

Energy Economist

Project finance in Asia 3

There are four ways to raise capital: debt, equity, assets sales and cash flow. All face difficulties, yet deals are being struck, with a shift towards risk sharing, debt re-pricing and new lending sources. And while the rest of the world economy stumbles, energy demand growth in Asia remains strong, leaving the business case for new project financing intact and providing new opportunities for Asian capital. **Ross McCracken**

Venezuela seeks partners 6

Declining oil prices and global financing difficulties threatens to seriously hamper Venezuelan oil production, already ailing from a shortage of natural gas for secondary crude recovery. However, one unforeseen, yet favorable outcome is that to secure technology, expertise and investment the government is opening up the industry to outside players, even if the terms could do with improvement. **Carlos Camacho**

Mediterranean gas potential 10

Despite their long history of gas production, the states of North Africa promise both rising output and reserves, providing a critical counterweight for Europe to Russian gas. Algeria is expanding its export infrastructure, Libya remains underexplored and Egypt has delivered a succession of new discoveries, while the area between Libya and Sicily is shaping up to be a new gas prone hydrocarbon province. **John Kendall**

Demand down, prices up: WEO 2008 15

In its World Energy Outlook 2008, the IEA produces no surprises in reiterating that the world is heading rapidly towards boiling point. However, it has both reduced its oil demand forecast and raised its expectations for prices. Underpinning this analysis is a comprehensive field-by-field study of decline rates that shows the oil industry faces a huge challenge simply to keep output as it is. **Ross McCracken**

Tax credits boost US solar 18

A tax credit regime lasting eight years is the stuff of renewable energy developers' dreams, but that is what solar power now has in the United States. However, with the financial crisis clipping the wings of traditional tax equity investors, developers are looking to the newly-empowered utilities to jump on the Concentrated Solar Power bandwagon. Typically risk averse when it comes to emergent technologies, the question is will they take the plunge? **Elisa Wood**

Equatorial Guinea develops regional gas role 22

Equatorial Guinea hopes to establish itself as a regional gas hub for LNG production, exploiting its own reserves and potentially bringing in gas from Cameroon and Nigeria. However, the bulk of the population receives none of the oil and gas wealth, while political expression and basic human rights are denied by an authoritarian and autocratic government. A coup is the only likely method of political change. **Neil Ford**

Petchems: where did it all go wrong? 27

The petrochemical industry find itself between a rock and a hard place – hit by rising costs and declining demand. Investment in new capacity, which is still coming onstream, coupled with the global economic slowdown, have left the industry fundamentally oversupplied. The result will be a long, tough, multi-year winter of low operating rates, margin compression and consolidation. **Shahrin Ismaiyatim**

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Trimming the hedges

Airlines' difficult relationship with hedging beggars belief. Head of Asia Transport Research for UBS, Damien Horth, told a meeting of the world's airlines in November, that "hedging is a waste of time". "Most of the hedging I have seen in the last two to three years has been speculative." That is an extraordinary statement. Almost as barmy as "making margin from hedging." If a company's hedging is speculative, or has a margin, then it isn't hedging, it's speculation.

Hedging buys a period of price certainty; no more, no less. A hedge means a firm suffers no loss if prices move against them and makes no gain if prices move in their favor (assuming an unhedged position). The question is can you make a profit in your chosen business (not oil trading) at the price you have taken?

Unfortunately, the short-run view predominates; if an airline hedges as prices rise, its management are financial geniuses, if an E&P company does the same, they are idiots. The idiots and geniuses swap hats when prices fall. But both miss the point entirely if they see a hedge as either 'in' or 'out' of the money. Hedging works as a continuous process valued over a long cycle of up and down price movements, in which the 'losses' and 'profits' balance out. The value is reduced price volatility. Or it can be used in other ways, for example, to protect a revenue stream to secure financing.

Hedges are hugely oversold by those paid to arrange them. The misguided short-term vision of losses and gains leads many into outright speculation – "making margin from hedging". At that point, your financial managers shouldn't be running airlines or E&P firms. Hedging offers price certainty over a defined time. It doesn't necessarily offer a good price, nor does it protect from long-term price trends. The only question is; are those limited periods of price certainty worth more to your business that the cost of arranging the hedges?

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platts Energy Economist

Issue 326 / December 2008

(ISSN: 0262-7108)

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Energy Economist is published monthly by Platts, a division of The McGraw-Hill Companies, registered office: 20 Canada Square, Canary Wharf, London, UK, E14 5LH.

Officers of the Corporation: Harold McGraw III, Chairman, President and Chief Executive Officer; Kenneth Vittor, Executive Vice President and General Counsel; Robert J. Bahash, Executive Vice President and Chief Financial Officer; John Weisenseel, Senior Vice President, Treasurer.

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Tax credits boost US solar

A tax credit regime lasting eight years is the stuff of renewable energy developers' dreams, but that is what solar power now has in the United States. However, with the financial crisis clipping the wings of traditional tax equity investors, developers are looking to the newly-empowered utilities to jump on the Concentrated Solar Power bandwagon. Typically risk averse when it come to emergent technologies, the question is will they take the plunge? **Elisa Wood**

For most people in the US, October 3, 2008 will go down in history as the infamous day that Congress approved an unprecedented \$700 billion bailout for the financial industry. But for concentrated solar power advocates, it will also be remembered as the day the door swung wide to opportunity. Attached to the Emergency Economic Stabilization Act of 2008 was an unrelated energy bill that included incentives for renewable energy, including an eight-year extension of the solar tax credit. Solar lobbyists had previously spent 18 months trying to convince Congress to pass the extension only to see it fail in 17 votes amid partisan haggling.

"It's really a big deal," said Frank Wilkins, team leader for CSP at the US Department of Energy. "Our basic mission is to try and help get solar energy into the economy. This extension will help developers do exactly that."

The credits attract large investors with a 'tax appetite,' i.e. those willing to back a project in return for a tax reduction. In many ways, the investment credits are the US answer to the European feed-in tariff. US lawmakers tend to avoid direct market subsidies like the feed-in tariff, but are open to policies that ease tax burdens.

The 30% solar credit is not new; its duration is what the solar industry is celebrating. It is typically difficult to convince Congress to make an eight-year commitment. Wind energy, for example, won only a one-year extension for its production tax credit, again exposing the industry to the notorious boom and bust development cycle.

"It takes about four years from the time a developer gets a power purchase agreement with a utility to the time that plant is financed and built. So the eight-year

extension gives developers essentially two shots at making their technology better and lowering the costs," Wilkins said.

Unfortunately, solar energy's win comes with a sad irony. It arrives just as the financial meltdown cripples traditional tax equity investors, among them Goldman Sachs, Lehman Brothers, and AIG. Fewer prospects are available for CSP developers as they try to finance their projects. "Some notable investors have fallen away; others that have been quite active are pulling back. There is clearly an impact on the market," said Kevin Walsh, managing director with GE Energy Financial Services. So while the door is open for significant CSP growth, the industry now wonders: who will usher through the projects?

Old technology made new

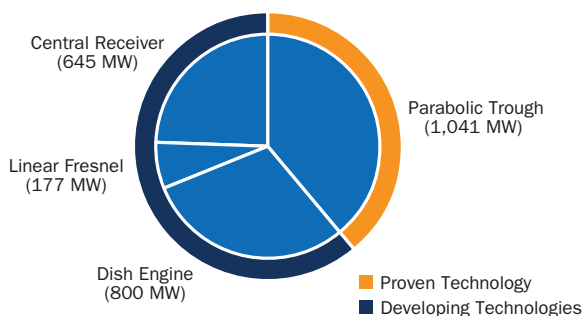
CSP is not new to the US, although it has seen a surge in interest in the last couple of years. The technology came to California's Mojave Desert in 1984 with the Solar Electricity Generating Station (SEGS), a series of projects completed in the early 1990s and still generating 354 MW. Developed by Luz International, most of the units were later purchased by FPL Energy and continue to operate today selling their power to Southern California Edison.

After SEGS was built, the industry went dormant in the US for the next 16 years until the 64 MW Nevada Solar One began providing power to the grid in 2007. The \$250 million plant was built over 16 months on 400 acres in Boulder City, Nevada, by Acciona Solar Power, a majority-owned subsidiary of Acciona Energy. Like the SEGS units, it uses what is known as parabolic trough technology. More than 182,000 mirrors concentrate sun rays onto about 18,240 receiver tubes, where fluid heats up to 735°F and produces steam that drives a conventional turbine.

Now more than a dozen solar thermal projects are on the drawing board, amounting to several gigawatts of power, most of them in the southwestern United States. A handful of the projects hold utility power purchase agreements.

CSP solves several of today's energy problems, say its supporters. Far larger than their sister photovoltaic projects, CSP units can produce as many megawatts as a conventional fossil fuel plant – and provide them during periods of peak demand. Their scale also helps utilities

Solar CSP PPAs by technology (MW)



Source: Emerging Energy Research

quickly meet government mandates in several states that a percentage of their supply come from renewable energy. The CSP plants appease public sentiment that the United States move toward energy independence through green technologies. And they create 'clean' manufacturing, assembly and construction jobs – the 'green collar' employment that many states now pursue.

Further, it is a renewable technology that utilities feel comfortable adopting because of the size of the plants and their turbine-based technology, according to Michael Fritsch, the president and chief operating officer of Confoe, a Texas management consulting company. "From the stand point of a utility looking at investing in a renewable resource, concentrating solar thermal makes a lot of sense. 'We know turbines. We know large installations. This is really familiar territory for us.'"

As a result, CSP proposals are cropping up throughout California, Nevada, Arizona and other southwestern states with arid conditions and large land masses. Wind power is the only utility-scale renewable energy moving into the economy at a faster clip, according to Emerging Energy Research. The Cambridge, Massachusetts firm forecasts that the United States will produce 10 GW from CSP by 2020, or possibly more depending on how quickly the financial markets revive. The industry is likely to make a \$20 billion investment over the next five years, largely in the US and Spain, the other epicenter of development.

Price on par with gas peakers

CSP is typically priced from 10 US cents/kWh to 16 cents/kWh in 20-year contracts with utilities, according to Reese Tisdale, EER research director and author of its report "Global Concentrated Solar Power Markets and Strategies, 2007-2020." The price may seem high, but it is on par with generation produced by gas-fired peaking plants, which is what CSP displaces, according to Confoe's Fritsch. "You tend to get the peak power demand when it is hottest and sunniest because the power demand is for air conditioning. So your best power generation (from CSP) comes at times when you need the power most, which is a big benefit. When people argue wind versus solar, solar matches up better with the demand peaks."

The DOE has set a goal of installing 1 GW of CSP in the southwestern states by 2010 in the hope that economies of scale will bring down the cost of the resource to 7 cents/kWh. "The whole goal of the game is to produce power at less cost...because financing is relatively expensive – and it just got a whole lot harder," said Chris Huntington, SkyFuel's vice president of business development.

So, the push is on among plant designers to create lighter and more efficient projects. Since the fuel – the sun – is free, CSP generation prices are heavily driven by the cost of steel and other materials used to build the plants. Engineers are trying to bring down costs with

Solar CSP PPAs by developer and utility

Project	MW	Utility
Bethel Energy	98.8	SDG&E
Solel	554	PG&E
San Joaquin Solar	107	PG&E
Abengoa Solar	282	APS
Stirling Energy Systems	500.0	SCE
Stirling Energy Systems	300.0	SDG&E
Ausra-Carrizo Solar	177.0	PG&E
BrightSource Energy	400.0	PG&E
eSolar	245.0	SCE

Source: Emerging Energy Research

more effective reflectors, energy storage, efficient manufacturing and assembly, fewer moving parts, and solar pairings with fossil fuel units.

SkyFuel, an Albuquerque, New Mexico company, says it has cut the cost of parabolic trough concentrators by 35% compared with other commercially available systems. Instead of conventional mirrors, Skyfuel uses a silvered-polymer film to capture the sun's rays. The new technology was designed jointly by the National Renewable Energy Laboratory and Randy Gee, SkyFuel's chief technology officer and a designer of Nevada Solar One. The plastic reflectors are lighter and 50% cheaper than the easily broken curved-glass mirrors that are typically used, according to SkyFuel. "We believe that building a trough with shard glass mirrors is just asking for higher capital costs because the mirrors will break and will rain down and break your receiver," said Huntington.

BrightSource, an Oakland, California firm is headed by Arnold Goldman, founder of the former Luz International, which built the nine original Mojave Desert plants in the 1980s. BrightSource is pushing a tower technology that it says operates at a significantly lower cost than the older Mojave trough units. The older plant uses long rows of curved glass mirrors to heat synthetic oil, which is piped to a heat exchanger to produce steam at about 375 degrees Celsius. The new system uses small flat glass mirrors that heat steam directly to a temperature of about 550 degrees Celsius, according to the company.

SolarReserve, a Los Angeles based company, is betting heavily on a tower system that uses molten salts for energy storage. It works by first capturing the sun with thousands of tracking mirrors in a two square mile field. The mirrors concentrate the sunlight on a receiver that sits on top of a tower in the center of the field. Molten salt in the receiver heats and then flows into a storage tank, and is eventually pumped to a steam generator.

In the late 1990s, United Technologies tested the system in a demonstration project called Solar Two in Daggett, California. It has since given SolarReserve an exclusive worldwide license for the technology. The storage makes the plants dispatchable and opens the door for pairing them on the grid with wind facilities. The

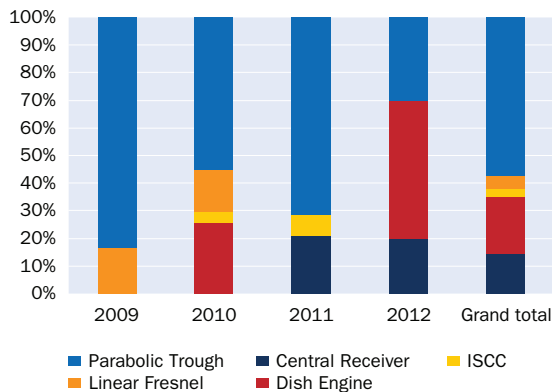
stored solar power can be dispatched when the wind is not blowing. Terry Murphy, SolarReserve CEO, said the company is now eyeing 50 different projects internationally. SolarReserve has not signed any utility power purchase agreements in the United States, but is instead pursuing a strategy of “doing the work first” – completing site development and certain regulatory reviews, Murphy said.

Ausra opened a 5 MW demonstration project in October that uses flat, rather than curved mirrors. The Palo Alto, California company says its simplified design makes more efficient use of land and lowers costs. Known as the Kimberlina, the demonstration project is a stepping stone toward the company’s 177 MW Carrizo Plains solar power plant, whose output is under contract to California utility Pacific Gas and Electric. Meanwhile, Washington-based Infinia is putting its money on Stirling engine technology with standardized and efficient manufacturing: “We’re creating a solar power generation appliance that can be stamped out like Chevrolets and deployed like Maytags,” said J.D. Sitton, president and CEO.

Still others are working on dual-fuel solar/gas-fired plants that back-out gas when solar is cheaper. Florida Power & Light in June announced plans to pursue the hybrid design at its gas-fired Martin plant. The utility intends to begin construction in 2009 on the 75 MW plant. SkyFuel, which is also pursuing hybrid technology, says the pairing significantly lowers generation costs to about 10 cents/kwh. “We call it our fuel saver system. In an environment of high natural gas prices, you can throttle back on gas and pump up the solar power,” Huntington said.

European companies are looking to catch a piece of the US market. For example, Irish company NTR in April invested \$100 million in Arizona company Stirling Energy Systems. The company has proposed two California CSP plants, one in the Mojave Desert and a second in the Imperial Valley, which together will produce 1,750 MW.

US CSP projects announced by 2012, by technology



Source: Emerging Energy Research

The projects hold long-term power purchase agreements with two utilities – San Diego Gas & Electric and Southern California Edison.

Not all plain sailing

But for all of the progress CSP is making, it faces some roadblocks – today’s ailing economy aside. The projects work best in the desert, where clouds are few and humidity non-existent. But that places them far from population centers that need power. So like US wind farms, CSP relies heavily on transmission. And while US politicians say they favor national expansion and upgrades to transmission projects, little work has taken place to date. “Location is the primary siting factor – it brings a whole new dimension to transmission issues. How do you get the solar power to Chicago, Dallas or Houston?” said Charlie Ricker, BrightSource Energy’s senior vice president of Marketing and Development.

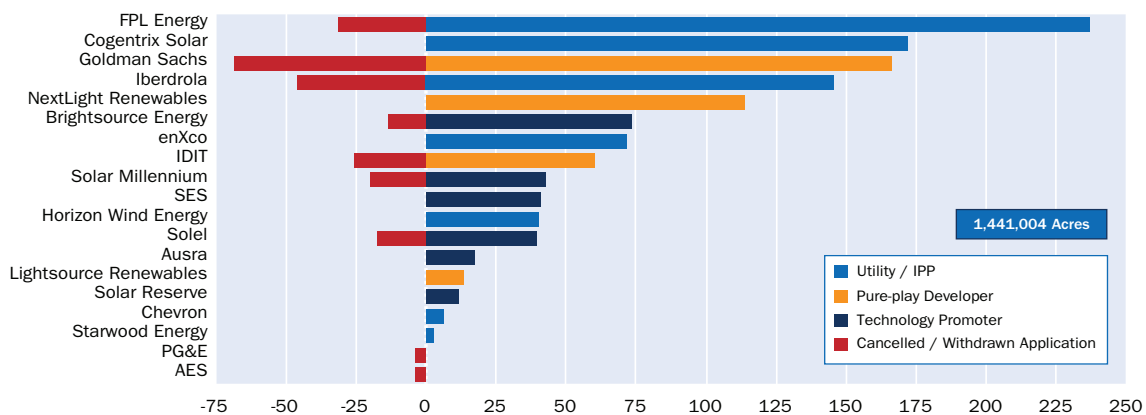
Further, the plants typically require water to operate, not easily found in the desert. While the technology can employ closed-looped systems, “the initial cost of bringing water to the desert can be an issue,” noted Confoe’s Fritsch. He added the project’s green credentials are tarnished in the eyes of some because of their use of water in arid lands.

And like its fast-growing brethren, the wind farm, CSP is creating growing pressure on turbine manufacturers to keep up with demand. “When the CSP bug hit a year and half ago, everybody wanted to build big stand-alone plants. But there are a lot of issues, not to mention getting the big turbines from Siemens or GE. You have to wait three years for a 100 or 200 MW stand-alone plant,” said SkyFuel’s Huntington.

Huntington also questions how many of the projects with utility power purchase agreements will be developed at promised prices. Having such contracts helps developers attract financing. But the contracts offer fewer guarantees than many realize, he said. “A PPA is one step up from buying a lottery ticket. It is so grossly misunderstood. The broad perception is that these companies are in business. What they’ve done is say that they will deliver power at a certain price, which is probably an aggressive price.”

Finally, CSP requires large swaths of flat land to operate – about 1,500 acres for 300 MW, according to the DOE’s Wilkins. “Where do you get that much land?” The industry sees possibility in the 219 million acres that the federal Bureau of Land Management oversees in the southwestern states, with the charge of securing the land’s health and productivity for future generations. After solar developers submitted 125 applications to use the land, BLM place a moratorium on further requests until it could conduct a comprehensive environmental review of the technology’s impact. The industry protested the moratorium, and, in July, BLM lifted it. But the federal agency continues its environmental review at what many in the industry consider to be a snail’s pace. The final environmental study is due out in spring 2010.

CSP applications by acres (000)



Note: Some applications are on top of other applications for the same land, causing elevated numbers

Source: Emerging Energy Research

Utilities to the rescue?

Still, the most pressing and immediate problem for the industry is attracting investment in an inhospitable economic climate. And given the sheer number of CSP projects – and the structure of the solar tax credit – the industry needs a lot of investors with a tax appetite.

Tim Howell, managing director at GE Energy Financial Service, says that solar investments are much more tax intensive in the first year of operation than wind power. Given how the tax credits work, 10,000 MW of wind projects create \$600 million in tax credits the first year, while 1,000 MW of solar, at \$5/watt, produce \$1.5 billion in tax credits. “The competition for tax capacity, which is a scarce resource in times of financial crisis, the times we find ourselves in now, is a problem we have to solve,” he said.

Industry insiders see a solution: utilities. Until Congress’ October vote, utilities were prohibited from using the solar tax credit. However, the new law changed the playing field by allowing their participation. Utilities now can act as project investors, and could assume the role previously played by the private tax equity investor. It is too early to say how many utilities will engage and whether they will partner with private developers or compete with them by developing their own projects. But several solar companies say they are confident that utility involvement will come, and will prove a boon for the industry.

SkyFuel, for example, has supported the idea of utilities being allowed to take the investment tax credit, bucking others in the business who fear the competition. “We felt it was best to have the biggest, most serious players, free to build. It is only through scaling up that prices will come down. I do think eventually utilities will take an equity position,” said Huntington.

Infinia expects utilities to “get aggressive and deploy capital in the CSP space,” added Sitton, but not immediately because they must get the proper signals that state regulators will support the activity. “They are cash flow

positive and net income positive. This is a way for them to provide extra returns to shareholders. I don’t expect the capital will come flooding in overnight. But I’d say some time in the first or second quarter of next year, we can expect to see some of the better positioned utilities begin.”

BrightSource’s Ricker also sees utilities moving into the space, if they can overcome their aversion to risk. “Utilities historically have not been big investors in new technologies. But certainly in our conversations with utilities, they have always evidenced an interest in being owners. That was not an option until recently. We’ll find out if their interest is as strong when it comes time to write a check.”

Whatever utilities do, Ricker says the most viable projects will find financing, but maybe not immediately. “We certainly think things will get better. There is a general sentiment that good projects will go forward – with a bit more due diligence than before.”

Many in the industry also expect increased support because of the election of Barack Obama as US president. Obama has signaled that he will support a national renewable portfolio standard. More than half of the states have passed RPS requirements – a mandate that a percentage of power come from renewables. Those who support a national RPS say it will enliven the green market because companies will no longer have to deal with a hodgepodge of rules that lack consistency from state to state. But it remains to be seen how soon or even if Obama will follow through with the RPS – or be waylaid by the nation’s pressing economic concerns

So for now, the CSP industry finds itself in a waiting position. The door is open and the tax credits are in place for developers to realize their goals. Whether projects trickle or surge through the entryway depends on who will join them. The industry looks with hope to utilities, a new president, and the possibility of a re-invigorated market in 2009.

Research assistant Corey Haga contributed to this article.