

Think Outside the Box & New Technology

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Details:

[Summary](#) | [Article](#) | [Current use](#) | [Related guidance](#)

About this update

This dated news record has been reorganised for clear reading and connected to current guidance.

Publication date: July 28, 2020.

Status note: Present-tense statements, market figures, deadlines and program details in the archived record belong to its publication date. Check current official sources before making a decision.

What this article reported

We here at Northmore Gordon, are very optimistic about the future. Some think that moving towards a carbon-neutral economy is too hard, too expensive and will take too long.

Moving to a carbon-neutral way of life is challenging, but completely do-able. Whatever technological, process, or economic challenges are in place, we can work together to find solutions.

The technology that we have is constantly changing, and who knows that amazing invention will be developed next that will have just as a big (if not bigger) impact as solar panels?

We must all take a multi-faceted approach to the challenge, and think outside the box to find novel solutions, and/or novel applications of old solutions.

How to get the most out of your solar power?

If your facility has solar panels, or you are thinking of getting solar panels, or both, and your system is likely to generate more power than you use, especially in summer, here are some strategies on how to make the most of the power from your solar system.

Solar Power Variability

The nature of solar panels is that its output is highly variable with with seasons. The output in summer can be approximately three times of the output in winter.

Feed-in Tariff

Once upon a time there was a legislated minimum feed-in tariff from solar panels, the tariff was very generous, and had the desired effective of increasing solar installation domestically around Australia.

The feed-in tariff now is small comparatively, and typically ranges 10 - 15 cents per kilo-Watt-hour depending on your retailer, location, time of day, and contract.

Are we better off using excess power on site?

Depending on the cost of your facility's electricity - you may well be better off, economically, to use as much electricity as possible during high-output times.

How to use more power smartly?

Batteries

One of the most obvious ways to store excess electricity for later use is batteries. The downside of course is that they are somewhat expensive at the moment.

Non-Battery Batteries

There are other ways to store excess power for use later:

ice storage : existing refrigeration compressors are used to generate ice in a dedicated unit during times of free or no-cost electricity. The ice can also be used to assist with site chilling or cooling requirements during times of high-cost electricity. The ice storage unit can also act as a buffer tank for times with there are spikes in refrigeration demand. Example: a dairy facility uses their excess solar panel power to generate ice during the peak of the day, that stored ice is then used later in the day with little or no solar power to cool deliveries of milk

hot water storage : use existing solar thermal or heat pump units to generate excess hot water, and store for later use. Depending on the storage tank, the temperature of the stored hot water can be higher to enable more energy storage - mixing with cold water at time of use may be appropriate. Just make sure the tank is very well insulated to minimise heat loss to the environment. Example: a dairy farmer uses the excess solar power to generate hot water using their heat pump units during the middle of the day; in the late afternoon after milking, the hot water is used to clean and sterilise all milking equipment

phase change materials (PCM) : A PCM is a material that changes phase (e.g. solid to liquid) at a certain temperature e.g. ice to water at 0 degrees C; other materials are available that change phase between 0 - 10 degrees C. Due to the phase change, a large amount of energy can be stored in the PCM. If there is cheap or excess electricity supply, then room set points can be changed, with the PCM storing the thermal energy as it freezes.

hydrogen : hydrogen has been making a quiet come-back with companies developing (relatively) simple plug-and-play units where hydrogen is generated (via electrolysis) using excess electricity, stored, and then converted back to electricity via fuel cells. It is, at the moment, very expensive. However, hydrogen is a highly viable carbon-neutral fuel for buses, trucks and large transport vehicles.

Load Shifting

Load shifting - which is changing the times when items are used when electricity is cheapest - is an old concept. Historically, when off-peak electricity prices are lower than peak prices, then operating equipment during off-peak where possible, could reduce your overall power bill.

With excess solar power, the concept is the same, but the equipment now needs to be operated during middle of the day rather than at night.

The limitation, of course, is the process flexibility to change equipment operating hours.

Example: A water treatment plant that needs to pump water from location A to B for several hours a day on a daily basis can schedule their pumping hours to best suit their solar panel power output, and/or times of off-peak power.

How to use this information now

For current use, confirm the applicable scheme rules, regulator notices, market date and reporting period. Keep historical prices or forecasts separate from present quotes and verified outcomes.

Separate source-reported facts from forecasts, targets and commentary. For a current project, retain the official source, version, effective date, assumptions and decision record in the evidence file.

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What are the main energy storage alternatives to conventional batteries for managing excess solar power?

The article identifies four non-battery storage methods: ice storage, hot water storage, phase change materials (PCM), and hydrogen. Ice storage uses refrigeration compressors during low-cost periods to generate ice for later chilling needs. Hot water storage captures excess solar thermal or heat pump output in insulated tanks. Phase change materials store thermal energy by changing state at specific temperatures, releasing energy when needed. Hydrogen, generated via electrolysis during excess electricity periods, offers a carbon-neutral fuel option for transport, though currently expensive. Each method suits different facility types and operating profiles.

Why is feed-in tariff revenue insufficient as the sole strategy for managing excess solar generation?

Current feed-in tariffs typically range from 10 to 15 cents per kilowatt-hour, significantly lower than historical minimum tariffs. This limited revenue makes exporting excess power economically inefficient compared to alternative strategies. Rather than accepting low feed-in rates, facilities can maximize value by storing or time-shifting use of excess solar power to reduce peak-period purchases or to supply high-value operations. This approach aligns solar generation with operational needs and improves project economics without relying on external tariff structures.

How does seasonal solar output variation affect energy management planning?

Summer solar output is approximately three times greater than winter output, creating significant seasonal imbalance. This variation means facilities cannot rely solely on solar generation year-round and must plan complementary strategies. Summer excess power—suitable for ice storage, hot water heating, or hydrogen generation—cannot directly offset winter demand. Understanding this pattern helps determine appropriate storage capacity, backup supply arrangements, and load-shifting opportunities. Our integrated energy strategy approach can help facilities coordinate seasonal generation patterns with storage, controls, and market participation to optimize economics across the full year.

What is load shifting and when is it a practical solution for solar energy optimization?

Load shifting involves timing equipment operation to match periods of lowest electricity cost or greatest availability. Historically applied to off-peak night hours, the concept now applies to midday solar peaks. A water treatment plant might schedule pumping to align with solar output or traditional off-peak times rather than running continuously. The limitation is operational flexibility—processes with fixed schedules or production requirements cannot easily shift. Facilities with flexible operations, storage capacity, or processes that can tolerate timing changes are best positioned to benefit from load-shifting strategies aligned with solar availability.

How can ice storage systems serve dual purposes in food and beverage facilities?

Ice storage systems use refrigeration compressors during peak solar periods to generate and store ice, which serves two functions: it can later meet site chilling or cooling needs during high-cost electricity periods, and it acts as a buffer for unexpected spikes in refrigeration demand. A dairy facility exemplifies this approach by using excess midday solar power to make ice, then using stored ice to

cool incoming milk deliveries during afternoon receiving periods. This dual-purpose application maximizes the economic value of ice storage by addressing both regular operational loads and demand variability, reducing peak electricity purchases and associated demand charges.

How do phase change materials store and release thermal energy for site operations?

Phase change materials (PCM) store significant thermal energy by changing physical state—for example, freezing from liquid to solid or melting from solid to liquid—at specific temperature thresholds, such as 0°C for water-ice or specialized materials operating between 0–10°C. During periods of excess cheap or free electricity, facility set points are adjusted to allow the PCM to undergo its phase change (freezing), storing thermal energy in the process. When cooling is needed later, the PCM releases this stored energy as it changes back to its original state. This approach decouples electricity supply timing from cooling demand, improving operational economics and reducing peak-period consumption.

What role can Northmore Gordon play in optimizing strategies for managing excess solar generation?

We provide integrated energy strategy development that coordinates supply, storage, operating loads, and commercial decisions. We conduct feasibility assessments for renewable heat and electrification options, evaluate storage technologies and load-shifting opportunities, and helps prioritize investments based on site-specific operating requirements and financial outcomes. Through measurement and verification services, we establish baselines and confirms realized savings from storage or load-shifting projects. The organization's energy optimization and carbon advisory platforms support portfolio planning across multiple facilities, helping identify which storage methods and timing strategies suit particular sites and operating profiles.

What are the practical and economic considerations when evaluating hydrogen as an energy storage option?

Hydrogen is generated via electrolysis using excess electricity and can be stored and converted back to electricity through fuel cells, offering a carbon-neutral energy pathway. However, current hydrogen production and storage systems remain expensive compared to other alternatives, making immediate economic payback challenging. Hydrogen's strongest application is as a transport fuel for buses, trucks, and large vehicles where carbon neutrality requirements align with operational needs. Facilities evaluating hydrogen should assess long-term decarbonization targets, available capital for emerging technology, and whether transport operations justify the investment. Plug-and-play systems are becoming available, though project-specific feasibility assessment remains essential.