Department of Primary Industries

Climate Change Research Strategy - Energy Efficiency Solutions

Feasibility Studies

The NSW DPI Energy Efficiency project conducted studies to assess the technical and commercial feasibility of innovative technologies and business models to address the cost, reliability and sustainability of energy use on farms.

Energy Efficiency Solutions Project feasibility studies

Increases in energy costs over the last decade have eroded the profitability and international competitiveness of NSW agricultural producers, particularly those in intensive subsectors. In response, during the first half of 2020 studies were conducted to assess the technical and commercial feasibility of innovative technologies and business models to address the cost, reliability and sustainability of energy use on farms. Proposals were sought through public advertisements and direct engagement with associations and networks.

The initiative canvassed concepts that:

- provide opportunities to optimise on-farm energy management through an enhancement of efficiency and/or productivity;
- deploy technologies or business practices to optimise energy management on farms or in related supply chains;
- use innovative business models to increase farm productivity and profitability, such as increasing the proportion of processing conducted on-farm; or
- incorporate on-site energy generation, storage, demand management and/or microgrids.

An independent advisory group identified ten priority proposals through a merit selection process, then an independent expert assessor was matched to each priority proposal to undertake a detailed feasibility study.

A list of the Energy Efficiency Solutions feasibility study participants, a brief description of the proposals evaluated in the studies and the site locations can be found on the following page. A case study summarising the context, proposal and results of each of the feasibility studies can be found on the DPI website https://www.dpi.nsw.gov.au/climate-and-emergencies/climate-change-research-strategy/energy-efficient-solutions/funding

Feasibility study participants

(*proponents selected to proceed to pilot projects)

Proponent	Proposal	Site location
Avondale Feedlot*	Electrification of grain mill; automation of grain mill; off-grid 100 kW single axis tracking solar photovoltaics (PV) + 264kWh lithium ion battery + 150kVA backup genset	Rowena
Dairy NSW*	Solar powered chilled water storage for milk cooling	5 dairy farms
Farrer Agricultural High*	Electrification of irrigation pumps and 60kW raised single axis solar PV tracking system to power irrigation pumps and demonstrate Agrivoltaics	Calala
Haddon Rig Stud*	Grid connected solar PV with a battery backup system to supply electrical equipment to three independent electrical systems and improve reliability of electricity supply on site	Warren
Ingham's	Poultry litter digestion in a covered anaerobic lagoon (CAL) to produce biogas to generate electricity; solar PV installation	Tahmoor, Bargo
JBS Australia	Anaerobic digestion of liquid waste stream in a covered anaerobic lagoon (CAL) to produce biogas on site and produce fertiliser and wastewater for reuse on fields	Yanko
Pecora Dairy*	On farm energy generation with solar panels, flow batteries and peer to peer energy trading; electrification of LPG fuelled equipment	Robertson
Riverina Fresh	Business model: install solar PV at a group of dairy farms linked via a peer-to-peer trading to sell excess electricity generation to the Riverina Fresh factory	Wagga Wagga
Rosnay Organic Wines*	On farm energy generation with solar panels, flow batteries and peer to peer energy trading; electrification of diesel fuelled equipment	Canowindra
Sivermere Holsteins	Covered anaerobic lagoon (CAL) to capture biogas and biogas engine for electricity generation	Cowra
The Pines*	On farm energy generation with solar panels, flow batteries and peer to peer energy trading	Kiama

Key findings

All proposals assessed in the feasibility studies were found to be technically feasible, with the exception being the peer-to-peer trading model examined in the Riverina Fresh study. This concept is theoretically possible, but not at the particular location evaluated in the feasibility study due to local network constraints. All technologies assessed are currently available in Australia. The commercial feasibility of some proposals was stronger than others, with the initial cost of implementation being the primary driver of commercial feasibility.

A high-level summary of the key benefits of and challenges to adoption of the proposed technologies and business models assessed in the feasibility studies can be found below.

Benefits

Broadly speaking, the types of benefits identified in the feasibility studies that could be achieved by implementing the proposals evaluated include:

- ***Reduced energy costs and reduced exposure to future energy prices increases:*** All proposals would be expected to result in a reduction in energy costs. However, reductions in costs over the life of an asset and the other benefits accruing from investing in an asset must be offset against the up-front and ongoing costs of investing in that asset and compared to the business as usual scenario. The costs and benefits must be weighed up by each business making an investment decision, taking into account their own specific circumstances.
- ***Reduced fossil fuel use and emissions:*** All proposals would be expected to result in a reduction in fossil fuel use and emissions. In addition to doing their bit to save the planet, some proponents valued reducing emissions for the business benefit of improving the sustainability credentials, and thus the marketability, of their product to retail and supply chain customers.
- ***Reduced operating costs:*** In addition to reduced energy costs, some proposals would be expected to result in reductions in other operating costs, for example, reductions in labour costs associated with refuelling and maintaining diesel engines. For some technologies, however, there was an increase in other operating costs, for example, increased costs related to operating and maintaining biogas facilities.
- ***Increased energy security:*** Numerous sites that participated in the program suffer from frequent brown and black-outs or are not connected to the electricity grid. Implementing solutions to improve energy security can have many benefits including: improved productivity as operations would no longer be interrupted by loss of energy supply; reduced loss of refrigerated product; improved animal welfare; improved site safety; and, improved mental health for business owners and managers no longer having to worry about unpredictable outages.
- ***Improved social licence to operate:*** It was recognised that benefits such as reduced emissions, improved animal welfare and reduced odour can enhance a business's social licence to operate.
- ***Improved energy productivity:*** All proposals factored either a reduction in energy consumption or an increase in yield and profitability. Some proposals identified changes to business practice that would save cost, boost efficiency or increase output. Some

proposals identified new income streams, for example, from selling excess electricity into the grid.

Challenges

Common challenges identified in the feasibility studies include:

- ***Long payback periods, primarily due to high up-front capital costs:*** High capex costs were the biggest barrier to achieving commercial feasibility for the proposals evaluated. It is expected that the cost of the technologies investigated would reduce over time as adoption increased. Government sponsored technology demonstration pilots, such as the next phase of the Energy Efficiency Solutions project, assist with de-risking investment in novel technologies, establishing supply chains and encouraging large scale adoption.
- ***Scale of project****:* In some cases, the small scale of the proposed project resulted in it being commercially unviable, but the proposed concept may be commercially viable for a larger project able to achieve economies of scale. This was particularly the case for the biogas proposals, where there is less opportunity to scale down equipment for smaller projects, than for example, a solar photovoltaic system which can be accurately sized to meet the needs of a specific site.
- ***Network infrastructure constraints***: Lack of network capacity to accept exports from on-farm generation is an issue in some areas, as can be no or low feed-in tariffs where exports are allowed.

Forward plan

Through a rigorous evaluation process, the independent advisory group to the Energy Efficiency Solutions project selected seven feasibility study proponents to proceed to pilot projects. NSW DPI provided $1.32 million in grant assistance to the seven successful proponents, this grant equated to 50% of the cost of implementing their project. The proponents participating in the pilots are: Avondale Feedlot, Dairy NSW, Farrer Agricultural High, Haddon Rig Stud, Pecora Dairy, Rosnay Organic Wines and The Pines.

The pilots commenced in November 2020. Once implemented, these pilot projects will provide real world examples of innovative approaches to improving energy efficiency and reducing energy costs on NSW farms. The pilots will enable the dissemination of case study information to the sector more broadly and reduce risks associated with the early adoption of energy efficient technologies in agriculture. The pilots will demonstrate a variety of technological solutions at a range of farms located across NSW in intensive sub-sectors including dairy, horticulture and feedlots.

Acknowledgments

The Climate Change Research Strategy (CCRS) is an initiative of the NSW Department of Primary Industries (DPI), supported by an investment from the NSW Climate Change Fund. The Energy Efficiency Solutions project is one of seven CCRS projects. More information is available online here: https://www.dpi.nsw.gov.au/climate-and-emergencies/climate-change-research-strategy

The objective of the Energy Efficiency Solutions project is to help energy-intensive farms identify options to improve their energy efficiency and reduce costs. The project is led by NSW DPI, advised by a steering committee. NSW DPI contracted the Australian Alliance for Energy Productivity (A2EP) to provide management services for the conduct of ten feasibility studies.

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