# ACC Users Group

Xcel Energy Comanche Station

# FAN ISSUES FOR ACC USERS

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# Fans in ACC applications, open discussion

- Not about fan selection
- Not about fan designs

- Generic discussion about operation, or maintenance. or system upgrades
- Discussion and Q+A session, jointly with OEM ACC suppliers

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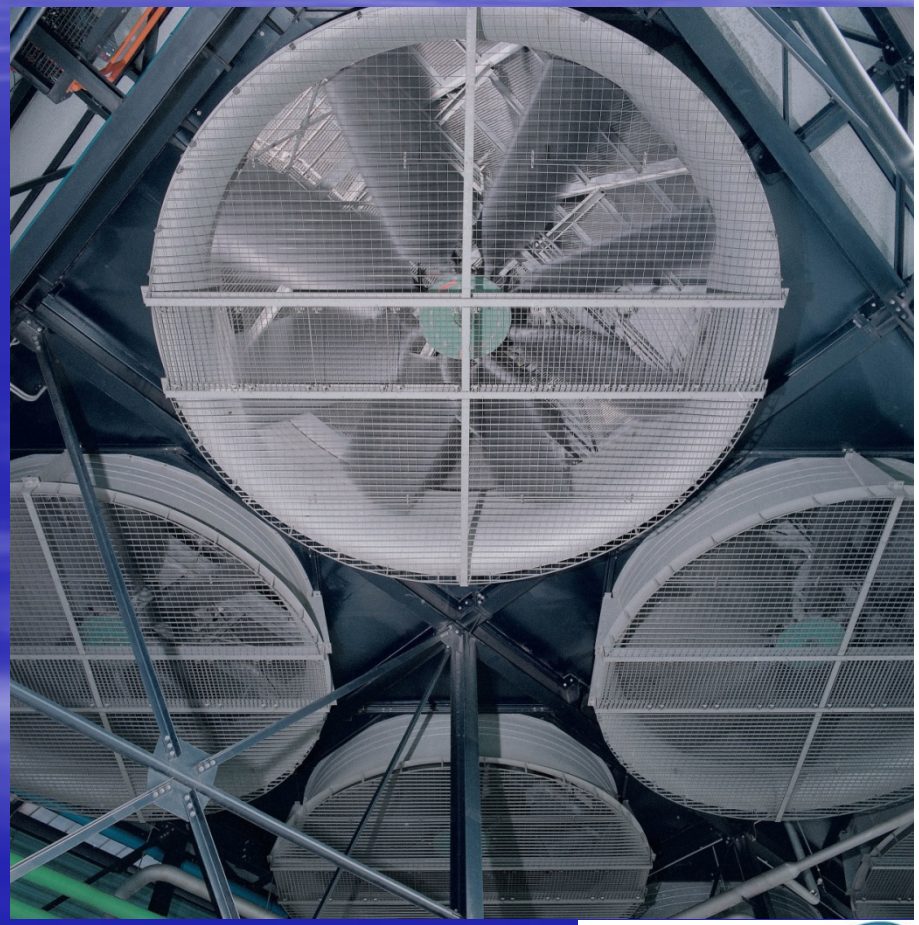
# Fans in ACC applications

- For a given MW cooling value dry cooling requires much more air movement than wet cooling.
- Therefore more cooling fans…with a potential for more problems…



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# Operation and Maintenance

- Fans used in North America:

- Cofimco — Aluminum - FRP
- Howden — FRP
- Tecsis — FRP

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# Operation and Maintenance

- Fans used in North America:

| | |
|---|---|
| Cofimco | Aluminum - FRP |
| Howden | FRP |
| Tecsis | FRP |
| Hudson | FRP |
| Alpina | FRP |

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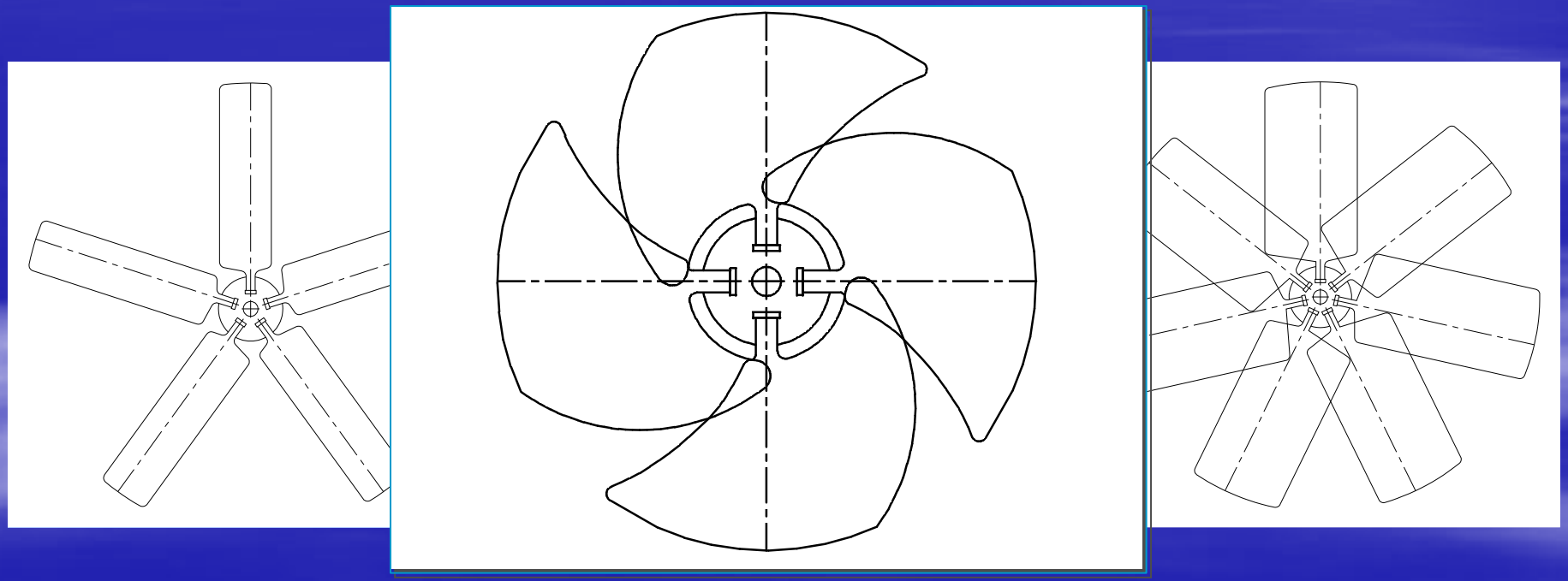
# Operation and Maintenance

- Fans shapes:



# Installation and Start-up

- Out of your control, this is performed by the contractor

- Plant layout and design
- Blade pitch
- Blade tracking
- Tip clearance
- Fasten and torque all hardware
- Vibration signature
- Fan shaft power signature

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# Maintenance

- These are under your control…annual checks

- Drain or weep holes open
- Bolt torque
- Blade angles/pitch
- Tip clearances
- Check for deviations in vibration levels

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# Maintenance

- These are under your control…annual checks

- Clean the bundles
- Visual inspection ‘wear and tear’ on blades
- Replace corroded hardware

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# Major Failures

- Are these under your control ?..regular checks..

- Not all are preventable
- Manufacturer's issues
- Resonance between 'fan bridge' and fans
- High wind conditions
- Design of motor control

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# Mechanical fan failures

Supplier ‘A’

- Hardware failures
- Airfoil connection failures

Supplier ‘B’

- Z-series blade failures (2005-2007)
- Split trailing edges (2001-2003)

Supplier ‘C’

- Hardware failures
- Airfoil root to hub connection failures

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# Sample Failures

- Are these under your control ?..regular checks..

- Bolts not re-torqued to specifications

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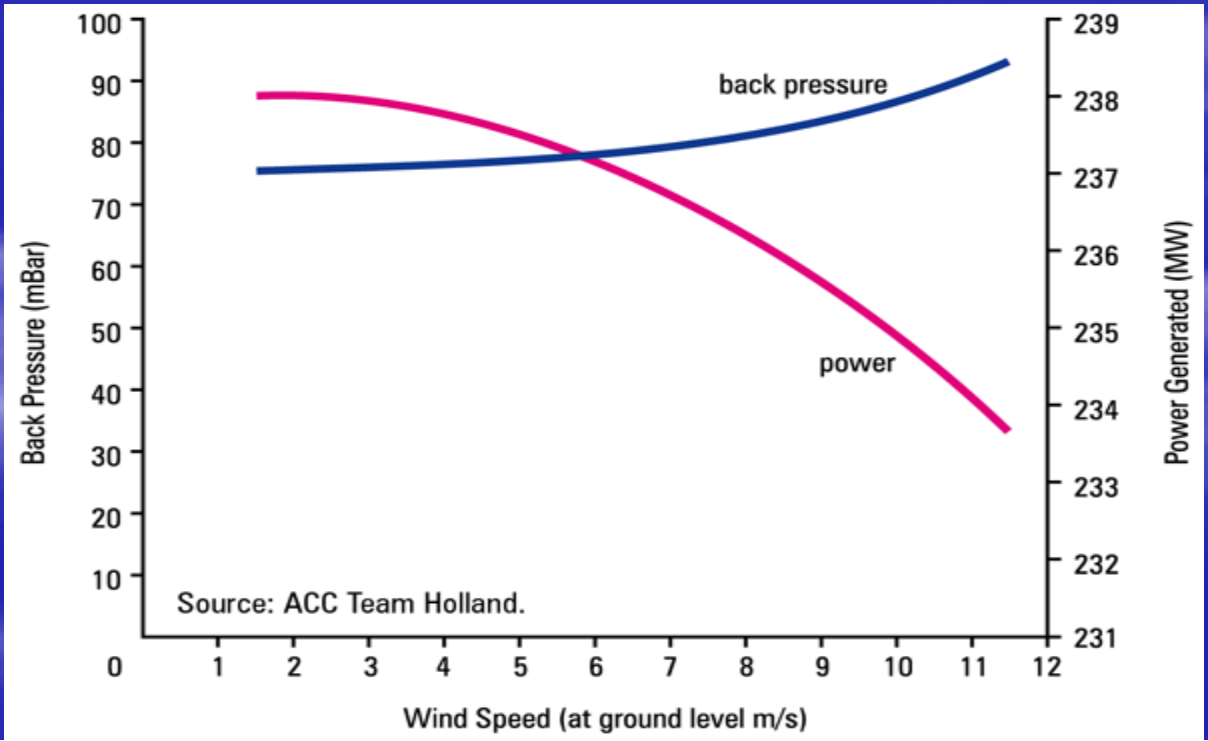
# Wind effects

The lower the temperature, the lower a pressure it takes at the outlet side of the turbine for condensation of steam.
The lower the pressure is at the outlet side, the higher the pressure difference is over the turbine.
Higher pressure difference means more power to drive the generator hence more generated electrical power.

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FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
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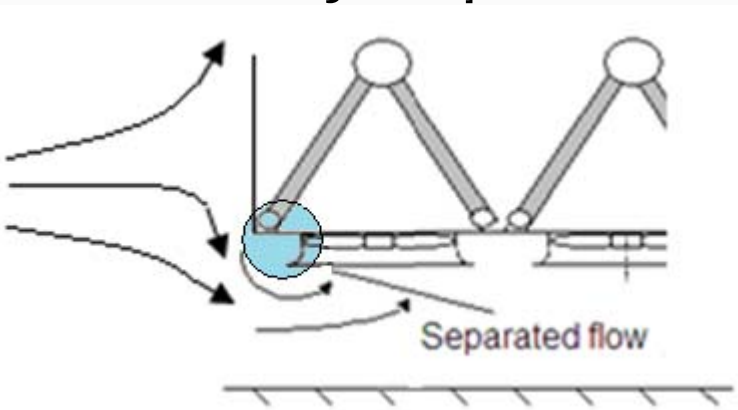
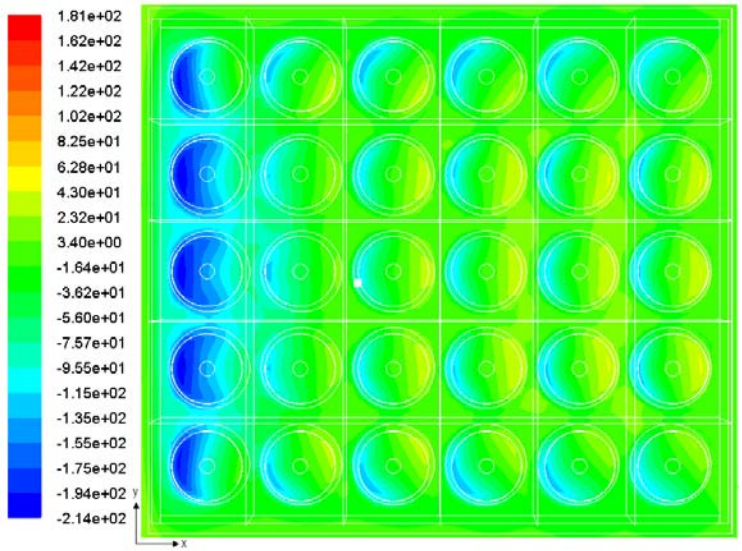
# Results (continued)

- Reduced fan performance
- Occurs predominantly at the windward or leading edge fans
- Results from off-axis or distorted flow conditions at the inlet of these fans caused by separation of the flow as it



# Improvements for fan performance under windy conditions

- Skirts around the ACC
- Wind screens under the ACC
- Change fans to larger cord width for greater pressure margins

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# Improvements for fan performance under windy conditions after the fact

- NETL study in cooperation with SPX
- GEA is conducting studies
- Howden conducting studies with OEM's + End-users

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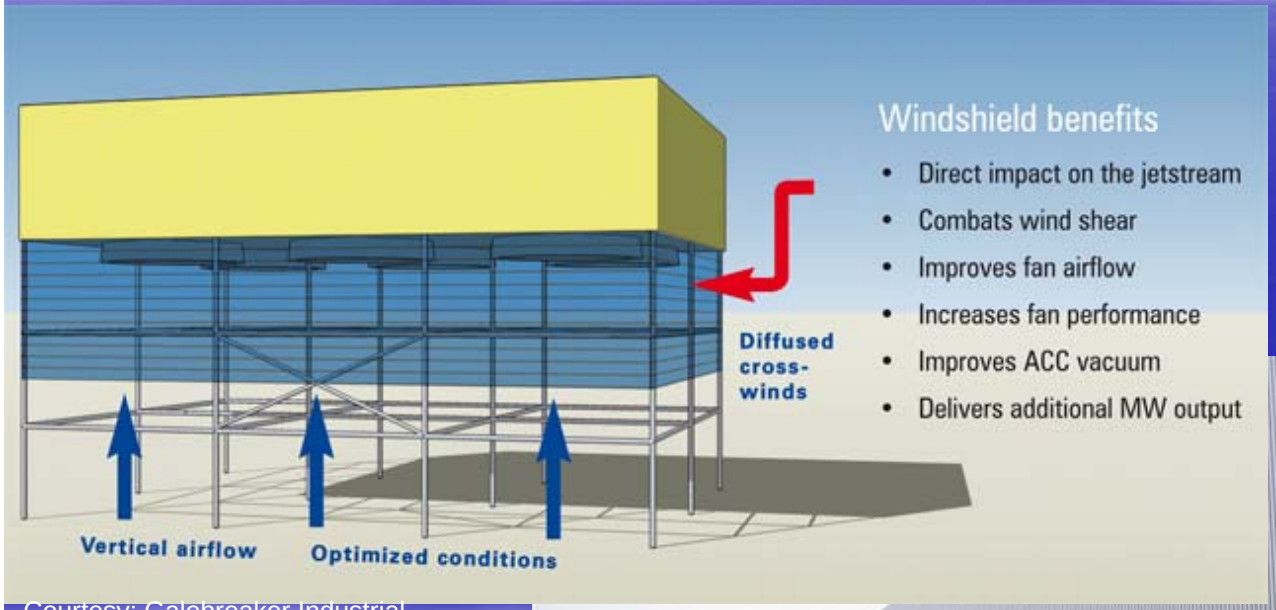
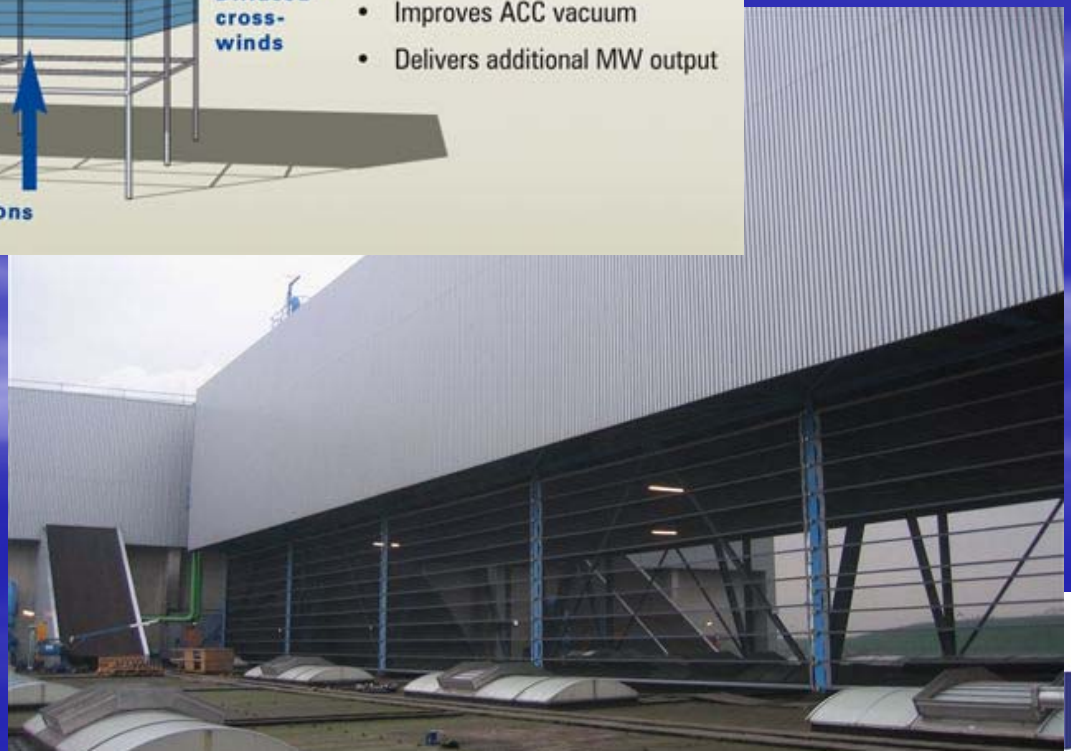
# Wind effects




Courtesy: Galebreaker Industrial



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# Improvements for fan performance under windy conditions after the fact

- Performance trends of air-cooled steam condenser under windy conditions
  CEC-500-2007-124 May 2008
- The effect of screens on air-cooled steam condenser performance under windy conditions
  12th Conference on Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction
- Wind Effects On Air-Cooled Condensers For Power Plant Cooling
  Proceedings of the International Heat Transfer Conference, Pasper No. IHTC14-23250 August 8 – 13, 2010, Washington, DC, USA
- CEC ( Maulbetsch et all ) study to be published 5 ACC's in the USA)

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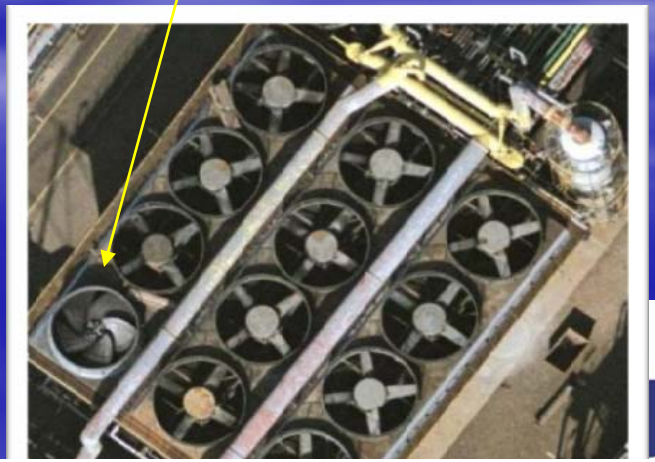
# Advantages of a cooling system enhancement

- A cooling fan exchange is an effective way to reduce noise or increase the capacity of an existing system

- Use wider of cord fan blades
- Noise reductions
- Capacity increase
- No extra plot area required
- Cell by cell replacement
- Trial unit to proof concept and to check return on investment



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# Discussion

- Panel discussion
- Open questions related to fans and fan performance
- Participation by ACC OEM's:
  GEA + HOLTEC + SPX

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