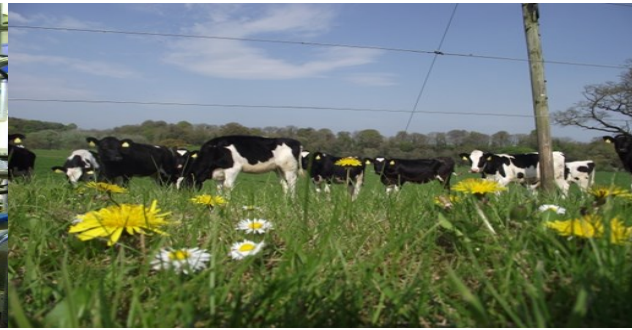
# Water Heating Options for Dairy Farms





**Dr. John Upton, Teagasc Moorepark**

**Milk Quality Workshop 2023**

Dairy Research Ireland
funded by Irish Dairy Farmers

MTU
Ollscoil Teicneolaíochta na Mumhan
Munster Technological University

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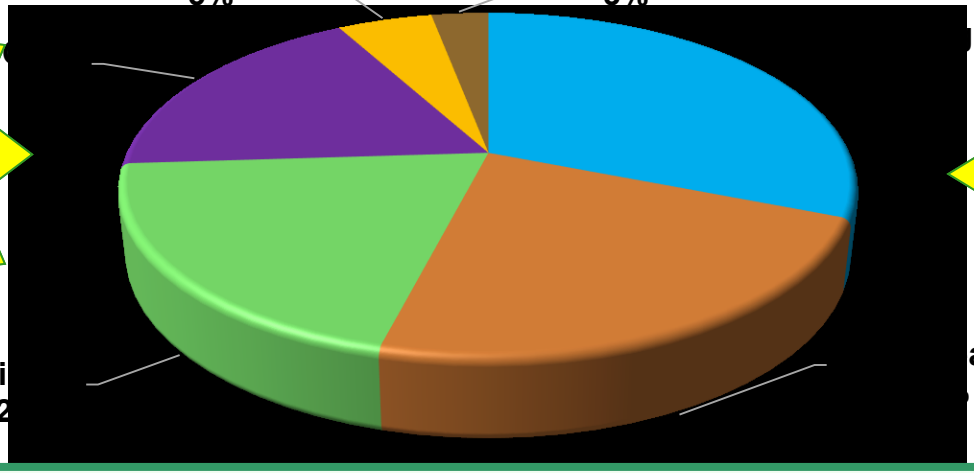
# Energy cost of milk production

*Use Night Rate electricity*




*Check for cheaper supplier*

**Cost of electricity = €12.00 per 1,000L of milk sold**

**Max = €14.00 Min = €7.50**

# Night Rate Electricity

- Day rate = €0.40 / kWh
- Night Rate = €0.20 / kWh
- Free installation, small standing charge
- Use timers with battery back up
- Night rate from 12 midnight to 9am – summer
  - 11 pm to 8am – winter time


# Water Heating Requirements

- **Ensure adequate supply at the correct temperature**

- **10 Litres of hot water required per cluster for machine washing – Generally at 80 degrees C, check wash trough size**

- **Allow for heating 2% of bulk tank volume for tank washing – Generally at 70 degrees C, check user manual**

- **Check wash trough size.**
- **Dairy Wash Trough Calculator:**

https://www.teagasc.ie/rural-economy/farm-management/farm-machinery/machinery-calibration/dairy-wash-trough-calculator/

# Electrical water heating

- Low capital cost (approx €1,500 for a system of 500 L capacity)
- Restricted by night rate electricity to keep running costs low
- Long heating times, approx 8 hours to heat 300 L from 10 to 80 degrees with 3 kW element

# Oil fired water heating

- Reduced heating times, 1.5 hours to heat 500 L from 10 to 80 degrees with 26 kW oil boiler
- Not restricted by night rate electricity
- Higher capital cost ( approx €5,000 for a 500 L hot water capacity)
- Available either tanked or instant
- Ensure system can deliver required volume quickly

# LPG fired water heating

- Not restricted by night rate electricity
- Higher capital cost
- Typically installed as instant heaters
- Ensure system can deliver required volume quickly
- Lower emissions – 2.4 kg $CO_2$ per 100 L

# Water Heating Running Costs

| System type | Cost per 100 litres hot water | $CO_2$ emissions per 100 litres |
|---|---|---|
| Day rate electricity | €4.18 | 2.7 kg |
| Night rate electricity | €2.09 | 2.7 kg |
| Gas (LPG) fired | €1.17 | 2.4 kg |
| Oil (Kerosene) fired | €1.22 | 3 kg |

- Convenience also affects decision making around system choice

- Day rate at €0.38 / kWh; Night rate at €0.19 / kWh;
  LPG at €0.82 / L; Kerosene at €1.15 / L

# Options to increase efficiency - Heat Recovery

- Heat energy is removed from milk during cooling
- Energy transferred to a tank of water
- Can reduce water heating costs by 40-50%
- Retrofitting is possible
- TAMS grant available

# Solar Photovoltaic (PV)

- Generates renewable electricity from the sun
- Size for self consumption
- Use energy storage (water heater, batteries or ice) big gap between export tariff and day rate
- 1 kWp generate approx. 850 units per year (worth €340 at day rate). 1 kWp = approx. 5 m2

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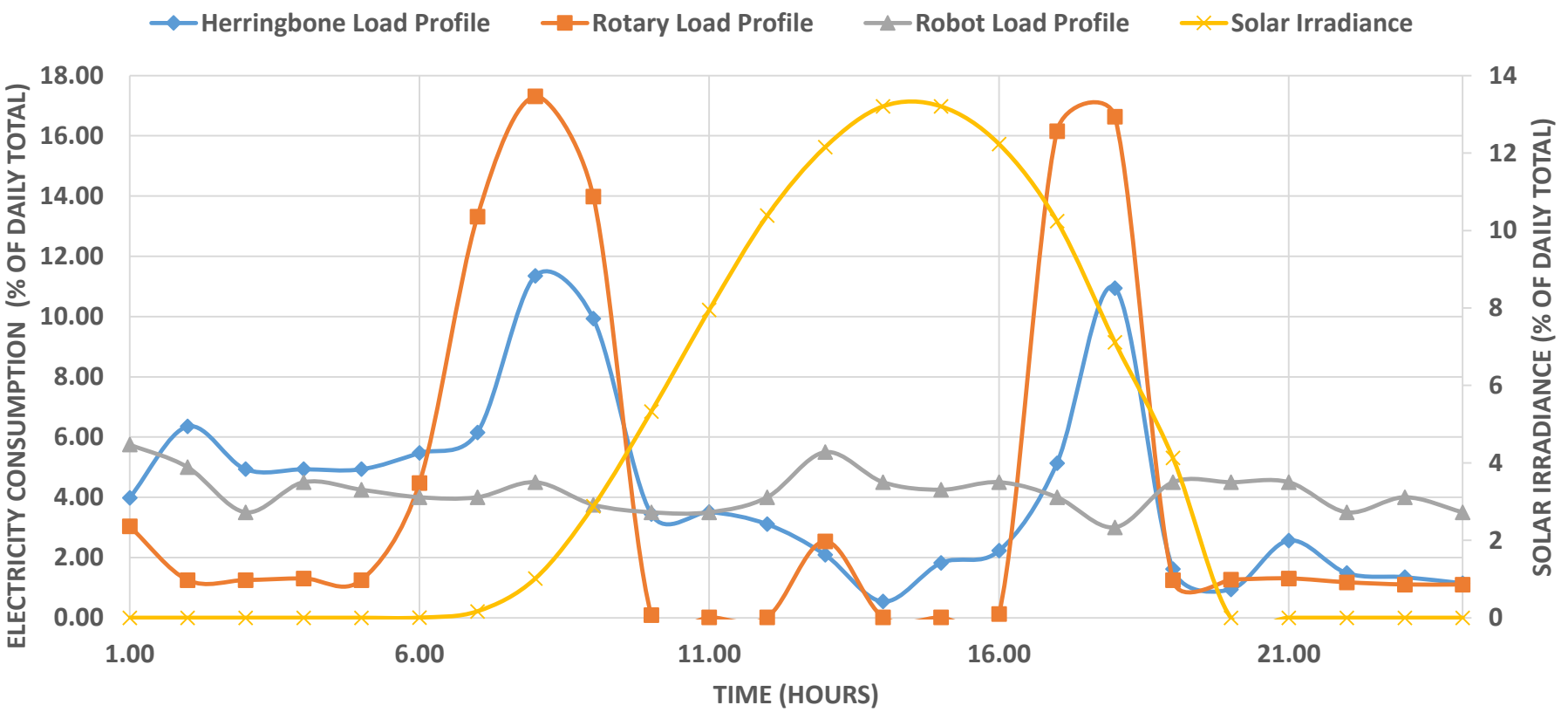
# Farm Electricity Demand vs Solar Irradiance



# Solar Panel spec

- Efficiencies typically > 20%
- Min 12 year product warranty
- Min 25 year linear performance warranty
  - For example: max. 0.54 % degradation per year.
  - At least 93.1 % of nominal power up to 10 years.
  - At least 85 % of nominal power up to 25 years.
- Check Triple E register (SEAI)

https://www.seai.ie/business-and-public-sector/triple-e-register-for-products/

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# Grid connection

- Micro generation scheme = up to 6 kWp single phase or 11 kWp three phase (no connection fee)
- Mini generation scheme = up to 17 kWp single phase or 50 kWp three phase (connection fee approx. €1,000) – NC7 form, allow three months
- Connection limited to maximum import capacity (MIC) of your farm (> 29 kVa = commercial)
- https://www.esbnetworks.ie/new-connections/generator-connections-group/mini-generation

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# Export and other supports

- Clean export guarantee available (14 to 20 cent)
- Accelerated Capital Allowance available
- VAT recovery available
- No Planning required for roof mounted
- 60% grant in 2023 under TAMS 3
- Payback 6-7 years without grant

Farm Details

Current Farm Setup

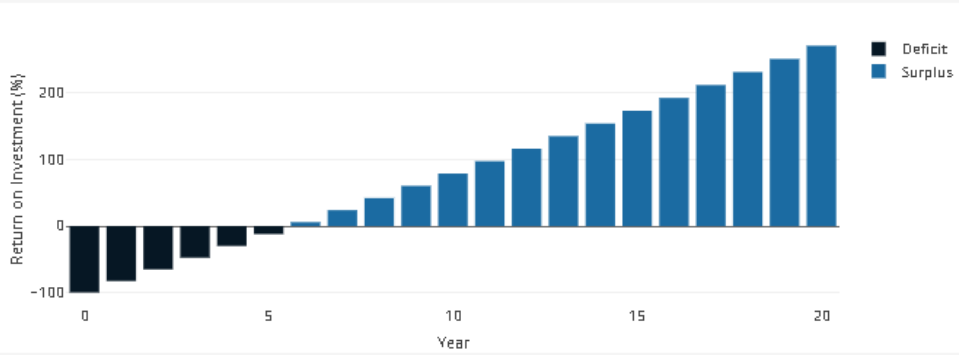
**Farm Location:**

Cork (West)

**Herd Size:**

5 100

Monetary



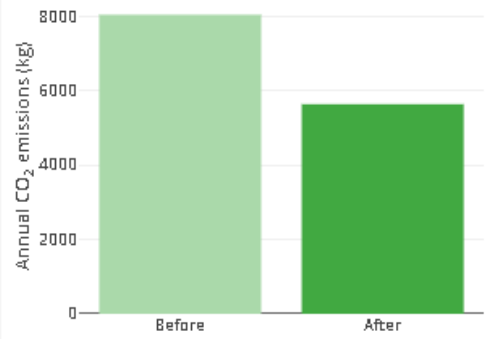

5.7

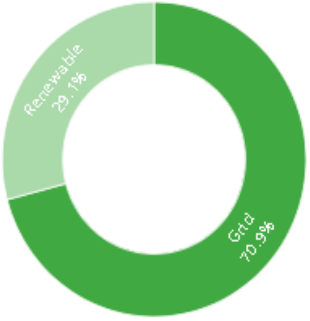
years payback

€3,960

net investment cost

Environmental




48,063

kg's of carbon saved over 20 years

€82

per tonne of $CO_2$ reduction

Hour of the day

# Summary

- **Calculate volumes required – ensure that water heating system can deliver the quantities required rapidly**
- **Chose a cost efficient system with low running costs and low $CO_2$ emissions**
- **Plan ahead to integrate renewable energy**

# Thank You