TRANSFIELD WORLEY SERVICES

WEA NZ CONFERENCE
Heat Recovery

September 2008

Overview of Presentation

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- Benefits of heat recovery
- How much heat can be recovered?
- Typical configuration (and possible shortcomings)
- Matching heat loads and heat sinks
- Improved design options (addressing shortcomings)
- What not to do with heat recovery
- Energy conservation performance contracting

Heat Recovery

- Waste heat can easily can be recovered from
  - Refrigeration plants
  - Air compressors

- This waste heat is otherwise lost to atmosphere via cooling fans and cooling towers

- Benefits of heat recovery
  - Reduced energy costs
  - Improves efficiency of equipment
  - Environmentally friendly, reduced carbon footprint
  - Reduced capital cost of equipment, smaller boiler etc
  - Provides safety/back-up in case of boiler failure

How Much Heat Can Be Recovered?

- Refrigeration plant
- Chiller output+ power input = waste heat
- 400kW chiller with COP of 4
  - 100kW power input
- 400kW +100kW =500kW waste heat
- 20% high grade superheat (up to 65ºC)
- 80% low grade latent heat (condensation temp ~35ºC)

Heat Recovery

- Technology is simple and readily available i.e. heat exchangers and control valves

- However: Commonly see heat recovery systems that fail to deliver the savings that were expected
  - System has not been designed to match the winery's heating requirements

Typical Heat Recovery Design

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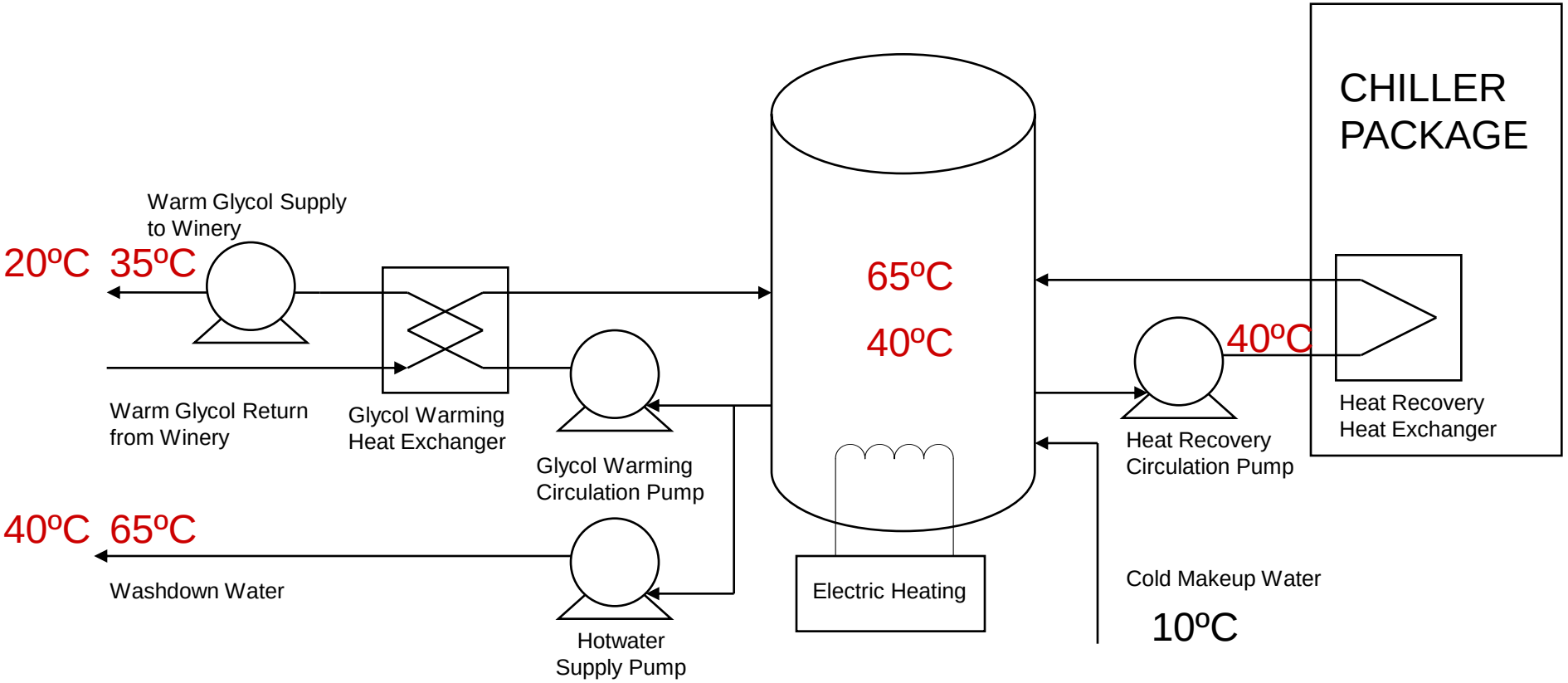

- Without electric heating hotwater tank only gets to 40-45ºC
  - Risk of legionella (legally must hold hotwater tank @ 65ºC)
  - Slow heating of wine tanks
- Only 5-15% of available heat is being recovered
- Failed to match heat sources to heat sinks

Winery Heat Sinks and Sources

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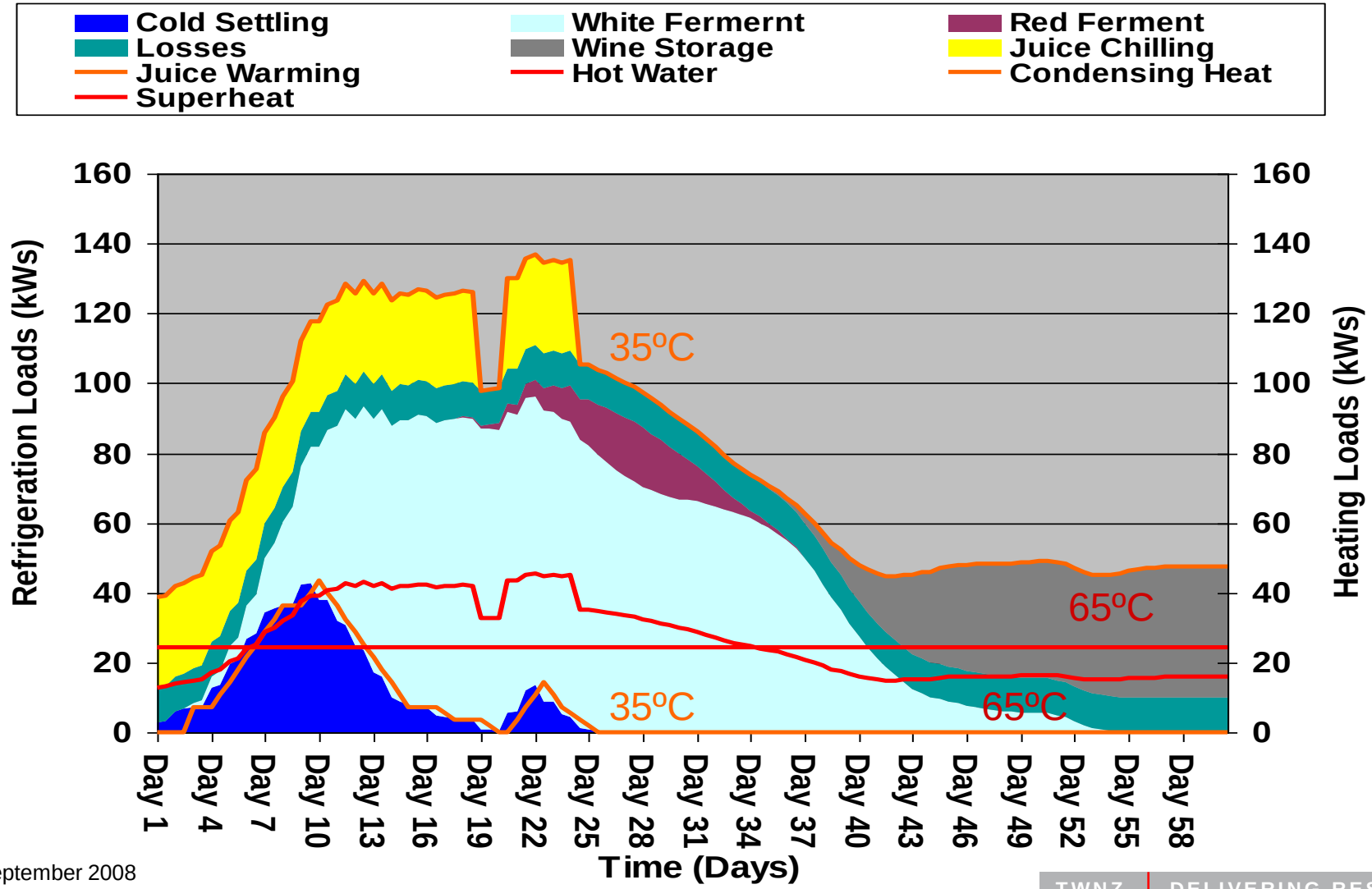
- Typical winery heat sinks
  - Washdown/cleaning water (65ºC)
  - Heating juice after cold settling (35ºC glycol)

- Typical heat recovery sources
  - 20% superheat @65ºC
  - 80% condensing heat @35ºC

- Different for every winery depending on chiller and wine making process

Winery Heat Sources and Sinks

- Look at typical winery (1000 tonne winery)



Improved Heat Recovery Design

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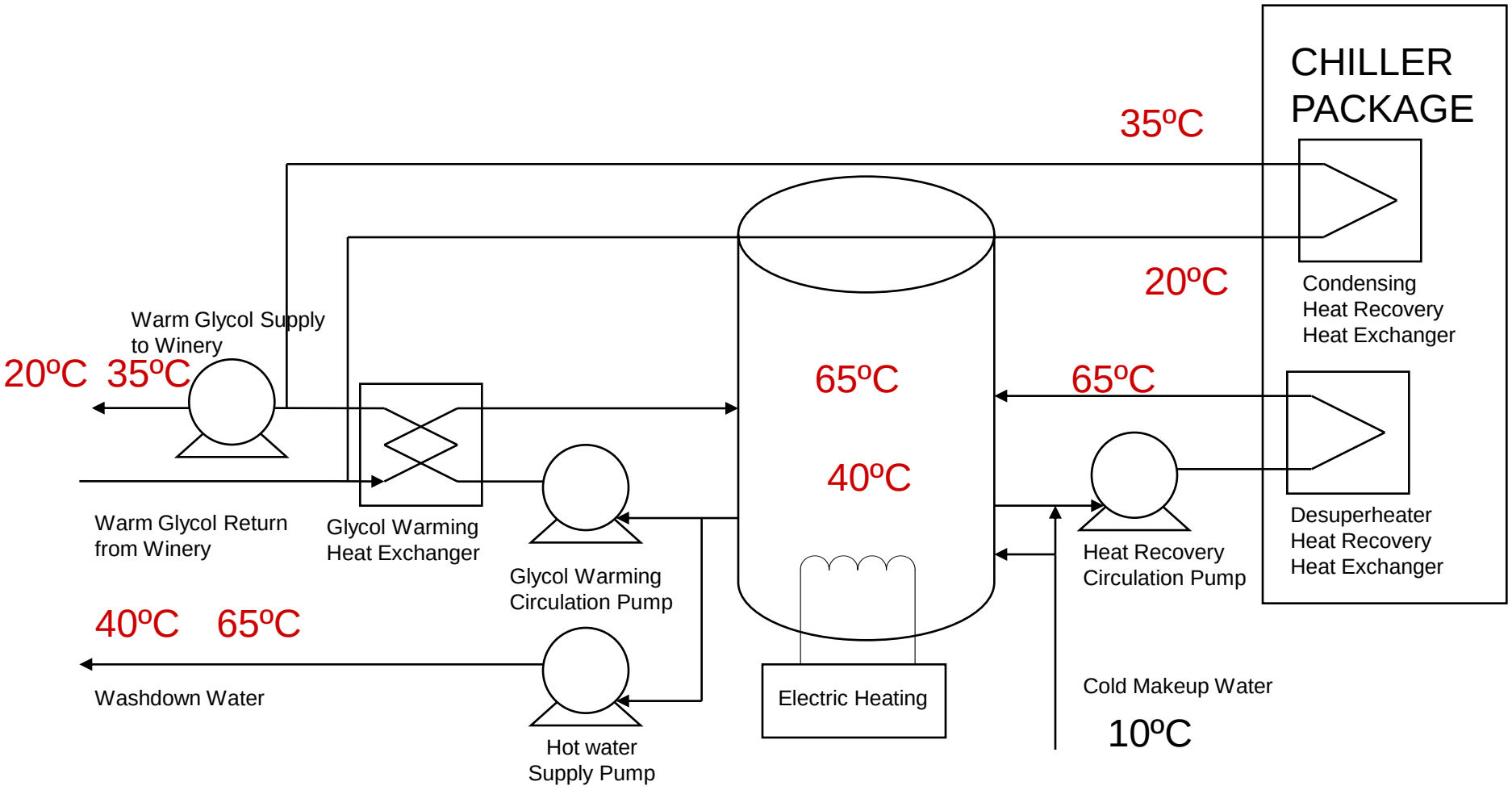

Improved Heat Recovery Design

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- Use of warm glycol prevents growth of legionella
- Heat recovery will save approx $5K in energy over 2 month period
  - 80% of heating costs
- Also
  - 60kW reduction in peak power usage
    - Saving of approx $400/month lines charges
  - Chiller runs more efficiently (savings on fan power, cooling tower usage
    - 5% efficiency improvement ($600/month)
- Reduced carbon footprint
- Payback can be as low as 1-2 years

What not to do with Heat Recovery

- Don’t run a chiller just to recover the waste heat
  - This is less efficient that using electric heating elements/gas/diesel

- Don’t run chiller with high condensing temperature (i.e. heat recovery mode) just to increase heat recovery
  - Less efficient refrigeration
    - @25ºC condensation temp, 28kW electricity per 100kW refrigeration
    - @43ºC condensation temp, 61kW electricity per 100kW refrigeration
  - Decreased refrigeration capacity
    - @25ºC condensation temp, 430kW refrigeration capacity
    - @43ºC condensation temp, 313kW refrigeration capacity
  - Harder on chiller
    - Reduced life time
    - Higher maintenance costs

Energy Conservation Performance Contract

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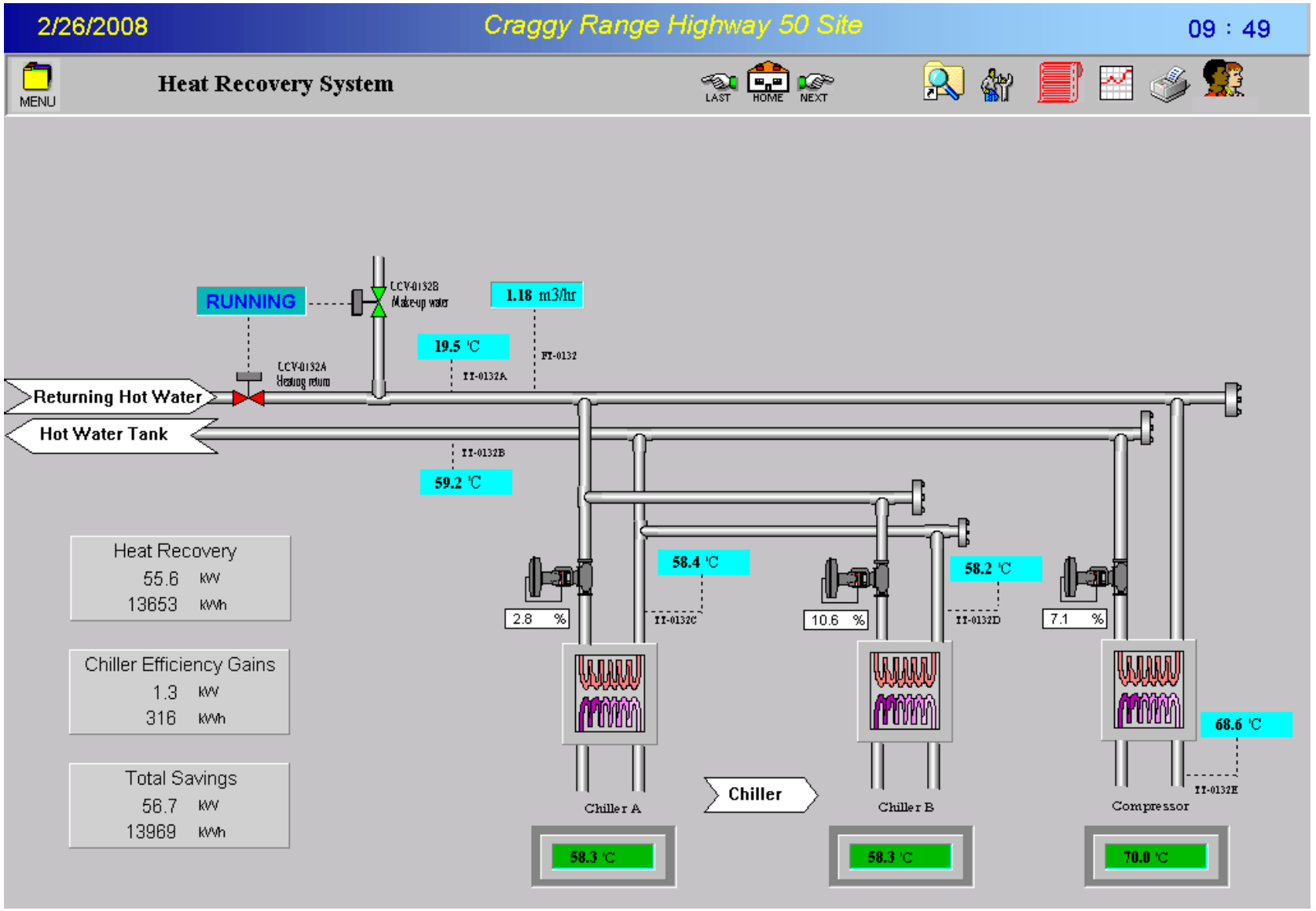
- Example: Transfield Worley and Craggy Range Winery
- Installed heat recovery system to utilise waste heat from
  - Glycol chiller
  - Air compressors
- Transfield Worley (with Demand Response) obtained $30K energy grant from Energy Efficiency and Conservation Authority (EECA)
- Design and installation works covered using energy conservation performance contract (EPCP)
  - Transfield Worley paid the capital cost of the heat recovery system
  - Reimbursed for costs out of actual energy savings achieved (measured not estimated)

Craggy Range Scada Screen



Benefits of ECPC Contract Mechanism

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- No risk or capital outlay to the client
- Immediate reduction in carbon footprint
- Immediate reduction in energy bill
- After the agreed pay back period , client keeps all energy savings

Heat Recovery Summary

- There are significant amounts of waste heat available that can be utilised using heat recovery
- Heat recovery sources need to be matched to the winery heat sinks
  - Matched in both time and temperature
- Optimum system design will be different for each winery depending on winemaking process, refrigeration chiller and heating requirements
- There is not always a business case for installing heat recovery
- Transfield Worley has experience and expertise designing and installing winery heat recovery systems
- Transfield Worley can offer ECPC contract mechanism