain a competitive edge over their rivals. And indeed lack of full

disclosure is clearly the industry norm. The one exception is JA Solar, which has disclosed prices around USD 210 per kilogram for the next one to two years.

Investors can, of course, look back at the cost of goods in a company's income statement and, with an educated guess or two, figure out how much was paid for silicon in the prior period. But share prices are determined on a look-ahead, not a look-back basis, especially in an industry growing as fast as solar.

Despite its obvious materiality in determining the health of these companies, there is nothing in law to force them to disclose information on their supply contracts, according to securities law experts in the US, where most cell makers trade. Companies are allowed to withhold the details of procurement deals even from their shareholders in the name of competition, it seems.

The current conventional wisdom among many investors is that cell makers with long-term silicon deals are the safest bets because they are not beholden to the spot market, where the commodity sells as high as USD 300 per kilogram. The assumption is that the long-term deals that are being signed will represent reasonable value for the buyer and, in theory, some degree of flexibility. However, there is simply no way to confirm that, given what companies currently disclose.

So back to the question of what happens when the silicon bottleneck unclogs. The current risk is that some cell makers are locking themselves into over-priced, long-term deals merely to meet Wall Street's myopic quarter-to-quarter

expectations. But when silicon drops from long-term contract current prices of USD 60 - USD 90 per kilogram to prices nearer their long-term average of USD 30 - USD 50, these firms and their investors will be out of luck. As cell manufacturers without high-price long-term contracts drive down the price of cells and modules on the markets, those locked in to high silicon prices are likely to see their balance sheets destroyed. That is when the consolidation in the industry would really heat up - the odd purchase of a solar installer would be nothing compared to the shake-out ahead.

And when the time comes, don't be too surprised to see a slew of class action lawsuits from disgruntled investors claiming they were not made aware of the dangers ahead.

A solar crash, driven by companies using IPO proceeds to enter into high-priced long-term silicon contracts, would not just hurt the industry's credibility with Wall Street but with mom-and-pop investors whose IRA's, 401(k)'s, or pension funds get hit. We at New Energy Finance believe investors and the industry would be best served if players put their cards on the table and disclosed the key aspects of all their major procurement deals. We would certainly encourage investors to demand as much information as possible from cell makers before taking the plunge. Reward companies that are most forthcoming about their supply deals. Punish those that are most reticent. And keep an eye on the development of new silicon processing facilities. Silicon supply is about to start growing faster than installation rates. These are dangerous times.

NEW ENERGY FINANCE WIND INSIGHT SERVICE

Portfolio Hunters: Focus on the Acquisition and Consolidation of Wind Power Assets



According to their published strategies and public statements, 20 global owners of wind power generation assets are planning to more than double their total onshore wind portfolios between now and 2012, through the addition of a further 28.4GW of capacity to the 23.2GW currently commissioned and operating.

"Portfolio Hunters", New Energy Finance's report on the acquisition and consolidation of wind power generation assets, is an in-depth look at the market and prices of these assets.

↘ To see the executive summary for this report please click [here](#).

↘ To purchase the report online, please click [here](#).

This report is available to members of the NEF Wind Insight Service at no extra cost. To find out more about Insight Services, please contact sales@newenergyfinance.com

Q3 2007: RENEWABLES POWER THROUGH CREDIT SQUEEZE

In July and August, as the world's debt markets imploded and liquidity dried up, it is doubtful whether anyone could have envisaged that clean energy asset financings would be enjoying their best quarter ever.

- By Rohan Boyle

While the Bank of England was bailing out troubled UK mortgage lender Northern Rock to the tune of GBP 31bn (USD 62bn) and banks on either side of the Atlantic were smarting from a series of write-downs on their loan books, renewable power projects were being bankrolled faster than ever.

A record 259 financings took place: this was 86 more than the previous best recorded in Q4 2006, and 103 up on Q2 2007 (see Figure 1). Activity seemed spurred on by the 'credit crunch' rather than curtailed.

Almost all of this increase was concentrated in new-build financings. Out of a total of USD 16bn, an estimated USD 13.7bn poured into new projects, surpassing the previous record by more than USD 1bn and dwarfing the value of similar deals in the previous three months by a resounding USD 5.1bn. The number of new-build deals at 227 was 101 more than in Q2.

Although investment has powered ahead and the sector appears to have weathered the turbulence well so far, it has not been entirely immune. "Generally, lenders are being more cautious about pricing," says Stefan Konhaeuser, a director of client relations at German bank WestLB. "Renewable energy is a megatrend and institutional investors are desperate to have a stake in these financings, but they are now being more cautious."

This is particularly so where syndication is involved. Simon Currie, a partner in the energy team at Norton Rose, the law firm, says, "If it is above a certain level, let's say EUR 100m, and will require underwriting and syndication rather than a club deal, then currently there is a lot more caution from potential providers of project finance. But deals involving

one to two banks should see only marginal changes in the terms and pricing of finance."

Generally, banks are now unlikely to agree to very high leverage and have also tightened the terms on which they lend. In addition, some flexible rate provisions have had to be triggered in order to get loan syndications away quickly. Spreads meanwhile have, on average, widened by 15-30 basis points since June, but recent cuts in interest rates by central banks have softened the blow.

Mark Muldowney, head of the global energy & utilities group at Fortis Bank in the UK, says that the impact has been relatively muted. "The impact of the credit crunch on projects has been limited to relatively highly leveraged deals," he says. "Margins had been under pressure and we might have expected to see further downwards pressure if the summer had continued. In some markets, spreads have risen rapidly but not

in renewable energy. Banks are happy to continue lending and renewable energy asset financing will continue to grow very quickly."

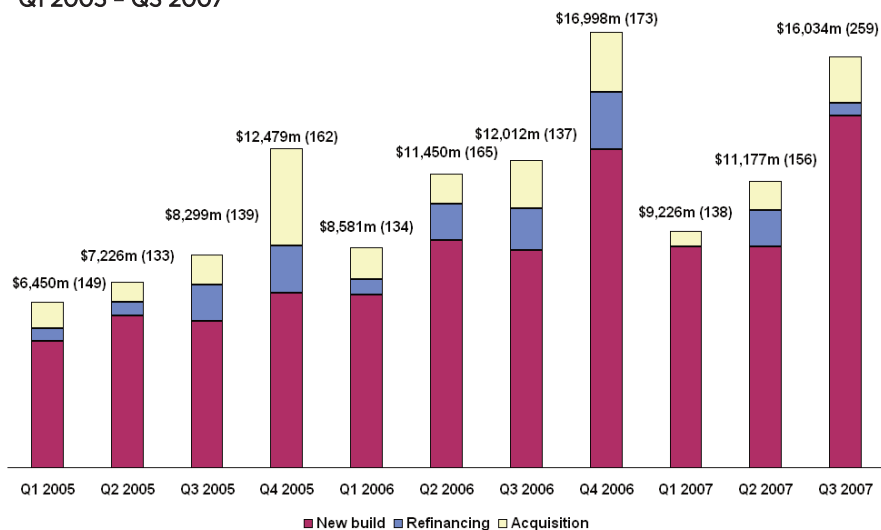
The reason, continues Muldowney, is that lenders have a higher level of confidence in renewable power projects. "Bankers know what they're getting into. They know the revenue stream and they know they can tie down the long-term activities of the projects. There is less uncertainty," he says.

Not only are bankers more certain of cash flows from projects, the deals are structured to provide protection to the lenders. In this regard, as well as the fact that clean energy projects are untainted by association with the residential mortgage market - the initial cause of the recent woes - they should maintain their appeal, provided, that is, they perform as expected and meet their predicted pro-forma cash flows.

Ultimately, though, clean energy projects vary widely across the different technologies and regions so that there can be no template and each project is financed on its own merits. "It all really depends on the structure of the deal and generally bankers prefer lower risk," says Konhaeuser.

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**FIGURE 1: GLOBAL ASSET FINANCINGS BY TYPE OF FINANCING
Q1 2005 - Q3 2007**



NOTE: Figures have been adjusted for estimated size of deals where no value was disclosed. Numbers in brackets refer to the total number of deals.

Source: New Energy Finance

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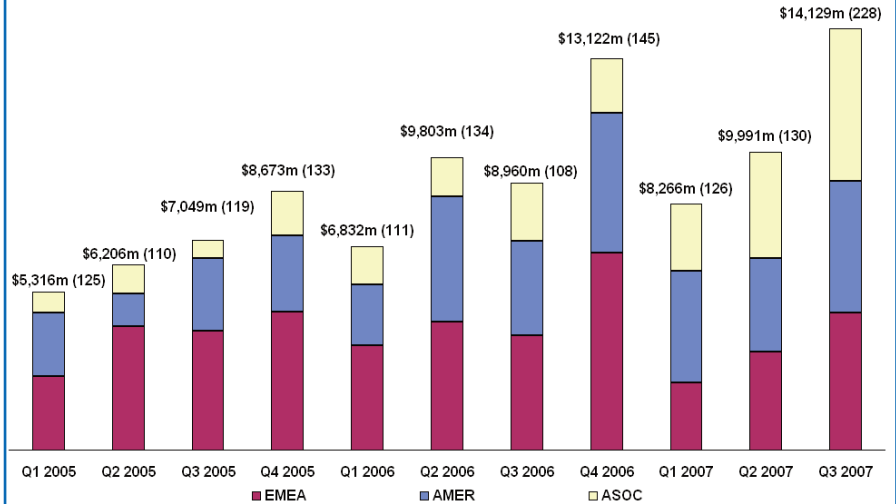
There were a number of hotspots in the third quarter. Biofuels was perhaps the hottest of the lot as the number of financings soared 250% from 28 in the second quarter to 73, and the value of deals more than doubled to USD 3.5bn, outstripping even the heady days of the US's ethanol binge in mid and late 2006 (see Figure 2).

Biofuels deals were so prolific that they accounted for the majority of project financings in the Americas in the third quarter: of the 85 deals that took place on the two continents, 47 were biofuels financings (see Figure 3).

Much of this activity took place in South America, chiefly in Brazil, where 11 new-build projects were financed. The arrival in 2003 of flex-fuel vehicles, which now make up 88% of the almost 2m cars sold annually, has created a large domestic market. The export market is also growing as OECD countries introduce ambitious biofuel consumption quotas, as grain prices remain high and volatile and as recognition grows that some biofuels are greener than others.

In one of the larger deals Brenco - bioethanol producer to the stars (it numbers Vinod Khosla, former World Bank president James Wolfensohn, AOL founder Steve Case, supermarket mogul Ron Burkle and film producer Steven Bing among its investors) - financed four 270m litre per annum (mlpa) ethanol plants.

FIGURE 3: GLOBAL ASSET FINANCINGS BY REGION Q1 2005 - Q3 2007



NOTE: Figures have been adjusted for estimated size of deals where no value was disclosed. Numbers in brackets refer to the total number of deals. Source: New Energy Finance

Brazil also has a growing biodiesel industry. Indeed, three of the 11 new-build financings in the third quarter were for biodiesel plants. In Argentina, where there were two new-build biodiesel financings, producers are geared towards export but from 2010 a 5% blend mandate will mean the domestic market will soak up more volume. Columbia too has a rapidly expanding biodiesel sector.

Activity in the US was also biodiesel flavoured: out of a total of 16 new-build biofuels financings in the third quarter, nine secured backing for new biodiesel plants.

Unfortunately for these producers, they now face the same challenges that have hampered the US bioethanol industry. Since the start

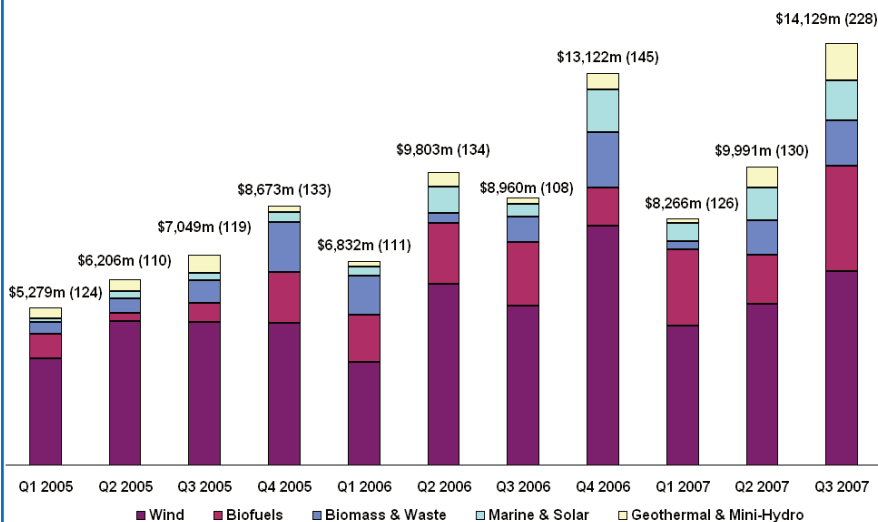
of the year, palm oil prices have jumped by 80%, putting margins under considerable pressure. But unlike the ethanol industry, US feedstock producers do not have the advantage of a tariff barrier and are not able to compete with imports from vast plantations in Malaysia.

Mascoma and the University of Tennessee have secured financing with the aim of finding a solution to this particular problem. The pair is building an 18.9mlpa cellulosic ethanol plant which they hope will be operational by 2009. But until they and many like them are successful, the biofuels industry in the US and Europe will have to contend with higher feedstock costs.

China accounted for the bulk of biofuels financings in Asia, despite the government's reluctance to endorse its grain-based ethanol production industry. In all, during the third quarter, the country saw six financings of new ethanol plants with a combined capacity of 1,021mlpa, and five biodiesel plants totalling 635mlpa.

European biodiesel producers not only have to contend with rising feedstock costs, they have the added problem of competition from 'splash and dash' traders. Fuel, often produced in Malaysia or Brazil, is exported from Europe to the US where it is blended with a minimum amount of mineral diesel to qualify for a USD 1 per gallon (USD 0.26 per litre) tax credit, before it is re-exported to the EU where subsidies are claimed again.

FIGURE 2: GLOBAL ASSET FINANCINGS BY SECTOR Q1 2005 - Q3 2007



NOTE: Figures have been adjusted for estimated size of deals where no value was disclosed. Numbers in brackets refer to the total number of deals. Source: New Energy Finance

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In Germany the industry is on its knees: according to the Federal Association of Biogenic and Renewable Fuels, 55% of German biodiesel capacity is idle and a large number of plants have been dismantled and transported abroad. Nevertheless, there were two new-build financings in the third quarter.

Financiers have not been impressed by what has happened in the sector. According to one banker, "This is the worst time possible to be looking for debt funding for a biofuel project in Europe."

Wind was also something of a hotspot in the third quarter as the number of deals almost doubled to 64 from 35 in the previous three months. Although the value increased by a smaller proportion to USD 6.5bn from USD 5.4bn, it was still by far and away the largest sector.

A surge in activity in China accounted for most of the increase, while the traditionally strong markets of the US and Europe were somewhat quieter. A total of 25 financings were recorded in China, equivalent to more than 1.4GW of capacity, with a value of approximately USD 2.2bn. This will go some way to achieving the government's ambitious wind targets as set out in its long-awaited Medium-to-Long Term Development Plan for Renewable Energy. The aim is to install 5GW of capacity by 2010, up from around 1.3GW in 2005, and 30GW by 2020.

Under the renewables plan, grid companies now have to buy a small percentage of their power from green sources, and the government has said it will establish 'reasonable' feed-in tariffs for renewable power.

In Europe, an estimated 1.4GW of new-build capacity secured financing in 22 deals worth approximately USD 2.6bn. There

was a scattering of financings in the wind heartlands of Spain, Portugal, Italy and the UK. In Greece, EEN Hellas, a subsidiary of EDF Energie Nouvelles, sponsored two new-build projects, and specialist wind investor Babcock & Brown financed a further two.

Overcrowded and more mature than most, the European wind market is ripe for consolidation: of the 13 wind acquisition financings worldwide in the third quarter, 10 related to European assets.

Babcock & Brown accounted for a sizable chunk of the activity as it has been buying up part of Gamesa's Spanish wind portfolio under an agreement that could potentially see more than 500MW of capacity change hands. Other notable deals included the acquisition by investment manager Christofferson Robb & Company of the UK's 300MW Thanet offshore wind farm project from Warwick Energy.

Competition for assets in Europe is such that utilities Eon, EdP and Iberdrola have been venturing across the Atlantic to the US where they have been buying up large swathes of that nation's projects.

In the US, 900MW of new-build wind projects secured financing in six deals. These were valued at an estimated USD 1.4bn, or USD 226m each, more than double the European average of USD 102m. Airtricity was behind two of the larger deals: the 209MW Roscoe and the 127MW Champion wind farms in Texas.

It had been hoped that the Energy Bill - currently undergoing a tortuous passage through Congress - would extend the production tax credit and introduce a renewable energy standard but, according to a recent report by the American Wind Energy Association, this now looks unlikely.

Solar PV asset financings in existing subsidised markets -

Germany, Spain, Italy, South Korea and California - maintained the momentum of previous quarters. There was a slight increase in deal value to USD 1.3bn from USD 1.1bn in Q2. Greece and France are largely markets-in-waiting, constrained by bureaucracy and the lack of building-integrated PV products, respectively.

In Spain, the feed-in tariff is heading for trouble. The industry is expected to pass the 371MW cap soon, two years early. This would effectively remove the subsidy, but the government has tabled a proposal that would increase the cap but lower the subsidy, thereby guaranteeing the continuing growth of the industry.

The German solar industry is also grappling with changes to its tariff regime. The government is expected to agree to more rapid depreciation of its PV feed-in tariff from 2009 with the final agreement on changes to be arrived at in December.

The quarter also saw evidence of a land grab for large-scale PV and solar thermal electricity generation (STEG) projects in California's Mojave Desert. So far, sites for 27GW of potential capacity have been earmarked.

In North Africa, a consortium of Iberdrola and Mitsui won the contracts for the 30MW solar/120MW natural gas Kuraymat STEG project in Egypt, signalling progress on a project that has been stalled for a long time.

The third hotspot was biomass and waste-to-energy financings. The number of deals leapt from 23 in Q2 to 43 in Q3 2007, but their value climbed at a slightly more leisurely pace to USD 1.5bn from USD 1.2bn. Again, as with wind financings, most of the surge took place in China. Of Asia's 25 deals, 19 related to Chinese assets.

The Chinese government has great hopes for biomass. There is currently 2GW of capacity but the recently published renewable

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Overcrowded and more mature than most, the European wind market is ripe for consolidation: of the 13 wind acquisition financings worldwide in the third quarter, 10 related to European assets.

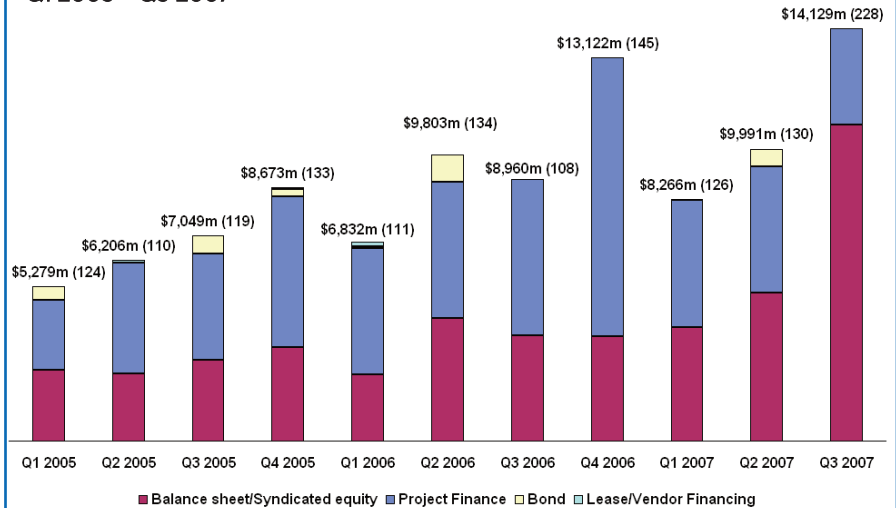
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energy plan envisages biomass technology taking a much greater role in the country's energy mix.

In the short-term, by 2008, the government is aiming to commission 400MW of agricultural (mainly straw-fired) and forestry biomass power plants and 50MW of biogas capacity. By 2010, the target is 5.5GW of biomass capacity and 19bn cubic metres of biogas (up from 8bn cubic metres in 2005) and by 2030, the plan is to have 30GW of biomass power generation capacity online, and production of 44bn cubic metres of biogas per year. This expansion is going to cost a significant amount: the government estimates USD 26bn.

Overall, the third quarter saw a swing away from project finance deals to on-balance-sheet financings (see Figure 4). The latter more than doubled to USD 10.8bn from USD 5bn during the previous quarter, while project financings declined to USD 3.3bn from USD 4.3bn. This is largely because of the recent boom in on-balance-sheet financings in the developing world: the jump in

**FIGURE 4: GLOBAL ASSET FINANCINGS BY TYPE OF SECURITY
Q1 2005 - Q3 2007**



NOTE: Figures have been adjusted for estimated size of deals where no value was disclosed. Numbers in brackets refer to the total number of deals. *Source: New Energy Finance*

transactions in the South American biofuels industry and the surge in Chinese wind and biomass and waste-to-energy deals.

The third quarter showed the industry's resilience to turmoil on the world's debt markets, although uncertainty will linger for quite some time to come. It

also saw a more marked shift in focus from the mature wind and biofuels markets of Western Europe and the US to the developing world. While the former are not in decline, the sharp growth seen in the late summer and autumn took place largely in the Far East and South America.



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Q3 2007: M&A HITS ANOTHER HIGH

Clean energy corporate M&A went stratospheric in the third quarter. More deals took place and more money changed hands than in any previous three-month period. The estimated USD 9.4bn worth of corporate transactions was a 225% increase on the same period last year and a 30% improvement on the previous quarter.

- By Rohan Boyle

So far this year, each successive quarter has set a new record for deal value. In our review of the second quarter in mid-August we reported that some market watchers were predicting an imminent slowdown in the general M&A market owing to overly high valuations. The signs, according to research by KPMG, were that deals were getting bigger but less frequent.

The clean energy sector certainly seemed to fit the bill: in Q2, deals had grown in size to an average of USD 183m from USD 110m over the past 12 months, and the numbers were down too (but they remained in line with the longer term average).

High valuations notwithstanding, deal activity bucked expectations and accelerated strongly through the late summer months and into autumn, seemingly unperturbed by turmoil on the world's debt markets. The total of 62 deals was an increase of 30%, and the average size remained high at around USD 175m per transaction (see Figure 1).

Mortimer Menzel, a founding partner of Augusta & Co, a small London-based merchant bank focusing on renewable energy, says that the high levels of activity and current high valuations are symptoms of the same thing - hype. "Valuations are very high at the moment because there is so much hype," he says. "The price of oil is very important but they are also being driven up every time there is a flood on TV. Look at Nordex and Repower. Nordex is taking a long time to sell and is surprisingly highly valued, and Repower was bought by Suzlon for more than 30x ebitda - it was in 'la la' land when it comes to valuations. The sector is growing fast but it still does not justify those sorts of multiples."

In the wider world, global M&A maintained its earlier momentum into July, according to Thomson Financial, and then faltered amid the deteriorating credit environment and investor uncertainty. By September, total deal volume had fallen to USD 192bn, down 66% from the heady days of July and its lowest level since August 2006.

In contrast, Dow Jones VentureOne reported that at the smaller end of the market there was something of an M&A boom in the third quarter. It reported that 90 venture-backed companies announced more than USD 10.5bn in M&A deals in the third quarter, a 31% increase over the same period last year and the highest quarterly amount since 2000.

Why the difference? One of the repercussions of the credit crunch was that it became harder to arrange debt syndication, which broadly speaking affected deals above USD 1bn. BusinessWeek reported that there were just three deals of more than USD 1bn in September, compared with 30 in May.

Another cause of weakness in the overall global figures is that the two-year boom in large private equity sponsored deals (not included in our analysis) came to an end as the flow of cheap and readily available capital began to dry up. Again BusinessWeek reported that global private equity sponsored M&A deals fell by 68% in Q3 2007 compared with the previous three months.

Although large-scale clean energy deals are generally few and far between, three significant wind company acquisitions took place in the three months to the end of September, which helped to propel the quarterly deal value into record

territory. They also ensured that wind was head and shoulders above the other sectors in terms of the value of deals completed (see Figure 2).

Right at the start of July, before credit issues began to surface, Goldman Sachs sold its Horizon wind energy business to Portuguese power utility EdP for USD 2.7bn. One month later, in August, Germany's Eon acquired the Iberian wind assets of Danish energy company Dong for USD 990m (early in Q4 the same utility agreed to buy Airtricity's North American operations for USD 1.4bn).

These deals were driven by the need to hedge against oil, coal and gas and to comply with national and international climate change legislation. Furthermore these European utilities, although not immune from credit concerns, have sufficient credit quality and ready access to the capital markets to carry out acquisitions on such a scale.

At the very end of the quarter, UK-based power generation company International Power finally completed its acquisition of the 648MW Trinergy wind portfolio for an enterprise value of EUR 1.8bn (USD 2.5bn). Syndication for the refinancing/acquisition loan has recently been launched and observers will be watching closely to see how successfully it is received in the market.

For the most part though, clean energy M&A deals are much smaller and are largely capitalised by equity. The boom in the US venture-backed M&A market is therefore, to some degree, being played out in the clean energy sector.

John Cavalier, a managing director and the chairman of the Global Energy Group of Credit Suisse, says debt is not something you see much of in clean energy. "The space is capitalised by equity," he says. "Look at the books of SunPower, First Solar, REC and EnerNoc - there is cash on balance sheet and little or no debt. This will be used to fund organic growth and to avail of opportunities

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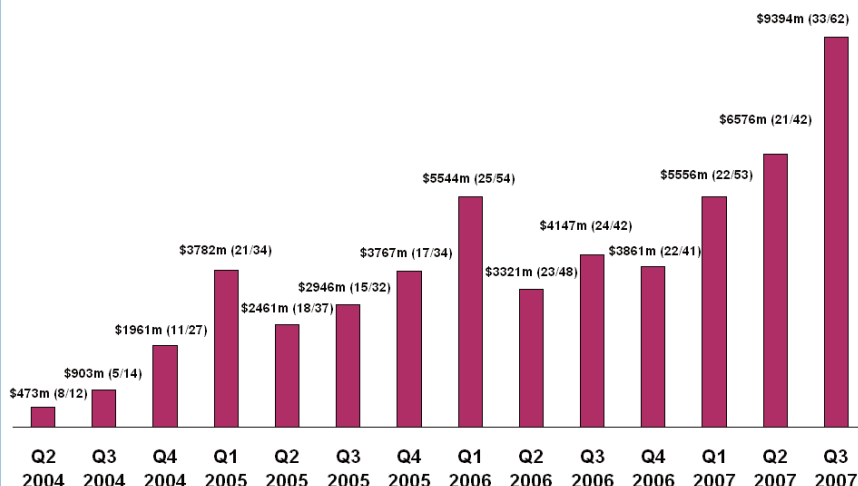
that present themselves.”

But when opportunities do arise, the bargains will be few and far between, judging by the level of interest in the sector. “There has been a surge in interest in cleantech in the US. Large sums are pouring into the sector from VCs. This has created enormous availability of capital in cleantech, some of which is filtering through to the wind and solar sectors,” says Menzel.

The sector is also attracting big-hitting investors, many of which are new to the sector. “Big US funds are now becoming interested. They ring me up and ask if there is anything they can buy in renewables. They are even moving into project finance,” he says, adding that more corporates are also keen to get involved. “Everyone who is a heavy polluter is getting into clean energy to appear to be green - they have to have a picture of the CEO leaning against a wind turbine on the cover of the annual report.”

No industry needs the help of a green makeover more than nuclear. So it was in mid-September that French nuclear giant Areva acquired a 51% stake in German off-shore turbine manufacturer Multibrid for USD 106m. Menzel, who acted for sellers Prokon Nord, says it is understandable that the move could be seen as a public relations exercise, but he defends both the motive and the price paid. “Areva has a real clean energy policy and always has,” he says. The French were up against a whole range of corporate financing options and investors, explains Menzel, but the price was based on a “normal, not nosebleed” valuation. Earlier in the year, the company’s efforts to buy another German turbine maker Repower were frustrated by Suzlon.

FIGURE 1: M&A DEAL VOLUME Q2 2004 - Q3 2007



NOTE: Figures have been adjusted for estimated size of deal where no deal value was disclosed. The numbers in brackets refer to the number of deals (disclosed/ total number of deals).

Source: New Energy Finance

Multibrid was not the only turbine company to attract interest from outside the sector. In September, Indian engineering firm Kalyani bought RSBconsult, a German wind turbine designer, with a view to creating a global turbine component supply business. Earlier, in July, Chinese electrical products manufacturer Guizhou Changzheng Electric Apparatus acquired a 55% stake in Guangxi Yinhe Avantis Wind Power, a researcher and developer of 2.5MW direct drive wind turbines. The firm expects to complete construction of its factory by December 2007 and to produce the first turbines in the spring of 2008.

The Multibrid deal was also a significant off-shore commitment. Despite the significant cost pressures and the limited scope for reducing costs in the near term, competition for off-shore opportunities seems to be hotting up. In September, New York fund managers Christofferson Robb & Company stepped into an arena dominated by utilities and bought the 300MW Thanet project situated 11km off the

southeast coast of England. It is thought the company will use its financial clout to secure a supply of turbines, then bring the project to completion and sell it on.

In a similar deal at the end of September, Australian financier Babcock & Brown purchased Bluewater Wind, the developer of the 450MW Delaware offshore project. The company didn’t reveal how much it paid for the project, which is slated to become the first offshore wind project in the US. Like CRC, Babcock has deep pockets and experience.

In yet another off-shore deal, Spain’s state-backed SEPI Desarrollo Empresarial bought a 10% stake in Capital Energy Offshore, a joint venture between Gamesa and Capital Energy that is developing three offshore projects with a potential capacity of 956MW.

The solar sector also had a good quarter. The 17 deals not only topped the previous quarter, it

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Everyone who is a heavy polluter is getting into clean energy to appear to be green - they have to have a picture of the CEO leaning against a wind turbine on the cover of the annual report. - Mortimer Menzel, Augusta & Co

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beat all other sectors. Furthermore this looks like continuing, judging by recent fundraising efforts: solar companies raised more money than any other sector from venture capital and private equity investors and on the public markets in Q3 (see the previous issue of the New Energy Finance Briefing Vol. V Issue 6).

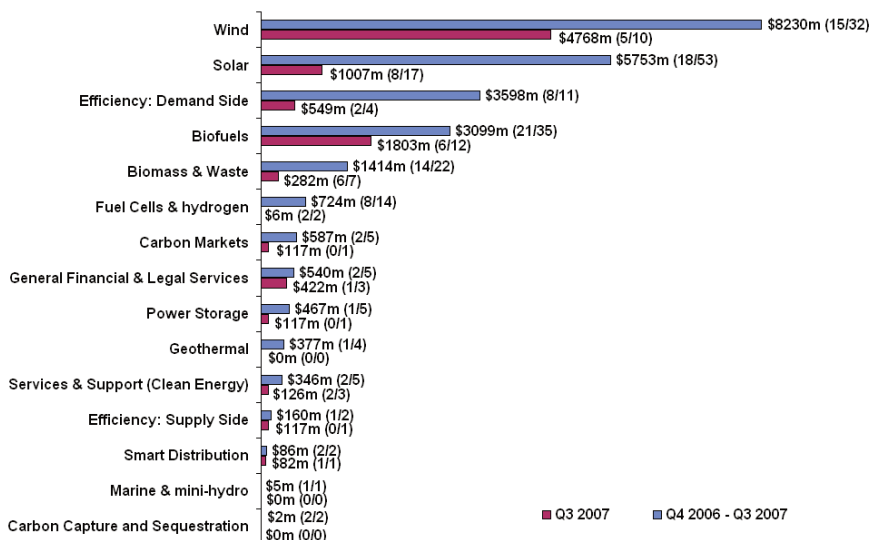
Flush with cash, companies are going to be on the look out for opportunities. "Well capitalised solar companies with strong balance sheets are looking to maximise their footprint. Mid-sized and smaller companies that are not as well capitalised and don't have access to silicon are going to look vulnerable," says John Cavalier.

Most of the activity took place in the US, China and Spain but was widely dispersed among the various technologies and along the length of the value chain. At the lower end of the supply stream, Ceradyne, a US producer of ceramic crucibles used in polysilicon ingot production, acquired raw materials supplier Minco for USD 27.5m in cash.

Slightly further up stream, Chinese silicon wafer manufacturer Solargiga was targeted by Taiwanese wafer company Wafer Works. The latter acquired 29.6% of Solargiga in exchange for 57.7% of its China-based subsidiary Solar Technology Investment in a deal worth USD 11.8m. Ten days later, Japanese trading company Sumitomo acquired a 3% stake in Solargiga for JPY 300m (USD 2.5m).

GE Energy's acquisition of a minority stake in cadmium telluride thin-film PV technology company PrimeStar Solar was a nod to the technology's potential to take a larger share of the market from traditional PV.

FIGURE 2: M&A DEAL VOLUME BY SECTOR



NOTE: Figures have been adjusted for estimated size of deal where no deal value was disclosed. The numbers in brackets refer to the number of deals (disclosed/ total number of deals).

Source: New Energy Finance

But German thin-film specialist Singulus appeared to be hedging its bets when it acquired 51% of Stangl Semiconductor Equipment, a company developing wet chemistry systems for processing both silicon and thin-film solar cells. Stangl chairman Hans-Jürgen Stangl remarked that "collectively the company would offer an even broader range of products that cover the value chain for production of silicon and thin-film solar cell areas."

Meanwhile, in the upper reaches of the value chain, acquisitions of small US solar installation companies continued. Two installers, Sungevity and The Solar Center, were snapped up by German module manufacturer Solon, while in a rare appearance by the UK solar industry, Kingspan, an energy efficient building products manufacturer, acquired UK solar outfitter Thermomax after it was placed in administration in July.

The cooling of the US biofuels

market saw the first efforts at consolidation as companies with established credit lines or strong balance sheets sought to reinforce their positions, while weaker companies looked for dignified exits. "It is very safe to say that there is a lot of homework being done at the moment," says Cavalier. Ethanol company valuations are dropping but for many they have not dropped far enough. The number of deals, although higher than in previous quarters, could become much higher when more people become convinced the market has bottomed out.

In August, Verasun bought three ethanol projects with a projected capacity of 1,248m litres per year from ASAlliance Biofuels for USD 725m, consolidating its position as the second largest US ethanol producer after Archer Daniels Midland. The third largest producer, US BioEnergy, also added capacity when it bought Millennium Ethanol for USD 133m.

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Well capitalised solar companies with strong balance sheets are looking to maximise their footprint. Mid-sized and smaller companies that are not as well capitalised and don't have access to silicon are going to look vulnerable. - John Cavalier, Credit Suisse

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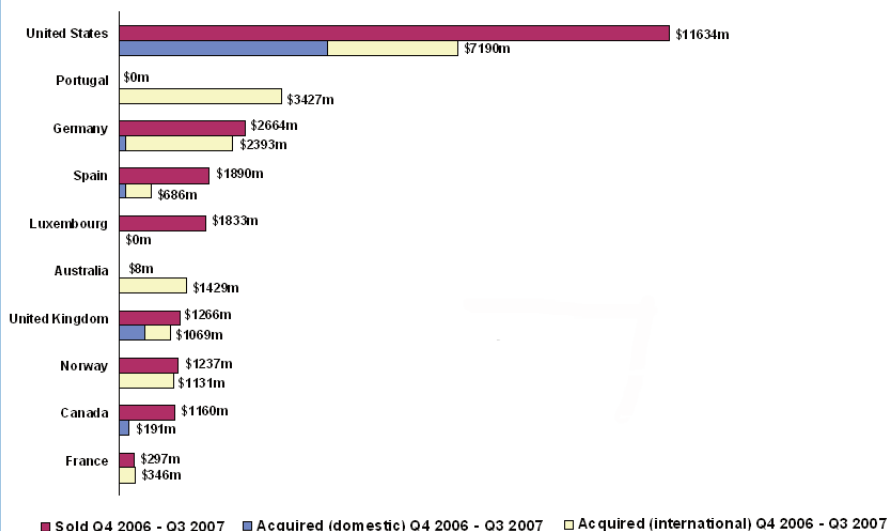
In the current climate of tightening corn supplies it would seem that companies prefer to acquire complete or near-complete facilities with feedstock guarantees rather than finance new capacity from scratch.

The third quarter also saw the acquisition by Bateman Litwin, a mid-sized Dutch gas, oil and power engineering and construction contractor, of US ethanol engineering specialist Delta-T for USD 120m. The deal illustrates that even though the biofuels industry has matured rapidly, clear lines have yet to be drawn and that oil, biotech and engineering firms will not cease to compete assertively for biofuel assets.

As with so many of the big acquisitions in the third quarter, Bateman is a European company that crossed the Atlantic to buy a US firm (Figure 3 reveals the extent of overseas acquisitions). US companies worth USD 11.6bn were sold in Q3. Of this amount, only about one-third was bought by domestic acquirers, the rest went to overseas acquirers.

The largest such deal was EDP's USD 2.7bn acquisition of Horizon Wind Energy. Add to this the purchase of the Bluewater Wind off-shore project by Australia's Babcock and Brown, Eon's acquisition of Airtricity's assets and Iberdrola's USD 4.5bn bid for Energy East and the pattern is clear.

"The wind opportunity in the US is extremely substantial. The arrival of overseas players is good from the American energy perspective," says Cavalier. However, it must be asked why US utilities are not keener to acquire such assets, given that there are renewable portfolio standards in 25 states. One possible explanation is that they are developing assets in-

FIGURE 3: M&A DEAL VOLUME BY COUNTRY OF TARGET AND ACQUIRER


NOTE: The 'sold' bar refers to the value of targets in a particular country. The 'acquirer' bar refers to the value of purchases made by acquirers normally based a particular country, divided into domestic and international acquisitions. Figures have been adjusted for estimated size of deal where no deal value was disclosed.

Source: New Energy Finance

WHAT DO WE MEAN BY CLEAN ENERGY M&A?

- Figures 1-3 are based on acquisitions by corporates where the target derives more than 50% of its revenue from clean energy-related activities. Most power utilities and generation companies are therefore excluded from consideration.
- Project acquisitions are addressed separately, although a number are referred to in the text. See previous article.
- Private equity sponsored buyouts have not been included and are reviewed in our round-up of venture capital and private equity investment. (See October 2007 New Energy Finance Briefing Vol. V Issue 6.)

house. FPL, the country's largest wind power owner, has grown mostly organically since 2003.

For its part, Eon says it has seen this movie before. The company watched as concerns about climate change took hold in its native Germany and had a profound effect on the country's power sector. It now assumes that the US will provide the sequel. In recent days though the American Wind Energy Association reported that two key policies intended to spur further expansion of US wind – the renewable energy standard and

the production tax credit – are likely to get dropped from the final version of the US Energy Bill.

Although this would be a setback, the industry is still healthy. Looking to the future, Cavalier is confident that, in the long run, the cost of wind and solar will come down. "Although the shortage of silicon and of turbines means that the price of solar and wind has done a U-turn, prices are still going to come down. There is a lag but high oil prices will translate into increasing retail prices meaning that renewable energy will become more competitive."

In recent days, the AWEA reported that two key policies intended to spur further expansion of US wind – the renewable energy standard and the production tax credit – are likely to get dropped from the final version of the US Energy Bill.

PROJECT TEAMS HOPE BRINE PLUS FRESH WATER EQUALS ENERGY

Moving water has been harnessed to generate power for centuries. Now, a small group of researchers in Norway backed by heavyweight power company Statkraft are working on a new, totally clean form of water power that uses water's chemical as well as its physical properties.

- By Angus McCrone

Near the point where the Oslo Fjord widens on its way out into the Baltic Sea, just south of the Norwegian capital, sits a modest paper pulp factory.

The site however, at Hurum in Buskerud, will soon become the location for the world's first pilot plant for a fresh renewable generation technology - one that might, one day, sit alongside wind, solar, biomass, geothermal, hydro-electric, wave and tidal.

That technology is osmotic power - the creation of electricity using changes in pressure across a membrane separating fresh water from salt water (see Figure 1).

The concept sounds improbable, almost as if power is being produced with no effort in some magical way. But it has a heavyweight backer, in the shape of Statkraft, the state-owned Norwegian energy firm, which owns 78 hydro-electric plants in the Nordic region and is building gas-fired power stations and wind farms in its home country and in Germany.

Statkraft has invested 10 years of research in the idea, and its efforts will have cost NOK 100m (USD 18.5m) when the current phase of development and testing is complete. It claims that the "global technical potential for osmotic power production is estimated at around 1600TWh". This is equivalent to about 9% of total world electricity generation in 2004.

Jon Dugstad, business development advisor for Statkraft Development, says: "We expect the first commercially sized osmotic plant to be operating by the middle of the next decade. As far as costs are concerned, we estimate that it will be possible to achieve similar output to wave and tidal devices, in other words in the EUR 50 to EUR 100 range per MWh."

Statkraft currently has a project team of 15 working on osmotic development, under the leadership of Stein Erik Skilhagen. The pilot plant at Hurum will be designed to have a modest capacity of between 2 and 4kW.

Dugstad admits: "Our first prototype will be rather small, but we hope it will show that we can get the technology working. We will then need another pilot, on a larger scale, to prove the economics."

If these efforts bear fruit, the company will have to throw in further money to take osmotic power to the commercial stage. "Exactly how much will depend on which technology we choose," Dugstad says.

"The first osmotic prototype will be roughly 100 square metres in size. It uses pressure retarded osmosis, in which we allow the osmotic effect to pull fresh water through the membrane into the seawater part." This increases the pressure on the

seawater side and this pressure drives a turbine to produce power.

"Desalination plants, by contrast, use reverse osmosis - a highly energy intensive process in which you force the salt water through a membrane to produce fresh water. The membrane is made of plastic materials and is a very thin sheet, wrapped in a spiral and placed in a pressure vessel."

The planned pilot plant, shown in Figure 2, includes a pressurised seawater tank (in green) and, a fresh water tank (in blue). The membrane spirals are located below the orange section in the right side.

Statkraft says that osmotic power plants can be constructed partly or completely underground. Fresh water can be taken from an adjacent river, and seawater pumped in via underground pipes.

The idea sounds great in principle but the history of renewable energy is littered with examples of schemes that did not deliver as hoped. What do other experts think of the potential of osmotic power?

Sidney Loeb, the 91 year old inventor of reverse osmosis, found his efforts over several decades to generate osmotic power stymied by the shortcomings of membrane technology. Recent improvements suggest that this particular corner is now being turned.

A UN report in the late 1990s summarised the advantages of osmotic power as the absence of environmental damage, the constancy of energy (unlike wind and wave) and its suitability for anything from small to large plants. The drawbacks were listed as question marks about equipment efficiency, "high capital costs of plant construction", "energy cost very sensitive to membrane cost and efficiency" and membranes "vulnerable to fouling".

Since 2001, Kema, the Dutch energy consultancy and testing house, has been developing a different osmotic technology in partnership with utilities, under the name "blue energy". It also uses membranes, but instead of using pressure like

HISTORY OF OSMOTIC POWER

- 1973: Pressure retarded osmosis discovered by Sidney Loeb, but progress held back by inefficient membranes.
- 1980s: Membrane technology improves, and is used in industrial applications.
- 1997: Statkraft decides to invest in osmotic power development programme.
- 2003: Statkraft's first pilot plant for pressure retarded osmosis starts operations.
- 2007: Decision to build the first prototype osmotic power plant at Hurum, Buskerud, Norway.
- 2015: Around then, Statkraft expects the world to have its first serious-scale osmotic generation plant.

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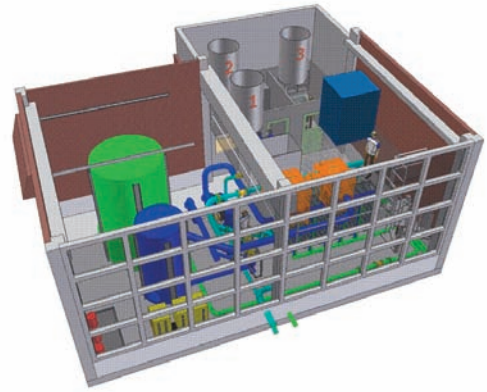
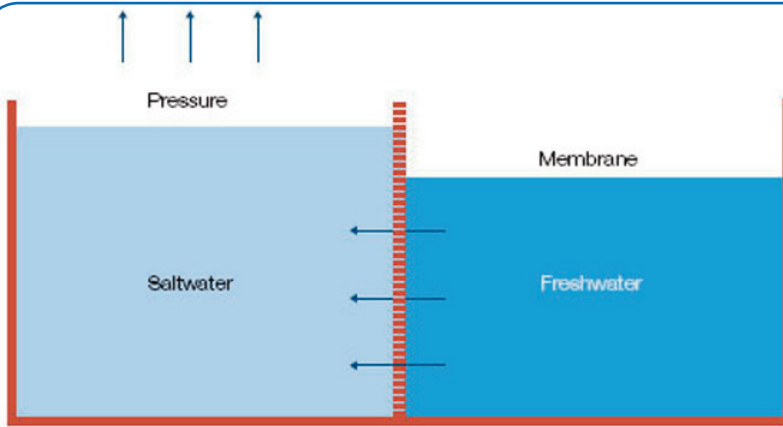


Figure 1 (left): Pressure retarded osmosis harnesses energy to run turbines.

Figure 2 (right): The proposed plant at Hurum. As freshwater passes through a semi-permeable membrane to a saltwater chamber with limited volume, pressure will theoretically rise to a maximum of 26 bars. The operating pressure in a power plant will be in the range of 11 to 15 bars, equivalent to a water head of 100 to 145 meters in a hydropower plant.

Source: Statkraft

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Statkraft, it relies on reversed electrodialysis – in a plant that looks more like a big battery – to generate electricity.

Kees van den Ende, account manager for European and national projects at Kema, says the price – and future price – of membranes will be very important to the cost competitiveness of osmotic power.

“For plants of more than 25MW, we estimate that a cost of EUR 0.11 to

EUR 0.18 per kWh is possible, putting osmotic power on a similar level to offshore wind. Larger plants, benefiting from economies of scale in pump technology, may be able to achieve a lower cost per kWh, especially if a concentrated salt solution such as brine is available.”

Van den Ende says that membrane prices should continue to fall over the next few years, and if so, it may be possible to have the first commercial-sized plants operating before 2015.

“First of all, you need small scale proof of the technology, then pilot testing for three years to check the influence of the seasons, the lifetime of the membranes (will that be five years, or 10 years?), and then scaling up to a plant of a few megawatts, with construction and testing taking a further three years,” van den Ende says.

For both Statkraft and Kema it will be an expensive and nerve-racking next few years as they put their pilot projects to the test.

Take a closer look at offshore wind



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CEMENT: A BUILDING BLOCK OF CLIMATE CHANGE

No house, hospital, road, school or bridge would be built without it. Cement is ubiquitous. Its production process is also one of the largest sources of greenhouse gas emissions, especially in the developing world. NEF visits a plant in Uganda and asks what can be done to clean up the industry.

- By Mike Scott

Making cement is a dirty, fuel-intensive, carbon-emitting business – there's no getting away from it. The industry is responsible for about 5% of man-made CO₂ emissions but, like that other key indicator of development, aviation, demand is growing fast, particularly in the developing world.

Indeed, cement sales can be seen as a proxy for development, with sales in emerging markets generally growing at about twice the rate of GDP as countries put in place basic infrastructure such as roads that more developed economies take for granted. Global demand for cement is predicted to rise 80% by 2020, with that growth being five times faster in emerging economies than in the developed world – indeed four fifths of global cement produced is consumed in the developing world.

Couple this explosive growth with the polluting cement production process and you have a serious emissions issue. Not only does cement-making call for kilns to be heated to 1,482°C, often by burning coal, this is not even the main source of the industry's emissions. Such heat is needed to remove the CO₂ from the limestone. It is this treatment of the limestone itself that contributes the bulk of the emissions.

The sector is further constrained by logistics. Cement plants have to be

near limestone supplies – limestone is not only central to the process, it is bulky and heavy. Cement is equally bulky and heavy, so it has to be made near to its intended market otherwise the cost of transporting it makes it unprofitable. As a rough rule of thumb, for every 200km the cement travels from the plant, the cost doubles, according to French cement company Lafarge. Add in the problems of doing business in emerging markets, which is where most demand now is and companies in the sector face a number of challenges.

The issues that Lafarge, one of the global leaders in the sector, faces in East Africa are typical. The company's Hima cement plant in western Uganda serves the domestic market, as well as the neighbouring countries of Rwanda, Burundi and Democratic Republic of Congo. However, the plant is isolated – it is 300km from the capital Kampala – and the power supply is unreliable. Uganda gets a large proportion of its electricity from hydro-electric power, but has been hit recently by shortages of supply caused by drought. As a result, the company has installed a 2MW generator, powered by fuel oil – however, this has to be trucked in from the nearest port, Mombasa, which is 1,500km away.

This is one reason that cement prices in Uganda are 2-3 times the world average, according to the

country's president, Yoweri Musaveni. Average fuel costs for Lafarge's Mombasa plant are USD 9.25 per tonne while in Uganda, they are almost four times as high, at USD 28 per tonne.

In order to cut costs and emissions, the company has taken a number of steps. It uses an alternative to limestone, pozzolan, a rock of volcanic origin widely available in Uganda that has the same hydraulic binding qualities but contains less CO₂ than limestone.

As part of a group-wide initiative to increase the use of alternative fuels, the Hima plant has started using coffee husks and rice husks to help power the kiln. Coffee residues, in particular, are widely available as the sector is responsible for 50% of the country's exports. Using coffee husks has cut fossil fuel use by 30% and the project is in line to receive carbon credits under the Clean Development Mechanism. Lafarge plans to lift the proportion of biomass to 40%. The programme has cut emissions by 78,000 tonnes per year and in 2006 saved the company USD 2.4m. The company also has CDM projects under way in Malaysia, Brazil, the Philippines and India.

The company's Mombasa plant also uses biomass, but the problem is less urgent – the same fuel oil that has to travel 1,500km to reach Hima has to travel only 5km to get to the Mombasa plant. The company is planting hundreds of thousands of trees every year on land that it has set aside for quarrying limestone in the future. The trees will be harvested and burnt in its kilns, but even so, the proportion of biomass used in Mombasa will reach only 9%, illustrating that its use is primarily a cost and social matter.

The tree planting programme will not only reduce emissions and fuel

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The industry is responsible for about 5% of man-made CO₂ emissions but, like that other key indicator of development, aviation, demand is growing fast, particularly in the developing world.

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costs, it also provides work for the local community and discourages them from encroaching on the land because they can see it is being put to good use. However, with the price of oil tipping USD 100 a barrel, the use of biomass is a trend that is set to continue throughout the industry.

Lafarge is on track to reduce its CO2 emissions by 20% per tonne of cement produced by 2010, and its absolute emissions are slightly down in industrialised countries. However, the company is growing so fast in emerging markets that its overall emissions are climbing – in 2006, they were 94.4m tonnes compared with 79.2m tonnes in 1990. “The company should now develop a strategy for reducing its dependence on fossil fuels, while setting challenging targets to increase the share of biomass,” says Jean-Paul Jeanrenaud of WWF.

“Cutting our emissions by half in Europe does not deal with the problem of emissions from cement,” acknowledges Vincent Mages, the company’s vice-president for climate change initiatives. The EU makes up 10% of world demand, a figure matched by the US, Canada and Australia combined, says Mages. Emerging markets excluding China

account for another 30% “and the other 50% is China,” he adds.

Lafarge, one of the founders of the World Business Council for Sustainable Development’s Cement Sustainability Initiative, takes a two-step approach to the problem. “We are working on R&D to come up with low CO2 products and we believe that ultimately, carbon capture and storage will have to be part of the solution,” says Mages. An example of its attempts to develop lower-carbon products is Ductal, an ‘ultra high-performance’ concrete that has 6-8 times the mechanical strength of traditional concrete, meaning the amount of raw materials and energy involved in any particular structure is reduced.

The other approach is to look at the entire life cycle of a building from design to demolition – Lafarge is also involved in the WBCSD’s Energy Efficient Buildings (EEB) initiative – and attempt to improve energy performance at every stage. “We have to work with other players in the construction sector, such as architects, developers and governments,” says Mages. “The cement industry is responsible for 5% of the world’s man-made CO2 emissions, while buildings account for 40%, throughout their active lives. This is why we must all work

together on improving the energy efficiency of buildings.”

Launched by the WBCSD in 2006, EEB’s ambitious aim is to create buildings that consume no net energy from external power supplies and produce no CO2 emissions while remaining economically viable. It is likely to provide a boost to companies in the NEX’s energy-smart buildings sector, in energy demand-side management, in distributed generation, renewables and energy efficiency.

Mages is adamant that simply mandating emissions cuts is not the way forward, given cement’s role in development. “The climate challenge is to provide a model for emerging markets that is a combination of growth and emissions performance,” he says. However, he sees emissions trading as one way of cutting emissions. “The EU ETS is a constraint, but we support this kind of mechanism – it is a good way to stimulate solutions. I think there will be a global scheme eventually, but I don’t know when,” Mages concludes. “There is no doubt that cement is part of the problem, but we want to be part of the solution as well – we believe concrete will have a big role to play in making energy efficient buildings.”

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CHINESE CELL MAKERS PUT FAITH IN DOMESTIC SILICON SUPPLIERS

Chinese silicon producers have ambitious plans that could transform the industry if successful. While many doubt their claims, two of the biggest names in Chinese PV manufacturing have more confidence. Could this be the boost the industry needs?

- By Jenny Chase

In October 2007, Chinese solar companies Suntech, Renesola and Yingli saw their stock prices rise substantially on the announcement of major silicon supply deals with Chinese silicon manufacturers. Any silicon deal usually lifts the share price of wafer or cell manufacturers, but the news that domestic suppliers had landed large contracts is particularly encouraging for the entire Chinese PV industry – and worrying for Western competitors.

Suntech's CEO Dr Shi Zhengrong is a well-known speaker on the Western conference circuit and has been heard to deplore the sharp practices of silicon suppliers, but when he announced the seven-year contract with Asia Silicon Industrial he declared it a milestone. He said it would allow for grid parity in the foreseeable future, and a decline in prices to "substantially below USD 40 per kg". The agreement will provide Suntech with enough silicon for 1.2GW of production capacity over a seven-year period, and is worth up to USD 1.2bn.

For its part, Renesola has secured supply of 3,700 tonnes of polysilicon from Yongxiang Polysilicon over the next three years, while Yingli revised an existing agreement with Sichuan Xinguang. Under the new contract, Yingli will pay a fixed price for 1,232 tonnes of silicon by the end of 2008 unless the price moves outside a 5% band in which case

the contract price will be adjusted.

China's PV cell and module industry is booming. To put this in context, total cell production was 361MW in 2006, up from 134MW in 2005. A series of 10 IPOs on overseas markets – starting with Suntech in December 2005 and ending, for the moment, with Jiangsu Jetion Holdings in July 2007 – have raised a total of USD 1.8bn.

Most of this capital is for expansion of production and to make prepayments on the long-term silicon contracts currently regarded by the industry as necessary. These can amount to up to 30% of total contract value and the terms generally allow the buyer little flexibility.

There are also estimated to be 30 or more 'second-tier' cell and module manufacturers who have not yet obtained the support or maturity to go public. The only thing holding these firms back, aside from lingering but largely unsubstantiated rumours of serious quality problems, is access to silicon.

The price of silicon is around USD 70 per kg under long-term contracts, but up to USD 300 per kg on the spot market. It is difficult for relatively new Chinese companies to secure the long-term supply relationships obtained by their Western competitors and so the average price paid by local

manufacturers is reported to be nearly USD 100 per kg.

A number of Chinese companies with government support and subsidy are responding to the high prices by becoming silicon manufacturers themselves. Some, like Huanghe Hydropower Development and Shanghai Industrial Investment Corp, are state-owned, while many others are subsidiaries of larger companies like Sichuan Yongxiang Polysilicon and Shanghai Shenzhou New Energy Development. There are a few that appear to be private such as electronics group DAQO, but often these firms still have strong ties to government.

In aggregate, these companies plan to have more than 30,000 tonnes of silicon manufacturing capacity by the end of 2008, and 70,000 tonnes by the end of 2010. Compare this with total PV industry use of between 20,000 and 30,000 tonnes in 2006 and the importance of Chinese silicon producers is clear.

This is all fine in theory but what about in practice? Conventional wisdom has it that silicon factories take longer than two years to build, and that the Siemens process – proprietary to the German engineering giant – is difficult to get right and cannot be achieved by the numerous consultants and engineering groups which have sprung up to help market entrants. Unsurprisingly, this point of view is perpetuated by the silicon giants Wacker-Chemie, MEMC Electronic Materials, Tokuyama and Hemlock Semiconductor, which are generally dismissive of the Chinese endeavours in silicon production. Analysts have also generally assumed that production start-ups will not meet their ambitious schedules and that there may be quality problems with

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More supply contracts will be announced as Chinese cell manufacturers gain confidence to tell investors and buyers that they are using domestic suppliers.

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the feedstock.

And if the capacity is built, will the end-product be good enough? Chinese JA Solar is the only solar company in the world so far to fully disclose the terms of its contracts. It pays approximately USD 5.00 per wafer, equivalent to about USD 210 per kg or USD 2 per Watt. JA Solar says it plans to buy from a Chinese silicon supplier but has been less public about it, maybe because the price is even higher at CNY 48 (USD 6.45) per wafer (although renegotiable every six months) or perhaps it fears that quality concerns may impact its stock price. It may remember that US-headquartered SunPower discontinued a cell purchase contract with JA Solar due to quality issues.

However, Suntech and Yingli are two of the best-regarded of the overseas-listed pack: they have avoided any hint of scandal and have seen strong stock performances since floating. Their willingness to sign contracts beginning in 2008 with domestic suppliers indicates that they believe their counterparts are capable of meeting ambitious production schedules and that the silicon will



Yingli's solar roof at the Kaiserslautern stadium in Germany. The company is among those that have signed contracts with local Chinese silicon producers. *Source: SolarPlaza.com*

be of sufficient quality. This does not mean all Chinese silicon manufacturers will succeed by 2008, but it does suggest that experienced players believe some will succeed.

More supply contracts will be announced as Chinese cell manufacturers gain confidence to tell investors and buyers that they

are using domestic suppliers. It won't be plain sailing all the way - some would-be silicon suppliers will fail and new industry bottlenecks could emerge, such as a rumoured shortage of the laminate TPT. However, these new contracts confirm that Chinese silicon is likely to make a substantial difference to world supply as early as the second half of 2008.

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SOLAR LEADERS DEBATE COSTS AND FINANCING TOOLS

The Investing in Solar conference held in Las Vegas on 29 to 30 October saw delegates comparing costs between thin-film and crystalline silicon and praising third party PPAs. The “B-word” kept firmly in the background.

- By Daniel Adams

The solar industry has enjoyed a fatted calf phase now for some time, with venture capital and private equity investors jumping on and riding it all the way to the bank. But worries have been increasing about the danger of a mood swing that could make the sector look more ‘skinny goat’ than fatted calf.

“Bubble” was the word that dare not speak its name at the recent Investing in Solar conference held in Las Vegas, one of the most energy hungry cities in the world, but concerns of that sort were a frequent undertone. On the occasions when the B-word was whispered, it was generally directed at thin-film. Of course, this may have been just executive name-calling by traditional mono or multicrystalline stalwarts worried about losing market share.

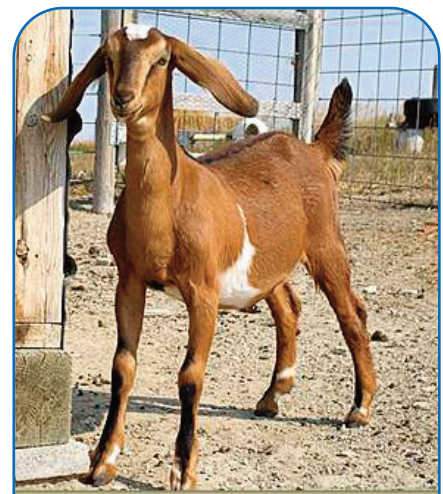
Thin-film is a standard VC play, betting on various disruptive technologies such as cadmium telluride (CdTe) or copper indium gallium diselenide (CIS or CIGS), hoping at least one can take a big bite from traditional silicon PV’s 90% market share by outperforming on a price per watt basis. However the economics might not bear this out as Suvi Sharma, CEO of US headquartered low concentration PV developer Solaria, argued during his conference address.

Sharma said: “One of the things we hear is silicon is great, it’s dominant today, but thin-films are much cheaper and so thin-films are going to dominate. I do believe that thin-film will take on a significant market share of somewhere around 20% over the next decade, but the reason why I believe silicon will continue to dominate is its cost position. If you look at the true cost of a silicon based PV module today with best of class producers you’re getting to about USD 1.82 per watt for a

module – that’s cost, no margin in there yet. If you look at the leading thin-film manufacturer, a great company called First Solar that has the leading cost position in thin-film today, they operate around USD 1.25 per watt on a pure cost basis. So it seems like thin film is cheaper, but when you add in the systems cost, thin-film, because of the lower efficiencies, requires approximately USD 0.80 to USD 0.90 per watt extra on systems level for installation. Which means based on a full kWh cost-stack, silicon today is the cheapest and I believe it will continue to be.”

His argument could be strengthened if the current silicon supply issues were met by the new silicon production coming online over the next 1-3 years. The price of a crystalline silicon module would drop as the feedstock became readily available and, on his view, thin-film would be faced with the problem of being half as efficient at a comparable price pre installation.

There was much buzz and bluff at the conference about a relatively new solar financing tool, the third party power purchase agreement, with Arnold Lietner of SkyFuel saying that 60% of the capacity installed in California in 2007 has been the result of this burgeoning solar finance method. If the third party PPA is here to stay and continues driving PV installation, something that is rather dependent on the extension of the solar tax credit incentive scheme, it could have some real effect on thin-film’s ability to gain market share. Due diligence is a mantra for a TPPPA man whose industry is a veritable minefield of risk, and anything that delivers uniformity and economies of scale across a portfolio of projects is likely to be welcomed with open arms. There is a plethora of due diligence questions a PPA financier



The shape of things to come? There are concerns that if the mood changes the solar industry will one day look more ‘skinny goat’ than today’s fatted calf.

must ask to model accurately the risk involved in an individual project such as, will the manufacturer be around to honour the warranty? How strong are the balance sheets of the power off taker?

Mark McLanahan, vice president for solar project development at MMA Renewables, said during his conference speech: “We’re very thorough about what we buy, maybe even more thorough than our customer would have been who’s just buying the electricity. The industry is still young and its still fragmented so we [MMA] have this concept of uniformity and standards that we are trying to lay out... stuff needs to be bomb-proof, it needs to last for 30 years or hopefully longer and in our society it’s hard to look past five years so resetting the expectations, on a thirty year horizon really changes the decisions that you make that the beginning of a project.”

So if the PPA does prove to be the engine driving current and future installation, then companies like MMA will work to impose uniformity across their portfolios, choosing the proven crystalline silicon in an effort to mitigate risk, better the devil you know than the devil you don’t. Its not a great leap to imagine the industry might follow and thin-film would, if you’ll forgive the over extended metaphor, be in

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for a devil of a time.

According to New Energy Finance statistics the biggest VC investment trend in Q3 2007 saw money flow downstream in to installers and solar service companies. This is not a standard VC play because the chances of a hammer and nails service company providing a tenfold return would appear remote. However Chris Sorrels of NGP said this was basically the natural order of things, what goes up must come down so to speak, saying, "There has to be a concentrated focus in capital investment down stream. Solar works like any capital formation in terms of investment, the money went upstream first and will now go downstream." Following this point David Kirkpatrick of SJF Ventures added, "We as a small fund are more interested in the down stream stage, I think that is more a local and

regional play with more defensible advantages...Some of the early stage high capitalisation, high valuation plays are more suited to funds with a lot of capital that are willing to take higher risk technology bets."

During the First Solar Q3 earnings conference call, CEO Mike Ahearn said, "I think the near-term market, for us, by way of expansion, would be the utility segment, if you will, in the US." With a manufacturing cost of between USD 1.19 and USD 1.25 per watt, how can an early stage VC funded thin-film manufacturer compete? If they're USD 0.10 per watt off the leader doing a 30MW solar farm, the difference starts to add up and will affect a company's ability to get financing - who is going to hand out money knowing that somebody else's technology is better? Nobody will pick something that is half as efficient at twice the price, no matter how technologically advanced it may be. However, First

Solar cannot meet global demand for sub USD 2 per watt products alone, so there may be time for new entrants to improve their technology.

This final point was echoed by David Dreessen, a Partner at Battery Ventures, during the conference VC panel: "In terms of valuations, if you add up the market cap of Q-Cells, RAC, SunPower, and First Solar last year at this time, it was under USD 10bn and First Solar was private. Today it's a year later and it is USD 50bn and they're a small part of the industry. There are certainly big valuations. Ultimately this is a commodity business and it comes down to dollars per watt. Different technologies play well in different applications. There is not going to be, when all is said and done, hundreds of winning companies, its going to get reduced down to those that are really leading providers in their given segment."

There has to be a concentrated focus in capital investment down stream. Solar works like any capital formation in terms of investment, the money went upstream first and will now go downstream. - Chris Sorrels of NGP Energy Technology

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