Economic Consulting Associates
Viewpoint

Night storage heaters as an ancillary service

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Because they are cheap to install, reliable, long-lived and have very low maintenance costs, night storage heaters are popular in granny-flats and with landlords in cheap rented accommodation who do not worry that they are costly to run. Electric night storage heaters are a thing of the past.

Or, are they a technology of the future? With moves to decarbonise space heating aren't they like electric road vehicles? And with an increasing need to provide storage in electricity systems to balance intermittent energy sources, perhaps they have a role in countries that need heating in the winter months.

Recent developments in ancillary services for meeting these challenges have focused on the fast developing battery industry. However, among their other potential benefits, could there be a complementary role for storage heaters to assist in frequency control and restoration? This was a question posed to ECA.

Night storage heaters have been around since the 50s

First introduced in the United Kingdom (UK) and other countries to fill the night-time valley of electricity demand, and boosted by the then new technology of nuclear power, night storage heaters absorb cheap electricity at night and release the energy as heat during the day and evening. An Economy-7 off-peak electricity tariff was introduced in the 70s in the UK and the arrangement remains largely unchanged today. Other countries, including some in the Mediterranean, have adopted similar arrangements.

Night storage heaters are very simple, robust and long-lived. Electricity is used to heat thermal bricks, typically for 7 hours during the night and the heat is then released slowly by opening or closing a flap that controls convective and radiative heat. A special circuit supplies the property and is energised only for the 7 (or so) hours. Usually, the special circuit supplies both the night storage heaters and a hot-water immersion heater in a water cylinder, both at off-peak tariffs.

Can they provide ancillary services?

Electricity system operators have always needed ancillary services to operate the system reliably and securely. The main services required come from generators to provide reserve responses ranging from seconds to hours to balance supply and demand and avoid triggering a collapse of the power system. With greater penetration of intermittent technologies such as wind power, there is an increased need for such services. In the past in GB, such reserve services came from large pumped-storage plants (e.g., the 1,800 MW Dinorwig in North Wales), fast-start gas turbines and spinning reserve from thermal power plants, but other

technologies have been introduced in recent years including large capacity batteries and demand-side response.

Off-peak electricity for night storage heaters and hot water has always been used to some extent by system operators to balance supply with demand during off-peak periods. But it can also be used to provide frequency and restoration reserve at night.

The supply may be controlled through a central ripple-control system that sends signals through the power network and switches the supply off or on. The SO can trigger a load reduction from the dedicated circuits within seconds (in the case of ECA's client, this would have been between 50 seconds for loads in towns and up to 3 minutes in remote areas) and can be targeted at different areas.

Is it valuable to the System Operator?

Unlike battery storage and pumped storage plants, a night storage heater and hot water cylinder currently only offer load reduction. Battery storage by contrast can absorb or release electricity and therefore provide greater flexibility. And night storage heaters today could only provide reserve services for 7 hours during the night-time when the need for and value of fast response can be lower. But much of this could change.

Is it inconvenient for customers?

Except in the coldest periods, a 15 or 20 minute interruption in electricity supply to night storage heaters or hot water cylinders can be recovered quickly by boosting the heat in the remaining hours (unless the interruption occurs at the end of the night). For fast frequency response, this 15 or 20 minutes is all that is needed. Some night storage heaters will automatically recalibrate the amount of heat needed but older or simpler models will not, and therefore there may be slightly lower room temperatures during the day/evening. Thermostats on hot water cylinders will stop heating when a certain water temperature is reached and will usually cope with a short interruption. The inconvenience to customers is likely to be minor.

Can it work?

Although the cost-benefit analysis could potentially favour a customer offering to provide fast-response reserve services to the SO, there are many complications.

Nevertheless, in combination with smart grids, interactive pricing in homes, increased penetration of some forms of intermittent renewable energy, and policies favouring decarbonisation of heating, who knows, perhaps night storage heating's day may be yet to come.

Economic Consulting Associates was established in 1997 to provide economic and regulatory consulting services to industry and government. Our senior staff have many years' experience of carrying out economic, market and policy analyses in the electricity, natural gas and water sectors.

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