Energising dairy decisions

A new tool developed by TEAGASC researchers easily and quickly allows dairy farmers to see their energy usage and evaluate how renewable sources could decrease energy costs.

Background

The average cost of electricity on Irish dairy farms is €5 per 1,000 litres of milk produced. The main drivers of electricity consumption on dairy farms are milk cooling (31%), the milking machine (20%) and water heating (23%). There is a large variation in that figure – from €2.60 to €8.70 per 1,000 litres produced, or from €15-€45 per cow per year. These figures suggest that there is potential for many farmers to reduce their electricity usage by making changes to how they produce milk. Teagasc estimates that the average farm could save €1,800 (and approximately 5.8 tonnes of CO_2) per year through altered management strategies and the use of energy-efficient technologies. A difficulty arises in delivering a set of generalised recommendations to farmers around energy efficiency because every farm is different in some key areas. These include herd size, infrastructure specification, farmer age and eligibility for grant aid, and availability of grant aid for specific technologies.

Dairy energy decision support

Teagasc has partnered with Cork Institute of Technology (CIT) and the Sustainable Energy Authority of Ireland (SEAI) under the Research, Development and Demonstration funding programme to deliver an online decision support tool to aid farmers in making decisions regarding energy efficiency and technology investments. The tool, known as the Dairy Energy Decision Support Tool (DEDST) is available to use for free at: http://messo.cit.ie/dairy. The DEDST can be used to obtain farm-specific recommendations relating to energy use, technology investments, CO_2 mitigation and renewable energy consumption. It is an interactive and easy-to-use tool aimed at farmers, farm managers and farm advisors. It provides information to the user regarding key decisions that determine the energy efficiency and cost effectiveness of the milk production process, such as investment in certain technologies and changes in farm management practices. It can also be used to support government bodies in forming new policy relating to provision of grant aid for energy-efficient and renewable energy technologies.

Description of the tool

The DEDST operates as a web-based platform, and encompasses a user interface that supplies information to a mechanistic model for dairy farm energy consumption. The user enters details of a specific farm, including farm size, milking times, number of milking units, cooling system type, water heating type and electricity tariff (**Figure 1a**). Details of an alternative technology to be evaluated on that

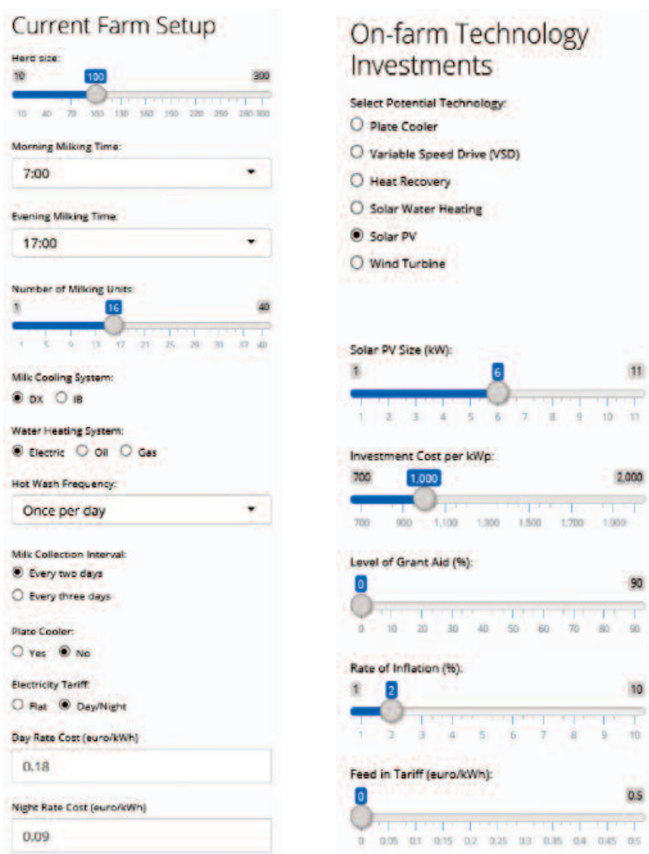

FIGURE 1: (a) input screen for DEDST; (b) alternative technology screen for DEDST.

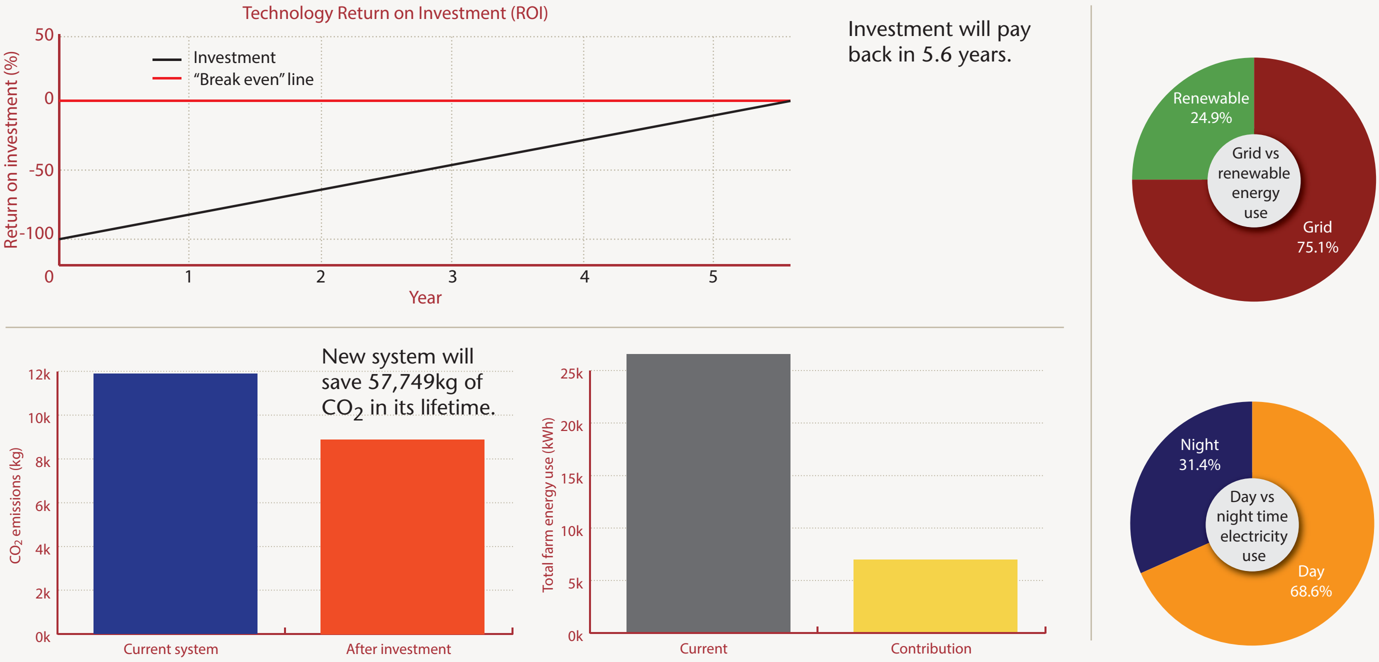

FIGURE 2: Output screen for the DEDST.

farm can then be entered (**Figure 1b**). Possible alternative technologies include plate coolers, variable speed drives, heat recovery systems, solar photovoltaics, wind turbines and solar thermal systems. The user may also enter economic details regarding potential future grant aid for the alternative technology, as well as renewable energy feed-in tariffs, and inflation. All energy and economic calculations are then computed by the model with the outputs being displayed on an easy to interpret output screen (**Figure 2**). The user can then easily change details relating to the farm or the alternative technology, with the displayed outputs updating accordingly.

Example – investment in a solar photovoltaic system

Solar photovoltaic (PV) cells generate electricity using energy from the sun, which in turn can be used by the farm. These systems can be standalone (i.e., the generated electricity is only used by the farm) or grid connected (where surplus electricity is fed into the national electricity grid).

Unfortunately, in Ireland, micro-generators who export power to the grid from small-scale PV systems do not receive payment for exported electricity. Furthermore, there are no capital investment grants to subsidise the purchase cost of PV systems. Hence, the most logical solution for Irish farmers would be a stand-alone system sized so that all electricity generated is consumed by the farm.

For a 100-cow spring-calving herd, the ideal PV system size falls at around 6kW of installed capacity, which would cost in the region of €6,000. In the absence of a capital investment grant, this system would pay back after nine years. If a 40% technology investment grant were made available, the payback period would fall to 5.6 years. This change would result in 25% of a farm's electricity coming from a renewable source and would offset more than 57 tonnes of CO_2 over a 10-year period. The output screen of the DEDST for this example is shown in **Figure 2**.

Benefits to industry

The methods deployed in the development of this tool utilised resources from multiple sources to package a suite of scientific outputs into a user-friendly decision support tool. The DEDST can now be used by farmers and advisors to make informed decisions around energy use and technology investments on a case-by-case basis. It will also allow policy makers to conduct macro-level analyses to inform decisions regarding provision of grant aid for specific equipment.

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