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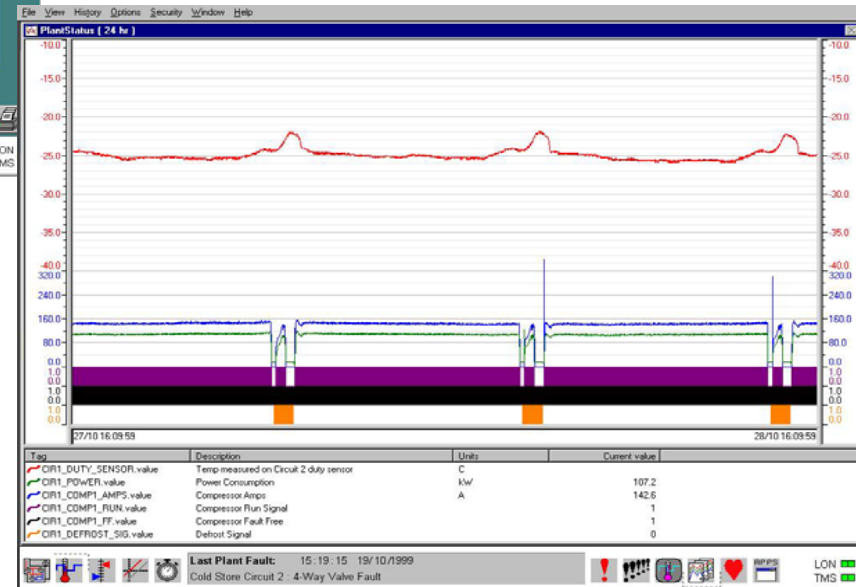
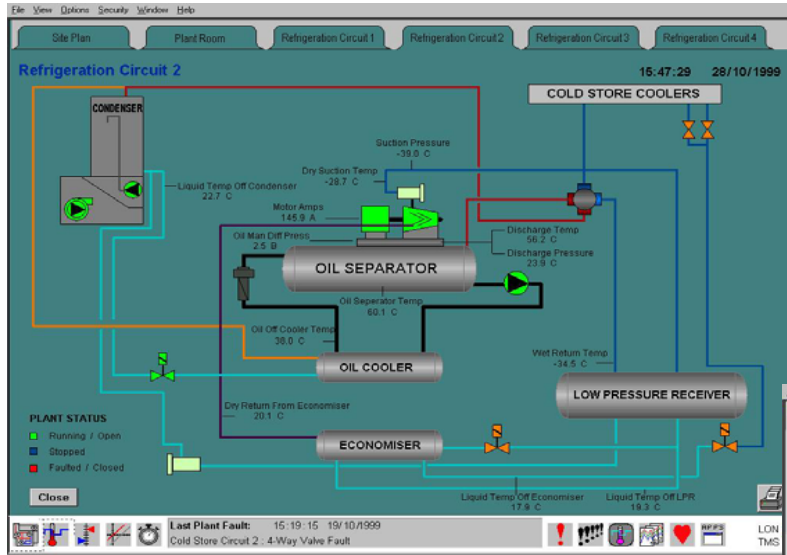
# Energy Optimisation in Current Refrigeration Installations



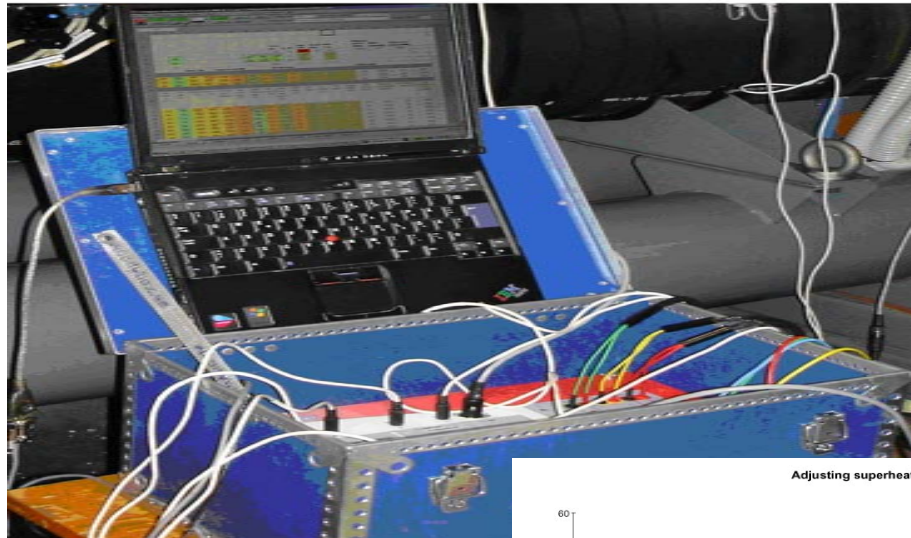
# Savings Opportunities

- **Lots of opportunities to improve existing refrigeration systems**
  - **10% to 20% savings are typical**
- **Requires operating improvements**
  - **better part load control**
- **Requires maintenance improvements**
  - **purging condensers of air**
- **Above all, you need regular measurement of system operation**

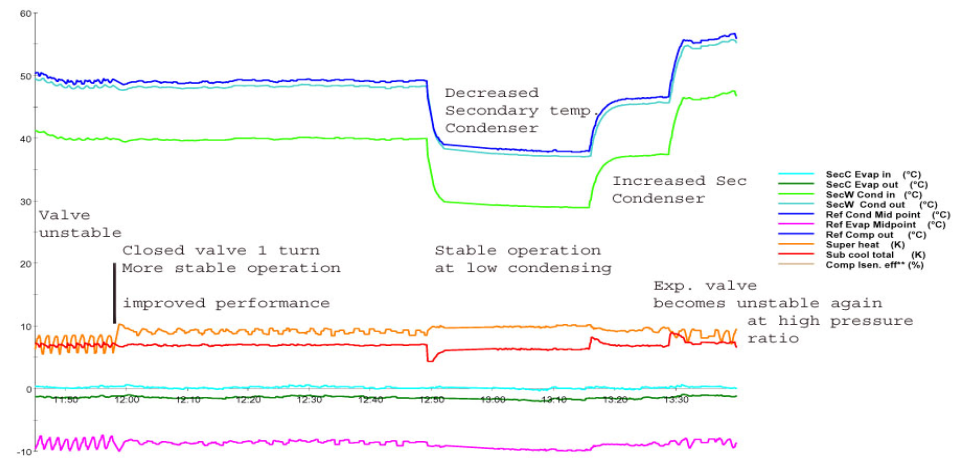
# Measurement of System Operation



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Adjusting superheat 2006-08-01 13:40:00



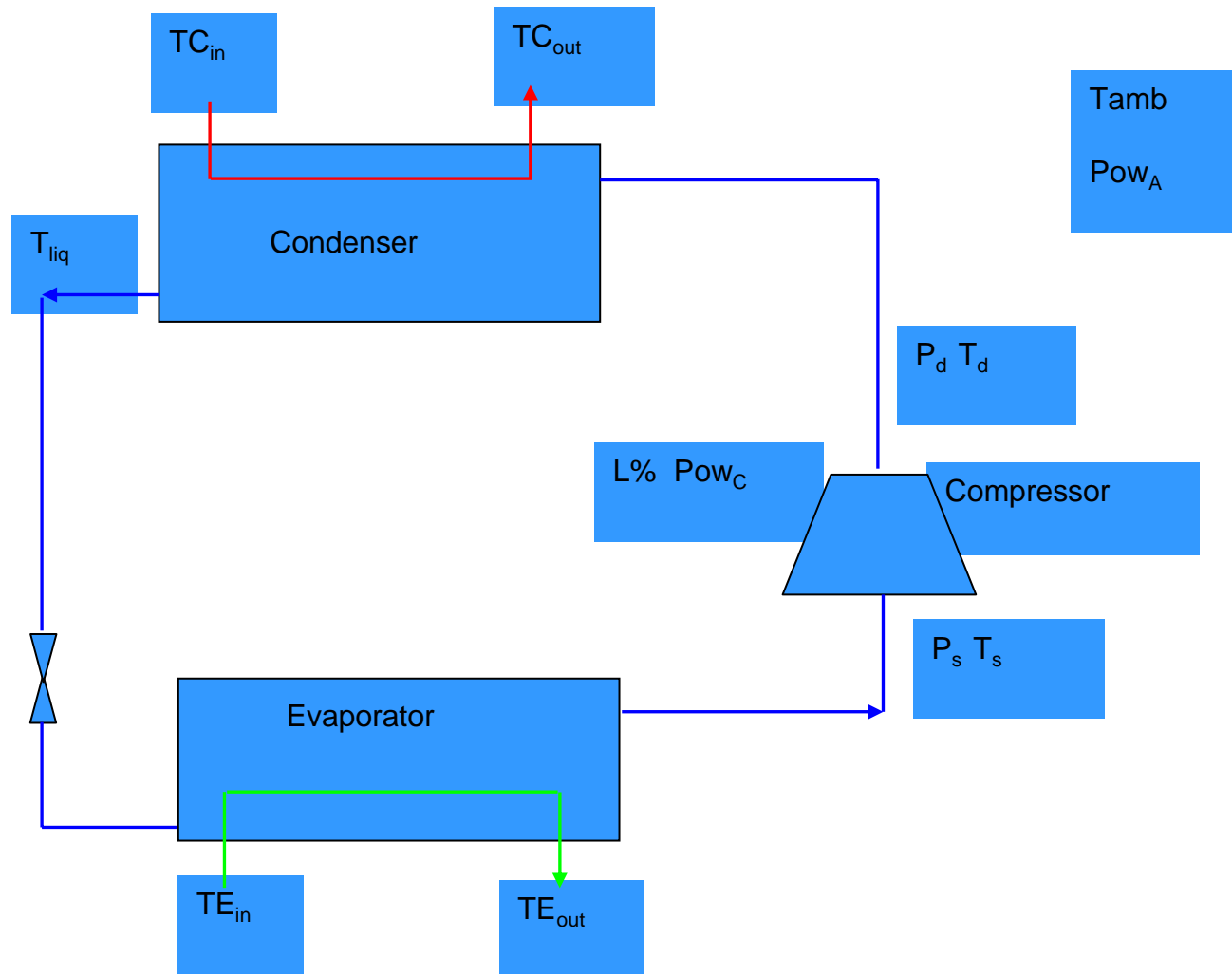
# Assessing System Operation



- **Indirect Assessment**
  - snapshot of relevant data (e.g. temperatures and pressures)
  - can interpret many types of fault
- **Direct Assessment**
  - integrated values of energy use and cooling
  - provides measurement of plant efficiency



# Information Required - Indirect



# Information Required - Direct



- **Compressor energy usage**
- **Auxiliary energy input**
  - pumps, fans etc.
- **Average weather conditions**
  - dry bulb temperature for air cooled condensers
  - wet bulb water cooled / evaporative condensers
- **Cooling carried out**
  - difficult to measure!



# Methodology - Indirect

- **Take data snapshot**
  - best with plant at steady full load
- **Compare with “expected values”**
  - based on design / commissioning data
  - taking into account ambient conditions
- **Look for discrepancies e.g.**
  - $T_c$  is higher than expected
  - $T_e$  is lower than expected
  - Power consumption is higher than expected
- **Diagnose and rectify faults!!!**



# Common Faults

- **Excess heat loads**
  - thermostat set too low
  - heat ingress through open doors
- **Fouled evaporators**
  - oil fouling in flooded systems
  - frost on air coolers
- **Head pressure control too high**
  - badly set up control – set high for convenience
  - set high for poor hot gas defrost system
- **Control of compressors & pumps**
  - compressor part load operation
  - pump fixed speed operation

# Conclusions

- **Many refrigeration plants do not operate in an “optimised” manner**
- **To improve efficiency you need to measure relevant data regularly – considering direct or indirect methods**
- **You must get information on “expected values”**
- **Capital expenditure may offer increased opportunities**