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# POWER SYSTEMS FOR DAIRY SHEDS

- an investigation into the right mix of energy efficiency, load shifting and energy supply technologies

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## Abstract

This study investigated the potential for using stand-alone power systems for dairy milking sheds in New Zealand.

The study was in two parts:

- designing a typical load profile for a dairy shed and evaluating changes that could be made to the dairy shed to improve energy efficiency or shift load, using a mechanistic modelling approach.
- using the optimisation modelling tool HOMER Pro to find the best configuration of power system, energy efficiency and/or load shifting improvements of a solar-diesel hybrid power system and a solar-diesel-biogas hybrid power system.

The study found that milk vat insulation, variable speed drives and generator heat recovery were good investments to reduce power system costs. The high capital cost of ice banks made them less attractive for herds less than 370 cows. Superheat heat pumps and biogas systems were poor investments and increased costs in most cases when compared with the base scenario. While there was variation within the regions, overall the optimal system, when sensitivity scenarios were accounted for, was found to be similar between the three regions studied with the Bay of Plenty having the lowest overall costs followed by Taranaki and Manawatu. Sensitivity scenarios showed bias against deferrable loads such as ice bank refrigeration systems, hot water storage systems and the pumping of effluent. Diesel prices had a greater effect where the renewable fraction was low. Increasing diesel prices resulted in larger PV arrays and batteries.

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