Robert Wiseman Dairies

”Cool Heating”

An end users view !

Robert Wiseman Dairies

- Who are We?
  - Robert Wiseman Dairies processes almost 2 billion litres per year of raw milk.
  - Largest fresh milk provider in the UK (32% of the UK's consumption)
  - 6 Dairies geographically spread over the UK
  - 14 Distribution Centres
  - Employ over 4,500 staff

- Sustainability for 2015 (based on 2009/10 base line)
  - Greenhouse gases
    - Gas – 30% reduction
    - Electricity – 25% reduction
    - Refrigeration leakage - < 3% (aspiration !)
    - Transport – 15% reduction in fuel use
    - Renewable energy 10% (non transport)

Potential investment to achieve above goals and other sustainability targets within waste and natural resources = **£25 million.**

Refrigeration in the Group

- Types and numbers of refrigerated systems within the Group:
  - 55 x HCFC refrigerated systems (typically distribution centres)
  - 30 x HFC refrigerated systems (typically distribution centres)
  - 13 x Ammonia refrigerated systems (larger distribution and Dairies)
  - Natural refrigerants > 60% of total installed capacity

- Capital invested installing natural refrigeration systems over the past 5 years: £5.2 milllion.

- Objective to replace all man made refrigerated systems with natural refrigeration by 2030 (unless legislation changes).

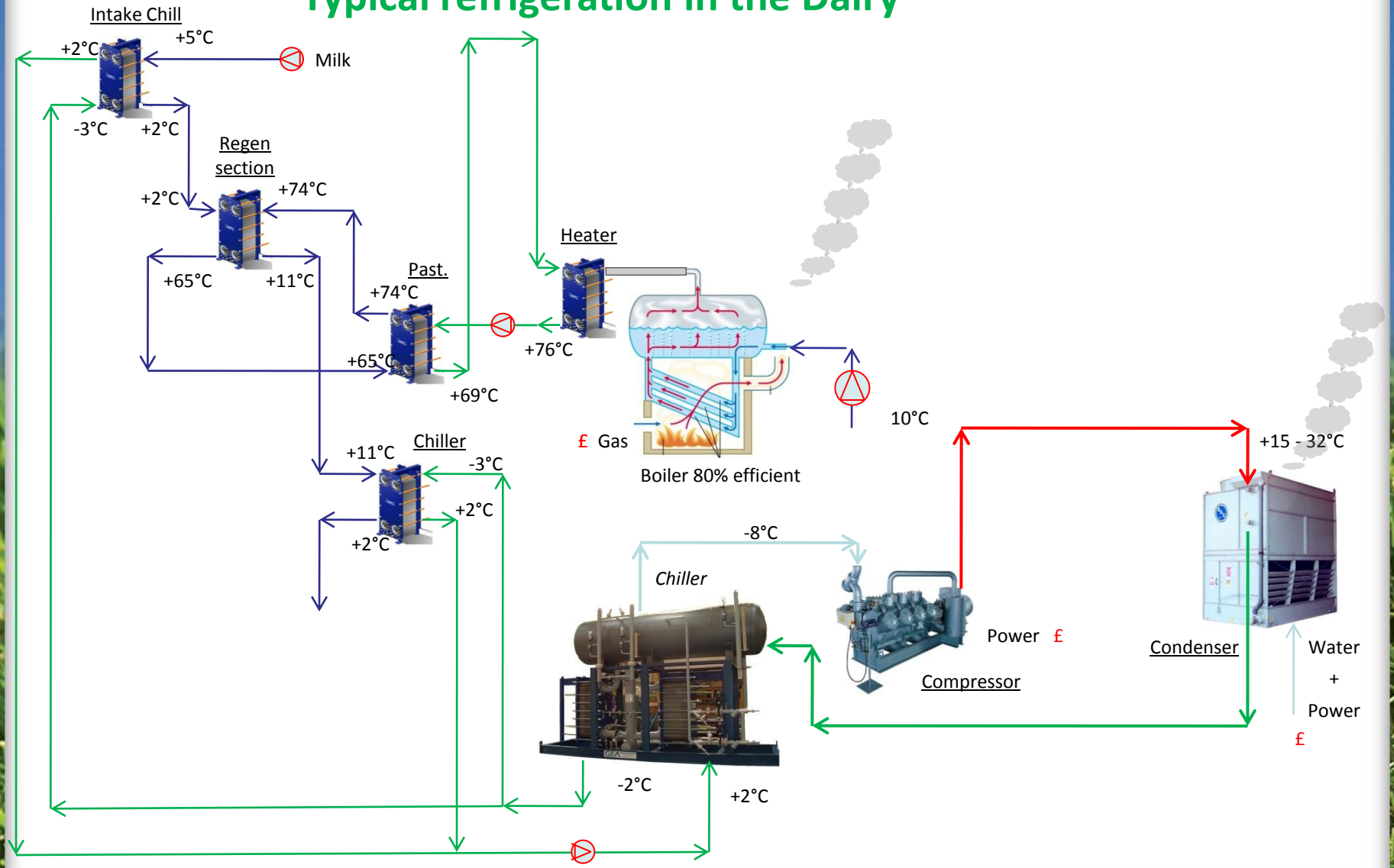
Manchester Dairy Project

- 10 million litre/week raw milk capacity with 3 milk and 2 cream pasteurizers.

- Original requirement to replace 3 ageing R22 water cooled chillers with either a “drop in refrigerant” (R422D or like) or new central ammonia based refrigeration plant (with no heating facility).

- Design
  - Average cooling requirements: 1400 kW, peaking at 2,500 kW.
  - Glycol temperature controlled at: -2°C
  - Required milk temperature: +2°C
  - Side load of maximum 400 kW for chill store.
  - Design evaporating system: -5°C (“floating”).
  - “Floating” condenser control (Design maximum +35°C).

Typical refrigeration in the Dairy



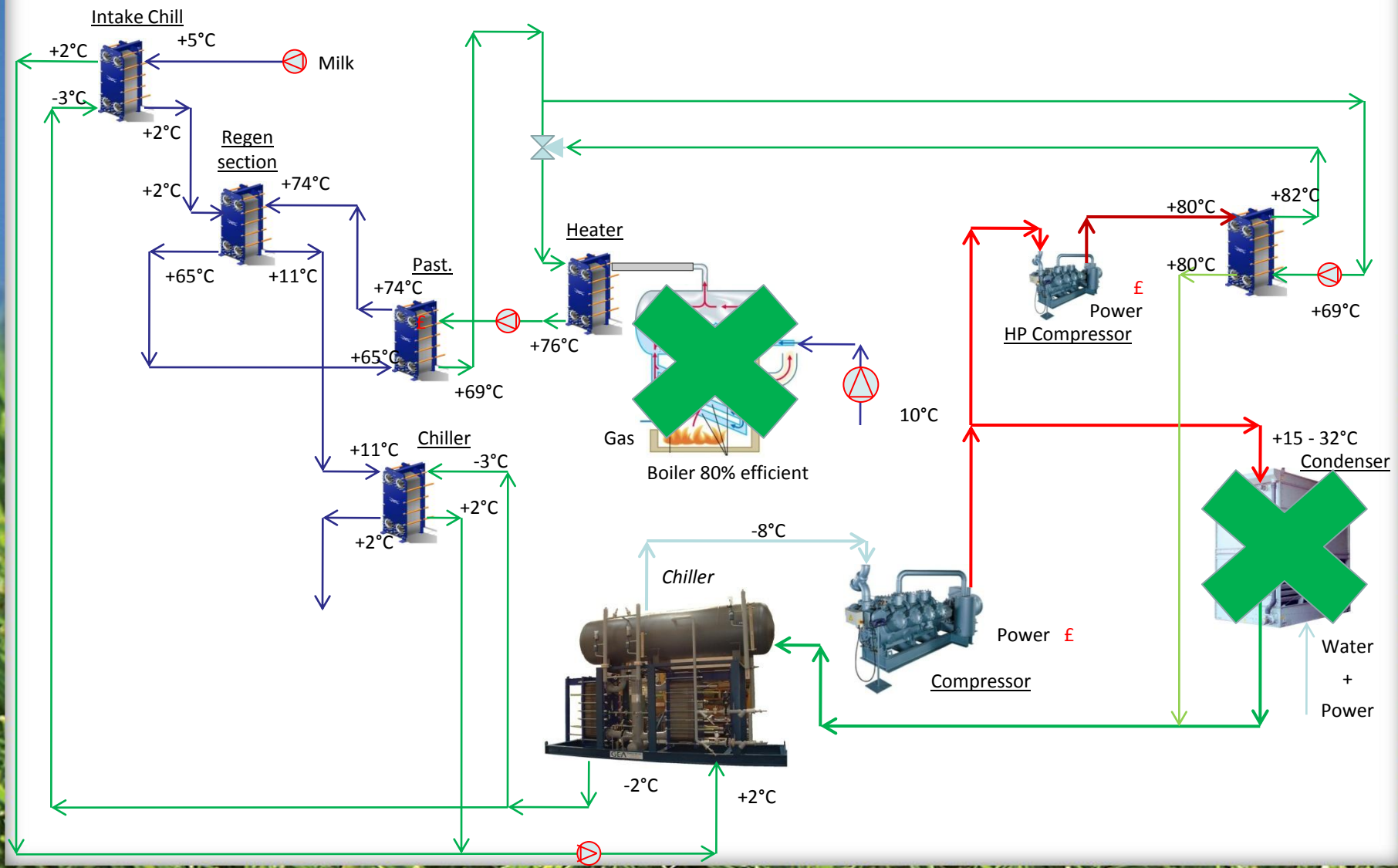
Incentive to Invest?

- Replacing old system with a central ammonia based refrigeration plant gave significant performance increases (40%) but the increased capital cost led to poor return on investment. 11 years +

- Working in cooperation with our chosen provider we looked at various schemes to drive the return on investment down. One of these was the introduction of a high temperature ammonia based heat pump.

- The Dairy heating requirement:
  - 3 Milk and 2 Cream pasteurizing lines.
  - Requiring milk pasteurising temperature: >72°C.
  - 76°C water loop currently produced by traditional gas driven boiler.
  - Additional C.I.P and sterilization processes.
  - Total heating capacity: 80 - 920 kW, peaking at 1,500kw.
  - Main loop design temperature: > 80°C water, blended locally with fine tolerance.

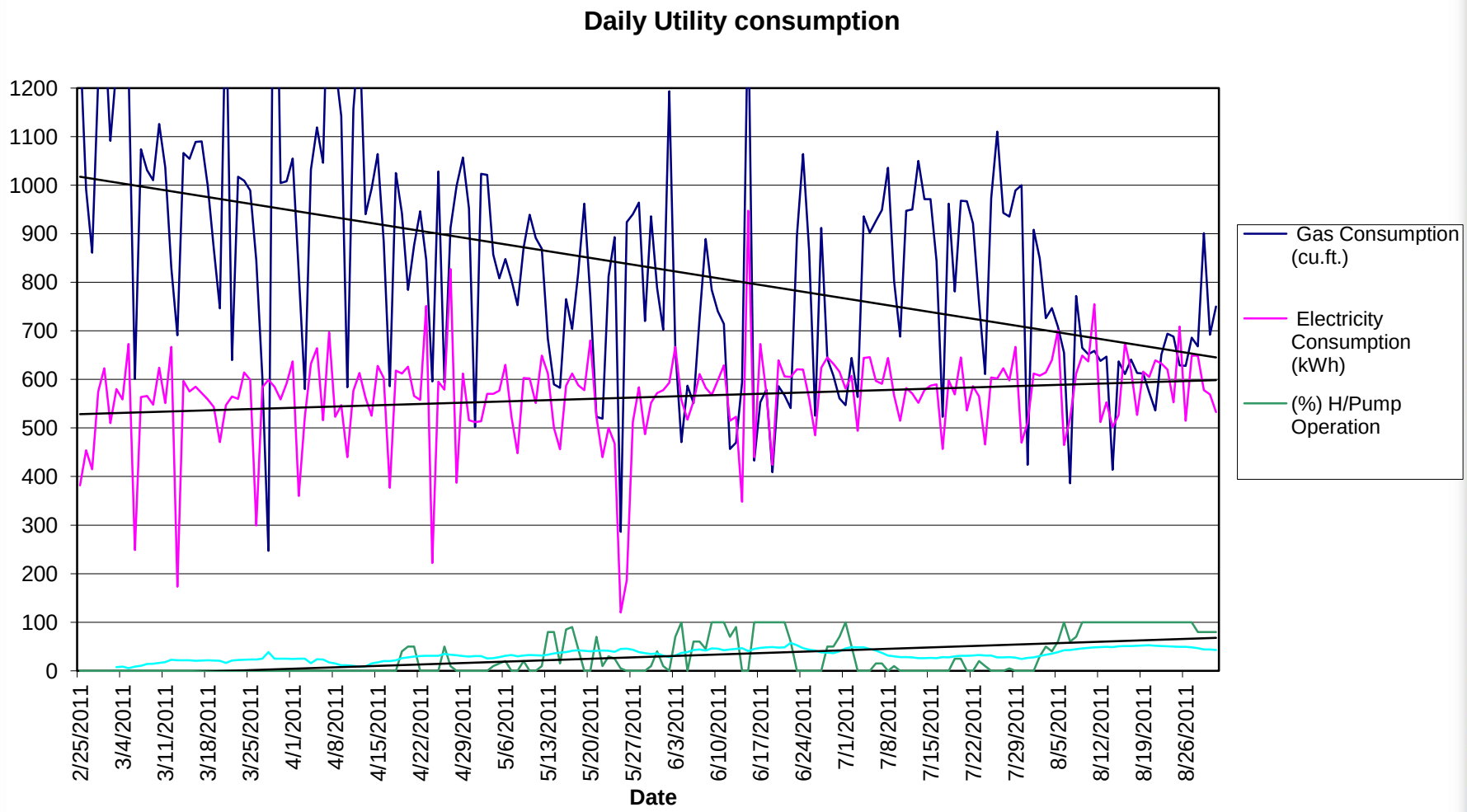
Refrigeration in Manchester Dairy – with heat pump



Challenges

- There have been a number of challenges during the commissioning of the system some of which are detailed below:
  - Initial reliability due to innovative nature of the project. (The first multi stage piston compressor heat pump working in these elevated conditions in the world)
  - End user confidence.
  - Project team confidence. R&D ?
  - Resource levels to manage the project.
  - Lack of realistic support from Governmental Funding (shared knowledge but not support).

Actual savings so far….



COP comparison (with and without heat pump)

Without Heat Pump

- Boiler performance: Cop Heating = 0,8
- Cost per kW natural gas = £0.038 - cost per MWh heating £30,40

With Heat Pump

Heating COP for system with two stage heat pump

Compressor	Rpm	To (°C)	Tc (°C)	Qo (kW)	P (kW)	Qc (kW)	COP cool	Cop heating
3 x Grasso V 1100	700	-5	16	1400	154	1554	9.1	
1 x Grasso 810	1191	16	43	684	90	774		
2 x Grasso 65 HP	1059	43	80	792	133	920		
Extra for heating					175	920		5.2

- Cost per kW electricity = £0.07 - cost per MWh heating £13,46
- Saving in water and effluent = £4,3 per MWh heating
- Saving in CO^2 per year 1,135,000kg

Actual savings so far..

- During recent performance trials (comparing with a similar period last year) the following measurements were recorded.
  - Net reduction in electrical energy for refrigeration and heating >20%
  - Gas usage down from 6,470 cu. Ft to 3,200 cu. Ft (>52%)
  - Water reduction. >50%

Reactions

- Senior Management and Board of Directors fully supportive of project
- Customers very interested in technology and potential savings !!!
- Industrial Energy Efficiency Accelerator Programme deemed project not to be innovative. Carbon Trust programme has been unsuccessful in sharing knowledge
- Plant supplier fully supportive during varied challenges of project
- Other companies within dairy sector very interested but market extremely competitive

The future.....Manchester

- Increase utilisation of Manchester heat pump (expect 70% gas reduction).
- Build confidence and reliability.
- Revisit Governmental funding initiatives for renewable heat
- Recover investment (especially in current market)
- Sharing of experiences within the industry? Caveat of funding??

The Future….General

- Do we invest again?? Potential to save significantly more at 2 larger dairies but ROI excessive (> 10 years)
- Plans to replace 3 more HFC systems with ammonia held due to poor ROI. Incremental upgrades only
- We need clear direction with respect to HFC's phase out.
- We need an incentive to invest…no user appetite. Capital is expensive – major barrier.
- Not classed as renewable energy – Encouraged to replace gas rather than reduce (Biomass)
- We need effective knowledge sharing in a competitive environment
- Manufacturers need support in development of these alternative technologies
- Heat pump is only beneficial if installed at same time as main plant. (Could be an incentive to change from HFC's)
- Would we do it again???

Thank You

Any questions?