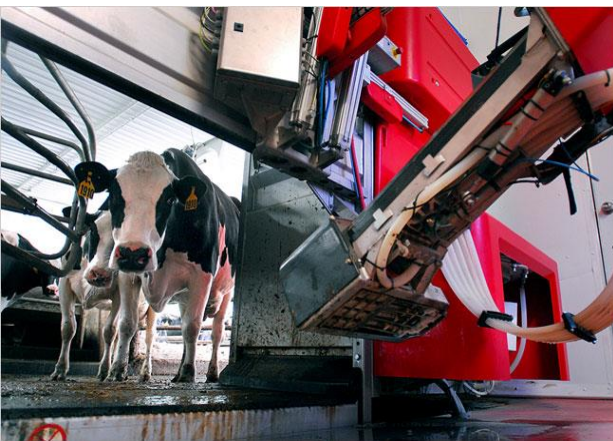


Energy Efficiency & Dairy Production - Decision Support

□ Dr. John Upton

□ Livestock Systems Dept. Animal & Grassland
Research & Innovation Centre, Teagasc
Moorepark, Fermoy, Co. Cork



Irish Milk production energy requirements

- Electricity consumed = 42 kWh/tonne milk produced (Upton et al., 2013)
- 7.3 billion Litres of milk produced in 2017 (CSO 2018)
- Total electricity required in 2017 was 312 GWh
- Projected that by 2020 Ireland will produce up to 8.8 billion litres; this will require 378 GWh of electricity
- Electricity related CO₂ emissions may be 182,000 tonnes by 2020 unless mitigation strategies are implemented

Irish Milk production energy requirements

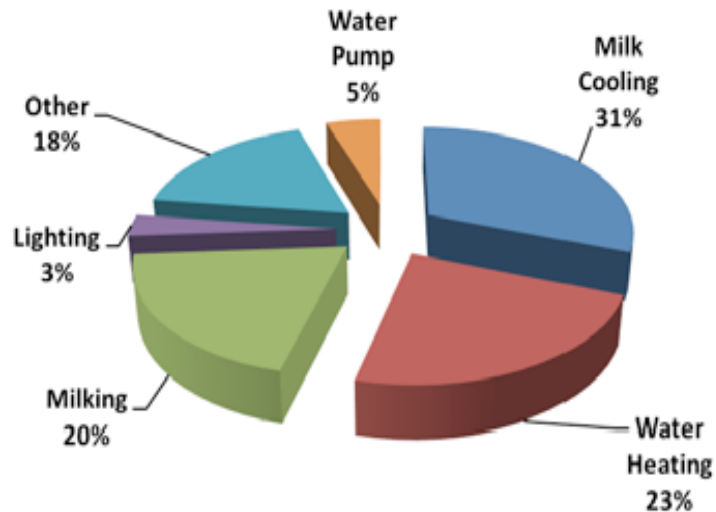
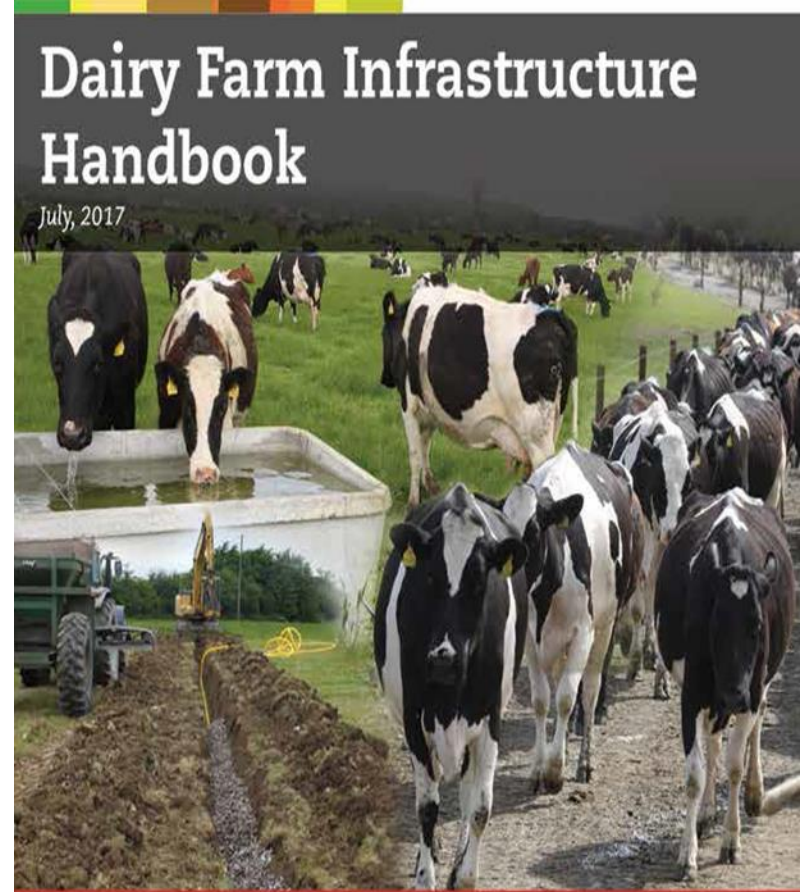


Figure 1. Shows the average component consumption on 60 commercial dairy farms

Cost of electricity

Average = €5 per tonne of milk



Potential for energy reductions

- Trend towards more automation of routine tasks
- 47% of cows milked in herds > 100 cows
- More automated farms use more energy, e.g. robotic milking systems
- Research has identified potential to reduce energy related CO₂ emissions from dairy production by 40% through adopting energy efficient technologies (on-demand water heating, heat recovery, VSD, plate cooler)
- Further 20% reductions are possible through adoption of renewables (PV)

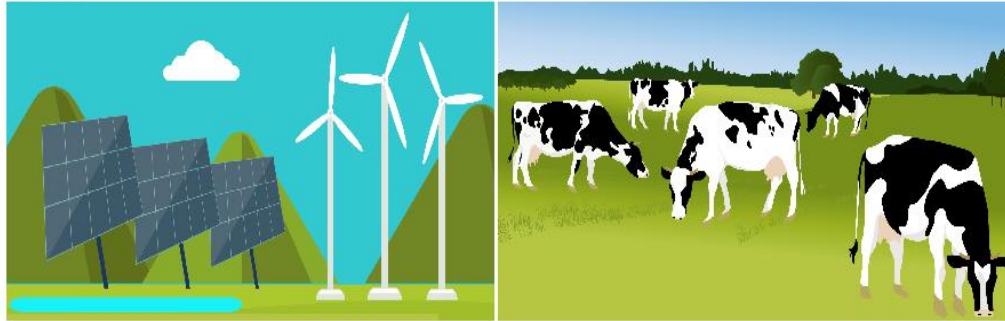
Necessity for decision support

- Every farm is different (cows numbers, farmer age, expanding, greenfield, water supply, milking system, grant eligibility)
- Many farms going through a phase of facility renewal (TAMS scheme, SEAI VSD Scheme)
- Difficult to distil generalised recommendations
- Ability to deliver farm specific advice related to energy management decisions is a huge step forward

Home Page

Home > Dairy

Dairy



The Dairy Energy Decision Support Tool aims to quantify and reduce dairy farm electricity consumption, greenhouse gas emissions and production costs through data analysis and mathematical modelling. Please see below instructions on how to use the tool. Before using the Dairy Energy Decision Support Tool, users must read the [Terms & Conditions](#)



Dairy Energy Decision Support Tool
ENTER

<http://messo.cit.ie/dairy>

Input Farm Details

Dairy Energy Decision Support Tool

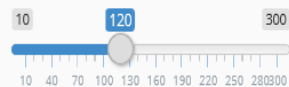
About

Technology Calculator

Consumption Summary

Current Farm Setup

Herd size:



Morning Milking Time:

7:00

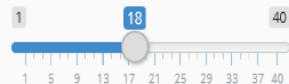


Evening Milking Time:

17:00



Number of Milking Units:



Milk Cooling System:

☒ DX ☐ IB

Water Heating System:

☒ Electric ☐ Oil ☐ Gas

Hot Wash Frequency:

Once per day



Milk Collection Interval:

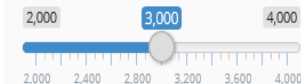
☒ Every two days
☐ Every three days

On-farm Technology Investments

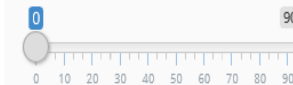
Select Potential Technology:

- ☒ Variable Speed Drive (VSD)
- ☐ Heat Recovery
- ☐ Solar Water Heating
- ☐ Solar PV
- ☐ Wind Turbine

Investment Cost:



Level of Grant Aid (%):



Rate of Inflation (%):



Run Technology Calculator



Plate Cooler Example

Dairy Energy Decision Support Tool

About Technology Calculator Consumption Summary

Current Farm Setup

Herd size:
10 120 300

Morning Milking Time:
7:00

Evening Milking Time:
17:00

Number of Milking Units:
1 18 40

Milk Cooling System:
☒ DX ☐ IB

Water Heating System:
☒ Electric ☐ Oil ☐ Gas

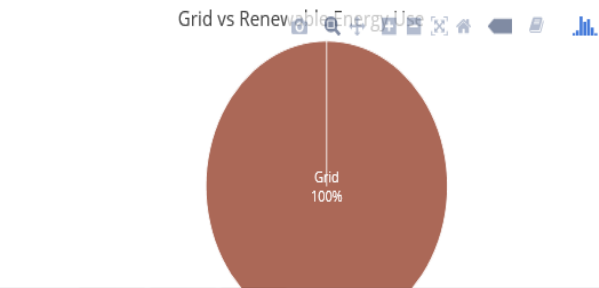
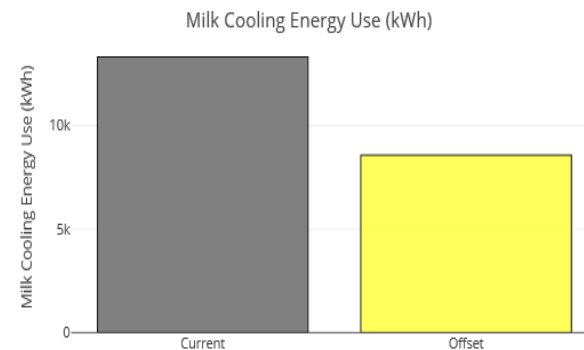
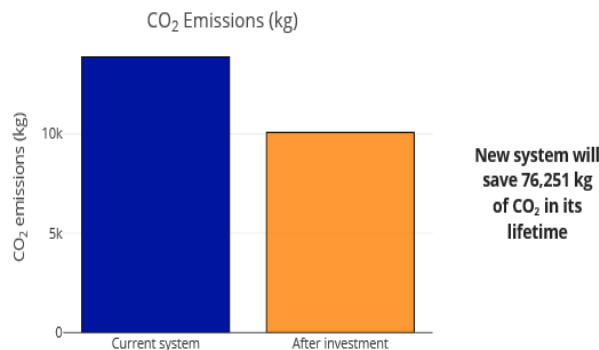
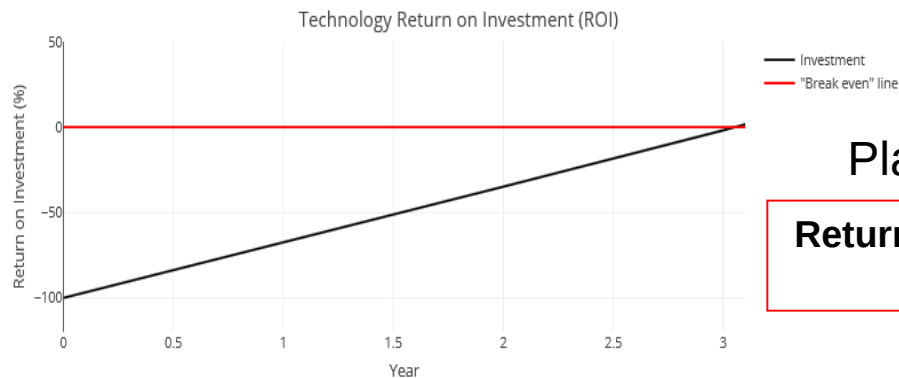
Hot Wash Frequency:
Once per day

Milk Collection Interval:
☒ Every two days
☐ Every three days

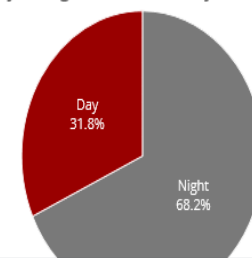
Plate Cooler:
☐ Yes ☒ No

Electricity Tariff:
☐ Flat ☒ Day/Night

Day Rate Cost (euro/kWh)



Day vs Night Time Electricity Use



On-farm Technology Investments

Select Potential Technology:

- ☒ Plate Cooler
- ☐ Variable Speed Drive (VSD)
- ☐ Heat Recovery
- ☐ Solar Water Heating
- ☐ Solar PV
- ☐ Wind Turbine

Investment Cost:
1,500 2,900 3,500

Level of Grant Aid (%):
0 90

Rate of Inflation (%):
1 10

Solar Photovoltaic Example

Dairy Energy Decision Support Tool

About Technology Calculator Consumption Summary

Current Farm Setup

Herd size:
10 120 300

Morning Milking Time:
7:00

Evening Milking Time:
17:00

Number of Milking Units:
1 18 40

Milk Cooling System:
☒ DX ☐ IB

Water Heating System:
☒ Electric ☐ Oil ☐ Gas

Hot Wash Frequency:
Once per day

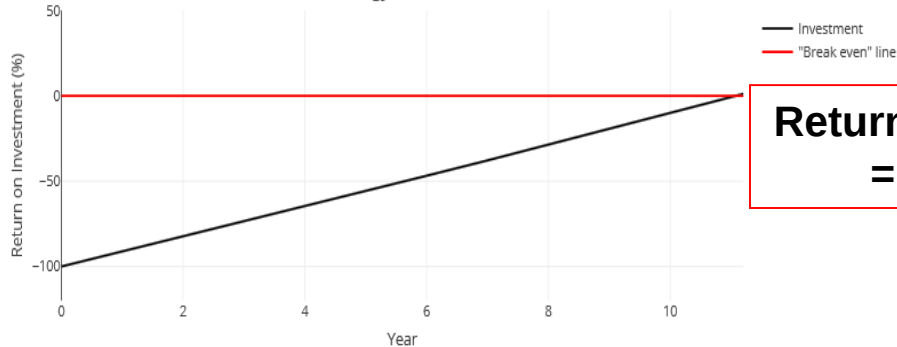
Milk Collection Interval:
☒ Every two days
☐ Every three days

Plate Cooler:
☐ Yes ☒ No

Electricity Tariff:
☐ Flat ☒ Day/Night

Day Rate Cost (euro/kWh)

Technology Return on Investment (ROI)



Return on investment
= 11.2 Years

PV →

On-farm Technology Investments

Select Potential Technology:

- ☐ Plate Cooler
- ☐ Variable Speed Drive (VSD)
- ☐ Heat Recovery
- ☐ Solar Water Heating
- ☒ Solar PV
- ☐ Wind Turbine

Solar PV Size (kW):
1 6 11

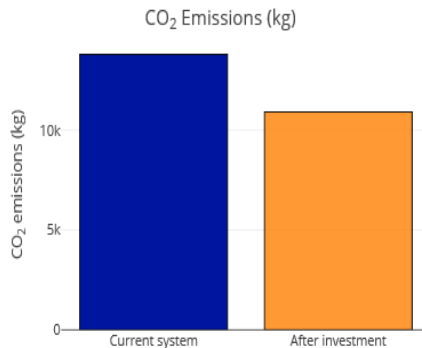
Investment Cost per kWp:
700 1,000 2,000

Level of Grant Aid (%):
0 90

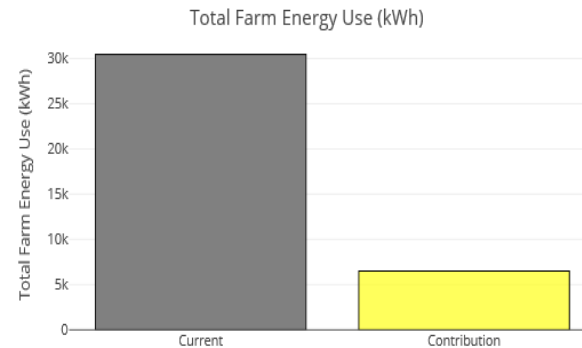
Rate of Inflation (%):
1 10

Feed in Tariff (euro/kWh):
0 0.5

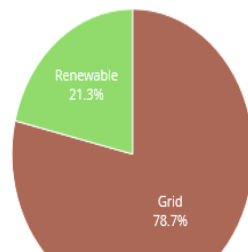
Also use renewable system for household electricity?



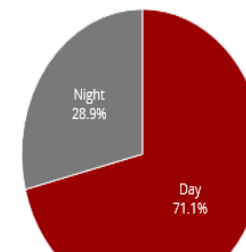
New system will
save 57,749 kg
of CO₂ in its
lifetime



Grid vs Renewable Energy Use



Day vs Night Time Electricity Use



Solar Photovoltaic Example 40% grant

Dairy Energy Decision Support Tool

About Technology Calculator Consumption Summary

Current Farm Setup

Herd size:
10 120 300

Morning Milking Time:
7:00

Evening Milking Time:
17:00

Number of Milking Units:
1 18 40

Milk Cooling System:
☒ DX ☐ IB

Water Heating System:
☒ Electric ☐ Oil ☐ Gas

Hot Wash Frequency:
Once per day

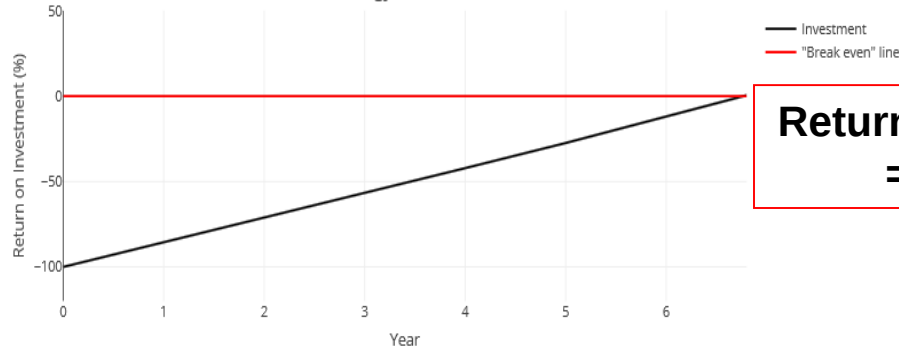
Milk Collection Interval:
☒ Every two days
☐ Every three days

Plate Cooler:
☐ Yes ☒ No

Electricity Tariff:
☐ Flat ☒ Day/Night

Day Rate Cost (euro/kWh)

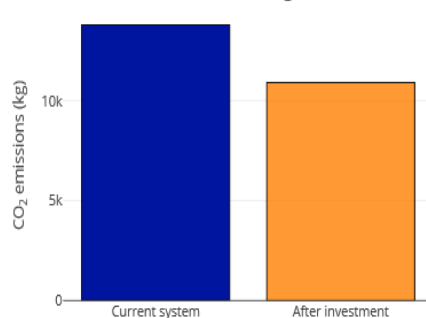
Technology Return on Investment (ROI)



**Return on investment
= 6.8 Years**

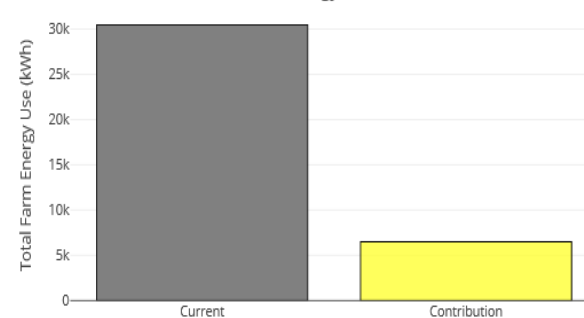
PV →

CO₂ Emissions (kg)

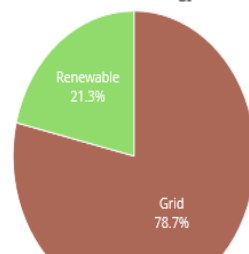


**New system will
save 57,749 kg
of CO₂ in its
lifetime**

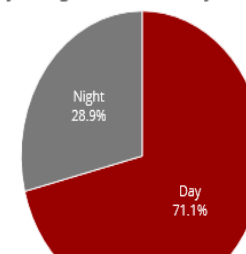
Total Farm Energy Use (kWh)



Grid vs Renewable Energy Use



Day vs Night Time Electricity Use



On-farm Technology Investments

Select Potential Technology:

- ☐ Plate Cooler
- ☐ Variable Speed Drive (VSD)
- ☐ Heat Recovery
- ☐ Solar Water Heating
- ☒ Solar PV
- ☐ Wind Turbine

Solar PV Size (kW):
1 6 11

Investment Cost per kWp:
700 1,000 2,000

Level of Grant Aid (%):
0 40 90

Rate of Inflation (%):
1 10

Feed in Tariff (euro/kWh):
0 0.5

Also use renewable system for household electricity?

Variable Speed Drive Example

Dairy Energy Decision Support Tool

About Technology Calculator Consumption Summary

Current Farm Setup

Herd size:
10 120 300

Morning Milking Time:
7:00

Evening Milking Time:
17:00

Number of Milking Units:
1 18 40

Milk Cooling System:
☒ DX ☐ IB

Water Heating System:
☒ Electric ☐ Oil ☐ Gas

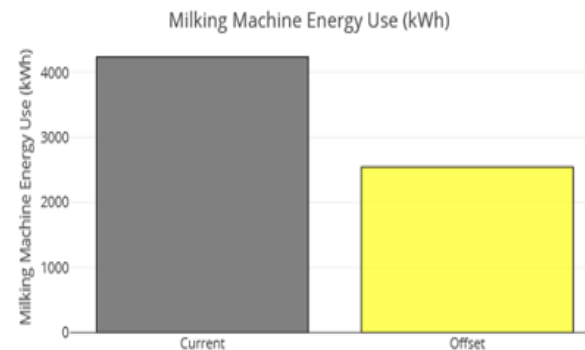
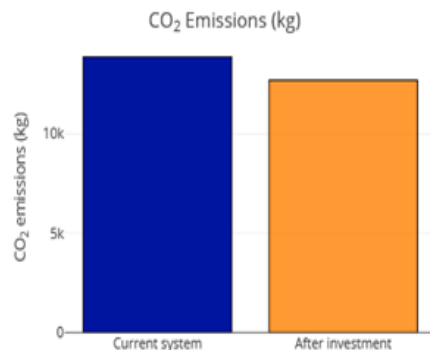
Hot Wash Frequency:
Once per day

Milk Collection Interval:
☒ Every two days
☐ Every three days

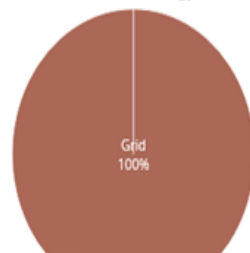
Plate Cooler:
☐ Yes ☒ No

Electricity Tariff:
☐ Flat ☒ Day/Night

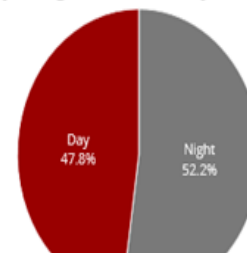
Day Rate Cost (euro/kWh)



Grid vs Renewable Energy Use



Day vs Night Time Electricity Use



On-farm Technology Investments

Select Potential Technology:

- ☐ Plate Cooler
- ☒ Variable Speed Drive (VSD)
- ☐ Heat Recovery
- ☐ Solar Water Heating
- ☐ Solar PV
- ☐ Wind Turbine

Investment Cost:
2,000 3,000 4,000

Level of Grant Aid (%):
0 90

Rate of Inflation (%):
1 10

Variable Speed Drive Example – 50% grant

Dairy Energy Decision Support Tool

About Technology Calculator Consumption Summary

Current Farm Setup

Herd size:
10 120 300

Morning Milking Time:
7:00

Evening Milking Time:
17:00

Number of Milking Units:
1 18 40

Milk Cooling System:
☒ DX ☐ IB

Water Heating System:
☒ Electric ☐ Oil ☐ Gas

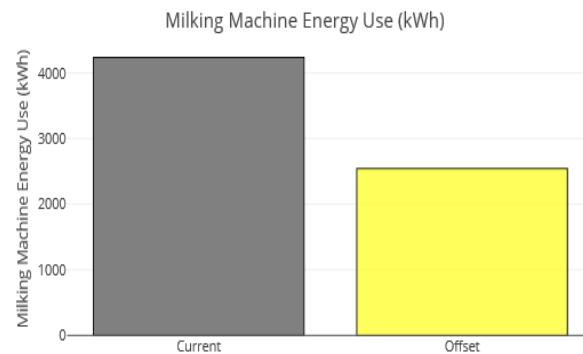
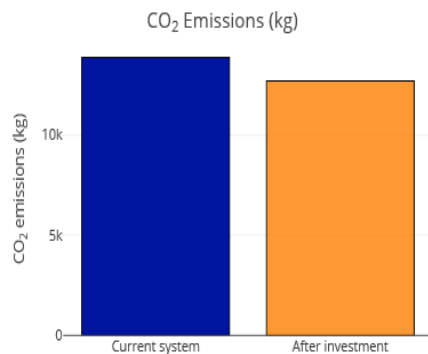
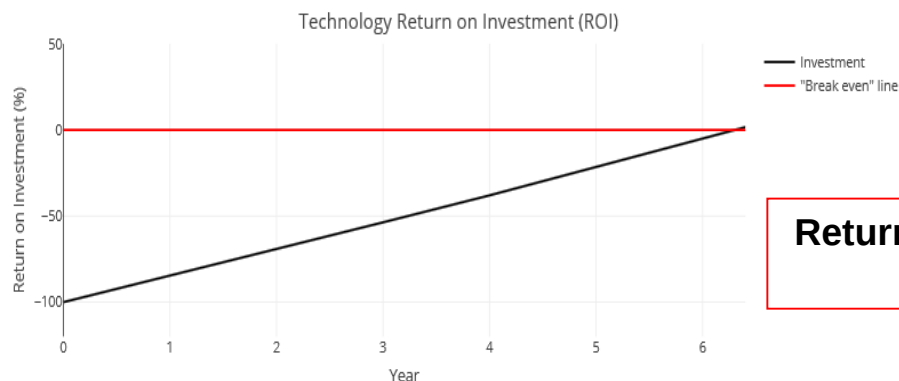
Hot Wash Frequency:
Once per day

Milk Collection Interval:
☒ Every two days
☐ Every three days

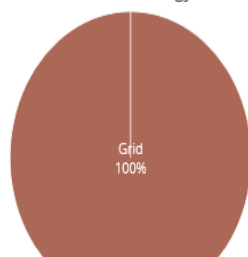
Plate Cooler:
☐ Yes ☒ No

Electricity Tariff:
☐ Flat ☒ Day/Night

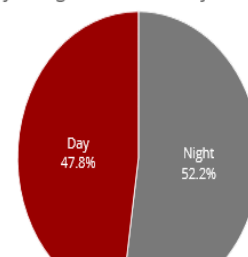
Day Rate Cost (euro/kWh)



Grid vs Renewable Energy Use



Day vs Night Time Electricity Use



On-farm Technology Investments

Select Potential Technology:

- ☐ Plate Cooler
- ☒ Variable Speed Drive (VSD)
- ☐ Heat Recovery
- ☐ Solar Water Heating
- ☐ Solar PV
- ☐ Wind Turbine

Investment Cost:
2,000 3,000 4,000

Level of Grant Aid (%):
0 50 90

Rate of Inflation (%):
1 10

Conclusions

- Decision support tool is available to help farmers make informed decisions around energy use and technology on a case by case basis
- Effect of grant aide can be quantified
- Potential to save money for farmer, plus huge national CO₂ savings of 110,000 tonnes per year (225 GWh of energy)
- Deliver on Irelands clean green promise through putting research into practice

Acknowledgements



The Irish Agriculture and Food Development Authority