



Calf Rearing Open Day

Energy Efficiency

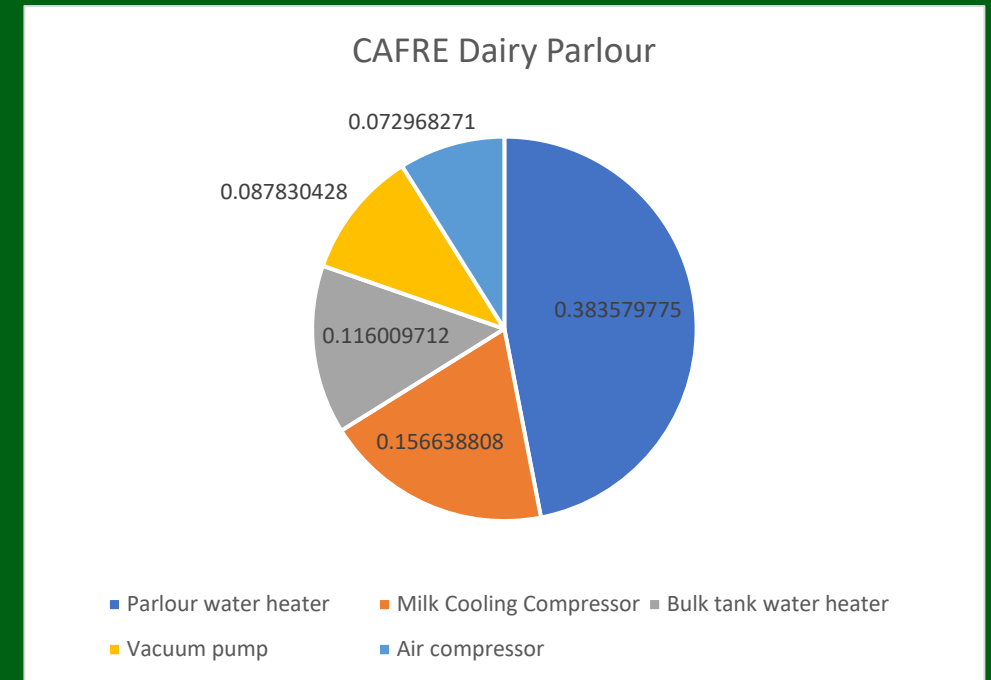
Stephen Gilkinson & Lauren Curry

Energy Efficiency

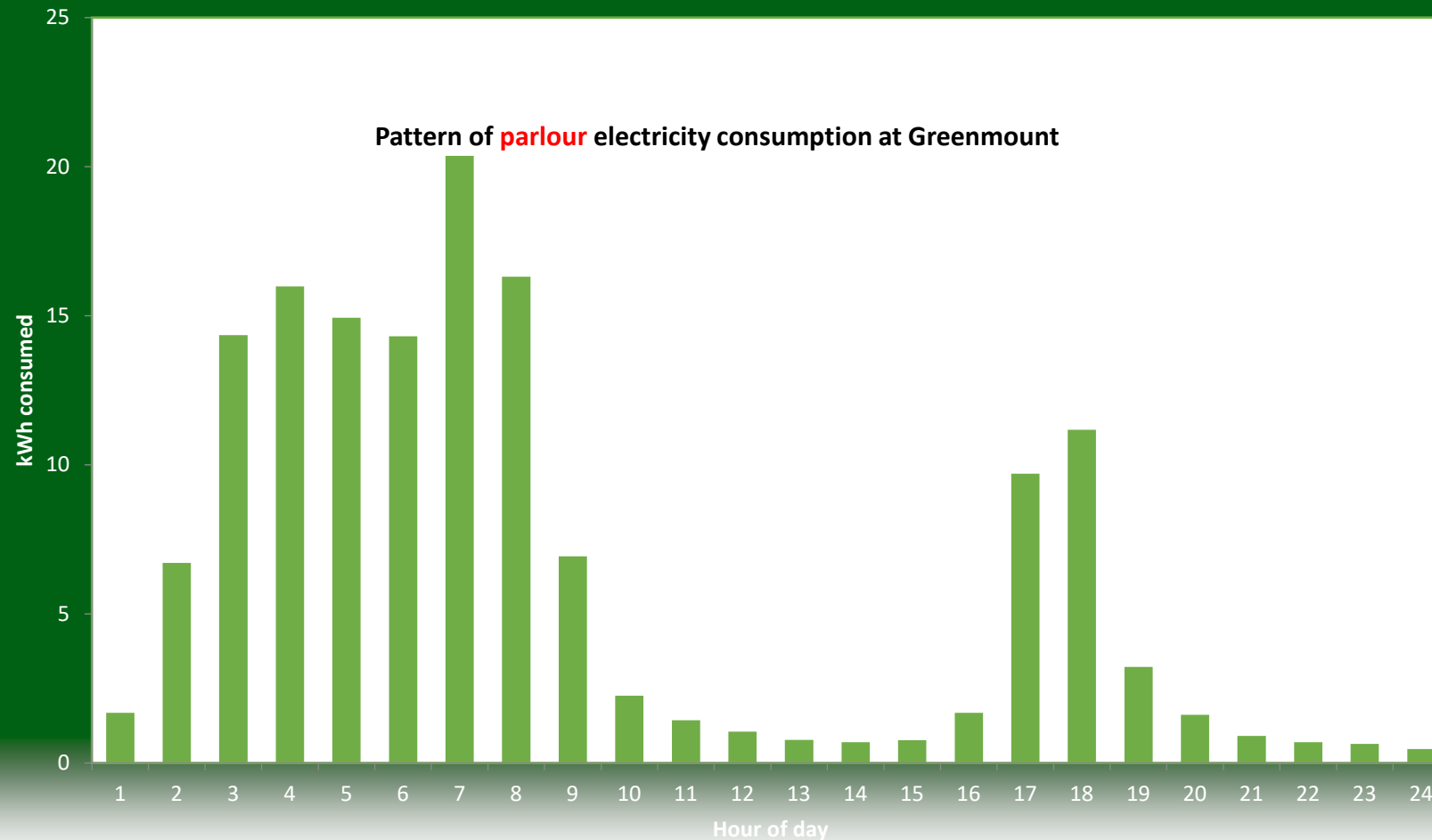
Energy prices have increased dramatically over the past year

– what can we do to reduce the impact?

- Milk harvesting and associated activities consume the majority of electricity on a dairy farm
- It is estimated dairy farms typically use 1-2kwh/cow/day¹
(CAFRE electricity use benchmarking data)



When is electricity required?



Variable Speed Vacuum Pump

	Variable	Set Speed	Difference	%
kWh/day	20.1	33.0	12.9	40%
£/day@30p/unit	6.03	9.90	3.87	
Electricity Cost/year	£2200	£3612	£1412	

Industry standard savings is 60% compared to set speed

Greenmount savings is 40% - length of wash cycle compared to milk time is a factor

Needs 3 phase electricity or inverter

No mess

Longevity?

Plate Cooler

Cheapest way to cool milk

Considerations:

- Water source
- Flow rate
- Water use after the plate cooler
- Number of plates



Plate Cooler

Greenmount Data

- Avg milk in temp 34.9°C
- Avg milk out temp 17.0°C
- Avg 4460 litres milk/day
- Water pump consumes 10% of heat energy extracted by plate cooler



Greenmount Water use/reuse System

Sometimes referred to as the 'Versatile Dairy Milk Cooling System'

Rainwater is harvested from roof of dairy buildings into below ground tank



Pumped to above ground header tank (30m³)



Water use and turn over



Low water availability kicks in: borewell and lastly mains water



Bulk Tank Cooling

Generally biggest power consumer associated with milking

Two main market options

1. Direct Expansion Tank (DX)
2. Ice Bank Tank

Net result = generally little difference in running cost of cooling between systems, but depends on price of day and night electricity and when milking is carried out

Difference in cost of tanks? Space for ice builder?

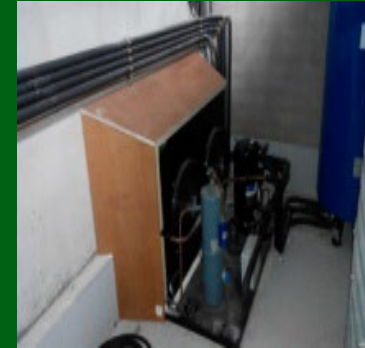
Generally use 3 phase electricity for compressor unit – depends on availability, cable size to farm etc



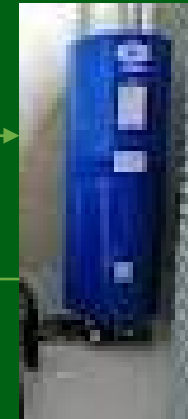
Heat Recovery Unit (HRU)

Applicable to direct expansion tanks only

- Transfer of waste heat from condenser to HRU
- Sized for milk volume per milking
- Maximum temperature ~ ~ 55°C
- If plate cooler used, less heat available for extraction
- Proper Integration important (specialist job)
- Greenmount: ~ 50% of possible heat is recovered
- HRU reduces immersion heater use for hot wash



Condenser unit



Heat Recovery Unit

Water Heating

- Requirement: no. of units, pipe diameter, dumpline?
- Insulation of tanks/hot water pipes
- Energy source? electricity, gas, oil, solar thermal, solar PV, or combination to heat water?
- Cost of each system?
- Convenience of each?
- Integration with existing system



CAFRE Greenmount Setup

	kWh/cow/year	% of parlour total
Milking Parlour	295	100%
Parlour Water Heater	113	38%
Milk Cooling Compressor	46	16%
Bulk Tank Water Heater	34	12%
Vacuum Pump	26	9%
Air Compressor	21	7%
Miscellaneous	55	19%

CAFRE Greenmount Setup



Plate cooler

- 1 kWh electricity for every 10 kWh milk energy extracted - extracts 57% of total energy required

The compressor

- 1kWh electricity for every 3 kWh energy extracted

Heat recovery

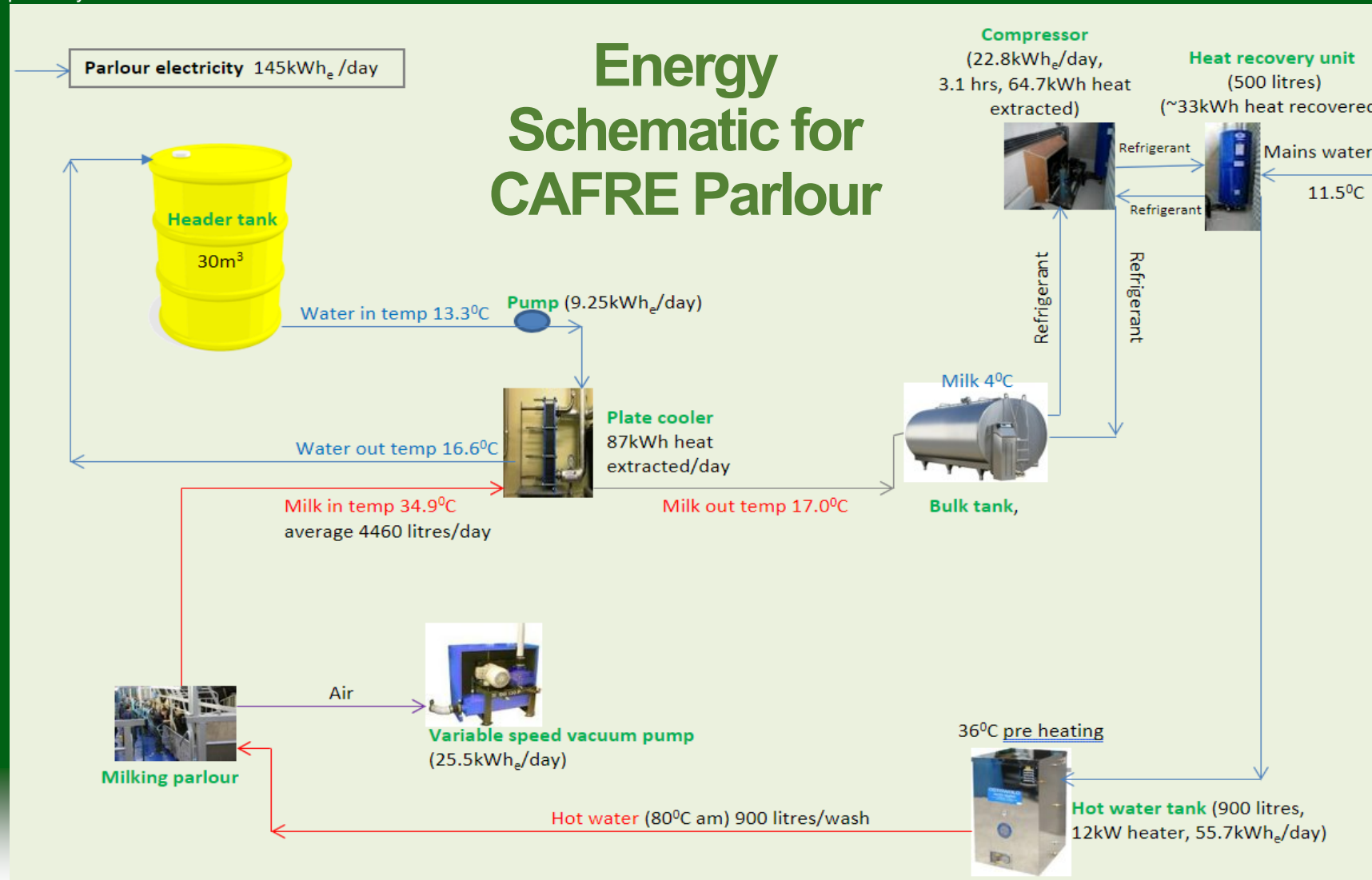
- Immersion heat tank was 25⁰C warmer than without heat recovery

Variable speed vacuum pump

- Savings up to 60% of set speed, Greenmount 40%

Harvested rainwater/borewell water

- 30m³ tank for milk cooling, used for cow drinking, pressure washing, volume wash



Different scenarios for milking parlour electricity usage with CAFRE data as baseline

	£/cow/year @30p/kWh	%
£/cow/year (CAFRE current set-up)	£89	100%
Set speed vacuum pump, no plate cooler, no heat recovery	£170	182%
Set speed vacuum pump, plate cooler, no heat recovery	£134	151%
Set speed pump, no plate cooler, heat recovery	£160	181%

Savings depend on when time of day electricity is used and amount of heat extracted by plate cooler

Lighting – savings are possible Cost/benefit?

Current – 200W high pressure sodium halide lights. Proposed – 100W LEDs

Low energy lights calculator

Existing bulb rating	200	watts
LED bulb rating	100	watts
Average usage	4.0	hours/day
Daytime electricity price	30	p/kWh
Night time electricity price	18.6	p/kWh
Percentage of night time electricity usage for light ^a	60	%
Cost of new LED light fitting and bulb ^b	£80	

	Standard bulb	LED bulb	
Electricity consumed/year	292	146	kWh
Cost/year	£67.63	£33.81	
Potential savings		£33.81	per year
Crude payback period		2.4	years

Summary

- Saving are possible
- Switch electricity supplier?
- Where is the low hanging fruit in your set-up?
- Optimise plate cooler efficiency – ensure adequate water supply
- Insulate pipes, especially hot water tank and associated pipes
- Install variable speed vacuum pump?
- Alternatives to electricity for water heating?
- Batteries? –charge using cheaper night-time electricity? Cost/benefit?
- Upfront costs of any changes to current system?
- Payback time on new lights, variable speed pump, etc?
- **There is a best solution for your farm**
- **Seek expert advice**