HighTable

Expert Perspectives on Renewable Energy

HighTable is a business-focused online platform where smart professionals connect with one another around the topics important to their industries. Our members share perspectives that help solve business challenges through questions and answers, topic-driven video, and virtual events.

Michael Liehr asks:

PARTNER, TECHNICAL CONSULTING | FORMER CTO OF LEYBOLD OPTICS GMBH

How decisive is the role of national grids for the development of different types of renewable energy?

Photovoltaics is still considered too expensive and too inefficient (energy payback times too long) vs. wind power, for example. But it doesn't rely on a strong national grid since the energy is usually produced with smaller de-centralized units quite close to the consumers. What is the significance of this issue in long term evolution of photovoltaics?

3 SELECTED RESPONSES

Answer 1:

DOUG HOUSEMAN
VP TECHNICAL INNOVATION, ENERNEX

If we could match load and supply dynamically, renewables would have no issue. The system as it exists was designed to be a one way, load following system—we have spent over 100 years optimizing this design.

Renewables—solar particularly requires a two way, supply following design. Even at the local level, system protection keeps solar from being as useful as it might, since relays are designed to prevent power flow in the "wrong" direction, even at the local level.

We do not yet have true electric storage that is cost effective, so we have to resort to non-electrical storage for most of the excess power locally if we want to be cost efficient (e.g. ice or hot water).

In many cases people would be better off using their roofs for hot water (for heating and washing, etc) than they are using them for PV. China has a massive program to put hot water heaters on the roofs of buildings, and is focused on areas where the winter is cold.

Some manufacturers are now offering PV/Thermal systems which actually make the PV more efficient (they run better cold) and the hot water is then used for space heating, etc.

Grid re-design at the local level, effective storage, and demand response are all key pieces of moving from the 20th century design of the grid to the 21st century design. Even the interface standards for PV into the grid (e.g. IEEE 1547) are designed with limits that cause the PV to stop making power when the local voltage gets too high.

There are a large number of issues yet to be solved in the next generation grid design. There are dozens of industry working groups (like the SGIP, and the European Platform Architecture Team) that are working on how to solve these problems.

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Answer 2:

WILLIAM ROSS WILLIAMS
CHIEF EXECUTIVE OFFICER, FOUNDER, ALTRESCO INTERNATIONAL

...Over the past two years it has become more clear to me that working on the load side of the equation in the US is much simpler. One of our biggest challenges is that we have indeed been developing our system over 100 years. Our model has been to add controllable generation to serve identifiable loads. Our dispatch system and grids were specifically designed for this type of firm, intermediate, and peaking power that were each controllable on a merit dispatch basis. Now we have already added as much as 20% nameplate capacity in wind generation to some ISOs. I believe the most saturated ISO is MISO, which is showing approximately 10 to 11% wind energy (as differentiated from capacity). In another load-balancing area in Colorado, the wind generation capacity is now nearly 13% of peak load. This does not sound like much, but on days in May, when it is quite breezy and no one is using either air-conditioning or heat, and the total off-peak load is about 3600 MW, the wind may be generating as much as 40% of the electricity being consumed. Now this is just grand, except that leaves us with nothing running but coal and wind. Coal is a very slow responding generation asset, whereas wind can go from 20% output to 105% output in 15 min. It can also go from 105% output to 20% output in 15 min. Because our grid was designed to have the maximum efficiency—all of the generation is designed for planned dispatch with continuous runtimes of at least 10 hours, and a start up time of 2 hours—we have about five instances of near black out situations in the March through May time period of every year. There is simply not enough quick responding generation in the system to cope with large rapid swings of uncontrollable input. This is the conundrum.

Our grids were designed for controllable energy to match predictable loads, now we have large amounts of uncontrollable energy, with no matching equipment or generation to compensate. The reality is that this situation is not going to be dealt with through electricity storage. Even if we were to build a battery bank big enough, its ability to accept charging and discharging at the rates of wind powers wrapping up and ramping down and the chemistry of the batteries would prevent them from accepting these large bursts of electricity...One other very important note is our regulatory environment. In the current environment, if someone were to devise the perfect instant storage device for huge amounts of electricity, they would be bankrupt after one cycle. This is because they would be charged retail for the electricity they are storing and only be paid wholesale when they put it back on the grid.

Michael Liehr asks:

PARTNER, TECHNICAL CONSULTING | FORMER CTO OF LEYBOLD OPTICS GMBH

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Answer 3:

MARK BURGER
PRESIDENT OF ILLINOIS CHAPTER OF AMERICAN SOLAR ENERGY SOCIETY

First of all, the energy payback on solar is fine, measured between less than a year for thin film to about two years for crystalline. The urban legend of too long an energy payback for solar occurred over 30 years ago when the technology was in its industrial infancy. Secondly, PV has dropped in price in the past three years where the cost of power generation on a multi-megawatt scale is comparable to many new power plant construction of renewable or non-renewable type. This is not to denigrate wind power, which is cost effective in its own right. PV can be deployed at the building level, sub-station level and even on a high voltage transmission level (combined nicely with wind) right now. The PV evolution is becoming a revolution as its manufacturing output is now 1% of the world's nameplate capacity and will be 1% of global electric consumption in another 2-3 years, following wind's growth pattern by about 5-7 years.

Gabriele Whyard asks:

VICE PRESIDENT, FEDERAL SALES – ENERGY DIVISION | ADVANCED STRATEGIES CONSULTING LLC

Would hydrogen be a viable option for energy storage from renewable sources for utilities?

We see that the EU in particular Germany is working on renewable energy distributed generation systems that utilize hydrogen within those systems as a storage component.

In the US we find that there are issues with grid congestion resulting from renewable intermittent energy generation. Some utilities are exploring battery storage to manage demand, would an on-site hydrogen system also be a viable cost competitive solution for storage?

3 SELECTED RESPONSES

Answer 1:

RICHARD KOMP
DIRECTOR, SKYHEAT ASSOCIATES

Hydrogen is an inefficient energy storage material. There is no free hydrogen on our planet, every bit of it has to be made and the most common way of making it is from methane from natural gas. When oil refineries have lots of methane available, this is cheap but not renewable since you are still using 100% fossil fuels. When you use electricity to make hydrogen (which is easy to do with well established technology) you are competing with other methods of storing electricity. The lead-acid golf cart batteries storing PV electricity in my off grid home ran about 80% efficient when I first put them in, but now they're 6 years old and are down to about 65%. The round trip efficiency from electricity to hydrogen and back to electricity is only 60% with present technology and you have all the other problems listed by other responders, like its lightweight gas state making storage difficult. It is not now economically sustainable to use hydrogen as a storage medium, even after 170+ years of trying.

Answer 2:

RICHARD CARO
CONSULTANT/CEO, CMC ASSOCIATES

Battery storage is both costly and degrades with time requiring eventual replacement. It is low tech. A packaged hydrogen generator could be developed for this purpose that would use the surplus electricity to electrolyze water generating hydrogen that would be stored. The oxygen that would be generated could be stored as well, but likely just vented to the atmosphere. When needed, the stored hydrogen would be burned to generate heat, making steam, turning turbogenerators; or used in fuel cells to generate electricity. Turbogenerators are part of existing power stations, but hydrogen is a new fuel. The hydrogen fueled generator with a fuel cell could be part of a packaged peaking station that would include the electrolyis unit and hydrogen storage. This is a product never before available, and an opportunity for a new venture.

Gabriele Whyard asks:

VICE PRESIDENT, FEDERAL SALES – ENERGY DIVISION | ADVANCED STRATEGIES CONSULTING LLC

Would hydrogen be a viable option for energy storage from renewable sources for utilities?

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Answer 3:

IB OLSEN
FOUNDER AND PRINCIPAL, IBD ASSOCIATES, INC

Renewable energy generation needs both short term, fast reacting storage and longer term energy storage. Battery based energy storage is already showing its merit in the first category with lithium ion working well in 0 to 3 hours and sodium batteries in 3 to 6 hours. There are other chemistries being used/demonstrated but lithium ion and sodium have the most installed base right now. It is only when we want extended charge and discharge of more than six to eight hours, that battery solutions gets to be too expensive. Some flow-battery technologies have the promise for longer duration discharge, but we have not seen enough commercial installations of them yet.

This is the justification for looking into hydrogen, compressed air, liquid air, and other non-battery based energy storage technologies.