

# ALTERNATIVE INDUCED DRAFT ACC SOLUTION

- ACCUG – Conference – July 2024

<https://johncockerill.com/en/energy/cooling/>





- Introduction to John Cockerill Hamon
- Induced draft ACC's (Generalities)
- Alternative induced draft solution
- Feedback from Plant in Belgium / BEE
- Perspectives



# About John Cockerill Hamon



International EPC,  
Main offices in Spain, France,  
Korea, Indonesia



In 1904 **Hamon** began  
building cooling towers for  
industrial plants



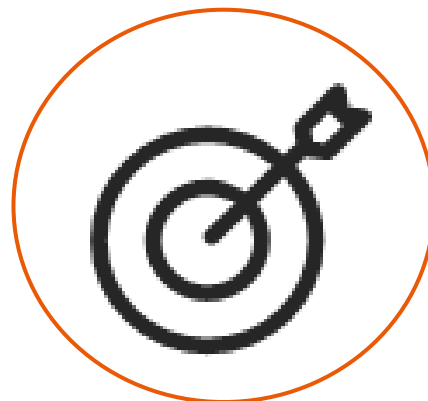
In 2021 Esindus became 100%  
part of the **Hamon Group**



In 2022 **John Cockerill** acquire  
Hamon group



Customer Service Oriented



Strong Reputation



Leader in the market



# About John Cockerill Hamon

- Hydrogen
  - Defense
  - Environment & Industry
  - Energy
  - Services
- Energy Solutions
  - Energy Transition
  - Cooling Systems



Wet Cooling



Dry Cooling



Water Solutions



Customer Service



Instrumentation



# John Cockerill Hamon around the world





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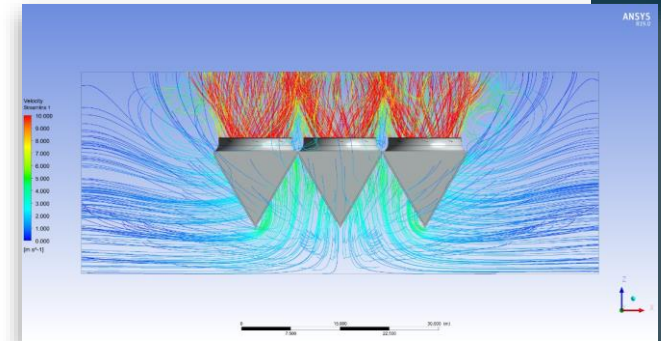
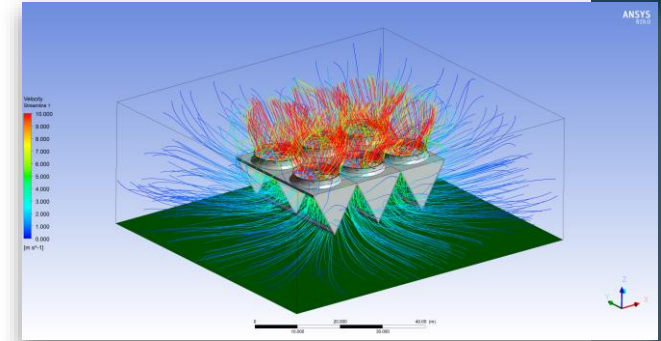
# Induced Vs Forced draft ACC's

## ○ Advantages - Drawbacks

Forced draft ACC

Induced draft ACC

	Forced draft ACC	Induced draft ACC
Hot air exhaust speed	—	+
Wind-sensitivity	—	+
Fan-group temperature	+	—
Fan bell diffuser	—	+
ACC motor consumption	—	+
Air repartition over the bundles	—	+
Fan group easy maintenance	—	+
ACC height	—	+
Bundle area exposure	+	—
Cleaning dirt evacuation	—	+



- Growing market
- Savings
- Complete product portfolio

# Induced Draft ACC Challenge

- On forced draft ACC, mechanical equipment is in the cold air stream
- Induced draft cooling towers & Induced draft condensers typically locate the gearbox in the hot air zone.
- Induced draft standard solutions locate the motor on the roof.

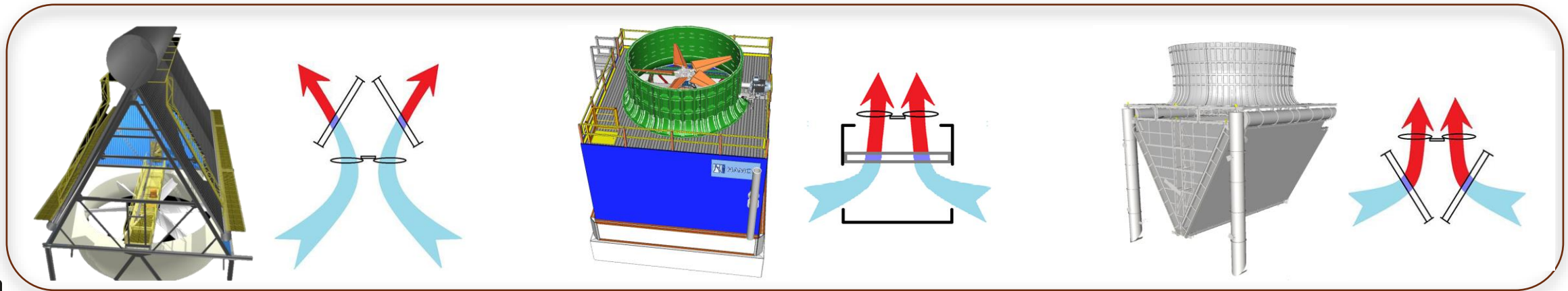
## Fan group T(°C) range

Forced draft ACC	[min. ambient, max. ambient (*) ]
Cooling tower	[min. ambient, 50°C]
Induced draft ACC	[ min. ambient, 90°C]

ACC Steam pressure	Steam turbine typical operating range	ACC by-pass typical operating range	Corresponding steam saturated temperature
50 mbar			± 32 °C
100 mbar			± 46 °C
200 mbar			± 60 °C
300 mbar			± 69 °C
400 mbar			± 76 °C
500 mbar			± 81 °C
600 mbar			± 86 °C
700 mbar			± 90 °C
800 mbar		SONARA **	± 94 °C
900 mbar			± 97 °C

\*\* SONARA is a waste incinerator plant, which Client (Buzzichelli) required to be able to operate ACC in continuous by-pass operation half of the year according the here under extract of functional description requirement:

TBP <sub>s</sub> default	TBP <sub>min</sub> / 0.75
TBP <sub>s</sub> normal operation	Min: TBP <sub>s</sub> default
TBP <sub>s</sub> by-pass continuous operation	800 mbar
TBP <sub>s</sub> by-pass operation before restart of turbine	Min: 370 mbar



(\*) all fans running





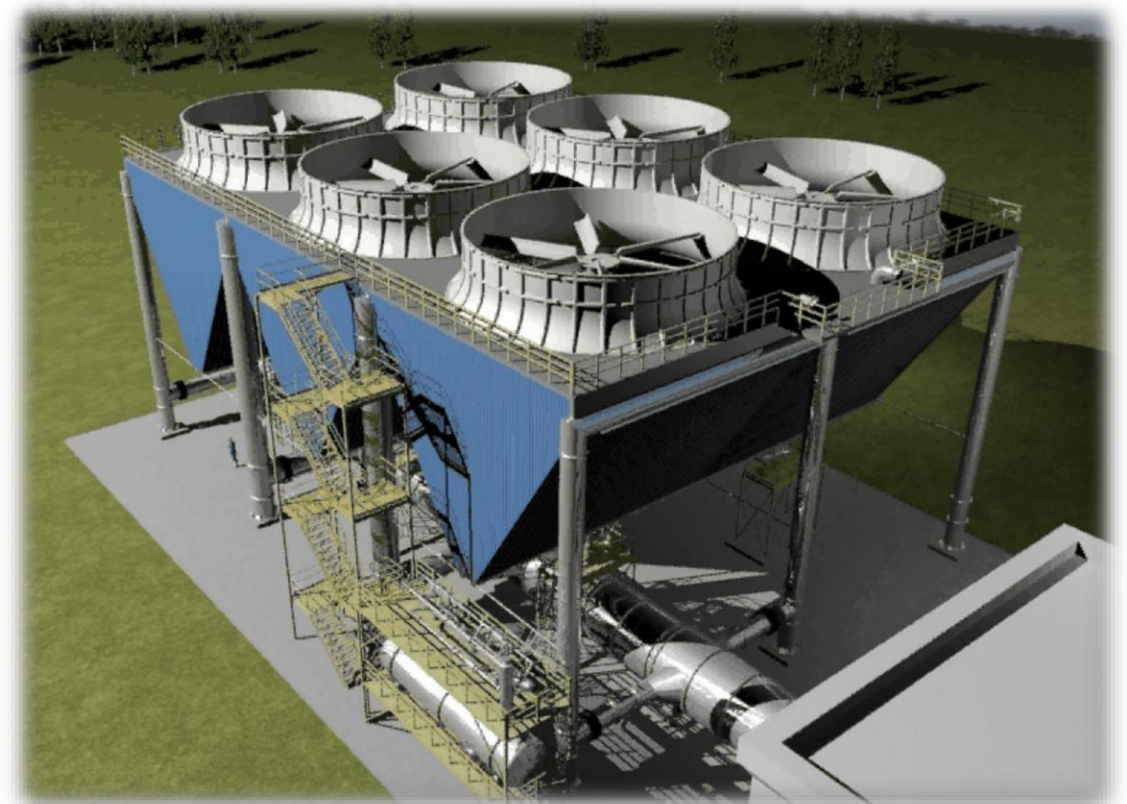
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# Alternative Induced Draft Solution

DESIGN

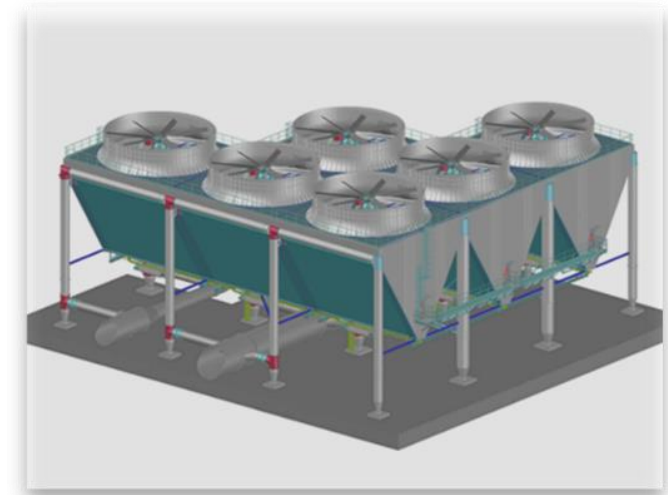
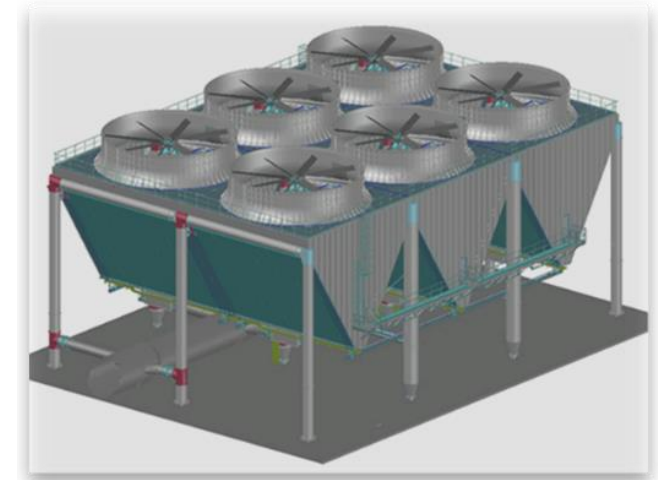
- **MARS (Modular ACC Riser Supported)**
- Induced draft solution “V-Concept”
- Standardized components (high preassembly at site)
- Any shape possible, not only rectangular
- Steam pipes are used as supporting structure
- Variable V-angle
- Gearbox & motor in a basket below the bundles (Efficient cooling of the drive unit)
- Flexibility for winter operation cases (module isolating valves)
- Un-condensable extractions at each module side extremities
- Condensates isolated between and at each module side (no risk of steam backflow)



# Alternative Induced Draft Solution

- Modular
  - Erection : Each module is identical & made of pre-assembled blocks
  - Process : Each module side is independent
  - Layout : Flexibility to arrange the modules and ease retrofit
- Steam pipe supported
  - 2 functions in a single element – cost reduction
- Gearbox/motor at the bottom in the cold air stream
  - Gearbox/motor cooling temperature as per forced draft configuration
  - No forces transmitted to the gear–motor assembly
  - High accessibility of the gear–motor assembly for maintenance operations
  - Limited vibration transmitted by the fan to the gear–motor assembly

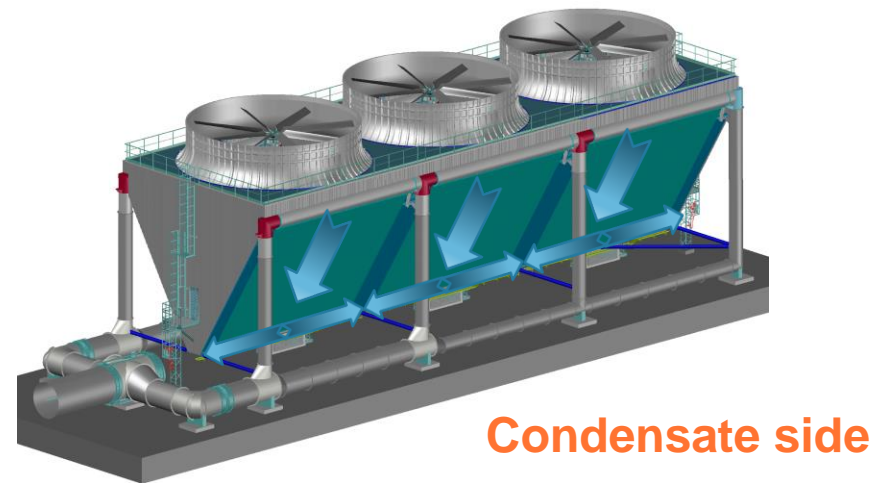
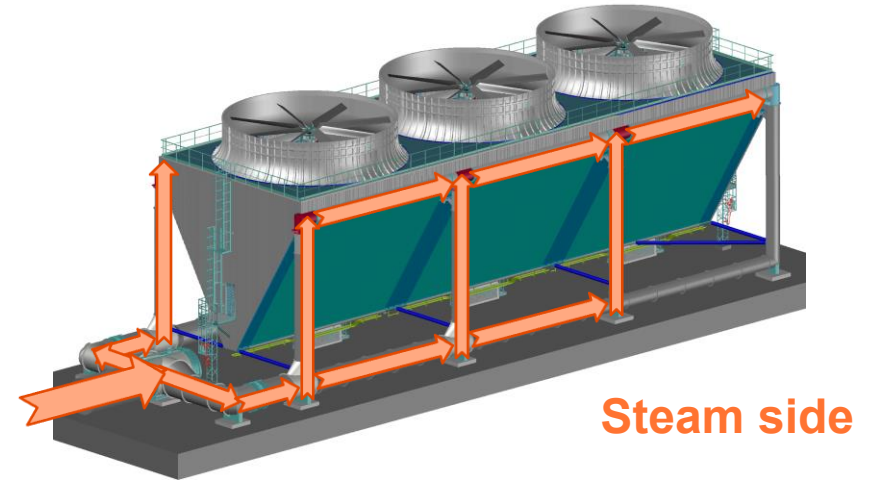
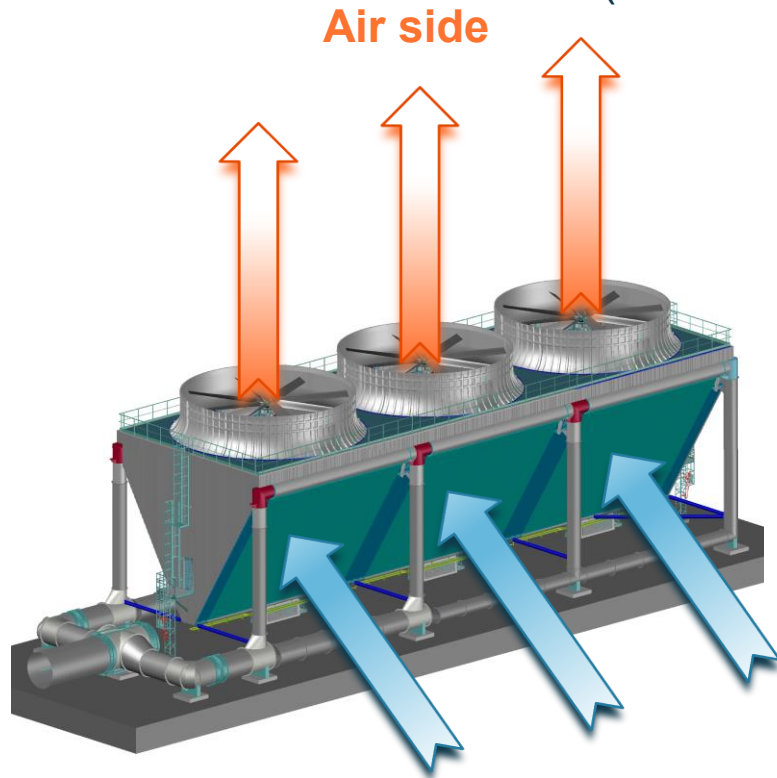
## DESIGN



# Alternative Induced Draft Solution

DESIGN

(How it works)

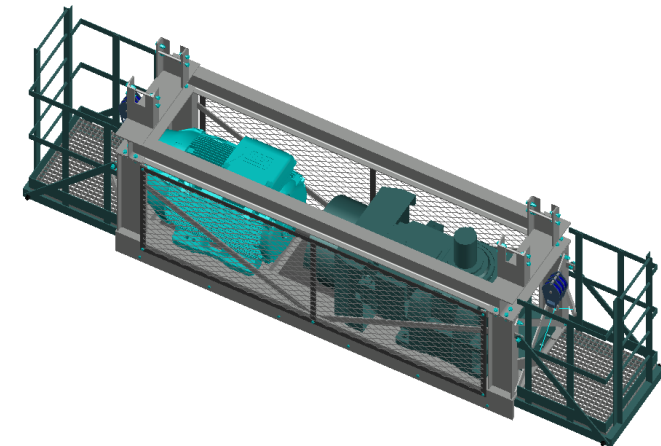
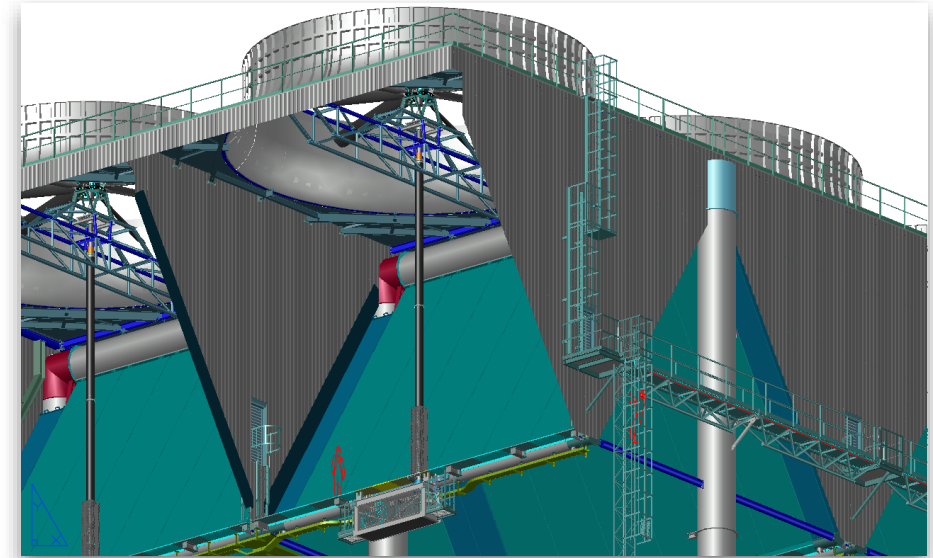


# Alternative Induced Draft Solution

DESIGN

(How it works)

- The drive unit & fan-assembly are connected by a shaft
- The shaft bearings absorb the axial and radial loads
- The gearbox is isolated from the fan assembly and only transmits torque
- Each motor-gearbox basket includes:
  - motor
  - gearbox
  - motor-gearbox coupling
  - access cages
  - frame structure
  - safety screens
  - frame plate preventing object fall/oil leak
- The gearbox and motor are in the cold air zone





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# CHP in GENT ( Belgium) - BEE

- Combined Heat & Power
- Burns waste wood (biomass plant)
- Commissioned in 2021

Power Generation	19.9 MW
Thermal Duty	32.9 MW <sub>th</sub>
Number of streets	1
Number of modules	3
Dimensions (w x l x h*):	13.2 m x 42.8 m x 15.4 m
Fan diameter:	36 feet
Motor Nameplate Power	75 kW
Fan RPM	~80
Tip-speed	~46m/s

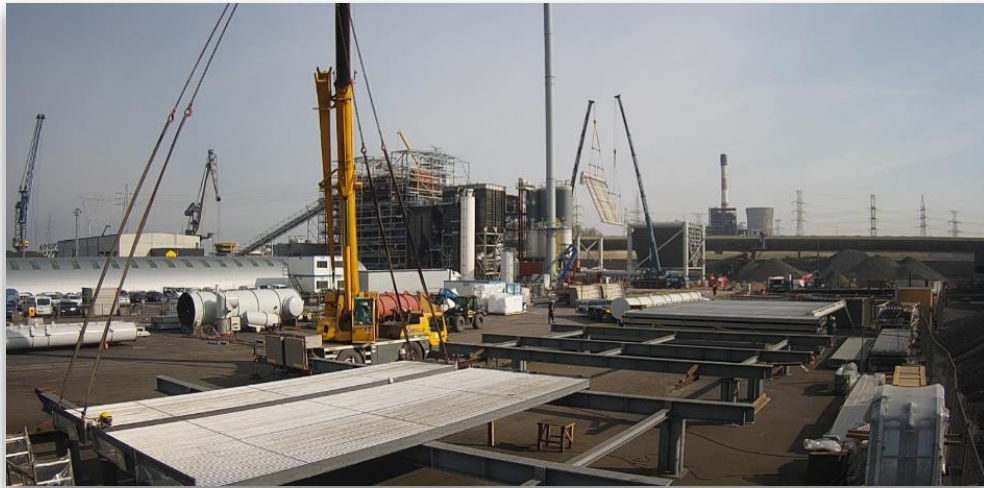


\* At fan-deck level

# M.A.R.S. Feedback

CONSTRUCTION

- Simultaneous work & repetitive actions
- Safe & quick quality controls
- 90% of welding performed at ground level as well as pre-assembly





# M.A.R.S. Feedback

- High pre-assembly
- Lateral blocks (Half-cell bundles, manifold and collector) lifted at once
- Time to install one complete L-block (worst time : 2h30 – best time : 45 min)
- Roof blocks (Fan, bridge, deck and stack) lifted at once

**Reduced Erection Time** compared to standard forced-draft ACC

## CONSTRUCTION



# M.A.R.S. Feedback

CONSTRUCTION

- Vacuum test over each module side at ground level
- Fan & shaft Pre-cold commissioning done at ground level



# M.A.R.S. Feedback

## MAINTENANCE

- Motor & gearbox in a basket (plug& play, easy and safe direct access)



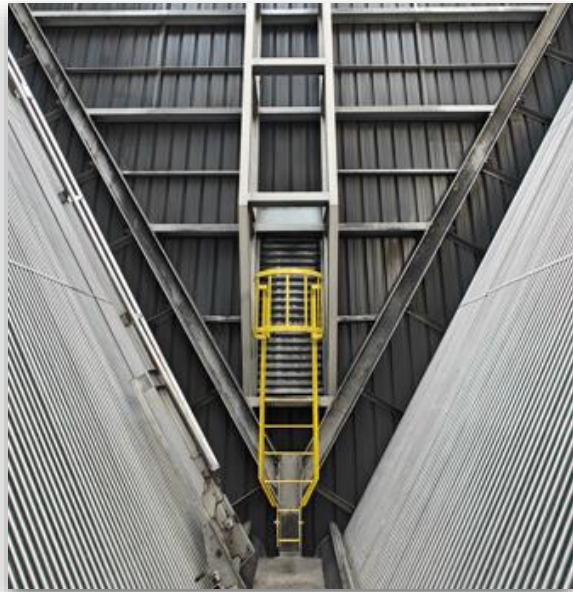
- Fan blades access thanks to removable access platform, blades lifted to ground level with JIB crane



# M.A.R.S. Feedback

## MAINTENANCE

- Semi-automatic cleaning system
  - Access with rolling doors.
  - Ongoing developments to switch to a fully automated solution
- Added safety for operators
  - Cost reduction per cleaning
  - Water-efficient consumption
  - Motorizations : Electric / hydraulic



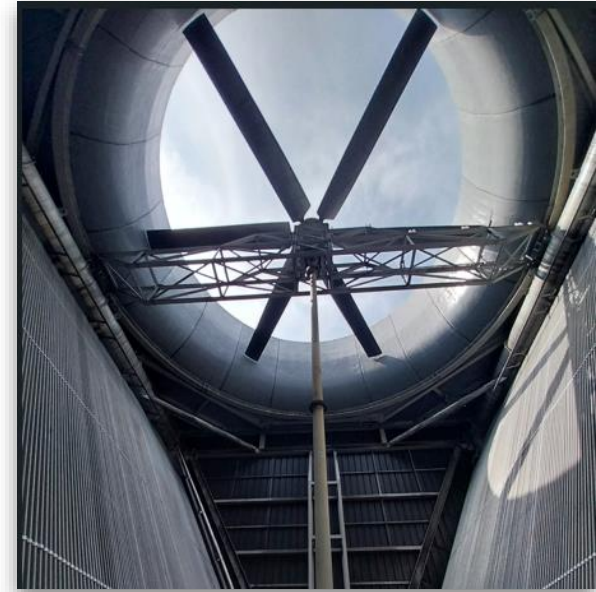
# M.A.R.S. Feedback

- Axial & radial loads absorbed by the structure
- No forces transmitted to the gearbox
- Almost no vibrations at the bearings & gearboxes
- Slight vibrations at the top of the fan-bells  
( solved by increasing rigidity of the bell)

	Alarm / Trip	Measured values
Gearbox vibration (true RMS mm/s)	4.5 / 7.1	[0.5 – 1.5 ]
Shaft Bearings Vibration (true RMS mm/s)	4.5 / 7.1	[0.3-0.5]

(\*) as per ISO 10816-3 – Table A2 – flexible mounted support

## VIBRATION



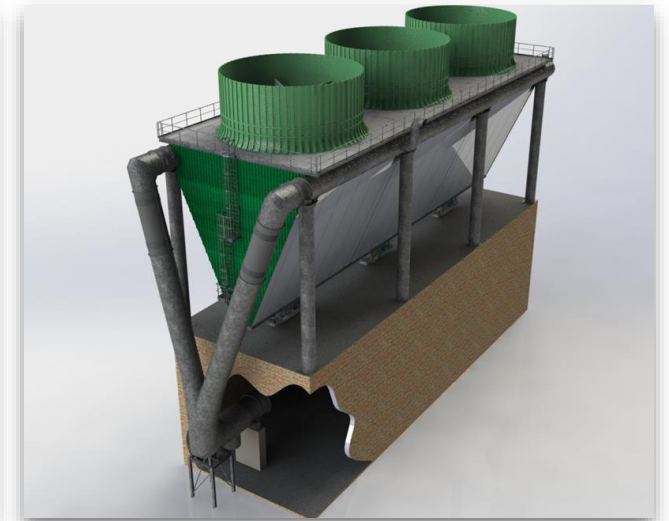
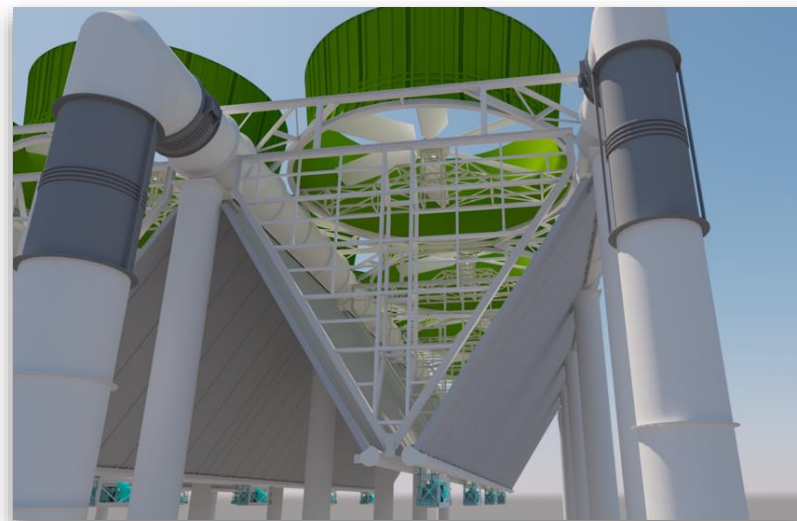
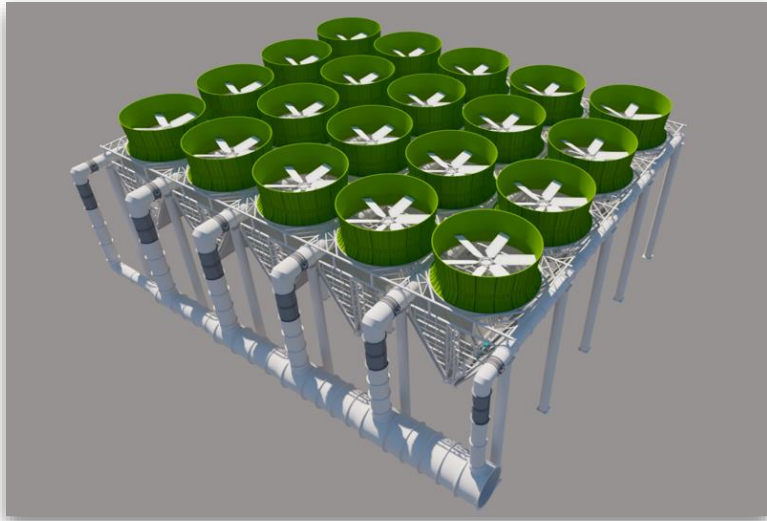


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# New Perspectives

- **VENUS**
- Updated support structure (truss columns or pipe)
- For added space below big ACC's
- All basic advantages of the induced draft
- Sensitive parts out of the air hot stream
- Easy maintenance of the motor-gearbox set
- Low maintenance of the shaft bearings



- **JUPITER**
- Gear-motor at the fan-deck
- ...



# Thank you

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