AIR COOLED CONDENSER
USERS GROUP

ACC Performance Enhancement Options

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Peformance in ACC units

- limited by heat transfer
  - ambient temperature
  - tube fouling
- limited by parasitic load
- potentially limited by non-optimal design

Outcome of limitations

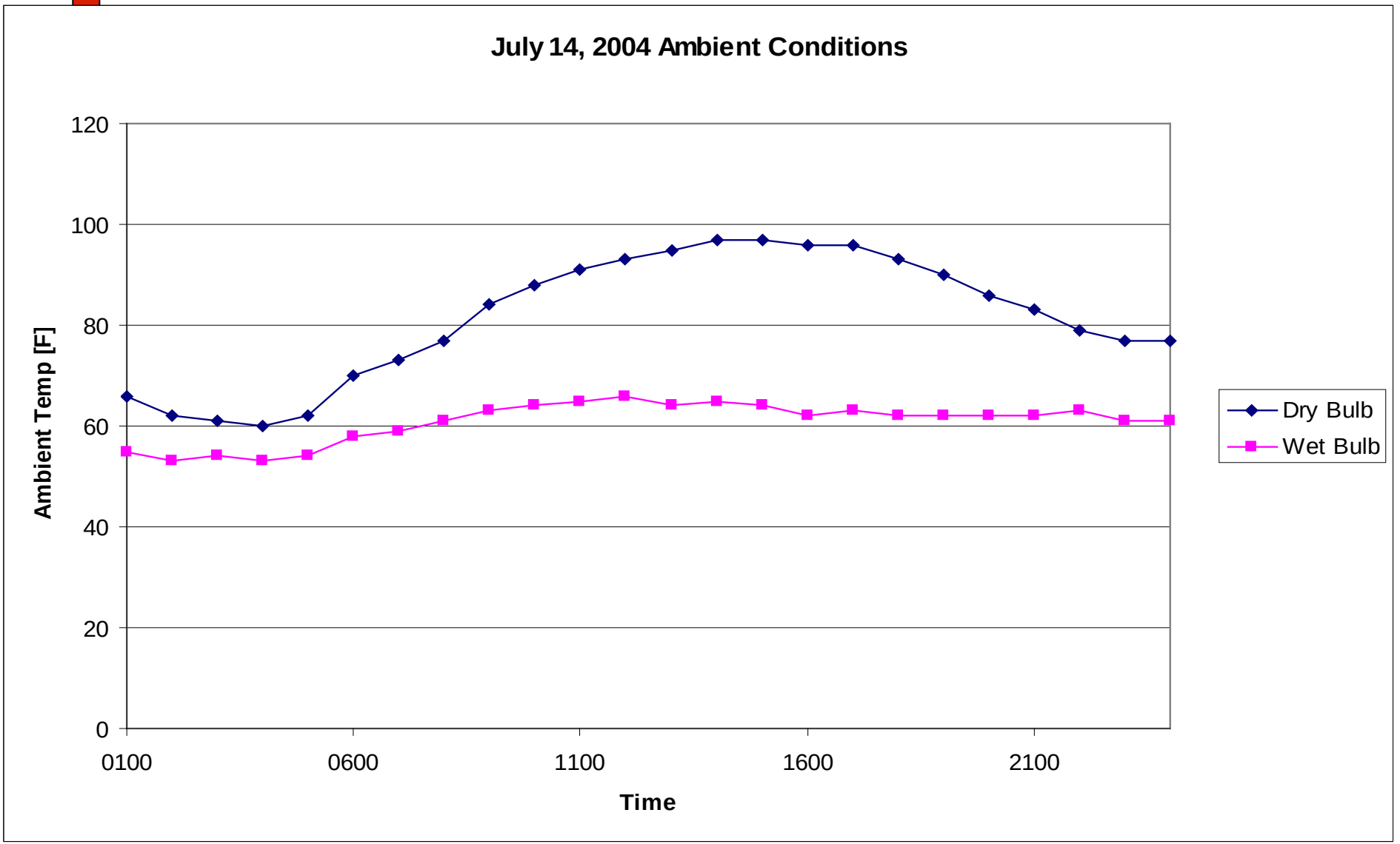
- **Increased cost for generation of electricity**
  - **higher fuel cost**
  - **generation deficiency on hottest days**

Performance is optimized by design, operation and upgrade / retrofit options.

Design Factors

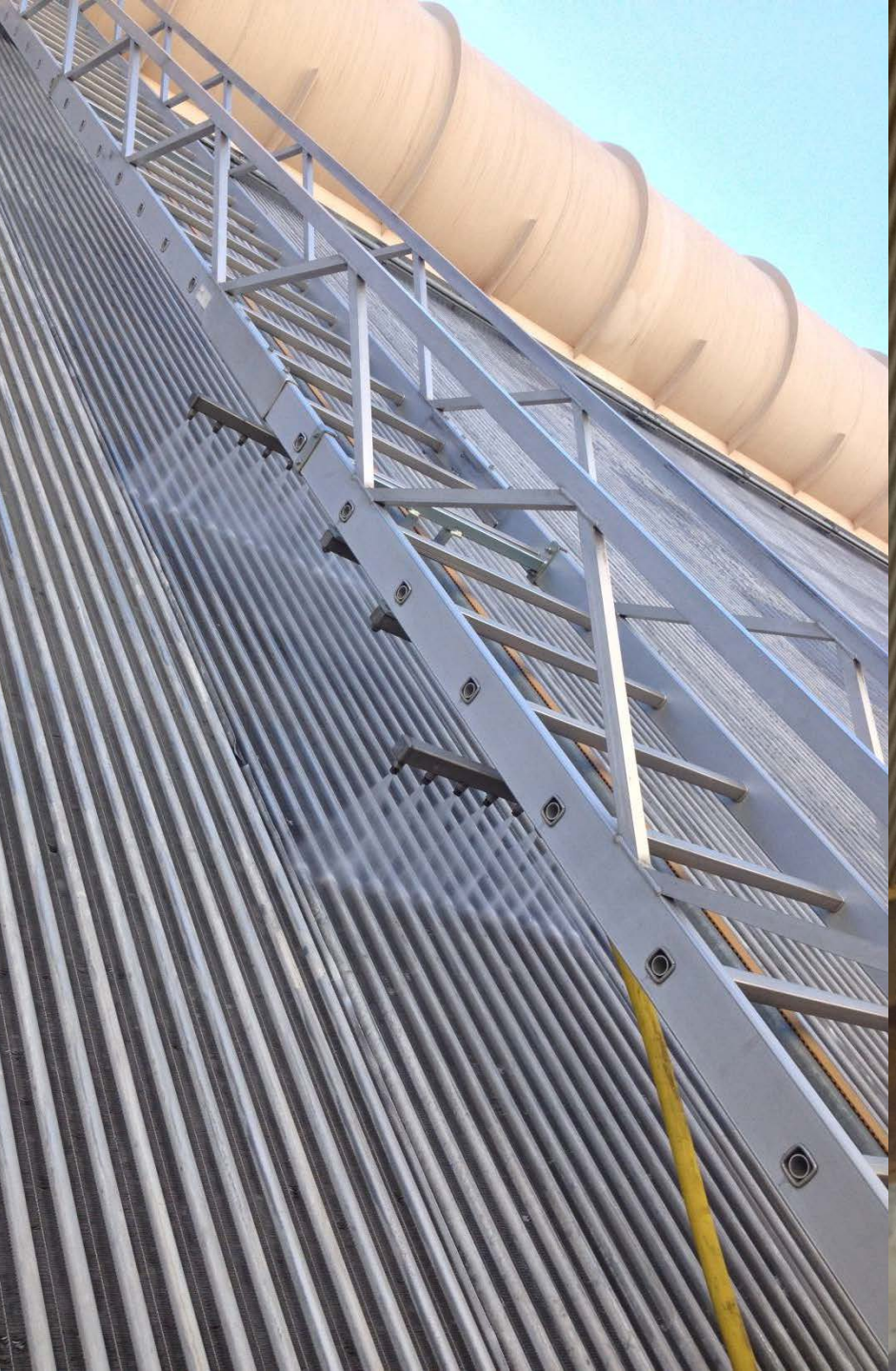
- ambient conditions:
  - wind
  - temperature
- anticipated load demand (internal/customer)
- steam distribution
- tubes
- fans

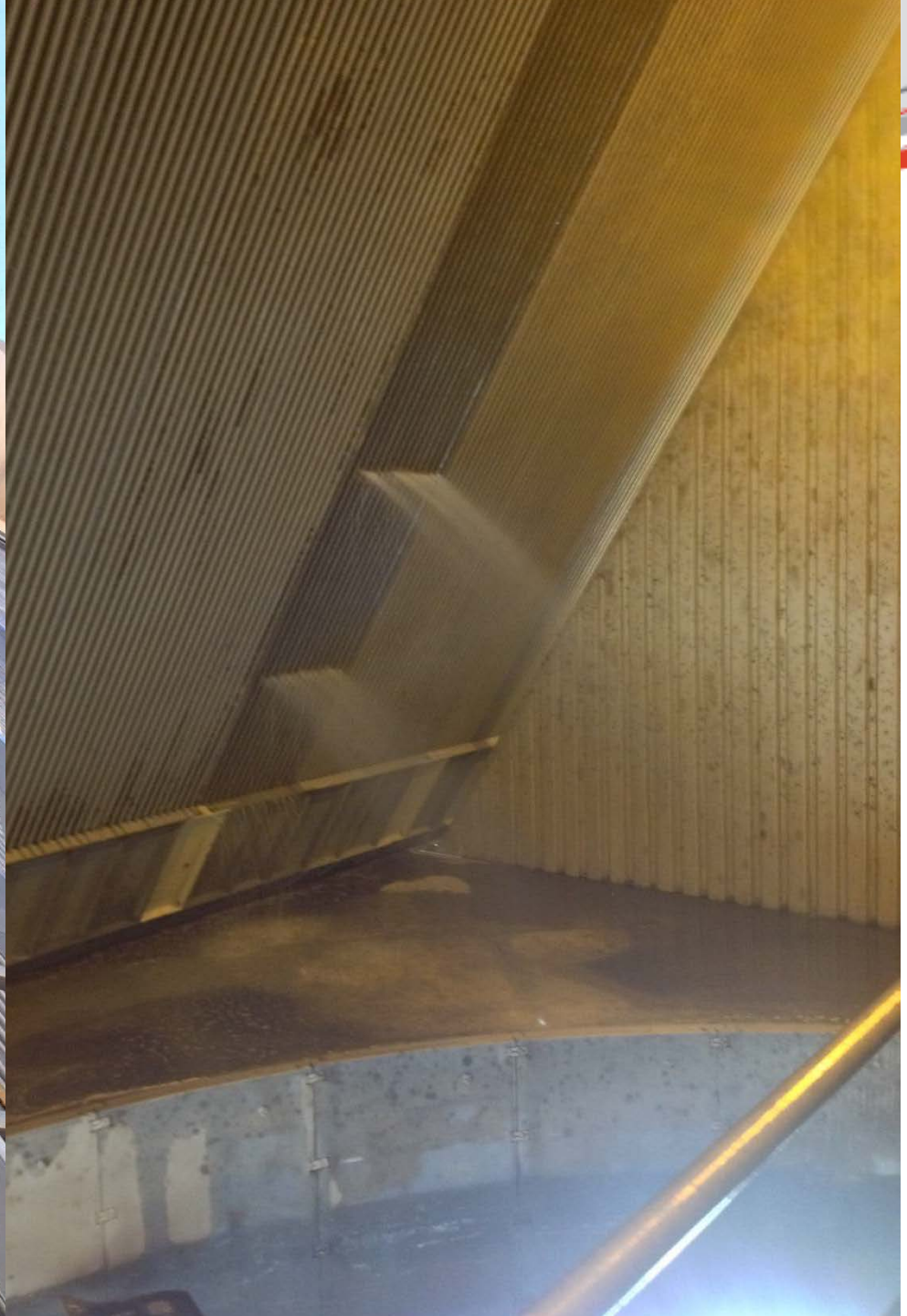
Design Day: dry bulb vs. wet bulb T



Operation

- external tube cleaning
- air flow management
- spray enhancement
- air inleakage
- misc.

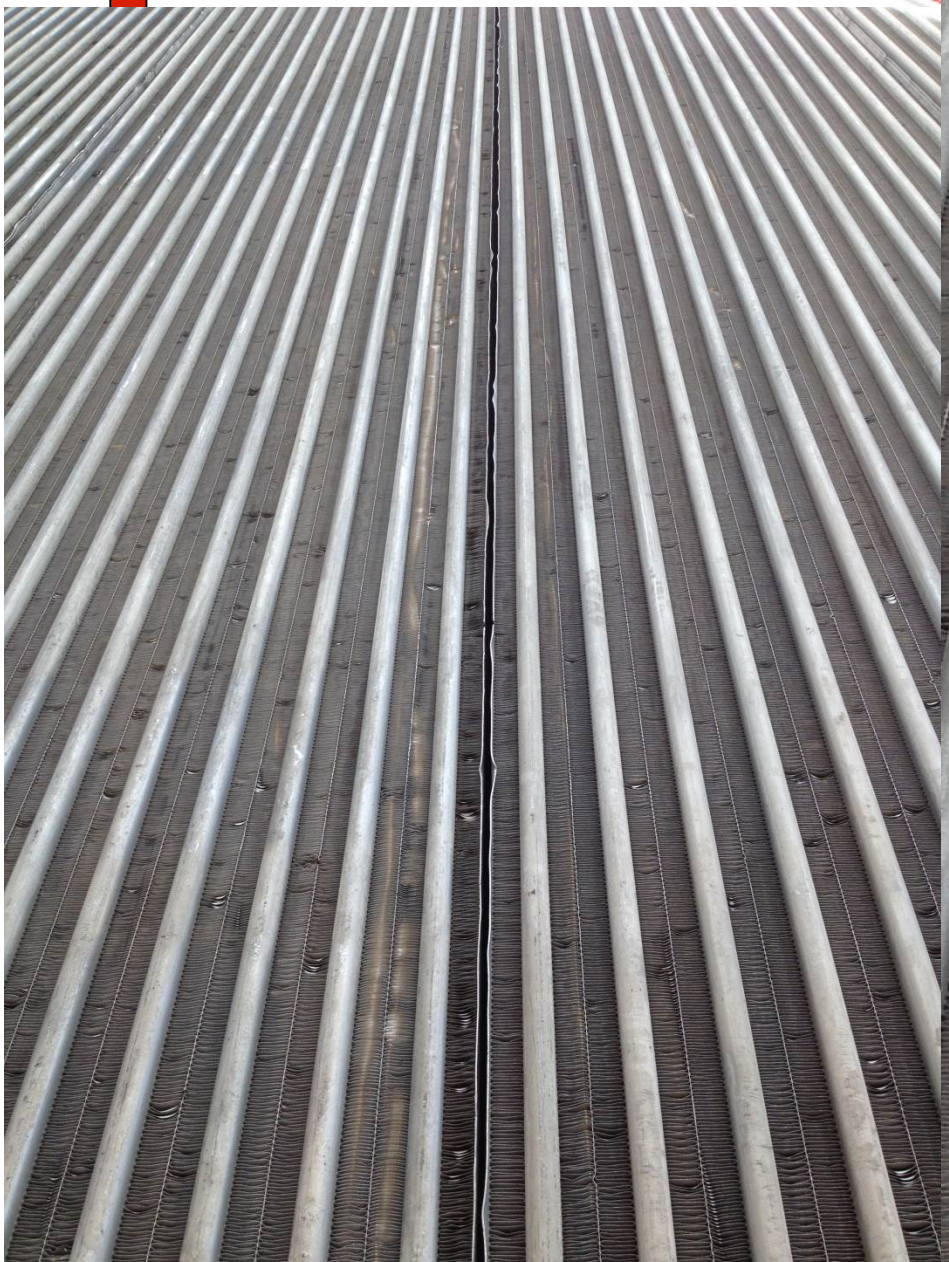





ULTRA BOOM

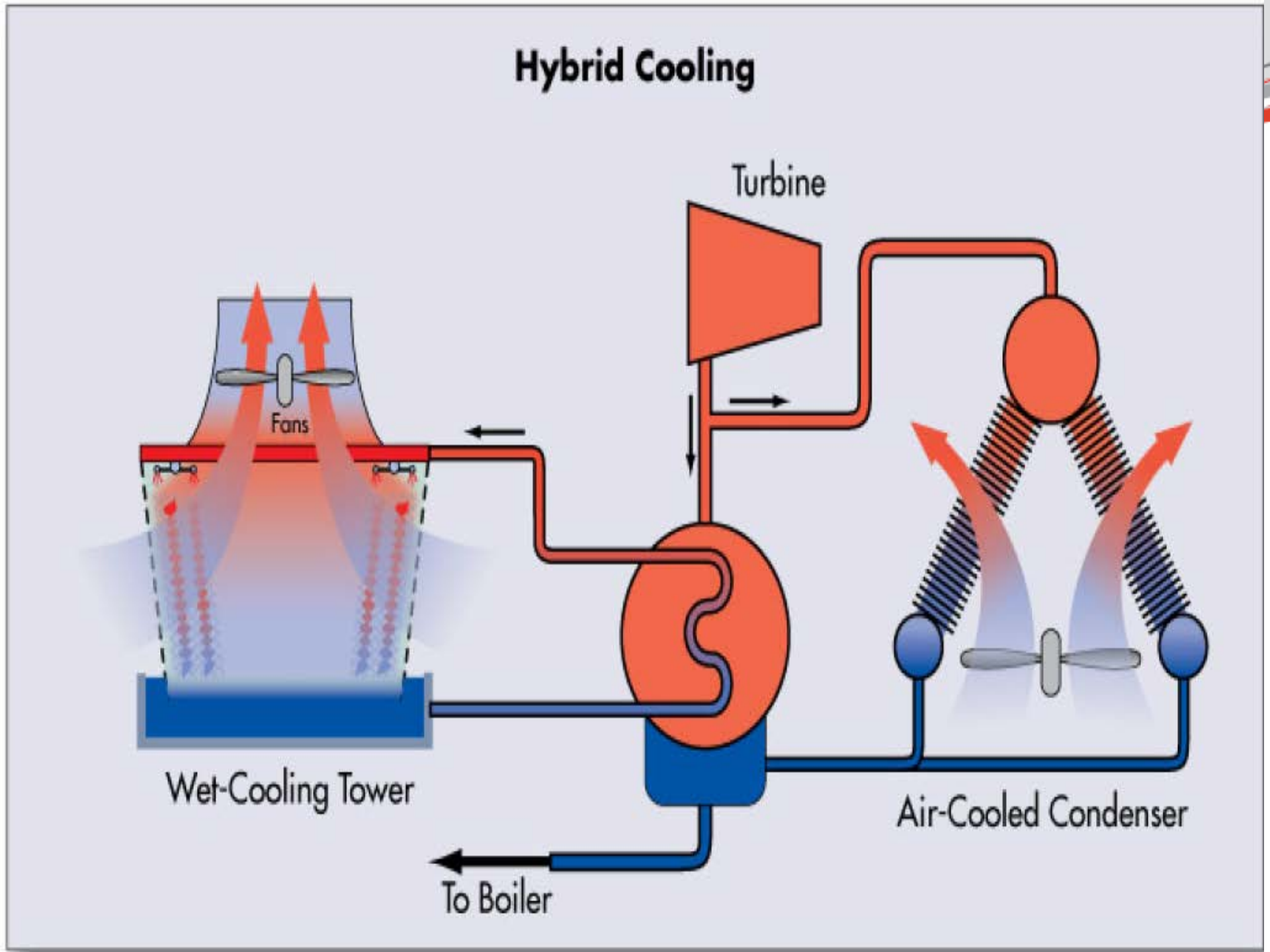
other issues

other issues

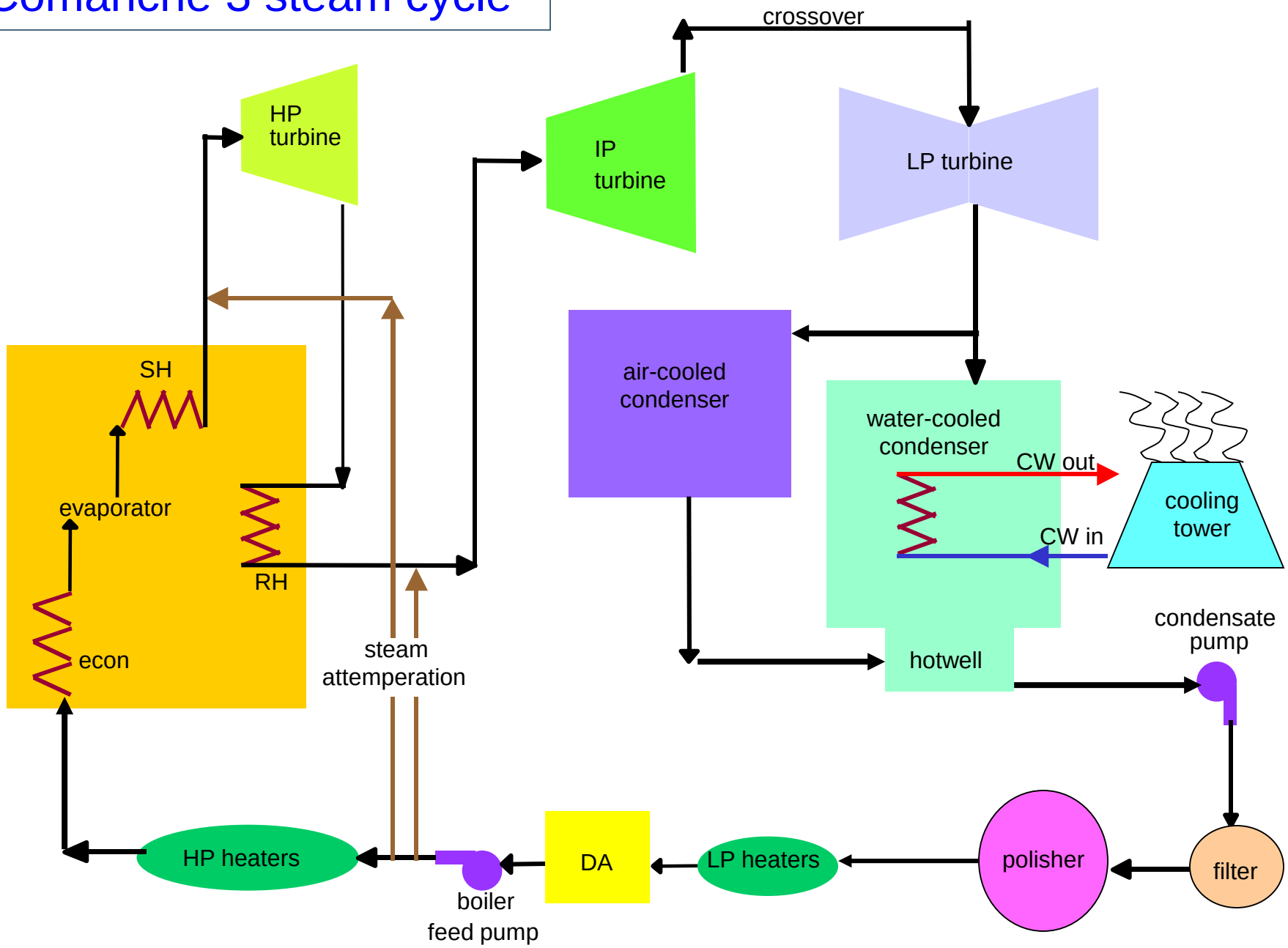


Retrofit Construction

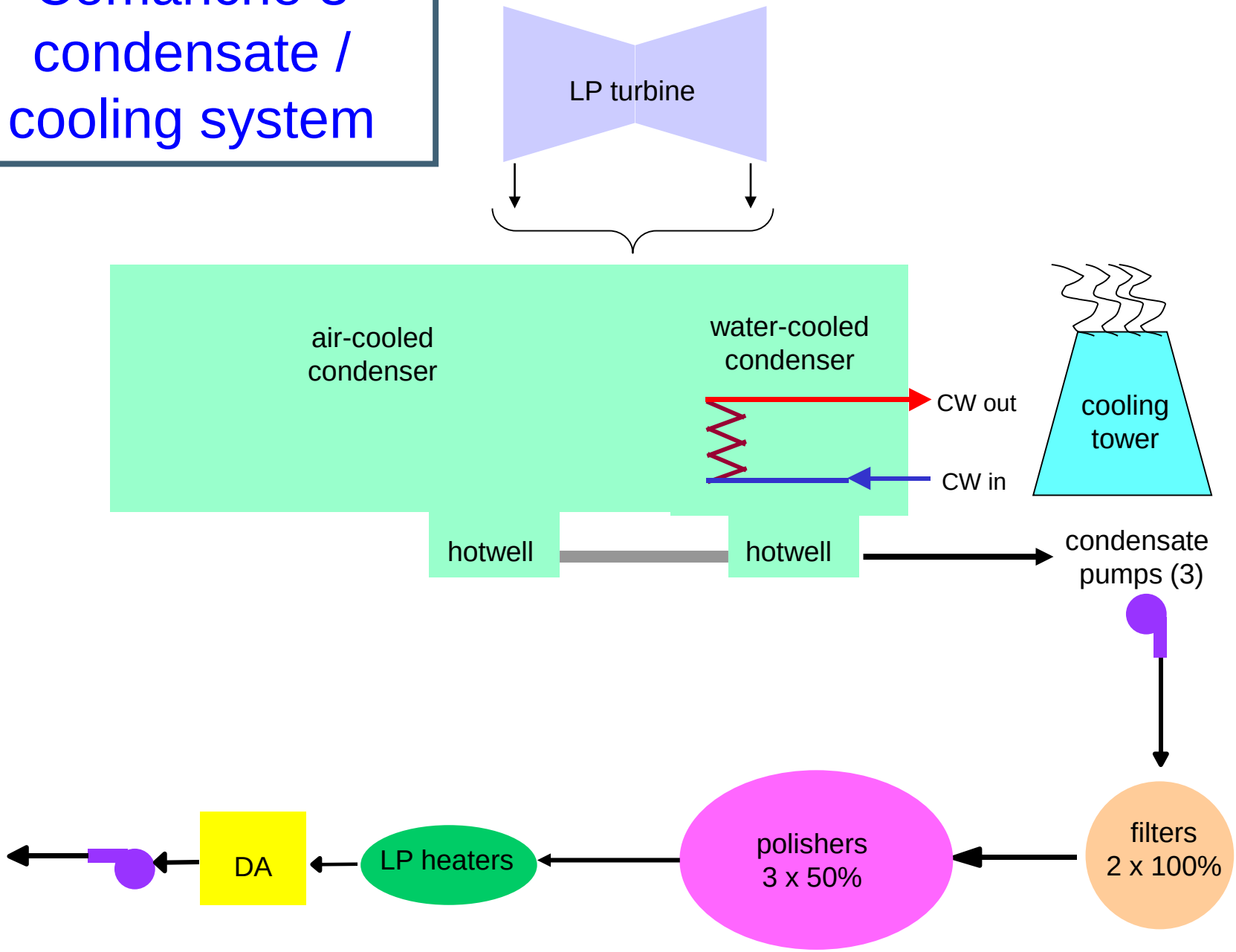
- add wet cooling (parallel)


Hybrid Cooling
Turbine
Fans
Wet-Cooling Tower
Air-Cooled Condenser
To Boiler

Comanche 3 steam cycle



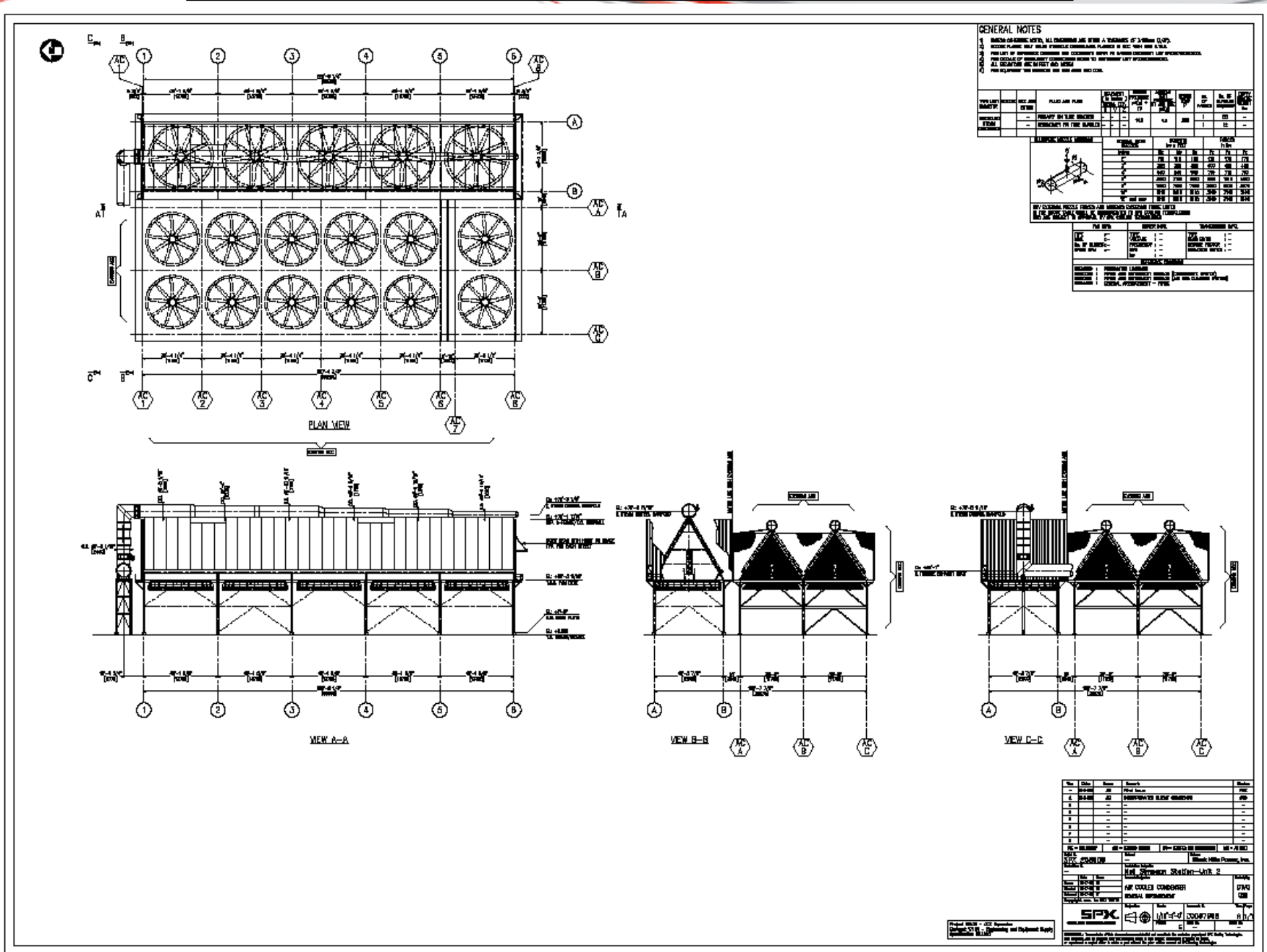
Comanche 3 condensate / cooling system



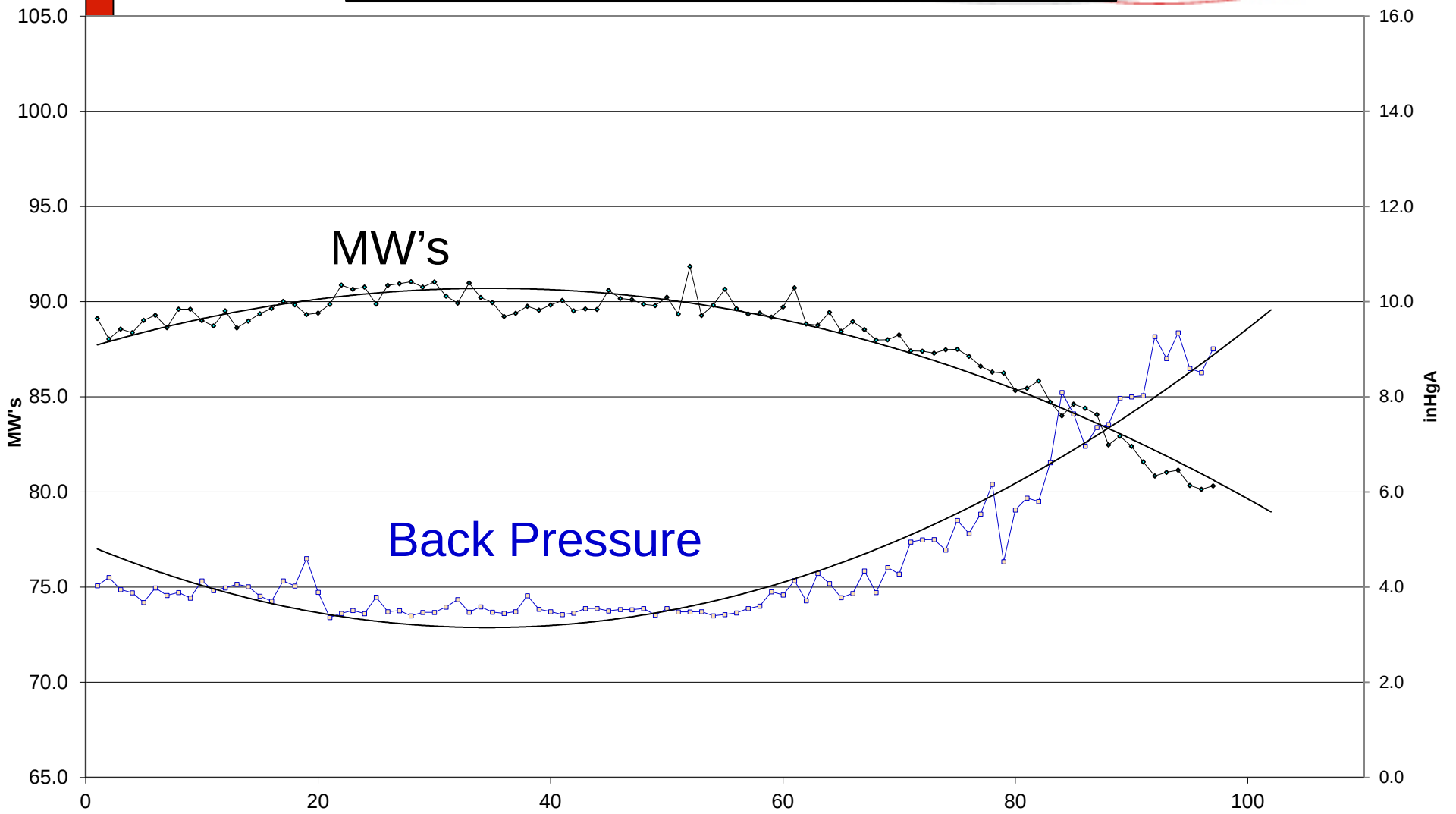
Retrofit Construction

- add wet cooling (parallel)
- **additional cells**

NSC NS2 – Wygen 1 ACC Expansion



Wygen I Temp -vs- NetMW Curve (2008)



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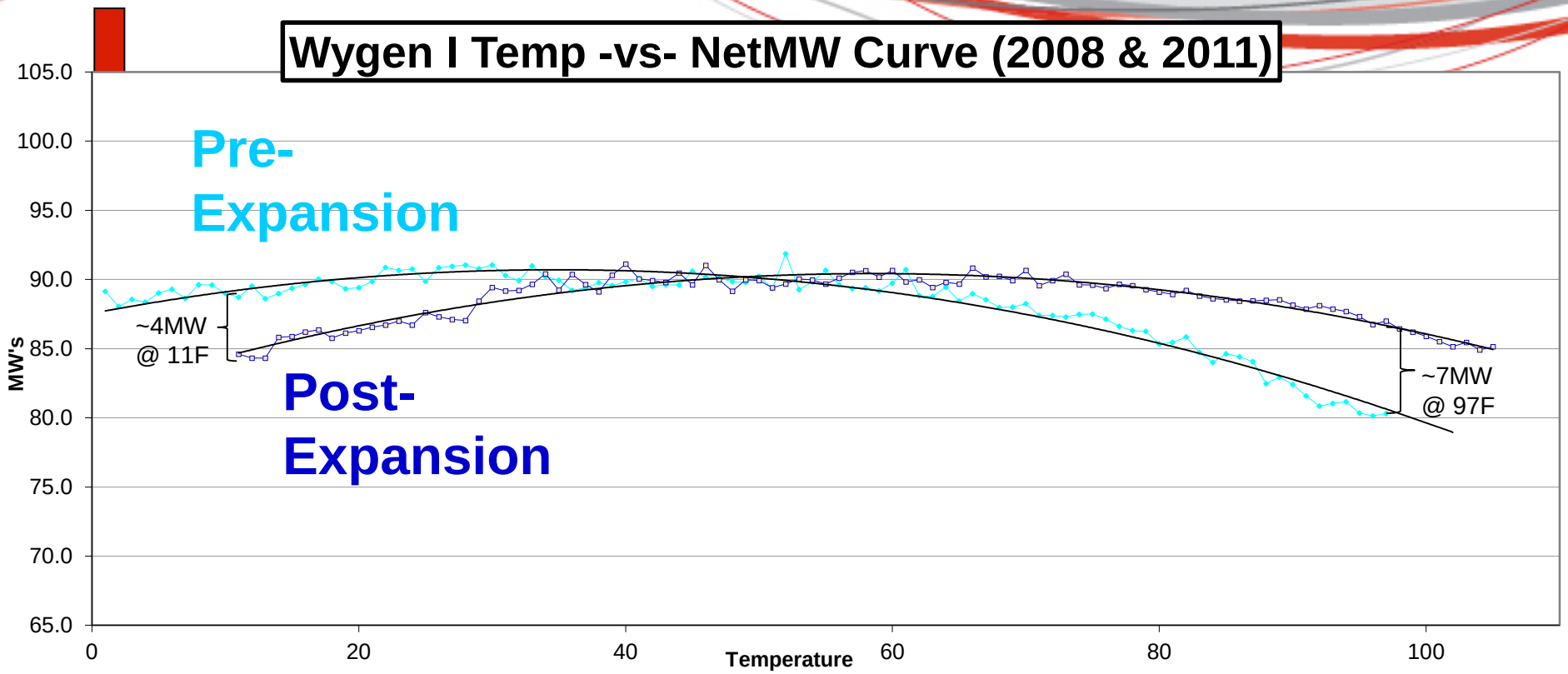
11/9/2016



Additional MW at Ambient Temperature >60F

- Measured Additional 7MW @ 97F Ambient Temp

Less MW Production at ambient Temperature <32F

- Measured Less 4MW @ 11F Ambient Temp
- More Conservative operation during cold weather.

Retrofit Construction

- add wet cooling (parallel)
- additional cells
- **fan / motor upgrades**

- No water source, at all, to consider a Parallel Condensing System.
- Solution must focus on increased dry cooling capacity, at minimum cost (no additional cells or ACC enlargement).
- ACC fan system upgrade from 100 HP to 200 HPs, which entail replacing electrical switchgear, cabling, motors, gearboxes and fans, as well as structural checks for load bearing and resonance issues.

15 new motors, gearboxes and fans were selected. The main differences with the original supply are:

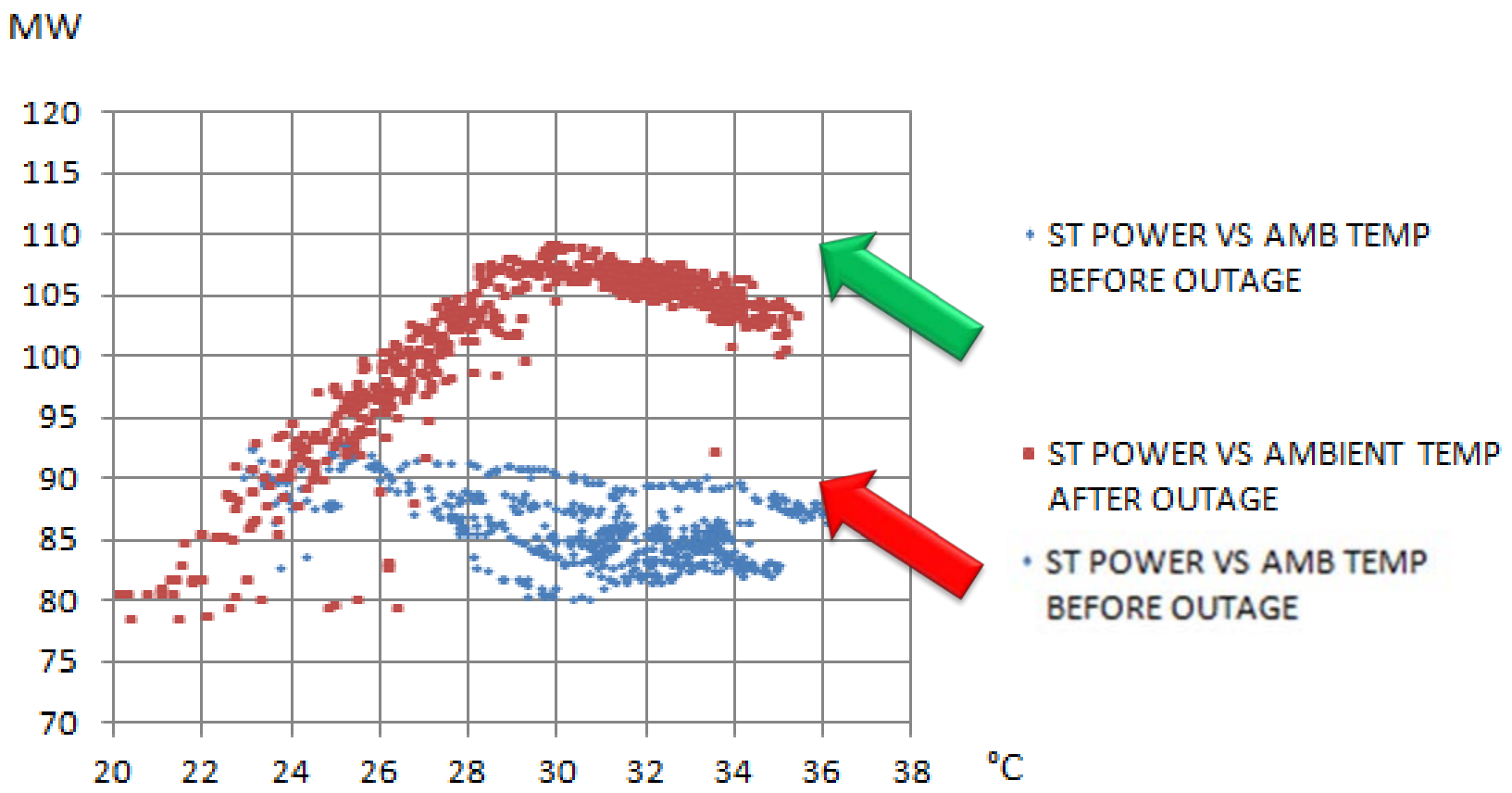
- Significantly improved ACC performance under adverse conditions.
- No additional water needed.
- 9 vs. 4 blades, which inherently minimizes vibration and resonance.
- 730 vs. 542 m^3/s air flow, 125 vs. 71 Pa static pressure.
- 1.12 to 2.24 MW's auxiliaries consumption increment.

ORIGINAL SUPPLY

U P R A T E D

The most relevant results after fans upgrade are:

- Auxiliaries consumption increase by about 1.12 MW's due to larger fan drive system.
- Complete elimination of the backpressure limitation, with a significant and sustained improvement of at least 120 mBar (3.5 inHg).
- Power output increase due to condenser pressure reduction and now the possibility of increasing condenser load, thus steam flow through the turbine and more power.
- Heat rate improvement due to lower condenser pressure and thus lower backpressure on the steam turbine (more "free" power).


MW
120
115
110
105
100
95
90
85
80
75
70
20
22
24
26
28
30
32
34
36
38
°C
ST POWER VS AMB TEMP BEFORE OUTAGE
ST POWER VS AMBIENT TEMP AFTER OUTAGE
ST POWER VS AMB TEMP BEFORE OUTAGE

Conclusions

- ACC performance is critical to low-cost unit operation.
- Initial design is critical to achieve suitable unit-specific baseline performance.
- Operating actions optimize performance of the existing unit.
- Retrofit options can improve performance and improve cost-effective operation.

Discussion:

- designing for performance

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- O&M activities

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- retrofit options