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March 30, 2009

Transitioning to Renewable Energy

How some traditional energy companies are reusing and repurposing their technology to develop renewables.

by Marsha W. Johnston, Contributor

California, United States [RenewableEnergyWorld.com]

Most people tend to think of renewable energy as a clear break with our energy history, jettisoning all of the trappings associated with a dirty industry. It thus may come as a surprise to discover that, in fact, certain conventional technologies and infrastructure, including those associated with fossil fuel production, increasingly are being adapted to facilitate renewable energy production.

Landfill gas, for example, must be cleaned before it can be burned and developers, such as the University of New Hampshire, are using the same oil and gas industry method of pressure swing adsorption to remove hydrogen sulfide, volatile organic compounds and CO2 to clean it. "The processes to remove sulfides, etc., are well established in oil and gas and industrial gas refining," says Bob Harrison, vice president for construction at Norwalk, CT-based Emcor Energy Services, which built and operates the UNH plant. "Pressure swing adsorption is essentially a sponge with specific sized holes. You force methane and CO2, which have different-sized molecules, through the sponge, and it separates gases of different molecular weights."

> "Companies like Ormat, ElectraTherm and UTC, are taking existing technology to convert the low-quality geothermal source into electricity."
>
> -- Doug Tennyson, Director, Technical Services, Department of Energy Rocky Mountain Oil Test Center

Another place where technology crossovers exist is in geothermal energy. Drilling geothermal wells in both high and low-temperature, water-dominated reservoirs also uses the same drilling equipment for oil and water wells.

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Nonetheless, the high costs associated with drilling have made it difficult for geothermal projects to get off the ground, making the use of abandoned or declining oil and gas wells particularly attractive. Estimates say there are more than one million abandoned oil and gas wells around the world, and Emcor's Harrison notes that the number of out-of-service gas wells is on the rise.

Historically, however, the water in those wells, at between 170-250 degrees, has not been hot enough for conventional geothermal applications, says Doug Tennyson, director of technical services at the Department of Energy's Rocky Mountain Oil Test Center (RMOTC) in Casper, WY. But since last summer. RMOTC has been running a pilot low-temperature geothermal installation from Ormat Technologies Inc. that provides enough electricity to run 2 or 3 oil well pumps.

"We have a lot of oil fields producing not much oil, but a lot of water," says Tennyson. "Companies like Ormat, ElectraTherm and UTC, are taking existing technology to convert the low-quality geothermal source into electricity. Since water is being produced as a byproduct, we can use the electricity to offset the cost to produce the oil. But the cost to produce the electricity can't be more than cost of buying electricity. That's what we're trying to validate now."

Should the costs pencil out, Tennyson says President Obama's Reinvestment Act contains money for low-temperature geothermal projects, and RMOTC would likely expand the project, potentially producing enough electricity to put back on the grid. It has been estimated that oil fields in the U.S. could provide an additional 5,000 MW of electricity with low-temperature geothermal technology.

In the meantime, the University of New Hampshire's biogas facility is well on its way to providing the majority of the university's electrical needs, with a Siemens natural gas turbine modified to burn processed landfill gas. "It was modified because landfill gas has a lower energy content," says Paul Chamberlin, UNH's assistant vice president of energy and campus development. "Natural gas is 96% methane and has higher energy hydrocarbons. Our landfill gas will be plus or minus 85% methane."

Emcor's Harrison says the turbine modification required depends on the machine's level of sophistication. "If it was not designed specifically for that gas, the changes can be substantial," he said. He adds that UNH is not only adapting its existing Siemens turbine, but is installing a Solar Turbines Inc. (Caterpillar) turbine already adapted to run exclusively on processed landfill gas.

Solar Turbines had been collaborating with Lawrence Berkeley National Labs (LBL) to commercialize a fuel-flexible, near-zero emissions combustion technology, but the firm will not use the technology until it resolves intellectual property differences with LBL, says Ram Srinivasan, head of Solar Turbines' advanced combustion program in San Diego. Robert Cheng, LBL advanced energy technology scientist and inventor of the low-swirl injection technology, says LBL continues to develop the "total fuel flex" version of LSI, which would allow gas turbine operators to choose among natural gas, propane, waste gases, biogases and petroleum refinery gases.

Vastly expanding the production of photovoltaic manufacturing equipment posed no such problem for semiconductor manufacturing equipment behemoth Applied Materials when it jumped into the solar industry in 2007, given the significant overlap between its LCD display expertise and solar cell manufacture. "It's a straightforward thing to convert a system for manufacturing an LCD panel to a solar panel, and the glass in a solar panel is actually thicker, so it's easier to handle. A lot of the know-how for making wafer-based solar modules is related to IC (integrated circuits)," says Charlie Gay, a solar industry pioneer and president of Applied Materials' Applied Solar.

Gay notes that the glass must have a semiconductor layer "traffic cop," a transparent conductor (+) and back metal (-). "You need a glass sputtering system used for architectural glass manufacture to deposit the conducting layers, but the semiconductor layer is the same as for the display industry," he said. To produce its first thin-film PV product, Applied Materials modified its display manufacturing equipment and combined it with glass coating technology it acquired with thin-film deposition equipment manufacturer Applied Films.

Neither was it much of a leap for Marine Innovation and Technology, a firm comprised of former oil and gas platform engineers, to morph offshore drilling platform technology into WindFloat, a semi-submersible floating wind generation system. WindFloat is intended for use in waters greater than 50 meters deep and ten miles or more from shore, providing physical stability for wind turbines so that existing offshore wind turbines can be used with very few modifications, says Marine Innovation's Dominique Roddier.

Whereas oil and gas offshore drilling platforms are engineered to minimize vertical motion, with less attention paid to angular motions, a platform for a wind turbine must minimize pitch and roll in order for the turbine to function optimally.

So Marine Innovation and Technology created a three-columned triangular design for WindFloat, placing the turbine on top of one of the columns, and giving more ballast to the other two columns to stabilize the entire platform. The ballast from the other two columns stabilizes the weight distribution and allows the turbine to stand upright.

Like oil and gas platforms, WindFloat has multiple mooring lines (six), although four of them are connected to the column stabilizing the turbine, creating an asymmetric design that supports the additional forces placed on the turbine's column. At the base of each column, water entrapment plates resist the water around them, effectively making the platform move less in waves. A "truss spar" type of oil and gas platform, by contrast, stacks similar water entrapment plates vertically, rather than spreading them horizontally.

As already reported in REW.com, Principle Power, a developer of offshore wind projects, has licensed WindFloat technology.

Although commercial licensees for its kinetic generator have dried up, Boise, ID-based M2E Power expects to go into production in 2010 for specialized military applications that would have "immediate crossover" into commercial markets, such as for charging wireless sensor nodes in logistics tracking or industrial uses like monitoring heavy equipment, says operations manager Jim Gutierrez.

M2E's technology integrates energy/battery management electronics and a unique generator capability, based on translation of kinetic energy into electric current via magnetic induction that uses abundant rare earth magnets. It has shown increases in power output of between 300-700% over existing kinetic-motion configurations.

The advantages to using cleaner, renewable versions of traditional technologies or to using them for renewable energy are too numerous to deny. Thus, the move toward them is inexorable and inevitable as the U.S. and other countries being to transition away from the traditional sources of energy and into renewables. As further indication, one need only look at the increasing deployment of renewable energy technology, notably solar, at fossil fuel plants to reduce the intensity of those plants' carbon production.

To learn more about a solar / fossil fuel plant combination, check out RenewableEnergyWorld.com's video tour of the 10-MW El Dorado Thin-film solar plant that resides next to Sempra's existing 480-MW El Dorado Energy power plant.

Video

Image Gallery (1)

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r-t-55471 March 31, 2009

As a young lad I was told that all change was evolution not revolution. I thot about that for a few years and had to agree - in general. Other things are cycles and have nothing to do with permanent change.

The evolution part of this article is apparent. The part of about a revolution is thankfully lacking.

One point I would like to raise:
"The advantages to using cleaner, renewable versions of traditional technologies or to using them for renewable energy are too numerous to deny."
I didn't know anyone was denying the benefits. What are the disadvantages?

When the advocationists (hey, I tried 'advocators' and it didn't like that either) learn to recognize the weaknesses of their own positions then real progress will be made. Good luck getting a detractor to say anything positive (but it really does happen, you just have to read a lot :).

Comment 1 of 10

natalie-villella-18262 April 1, 2009

With transmission lines already running to oil fields (such as W. Texas) it stands to reason that solar and wind installations in those oil fields would be a quick connect feed-in utilizing these lines feeding the grid. Geothermal as an adjunct to CSP may enable the "170-250 Deg." capability of the well holes to achieve the needed high temp geothermal differentials (at least during the day). The next great strides in Renewables will come from the synergy of system combinations. Wind pumping and/or direct Electrical production-> Geothermal wells-> Solar temp. boosting-> Turbine/Micro turbine->Existing Grid.

I'd also love to see the segway between Solar PV and Solar Thermal since (from my understanding) Heat is seen as a PV detriment. I already use Solar Thermal as an ajunct to my wood boiler heat reducing both the seasonal length and hieght of season intensity of my home heating (and DHW) by wood.

Concentrated Solar may facilitate Pre-Heating water for Landfill/Sour Gas Boiler burning in Turbine generation set-ups. The Idea is not to limit thought/innovation to Single method generation. To that end - Incentives that stipulate method of production should recognize "plants" for the %contribution to "total output" or savings (if they do not already).

(P.S. r.t. ; try advocates - those who advocate, My weakness is spelling)

Comment 2 of 10

r-t-55471 April 1, 2009

Nat, thx - it seems so simple in the sobriety of morning :) I usually would have bailed out and said proponent.

I'm with you on solar thermal. In the south I can not imagine why every hotel, hospital, and other hot water using operations do not have solar water heating. Inertia, I guess - there isn't enuf expertise available to promote it. Maybe it really is too expensive from an ROI point of view. I think that would go away with the economies of scale but there aren't enuf early adopters (back to the expertise thing).

Concerning Texas, I don't think the power lines that exist are sufficient for the load they want to send back east. I understand, from articles, there is discussion about building an adequate transmission line, but it would be a few billion $ and finding the people who want to pay for it is proving difficult.

Comment 3 of 10

mary-saunders-73470 April 1, 2009

The earth is such a good insulator, solar boost to the temperature makes great sense. There's a place in Oregon where interns do a competition with a parabolic solar cooker to see whose will boil their tea water first. They just use foil and cardboard. As long as you can have the water circulating, you wouldn't need to lose much to evaporation, in a closed-loop system.

I also like the idea that appeared here some time ago about enclosing quite a bit of territory with clear film, then generating energy with a heat stack. Doing this near or over other activity might work in some cases, especially adding greenhouse growing of plants suited to the particular climate and light timing. An advantage is that this may keep moisture on the land, confining evaporation and condensation, and using it to advantage.

Pres. Obama was touting U.S. creativity and vibrancy today in Europe against criticisms. We have had massive mal-investment and rewards for dissipating activities. I hope D.C. will come to understand the need to incentivize and sustain RE rather than letting mountain-top removal and other such abominations continue without the costs of environmental destruction and human health destruction covered.

Comment 4 of 10

joe-craft-160520 April 1, 2009

Mary, The idea is actually not as direct as you make it out to seem. The air under the enclosure is heated much like your car in a parking lot over the summer. this expands the air and makes it rise. in the center the enclosure is highest and narrowest. This forces the warm air to go very fast and turn wind turbines all day at a constant speed. the edges of the enclosure are low to the ground and open so as to draw in new air. This does trap moisture underneath and really does change the climate. Large saline pools could absorb some heat directly and heat the air over the night, and solar cells under neath the film/glass covering could create even more energy.
I think we are still massively underestimating the power that slips past us all daily in streams and rivers. Hydroelectric is proven, simple, baseline power that can be modeled to limit interference with natural systems and wildlife. Geothermal as well, these are both energy sources that will not go away at night or in bad weather. Hydro could be shut down in some extreme cases, but the grid it's self is probably down by then due to massive storm damage.

Comment 5 of 10

phil-manke-79191 April 1, 2009

Joe, blue sky aside, some holes in the theories. Wouldn't adding any moisture to a solar tower diminishes energy greatly by phase change depletion? Any moisture trapped under would be swept away by the constant hot breeze going up the tower. Might be better to have a big heated rock pile under a film to ad off-sun heat.
Solar cells under the film would also cut the energy delivered greatly. Better to have them out in the direct sunlight and perhaps take heat off the backside to keep temps down.
Hydro is OK if it doesn't interfere with natural biosystems evolution, as we are finding out.
Solar thermal, small direct scale, is easily stored in the form of hot water for the many processes that require it and can be more easily done with solar than geo thermal wells or converting to electricity and then to thermal or (yuck), burning stuff.

Comment 6 of 10

randy-scott-168368 April 2, 2009

For 30 years I have been a designing draftsman for various machinery companies serving the oil & gas industries in Texas.
Since it was first announced that Texas was on it's way toward making more electricity from wind than any other state, I have been trying to transition into the new energy technologies.
Unfortunately, I am finding that all the machinery being used in Texas is being manufactured in Europe. In effect, "green energy" in Texas means being a consumer of other people's productivity, not creating anything ourselves.

Comment 7 of 10

fireofenergy-150745 April 3, 2009

Yep, that's what I'm afraid of. We need to turn the deserts into CSP and seawater greenhouses. These two simple concepts together would solve ALL of the worlds problems except that of who gets to make what where! (Oh, and if that guy who complains about everything descends here, tell'm that we should only use bulldozers for the greenhouses as mirrored over land does not need to be bulldozed which may create another dust bowl).
Mirrors are the solution.

All them black panels (x thousands in that video) will make the deserts hotter and even less humid. The object is to put black PV on all roofs, and all sunny parking lots, and to use the mirrors and seawater greenhouses all over the desert. The excess evaporation (since not all of the seawater is retained in the process) would even grow more desert plants nearby. This in turn (with all the crops and no more need to build fossil fueled plants) would also sequester the co2 problem.

By now, it should be apparent that simply turning a desert into a black field is by no means, the right way to go solar, however that array is very encouraging because this is exactly what we need to do for parking lots!

Comment 8 of 10

thomas-schmidt-36371 April 5, 2009

Reading these articles and the reader comments that follow, I become more and more convinced that, the human race is lost.
Not one mention of the most basic and simple solution to this "energy crisis" that so many are perpetuating.
But I geuss thats it, right there? As long as there is a "crisis" of some sort, there is a way to profit from it, by the selling of a solution to combat the "crisis." So why not perpetuate it? Isn't this what the so called "energy crisis" is really all about? The bottom Line, money?

Do you want a real world solution?
One that does not exist in a pesudo world of smoke and mirror imagery and verbal prestidigitation?
One that does not wage war and send men and women into combat where they take the lives of men and women of another nation?
A world where those who deem themselves "in charge" do these things for the sake of commerce and industry but call it all by another name?
Do you? Do you?!

TURN IT OFF!

Its that simple. But you and I both know, that will never happen and this why it truly is a, Pity about Earth.

Comment 9 of 10

fireofenergy-150745 April 5, 2009

Ok, let's all outlaw the wheel LOL.
Anyways, on efficiency, Cree announced that they achieved 161 lumen per watt. The Q5 LED puts out about 100 (and has been available for quite some time) and the CFL is about 60 and the incandescent, about 15 or 20. So instead of turning off (and waiting for the last drop to expire), humanity will survive past this silly energy thing and learn how to do MORE with LESS!
I must repeat "Mirrors are the solution!" (If built by the country using them and with no bulldozers). Less powerplants should be needed as more people are born, even as old coal should expire.
Bty, the theoretical max lumen per watt is 683!

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