# Revolutionising energy management for buildings with Flexible Demand Application

With over 400 kW of existing solar photovoltaic panels, electric batteries and sophisticated energy monitoring capability, the project task for our Newcastle Energy Centre was to coordinate all these resources in a simple way to better manage its electricity use to reduce costs and emissions.

## The challenge

The timing of energy-use was seen as particularly important because our electricity tariff structure is linked to peak demand. The tariff is calculated based on the highest 30-minute power consumption spike over a year, and then extrapolated across the entire year. This, coupled with standard time-of-use tariffs, gave an opportunity to use the full capability of the existing equipment and explore innovative solutions for both reducing annual costs and working towards CSIRO's ambitious sustainability goals.

## The solution

In pursuit of the opportunity, we enlisted a team of energy scientists to devise an effective solution. The result? An advanced application named Flexible Demand Application (FDapp) that features 'look-ahead' controls designed to optimise energy consumption while maximising benefits. FDapp is user-friendly, empowering stakeholders to set their own objectives – whether it's reducing energy expenditures, minimising emissions, or enhancing comfort levels.


The app uses a three-day forecast incorporating weather, pricing, and emissions projections alongside site operation forecasts. The process involves continuous calculation of optimal actions, implementation of suggestions every five minutes, and refinement based on real-time updates.

We decided to use FDapp to optimise cost reduction and emissions mitigation.

Flexibility lies at the heart of the app's functionality: the ability to change the time of day when some or all of the site's energy is consumed. The app orchestrates use of the various available flexible resources, including flexible loads such as energy storage units, (e.g. electric batteries), heat pumps, electric hot water systems, Heating, Ventilation and Air-conditioning (HVAC) systems, electric vehicles, photovoltaic (PV) inverters, and gensets. The user retains control over the degree of autonomy granted to the app in managing these devices.

Depending on available digital infrastructure and approvals, the setup process for the app is streamlined and efficient, and can be done in a day.

At our Newcastle site, FDapp was initially entrusted with overseeing a 150-kWh battery.

## The result

The impact of deploying the app was transformative. Demand charges were reduced by 15%, and overall energy bill savings were around 5%.

Trials were also conducted to see how FDapp would perform if site energy bills were exposed to wholesale energy price (rather than time of use tariff). FDapp demonstrated a 10% reduction in wholesale energy cost.

The magnitude of energy savings correlates with the scale of equipment deployed. For instance, at our Newcastle Energy Centre, doubling the size of the battery would have likely yielded nearly double the savings.

An unforeseen benefit of adopting the app is the potential to move away from average annual $CO_2$ emissions accounting methodologies – to more accurate and dynamic measurement and management of real (time-of-use based) carbon emissions. FDapp demonstrated a 3% reduction in time of use $CO_2$ emissions.

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