AX GROUP

THE EVOLUTION OF

ACC CLEANING SYSTEM TECHNOLOGIES

Impact on Performance · Labour Intensity · Energy & Water Consumption

ACC USERS GROUP ANNUAL CONFERENCE | NASHVILLE, TN | 2026

AX GROUP | AX SYSTEM
David Clercq | Sales & Business Development Manager

WHO WE ARE

David Clercq
Sales & Business Development

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Senior Project Manager

AX SYSTEM AT A GLANCE

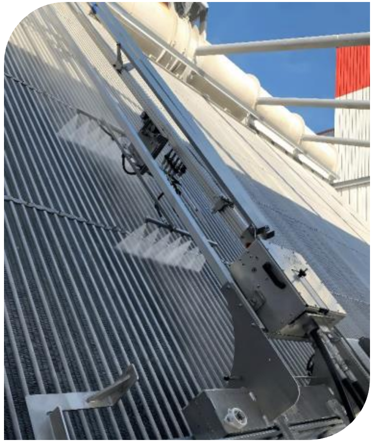
WE
IMPROVE
EFFICIENCY

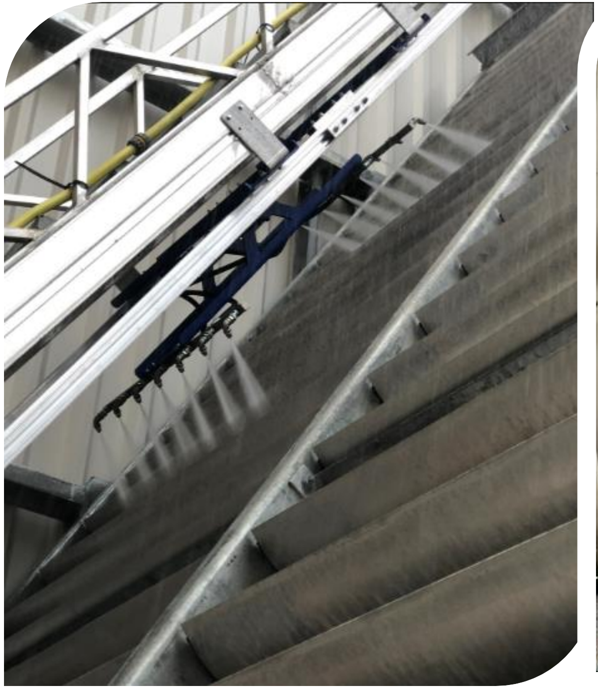
FOGGING & HIGH-PRESSURE CLEANING SOLUTIONS
NUCLEAR & THERMAL POWER PLANT – PETROCHEMICAL - AGRI-FOOD



AX SYSTEM AT A GLANCE

WE IMPROVE EFFICIENCY





-1,000,000 EUR per year!

Case Study: 13MW Hexacool ACC

NOMINAL ELECTRICITY PRODUCTION: **11MWe**

ACTUAL: 10,25MWe
LOSS: 0,75MWe (6.8%)

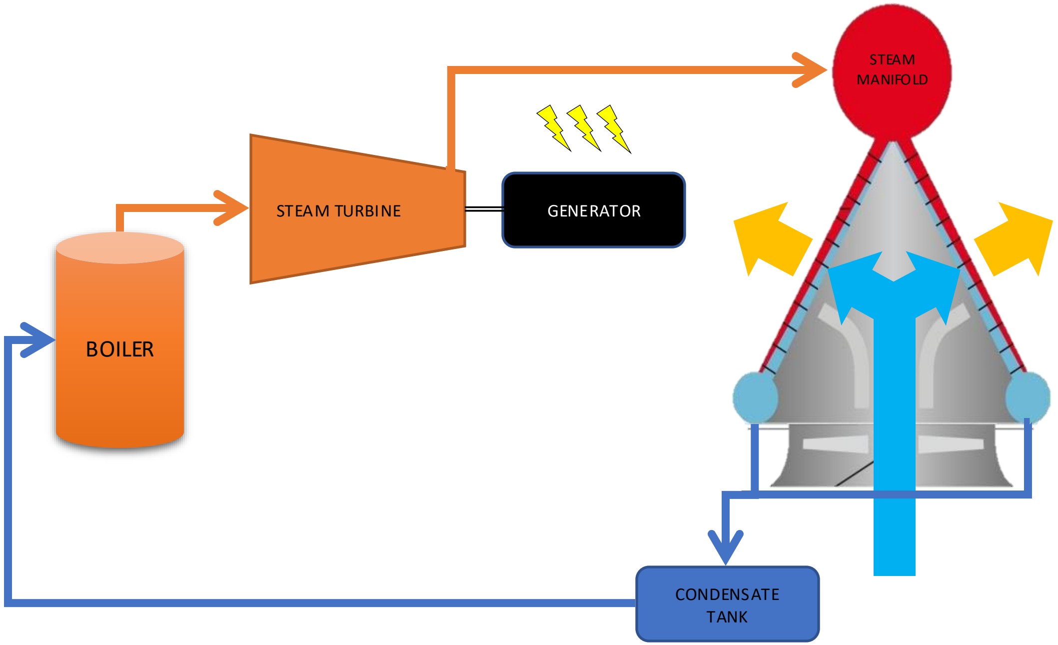
18MW.he/day

~3,100 USD/day

Annual loss:
~1,116,000 USD

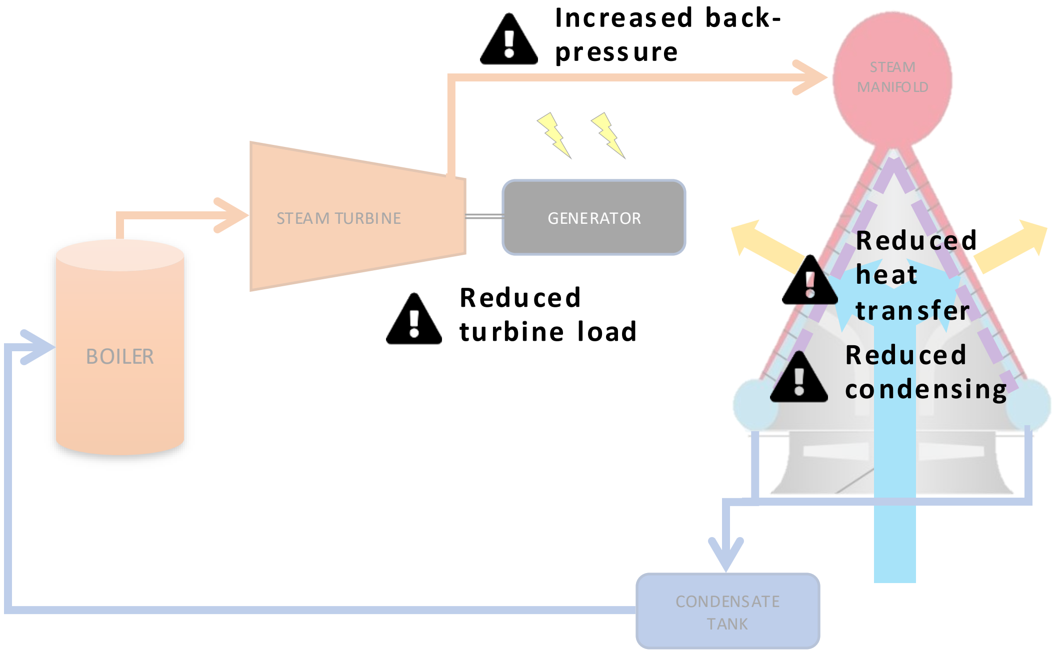
ACC FUNDAMENTALS

NOMINAL CONDITIONS



ACC FUNDAMENTALS

THE FOULING PROBLEM



Fouling isolation film

THE FOULING PROBLEM

Why external fin-tube fouling is the #1 **manageable** ACC performance killer

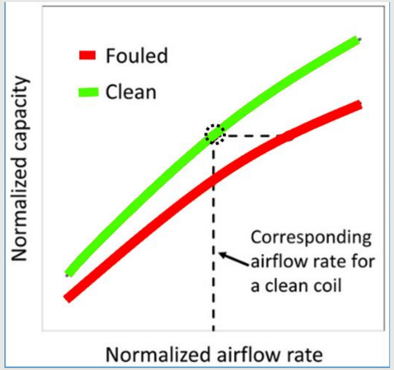
TWO-FOLD FOULING IMPACT

RESTRICTED AIRFLOW

Fouling deposits create a physical barrier, **increasing static pressure** above design.
A 20% reduction in airflow raises turbine backpressure by ~33%.

REDUCED HEAT TRANSFER

An insulation film on fin surfaces lowers the air-side heat transfer coefficient — **reducing condensing and turbine load**



COMMON FOULANT SOURCES

NATURAL

Pollen (cottonwood, agricultural), dust, sand, insects, bird & bat carcasses — seasonal peaks in spring/summer

INDUSTRIAL

Fly ash from nearby stacks, oil mist from gearbox leaks, industrial fibres & process dust — year-round accumulation

SCALING

Deposited by wet-spray cooling water with high dissolved solids. Cannot be removed by water alone — requires chemical dissolution

THE PERFORMANCE COST OF FOULING

Quantified impact on turbine backpressure, fans load and output

33%

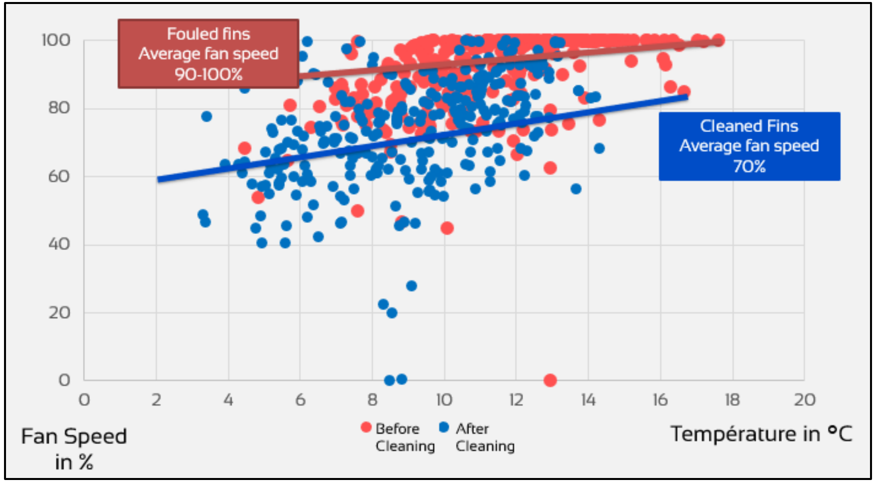
Backpressure rise
from 20% airflow loss

~10%

ACC efficiency loss
at peak summer conditions

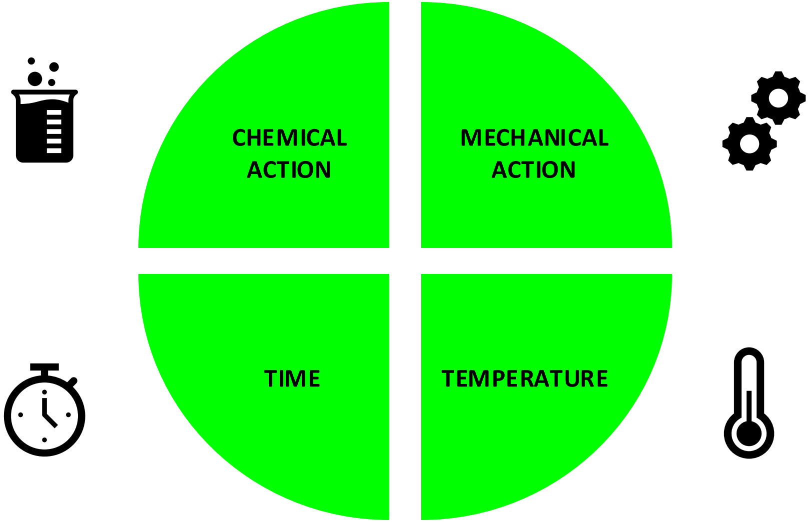
FAN ENERGY & FOULING INTERACTION

- Fouled fins ↑ static pressure → fans work harder at same RPM
- VFD-controlled fans: higher setpoints to maintain steam flow → ↑ kW consumption



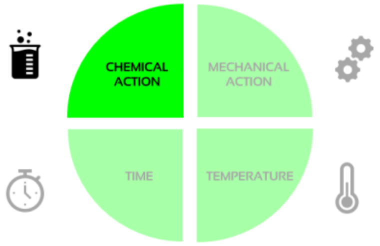
SINNER CIRCLE

CLEANING EFFICIENCY IS MODELLED



SINNER CIRCLE

CHEMICAL ACTION



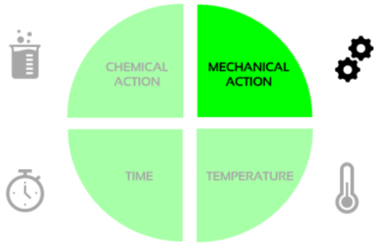
> Detergents, soaps, solvents, enzymes, disinfectants, etc.
> Stronger chemistry can remove soils more quickly or with less effort.

<u>ACC-specific considerations:</u>
ACC finned bundles are sensitive to chemical cleaning agents.

Potential drawbacks of chemical cleaning include:
>Induced corrosion and premature degradation of the fin material.
>Increased environmental impact due to the use of chemicals.
>Significant water consumption required for rinsing after chemical cleaning.

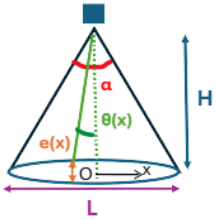
SINNER CIRCLE

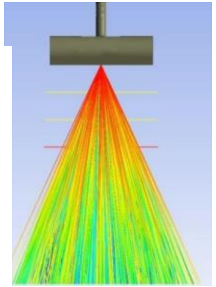
MECHANICAL ACTION



> Scrubbing, brushing, agitation, **pressure washing**, ultrasonic cleaning, **machine action**.
> Physical force helps detach dirt from surfaces.

<u>ACC-specific considerations:</u>
Effective cleaning depends on the right balance of:
> Water flow rate
> Operating pressure
> Nozzle-to-surface distance



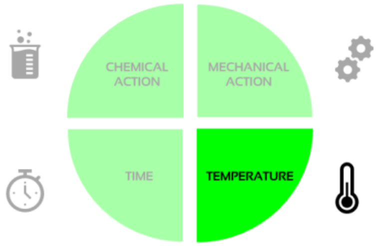


The cleaning impact is determined by the combination of **flow, pressure, and stand-off distance**, ensuring effective fouling removal while preventing damage to the finned bundles.

The cleaning water captures and carries away dust and fouling, preventing contaminants from becoming airborne and eliminating the re-dispersion of dust into the surrounding environment.

SINNER CIRCLE

TEMPERATURE



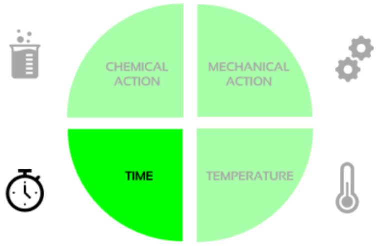
> Heat often improves cleaning by dissolving fats, speeding chemical reactions, and reducing viscosity.
> Higher temperatures can make cleaning easier, though not all cleaners work best when hot.

ACC-specific considerations:

> Hot water is typically not available
> Standard high-pressure plunger pumps are generally limited to a maximum inlet water temperature of 104°F (40°C).
> Risk of scaling coil fins during the cleaning process.

SINNER CIRCLE

TIME



> **The duration the cleaner is allowed to work.**
> Soaking is a classic example of increasing the time factor.

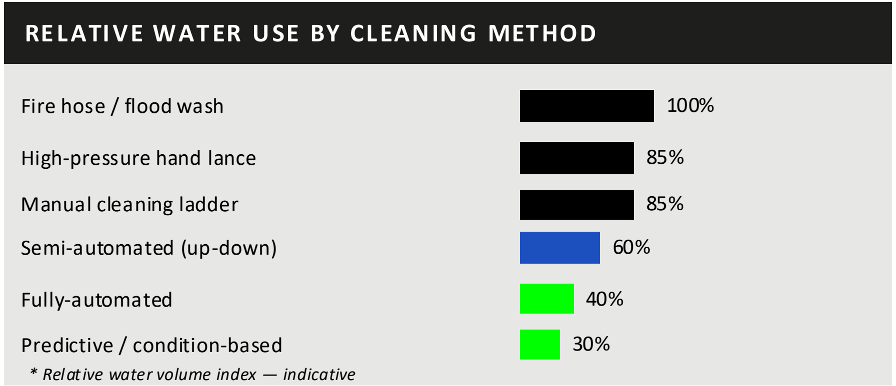
ACC-specific considerations:
Contact time = Cleaning speed

The cleaning effectiveness depends on the contact time between the water jet and the heat exchanger surface.
Cleaning speed is influenced by:
>The operator, when using manual cleaning methods.
>The cleaning technology, particularly the level of automation and the precision of the cleaning system.

Automated cleaning systems ensure a constant cleaning speed and uniform contact time, resulting in **consistent cleaning quality** and **repeatable performance**.

WATER CONSUMPTION

Cleaning method selection has measurable environmental and cost implications



Case Study: Hexacool in a WtE plant (Belgium)– ACC Cleaning Optimization

Current Process : high-flow fire hose mounted on a telehandler.
> 5-day manual cleaning
> 6,000–7,500 m³ water per cleaning
> Up to 10 cleanings/year

Achievable results with a semi-automatic cleaning system:
> 1-day cleaning (80% faster)
> 40 maintenance days saved/year
> 40 m³ water per cleaning (>99% less)
> 50,000 m³ (13,200 gal) water saved/year

LABOUR INTENSITY & SAFETY

The human cost of cleaning — and how technology is changing it

THEN — MANUAL & LANCE METHODS

LARGE CREW REQUIRED

Teams of 10–20 workers for large ACCs; 2-week campaign durations with scaffolding

WORKING-AT-HEIGHT RISKS

Full scaffold erected across ACC structure; falls & heat stress exposure — high HSE liability

PLANT OFFLINE MANDATORY

Most manual methods require unit shutdown — lost generation revenue can exceed cleaning cost

LIMITED EFFECTIVENESS

High-pressure hand lance covers only ~8-inch radius; dirt compacted deeper into fin pitch

NOW— AUTOMATED SYSTEMS

MINIMAL CREW

Fully remote-operated cleaning system requiring only periodic preventive maintenance.

SCAFFOLDING ELIMINATED

ONLINE CLEANING CAPABLE

On-line cleaning by selectively stopping the fans of individual ACC cells while the remainder of the condenser stays in operation.

SAFETY BY DESIGN

Remote-controlled robotic platforms — no workers in confined, elevated, or high-temperature zones

CLEANING TECHNOLOGY INTRODUCTION TIMELINE

From manual hose-down to AI-assisted autonomous cleaning

Manual Fire Hose

Hand Lance

Manual Cleaning ladder

Semi-Automated cleaning ladder

Fully Automated Cleaning ladder

Full remote automation.
IoT-enabled
Minimal human intervention
.
DCS-connected scheduling.
Real-time fouling index.
Condition-based cleaning.

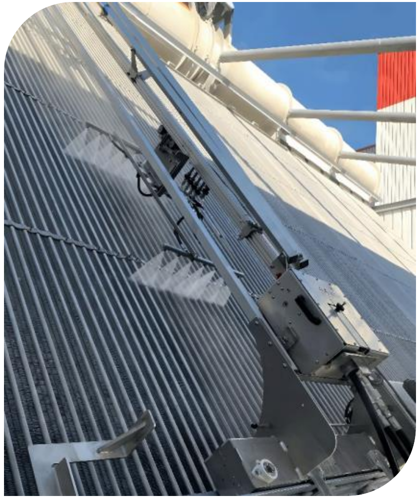
AI-Predictive Integration

CLEANING TECHNOLOGIES vs ACC TYPES

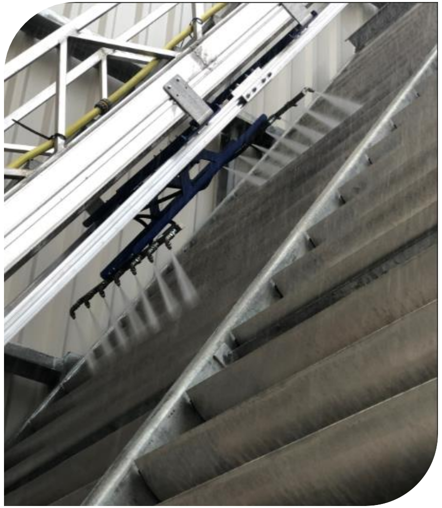
Cleaning solutions keep pace with ACC technology developments

A Frame ACC

Standard single
row bundles



Multi-row bundles
with louvers



Vertical Hexacool ACC

New Generation ACC

LET'S DREAM A LITTLE

The path to predictive, autonomous, zero-unplanned-downtime maintenance

AUTONOMOUS ROBOTIC PLATFORMS

Fully remote-controlled or self-navigating cleaning systems. Repeatable and efficient cleaning while no heat exposure to plant personnel.

WATER-USE OPTIMISATION

Pressure-adaptive nozzles modulate water flow based on fouling density.

Closed-loop wash-water recovery reduces freshwater draw

IoT FOULING INDEX MONITORING

Sensors integrated with the DCS measure real-time ΔP across fin banks as a fouling proxy. Enables **condition-based cleaning schedules** rather than fixed calendar intervals — optimizing both cleaning frequency and water use per m^2 of fin surface.

PREDICTIVE PERFORMANCE MODELLING

Machine-learning fouling-rate prediction enables pre-emptive cleaning before performance losses accrue to the turbine heat rate.

TECHNOLOGY COMPARISON MATRIX

Objective KPI assessment across cleaning system generations

Method	Probability of effective cleaning	Online Capable	Water Use (relative)	Labour Intensity	Safety Risk	System Cost (indicative)
Manual fire hose / flood	★★☆☆☆	✗	●●●●●	●●●●●	HIGH	$
High-pressure hand lance	★★★☆☆	✗	●●●●○	●●●●●	HIGH	$
Manual ladder	★★★☆☆	Partial	●●●○○	●●●●●	MED	**$$$**
Semi-automatic ladder	★★★★☆	Partial	●●●○○	●●●○○	LOW	$$
Fully automated system	★★★★★	✓	●●○○○	○○○○○	VERY LOW	$$$$
Predictive / condition-based	★★★★★	✓	●○○○○	○○○○○	VERY LOW	$$$$$

KEY TAKEAWAYS

What ACC operators should do differently

1 **FOULING IS THE PRIMARY CONTROLLABLE PERFORMANCE VARIABLE**

Unlike ambient temperature or wind, fouling can be actively managed. The ROI on proactive cleaning programs is measurable — typically payback within months, not years.

2 **SHIFT FROM CALENDAR-BASED TO CONDITION-BASED CLEANING**

IoT ΔP monitoring enables smarter scheduling — cleaning when needed, not at fixed intervals. This reduces both labor cost and water consumption simultaneously.

3 **TECHNOLOGY SELECTION MUST BALANCE CAPEX, OPEX & RISK**

Higher CAPEX, lower OPEX. Fit-for-purpose selection is essential, and **ACC end users should define cleaning system requirements for greenfield projects.**

4 **WATER USE IS AN EMERGING REGULATORY AND REPUTATIONAL RISK**

ACC operators must quantify and minimize cleaning water consumption in an increasingly water-scarce world.

THANK YOU!

KEY REFERENCES

· Combined Cycle Journal (CCJ) — ACC Users Group meeting reports (2017, 2019)

· EPRI ACC.02 — Finned-tube heat exchanger tube cleaning guidance document

· ARANER — Air-cooled condenser performance improvement strategies review (2024)

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