



YOUR EMISSIONS IN CONTROL

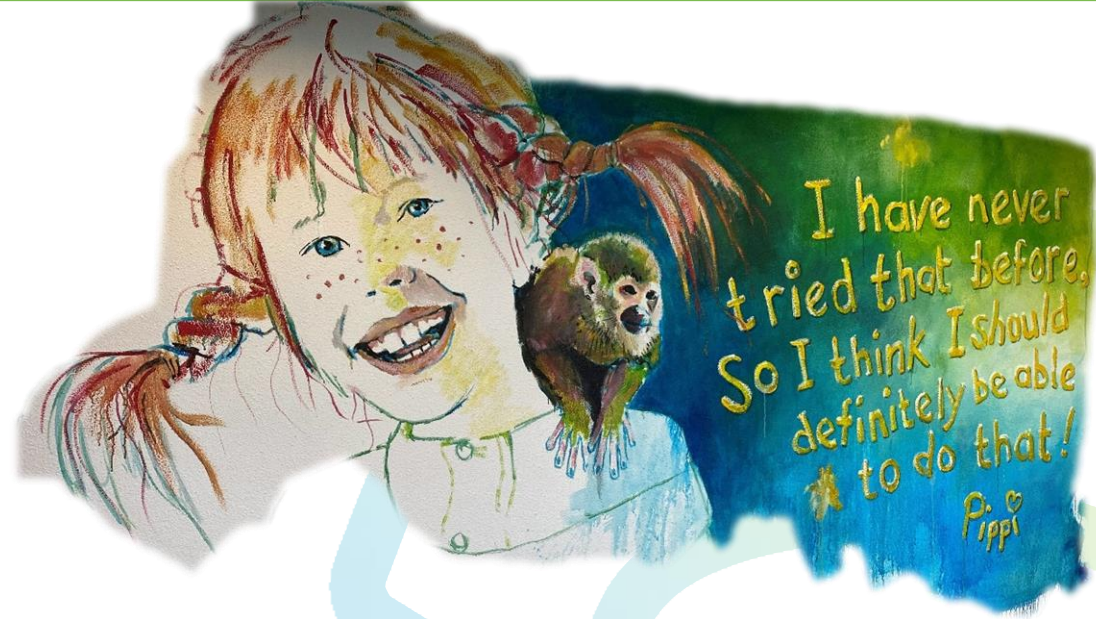
WHAT IS YOUR
EMISSION CHALLENGE?

CHP Balance of Plant Solutions in Confined Spaces

EGSA Fall Conference September 12, 2022

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- ▶ General Introduction
- ▶ Confined Space CHP
- ▶ Summary & Questions



YOUR EMISSIONS IN CONTROL

General Introduction



YOUR EMISSIONS IN CONTROL

General Introduction | Personal

Dan Howland

Business Development Manager, North America

Background: Technical Sales
Expertise: 25+ years Distributed Generation,
New & Retrofit CHP BoP solutions
Interests: Hunting, Golf & Home Improvement



General Introduction | Proposition

Emission defined as:

pollution, odor, noise and **heat** (challenges)

Array Industries offers integrated **emission solutions**:

- ▶ Contribute to client **productivity**
- ▶ **Compliance** with local regulations
- ▶ Provide **healthy working & living environment**

Clients value our:

knowledge, experience, creativity and **reliability**

What is your emission challenge?

General Introduction | Overview

Background:

- ▶ Founded in 1990
- ▶ Core: **ENGINEERING, DESIGN/INTEGRATION, MANUFACTURING**
- ▶ Diverse industrial project experience
- ▶ **Sustained CHP market success**
 - Balance of Plant (BoP) solutions

Solutions for **POLLUTION, ODOR, NOISE & HEAT** eg:

- ▶ Complete BoP System Integration
- ▶ Chimneys, Flares, (vent) stacks,
- ▶ (vacuum) ducting systems
- ▶ Exhaust gas cleaning / treatment

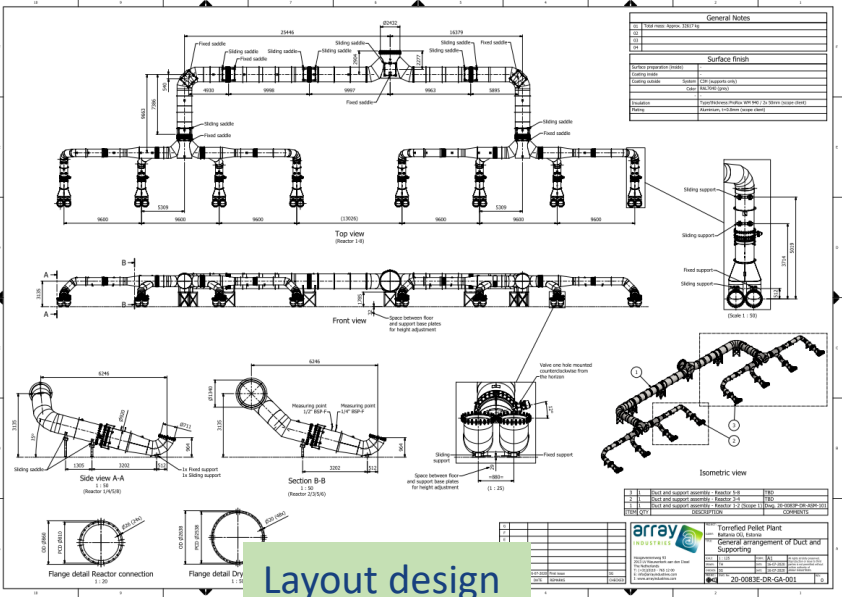
Markets (NL, UK, EU, USA, CAN):

- ▶ Energy / Power Generation / CHP
- ▶ Industry / Food / Chemical / Greenhouse

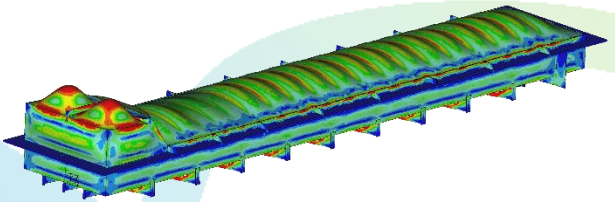
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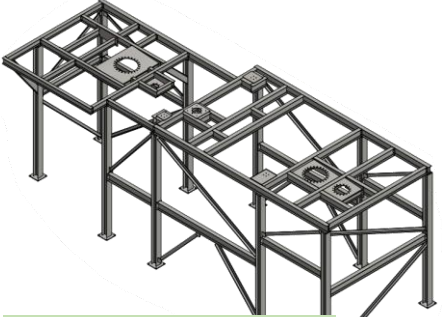
General Introduction | CORE: Engineering



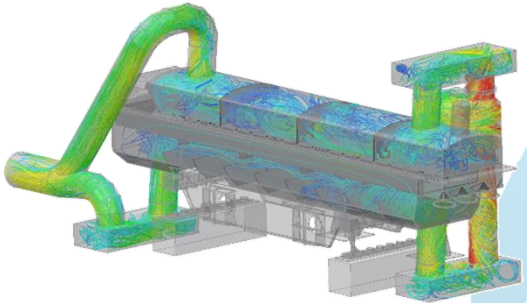
Equipment Layout



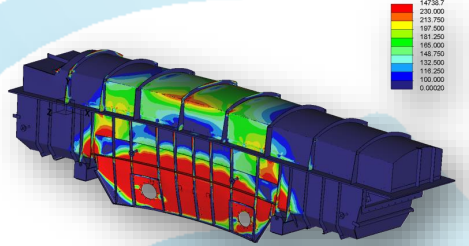
Overpressure check



Structural design

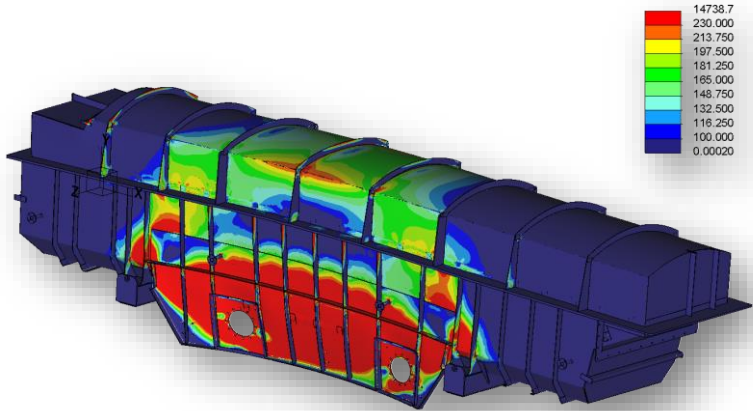


CFD analysis

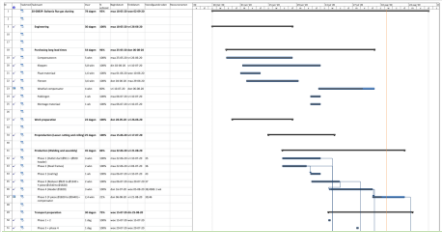


Stress analysis

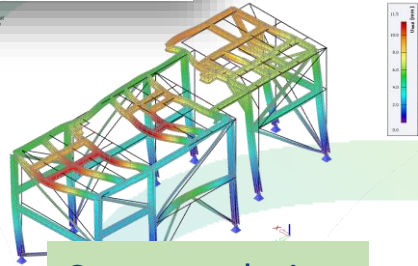
General Introduction | CORE: Design / Integration



Process optimization



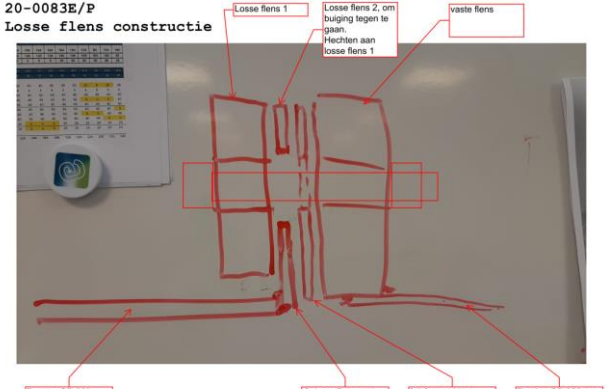
On demand engineering support



Stress analysis



Design confirmation



Installation assistance at site

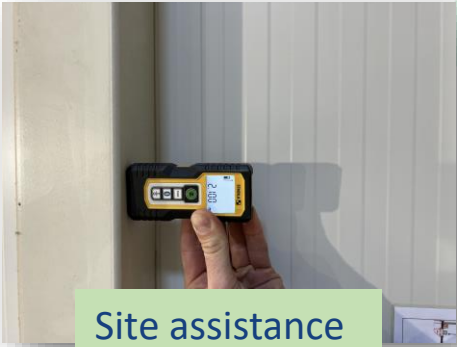


On demand spares

General Introduction | CORE: Manufacturing



Process ducting



Site assistance



Logistics



Plug & Play installation



Onsite integration



Consumables

General Introduction | CHP Experience

- ▶ Design, Engineering, Manufacturing, Integration of:
 - 1,500+ Greenfield
 - 100+ Brownfield/retrofit
 - Multiple generator exhaust flows into single pipe
 - ORC integration
- ▶ >30 years



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Confined Space CHP



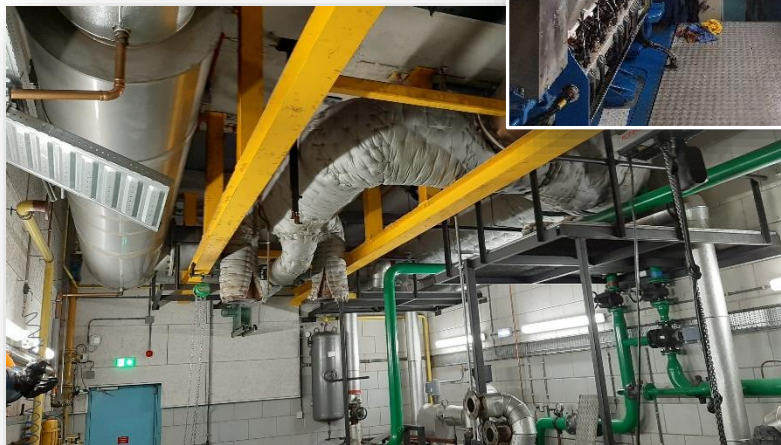
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Confined Space CHP | Challenges

- ▶ Available space
- ▶ Power density
- ▶ Back pressure
- ▶ Noise limits
- ▶ Thermal energy
- ▶ Pollution targets
- ▶ Ducting/stack integration
- ▶ Radiant energy



Confined Space CHP | Case study #1: Utrecht University



Client:
Utrecht University (UU)

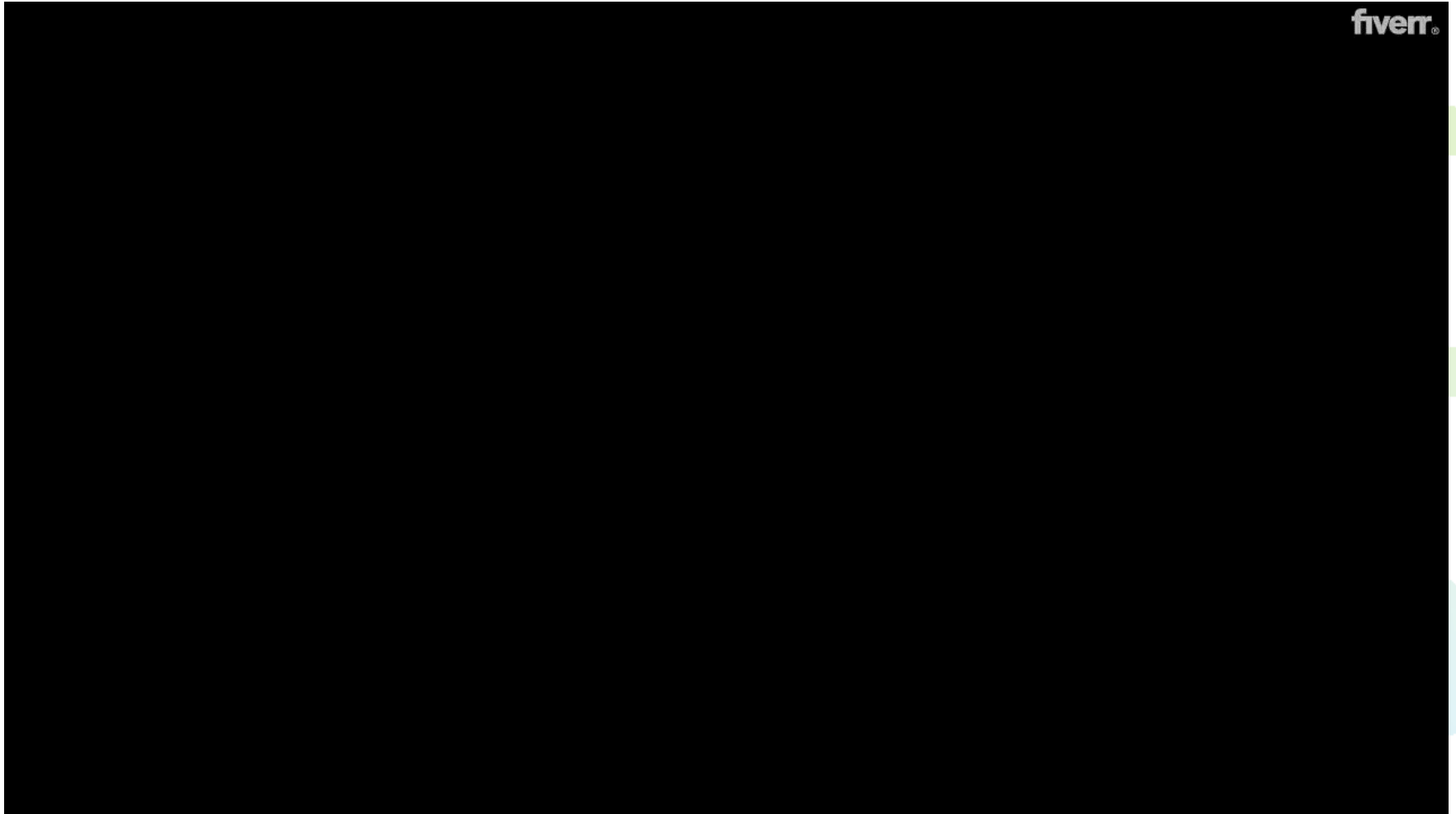
Challenge:
New pollution limits
New noise limit
Small concrete rooms

Solution:
Design, fabrication & integration of new
CHP Balance of Plant:

- ▶ SCR's
- ▶ Tailored urea delivery system
- ▶ Rupture Disks
- ▶ EGHE's
- ▶ Resonance & absorption silencers
- ▶ Existing stack integration

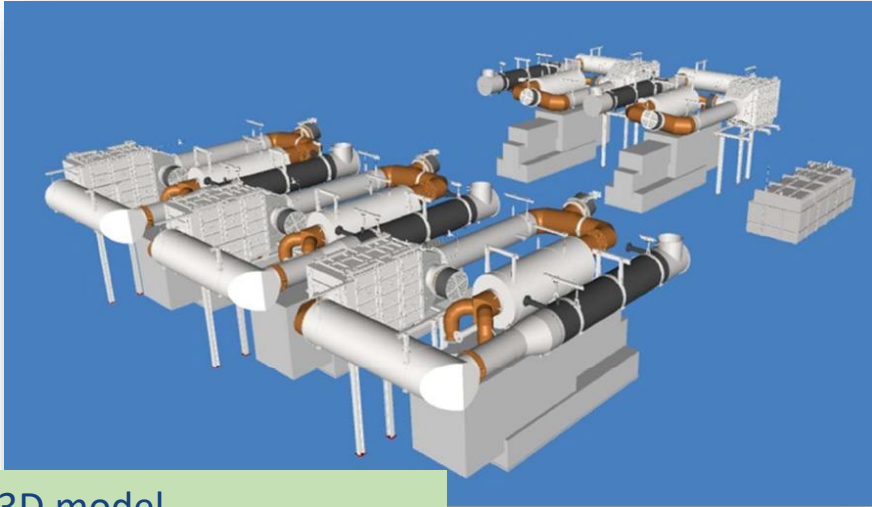
Benefits:
Single point of contact
Lower system back pressure

Confined Space CHP | Case study #1: Utrecht University



YOUR EMISSIONS IN CONTROL

Confined Space CHP | Case study #1: Utrecht University



3D model



Urea storage tank



Modified engine room



Modified engine room

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YOUR EMISSIONS IN CONTROL



Client:
Canadian Health Care Provider

Challenge:
New CHP units (13) to comply with new pollution limits utilizing existing footprint

Solution:
Design, manufacture, integration of
Balance of Plant:

- ▶ SCR & OxiCat's
- ▶ Urea tanks & remote fill systems
- ▶ EGSB integration
- ▶ Silencers
- ▶ Thermal insulation
- ▶ Piping and stack integration

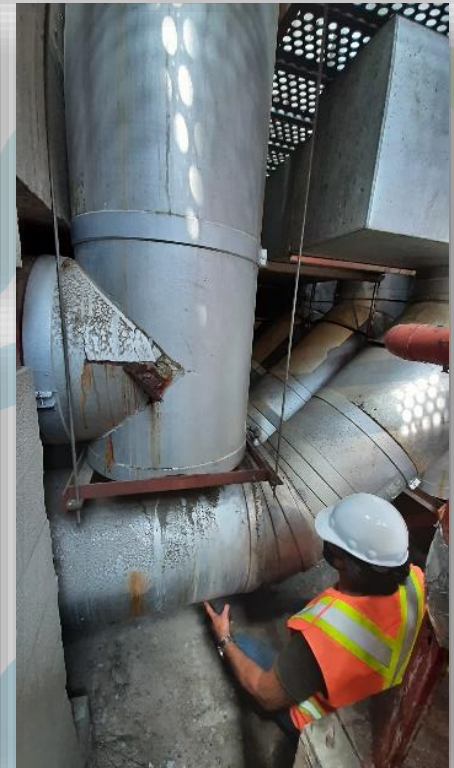
Benefits:

- ▶ Increased kWe/efficiency output
- ▶ Lower system back pressure
- ▶ Radiant heat reduction
- ▶ Lower carbon footprint

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Challenges:

- ▶ Above/below ground concrete rooms
 - limited access points
 - Minimal equipment spacing
- ▶ New SCR/OxiCat equipment
- ▶ Higher exhaust SCFM per unit
- ▶ Existing duct/stack integration
- ▶ Existing EGSB integration
- ▶ BoP install after generator placement
- ▶ Below grade urea storage & delivery systems



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Array Balance of Plant Premise

- ▶ Engine Turbo Outlet Flange to Atmosphere
- ▶ Design, Manufacture & Component Integration

Upstream

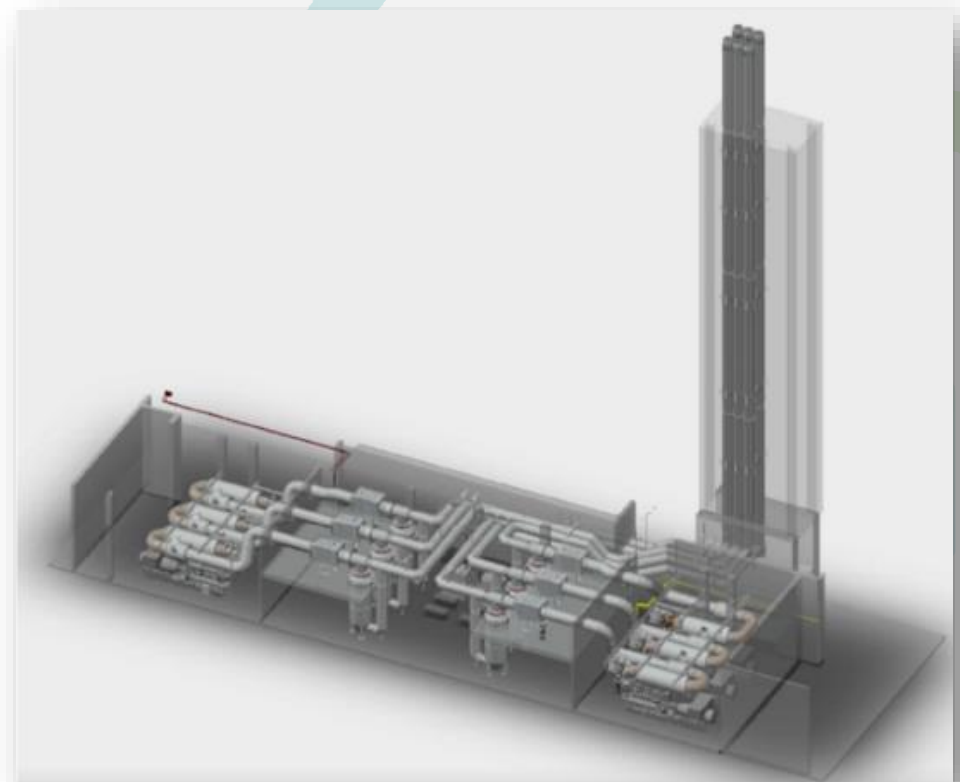
- ▶ Engine to Exhaust Gas Heat Recovery

Downstream

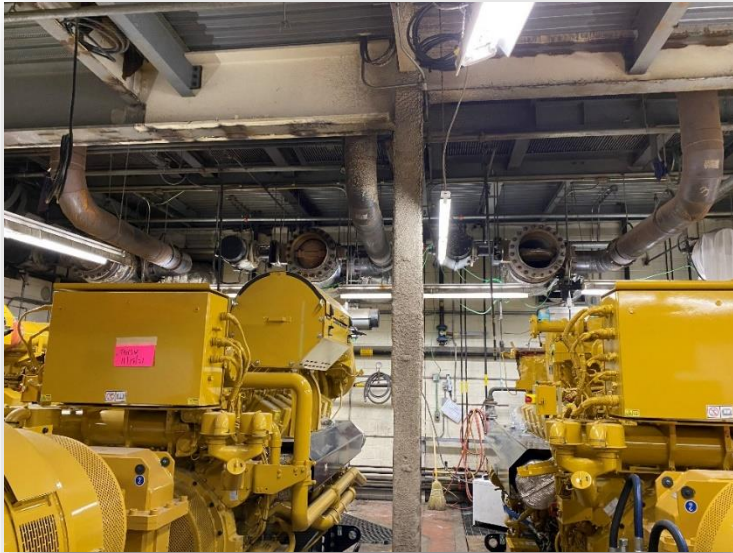
- ▶ Exhaust Gas Heat Recovery to Stack

Stack

- ▶ Vertical Ducting to Atmosphere

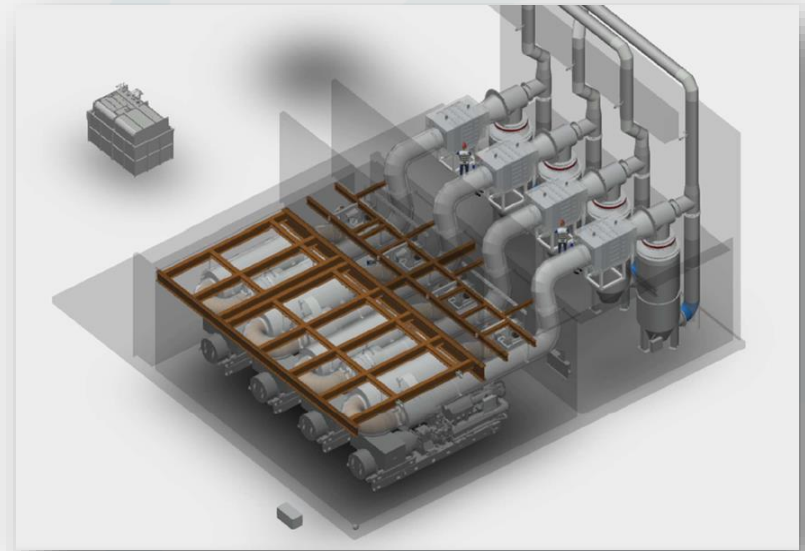


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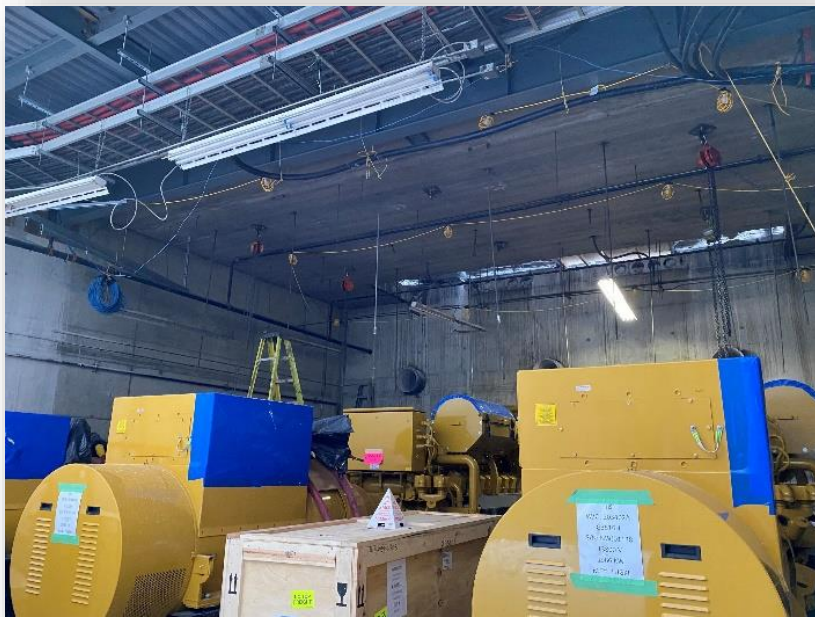
Site #1

- ▶ 4 x CHP's
- ▶ 1 x room
- ▶ Minimal ceiling height
- ▶ Urea tank system & remote fill
- ▶ BoP installed after generators
- ▶ Existing EGSB & stack integration
- ▶ Insulation blankets
- ▶ 6 compensators per unit



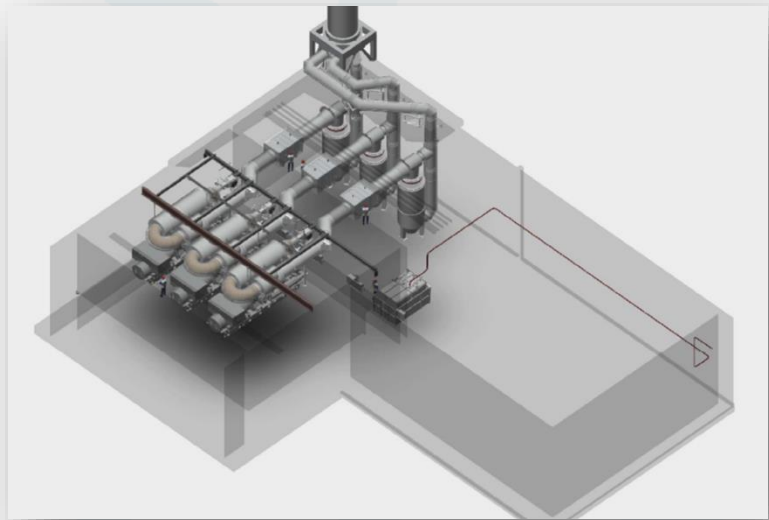
<https://youtu.be/14VKc5FogWU>

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Site #2

- ▶ 3 x CHP's
- ▶ 1 x room
- ▶ BoP support grid
- ▶ 8'x 16' Roof access
- ▶ BoP installed after generators
- ▶ Existing stack & EGSB integration
- ▶ Urea tank system & remote fill
- ▶ 8 compensators per unit



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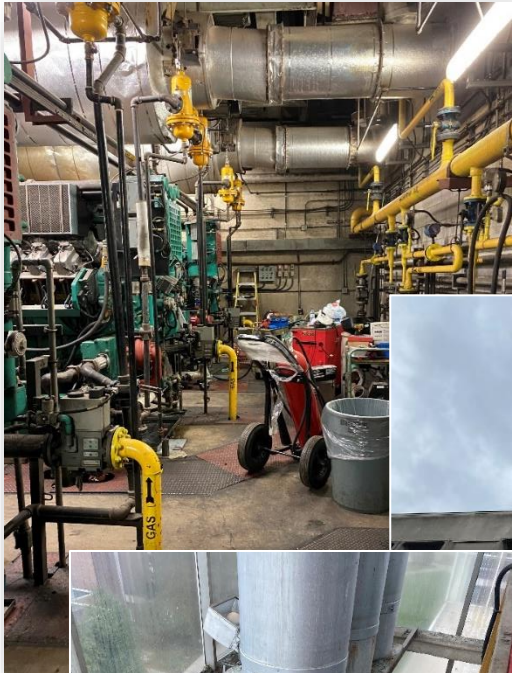


Site #2

- ▶ 3 x CHP's
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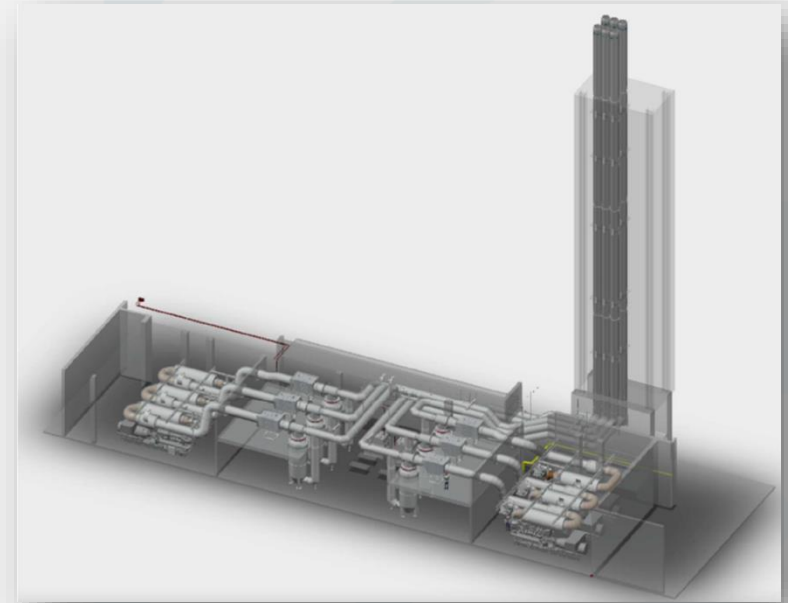


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Site #3

- ▶ 6 CHP's
- ▶ Underground
- ▶ Minimal clearance
- ▶ 300' Exhaust run
- ▶ Multiple rooms
- ▶ 130' Vertical stack



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Site #3

- ▶ BoP installed after generators
- ▶ 10'x16' Roof access



Confined Space CHP | Case study #2: Hamilton, Ontario, CAN



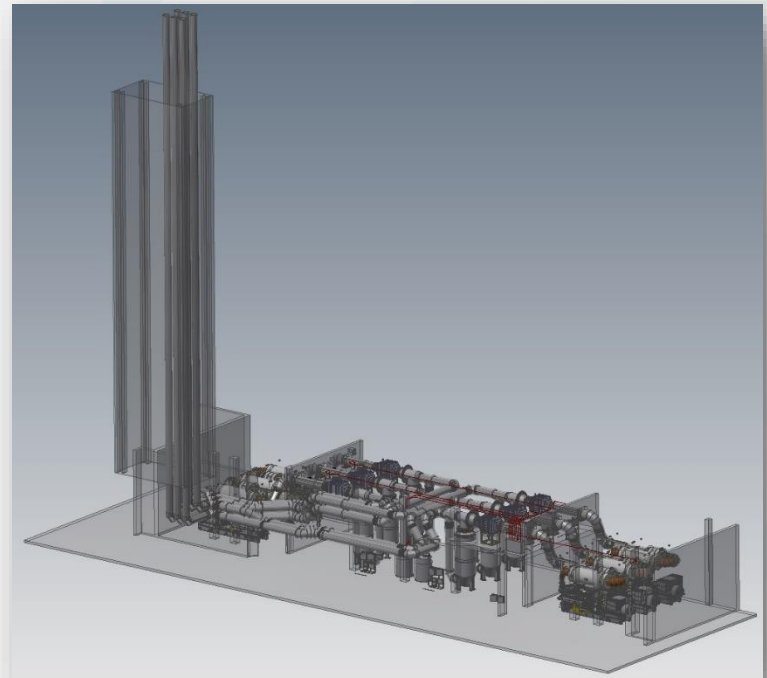
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Site #3

- ▶ BoP installed after generators
- ▶ Space for New ventilation
- ▶ Purge fan integration
- ▶ Free-standing stack design
- ▶ Urea tank system & remote fill
- ▶ 11 compensators per unit
- ▶ Full insulation of exhaust ducting



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Summary | Key to success

- ▶ Be flexible
- ▶ Think creatively
- ▶ Thorough investigation of site
- ▶ Know & understand equipment required
- ▶ Minimize impact to building space
- ▶ Team partner relationship approach

Thank you



Array Industries – Your Bridge for Success in CHP BoP Solutions

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Questions?

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