Cooling towers: Reducing water usage

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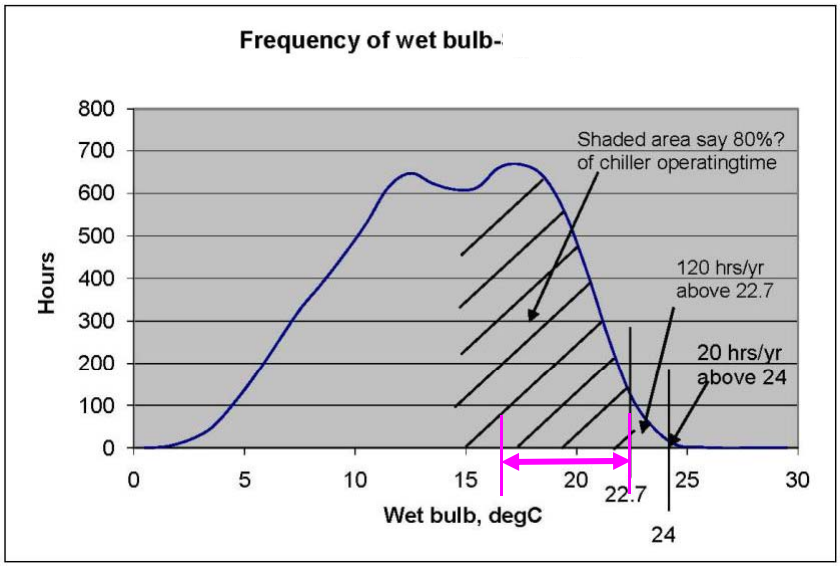
Installation fundamentals are important

- Specifying
- Piping Layout
- Balancing
- Water treatment covered by others

Ensure Tower sized correctly

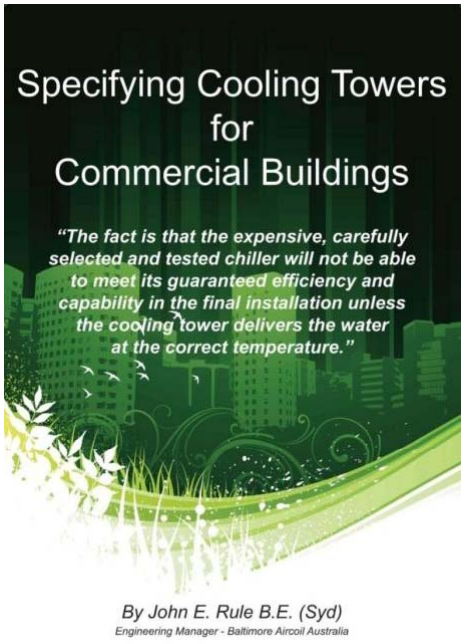
- 15% undersize tower: extra 4% chiller power.
- 30% undersize: tower: extra 8% chiller power.
- i.e. Extra water consumption

Wet Bulb say 24 degC



Specify A/C Towers more meaningfully.

- Extreme duty spec is ok- but…..
- Additionally specify cooler water at normal wet bulbs
- Allows tower commissioning
- All towers react to wet bulb changes in a similar way.



LAYOUT

- **Towers are the lungs of the building**
- **Suffocation:** Air flow restricted .
- **Recirculation:** Discharge cannot escape
- **Ventilation:** Inadequate breathing room. Allow 2m/s air flow to all inlets.

- **Don’t ask the tower supplier to guarantee poor layout by others**!

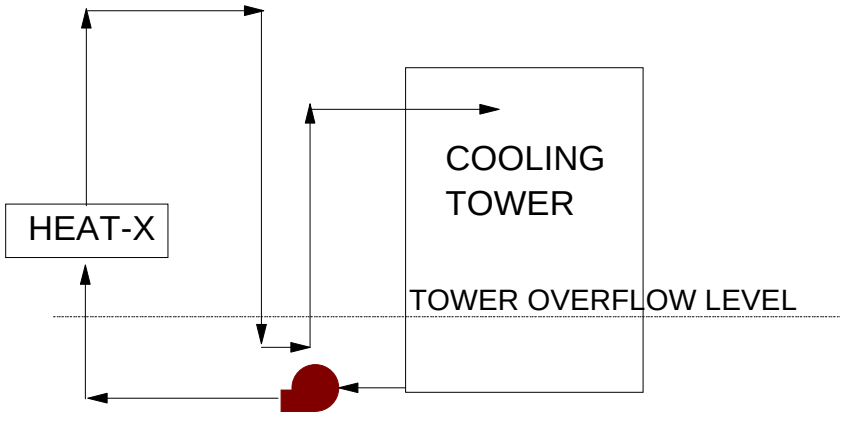
Towers in Parallel

- Water flow into each tower is not precisely the same as drawn from that tower outlet.
- A balance line is required to allow levels to readjust.
- Size balance line to accommodate 15% of largest tower with 25 mm diff.
- Towers should have same overflow levels. Adjust the makeup to have common operating.

Piping:
Starting and stopping pump

- When pump stops, water tries to settle at same level as tower sump.
- Tower sumps have limited volume.
- Water can flood back.
- Keep piping low.
- Check-valve impedes drain back.

Arrangement to minimise overflow and cavitation for excessive pipework above tower

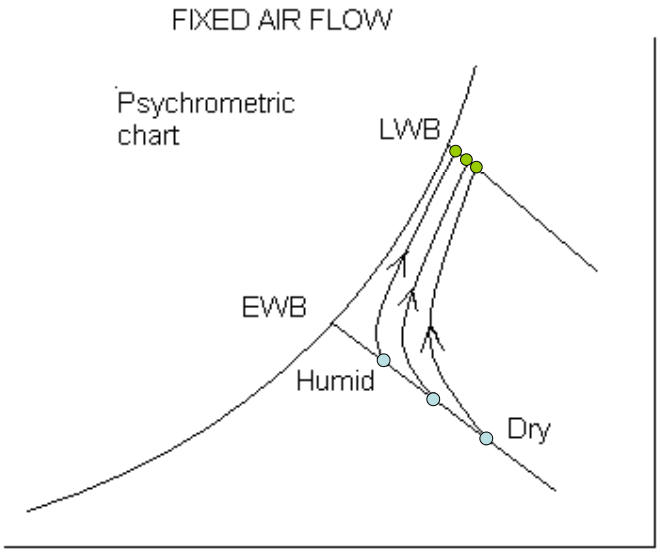


Reducing Water Flow To Tower

- Nozzles have a sweet range of operation;
  - Too much flow: Pop seals, grommets.
  - Too little flow; Cooling occurs but lose accurate predictability.
- Low flows
  - Usually off season, loads are low and the VFD compensates for the spray inefficiency.

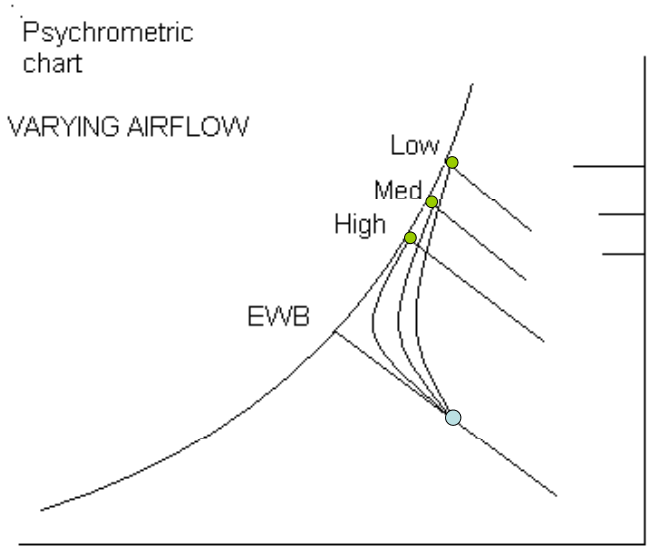
Can we evaporate less water?

- Convenient rule for evaporation:
  - 1.5 l/hr per Kw
- If say 1000 kw, expect 1500 l/hr
  - Or 0.42 l/s evaporation
- Does this change with climate or airflow?



Consider, 1000 kw,24 degC EWB,

- If HUMIDITY different; fixed airflow 35 m3/sec?
  - 39% RH, 0.47 l/s
  - 60% RH, 0.39 l/s
  - 92% RH, 0.32 l/s]
- c.f. 0.42 l/s]



Consider, 1000 kw,24 degC EWB,

- If AIRFLOW different; fixed air-on 30/24 [60% RH]
  - Low: 0.39 l/s [30 m3/sec]
  - Med: 0.40 l/s [35 m3/sec]
  - High: 0.41 l/s [45 m3 sec]

  - c.f. 0.42 l/s

Water saving options?

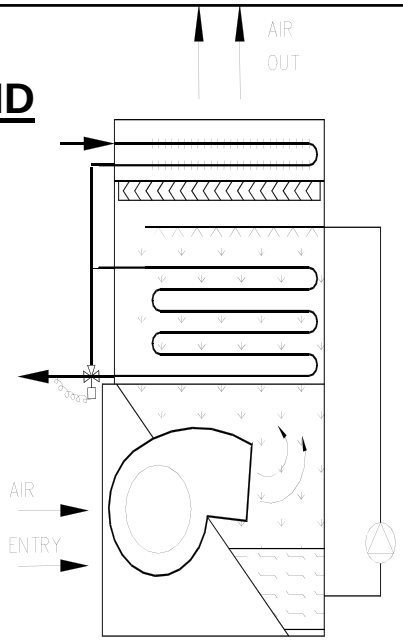
- Good selection, good installation and reducing building heat load will reduce water consumption.
- But no silver bullet to stop tower from evaporating water and doing its job.

Hybrid technologies to save water

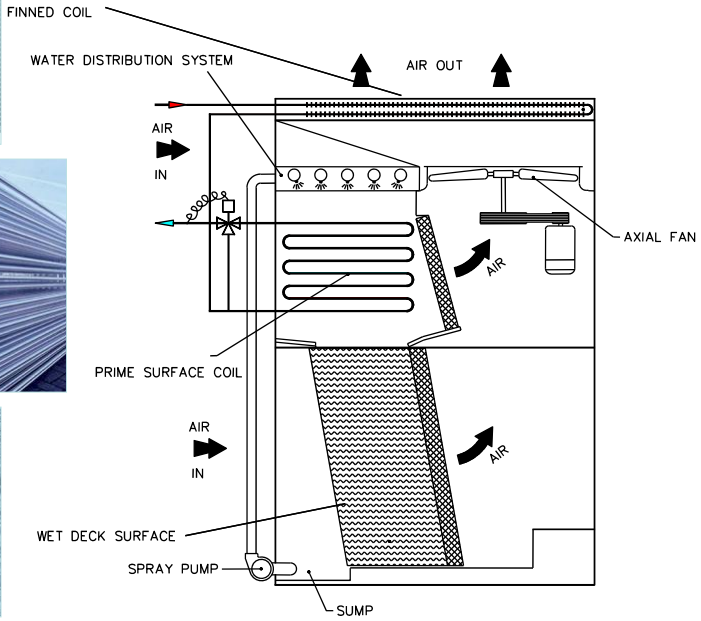
- Combine wet cooling with dry finned coil.
- Advisable to have a closed system.

- OPTION A: Finned coil after a wetted coil.
- OPTION B: Finned coil after adiabatic pad.

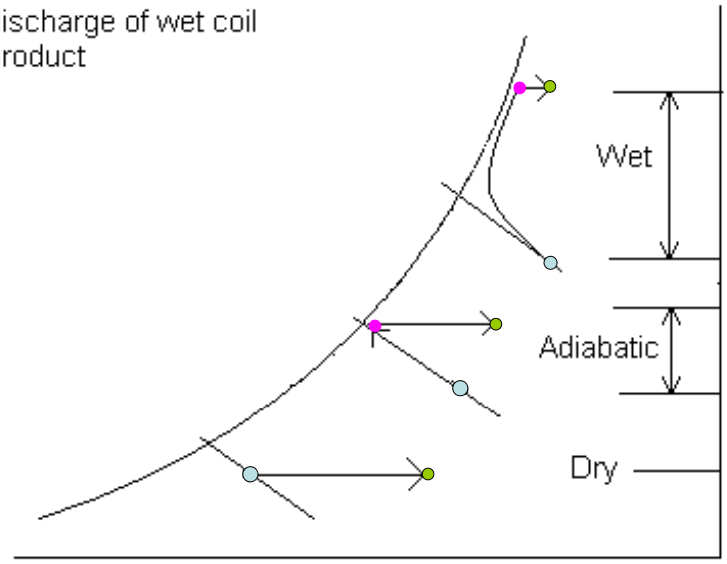
EVAPORATIVE FLUID COOLER WITH FINNED COIL ON DISCHARGE



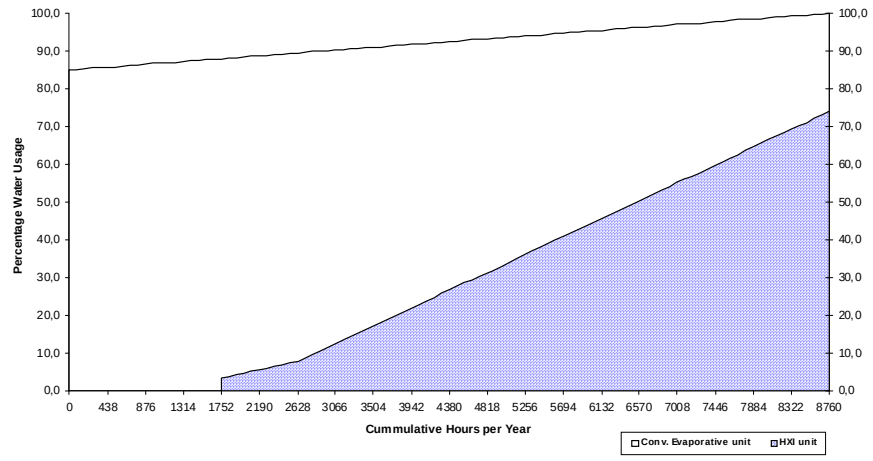
HXI



Finned coil on discharge of wet coil product

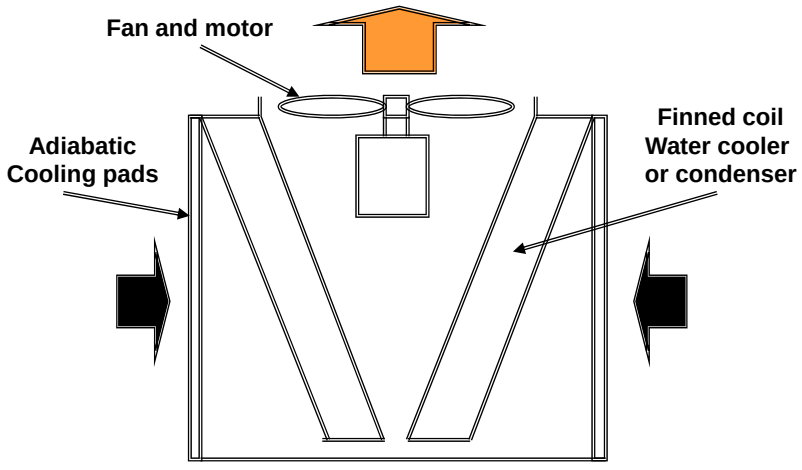


Annual Water Consumption



32.0 / 27.0 / 21.0 °C
1500 kW (= 100% load) (30% EG)
(2) x HXI-541-O

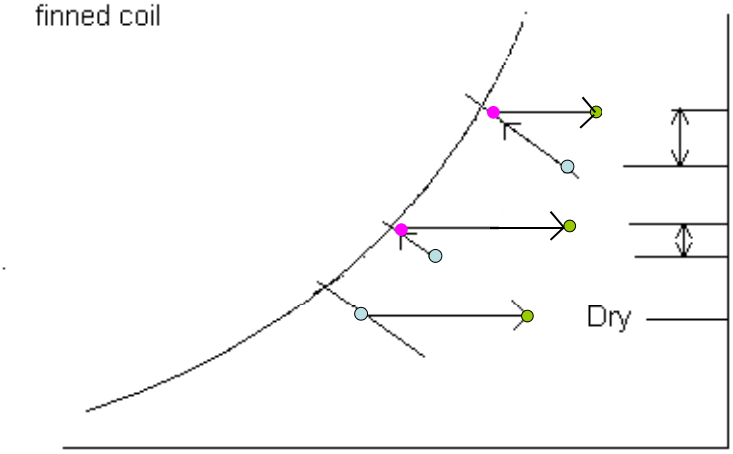
ESTIMATED water savings 69%
Graphs are based on a relative comparison
and can only be used for indicative purposes



ADIABATIC COOLER

[1] Water not required cold days
[2] L.D. safe
[3] Registration not req'd.

Adiabatic
Precooling of
finned coil



QUESTIONS