



# IDEA2021

Powering the Future: District Energy/CHP/Microgrids  
Sept. 27-29 | Austin Convention Center | Austin, Texas



# CHP Case Study and the Roadmap to Hydrogen

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# Aggressive sustainability goals

In 2005 Lucart Group (European leader in the production of tissue, air-laid and machine-glazed paper) defined aggressive sustainability goals:

- Lead the green transition in the paper industry
- Define a strategy with highlight on Industrial competitiveness combined with a business model focused on sustainability
- Sustainability reports compliant with the International Global Reporting Initiative (GRI Standard) – and report annually

# Achieving aggressive sustainability goals

Specific Goals: 2015 - Sustainability strategy aligned with the United Nations Sustainable Development Agenda (2016 to 2030)

- Climate action (reduce CO2 emissions by 16% per quantity of paper produced)
- Affordable and clean energy (use the technology that best fit the paper sector – CHP with Gas Turbines)
- Life on land (promote 100% recyclable packing by 2030)



# High efficiency CHP and Hydrogen Roadmap

- CHP projects for two existing facilities at Tuscany, Italy
- Baker Hughes selected as Technology partner for the two CHP plants
- **Nova LT12** Gas Turbine (12.6MW ISO)

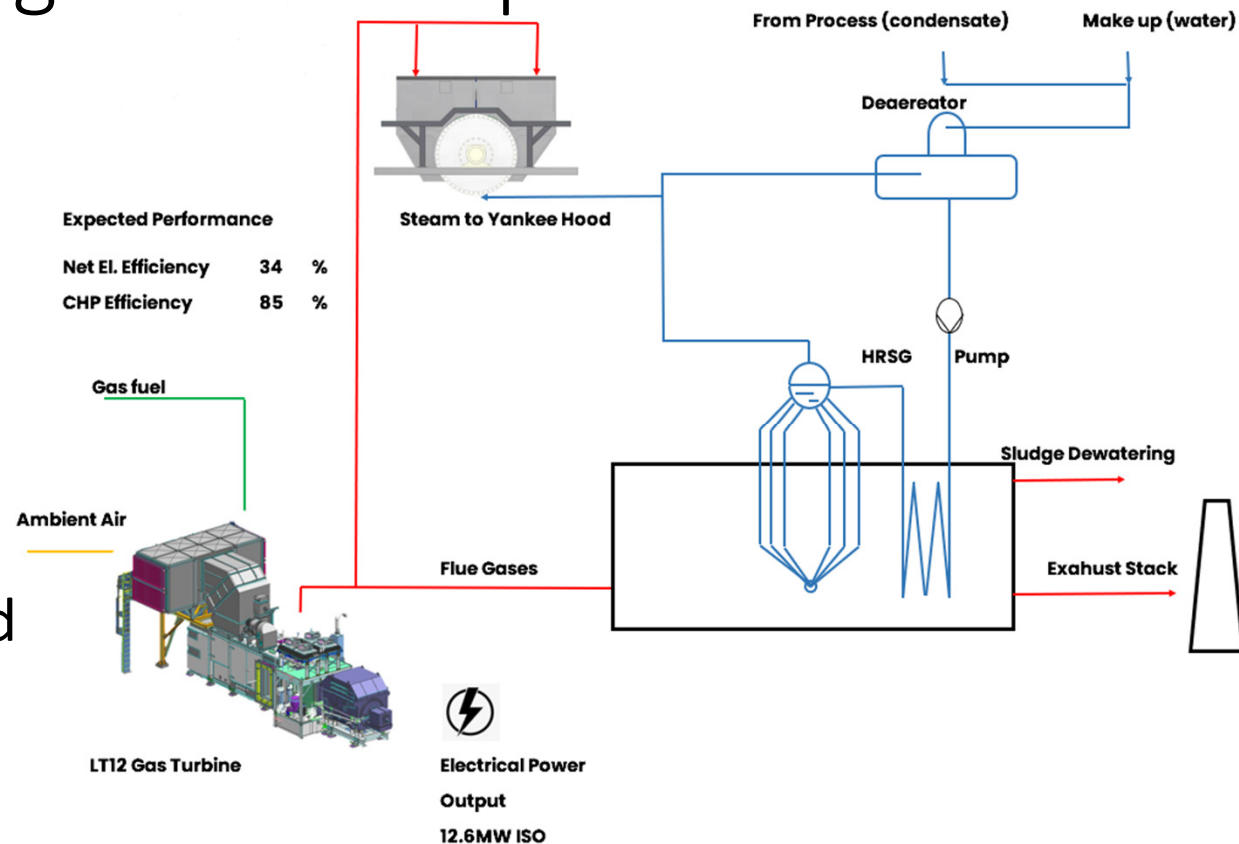
# High efficiency CHP and Hydrogen Roadmap

- Objectives:
  - Reduce energy costs
  - Reduce carbon footprint
  - Improve energy resiliency



# Solution: High efficiency CHP and Hydrogen Roadmap

- Energy input: Natural Gas with hydrogen roadmap
- Energy output:
  - Electricity
  - Steam to Yankee Hood
  - Hot air to Yankee Hood
  - Hot air to Sludge Dewatering



# Solution: High efficiency CHP and Hydrogen Roadmap

- Diecimo's paper mill CHP commissioned in 2019:
  - 12 MWe
  - 48,000 lb/hr steam
  - 85% CHP efficiency
  - US\$3,000,000 savings/year





# Solution: High efficiency CHP and Hydrogen Roadmap

- Diecimo's CHP sustainability achievements:
  - 7,000 tons of CO2 per year eliminated vs. grid
  - 12% CO2 reduction
  - 44% NOx emissions reduction
  - 2,500 tons of CO2 / year eliminated compared with previous technology



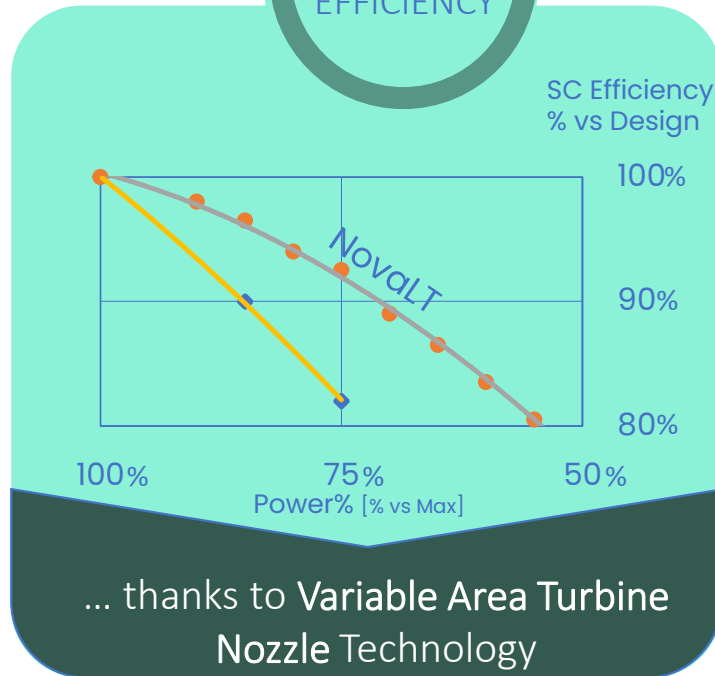
# High efficiency CHP and Hydrogen roadmap

- Low maintenance cost
- Extended time between overhaul (35,000 hours)
- One maintenance per year
- **High efficiency at partial load**

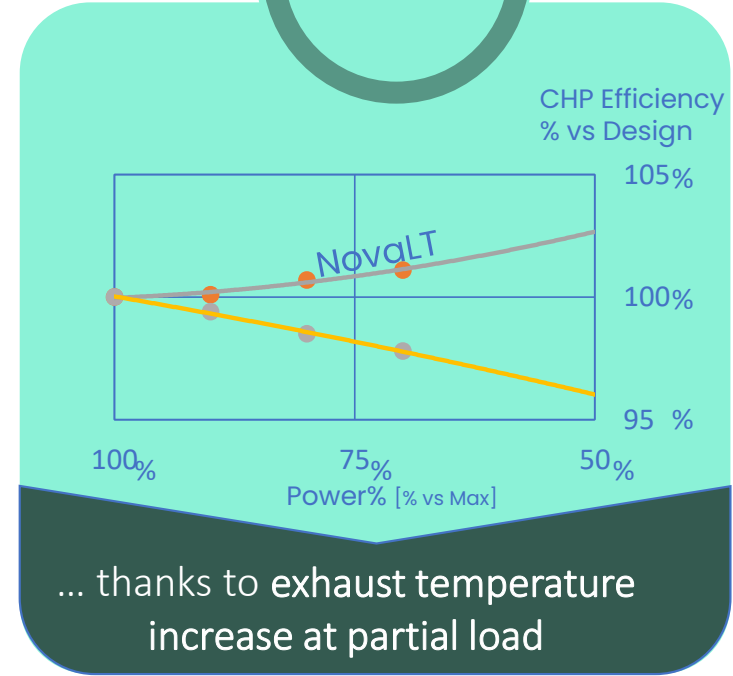


# High efficiency CHP and Hydrogen roadmap

## ON ELECTRIC EFFICIENCY



## ON CHP EFFICIENCY



# High efficiency CHP and Hydrogen Roadmap

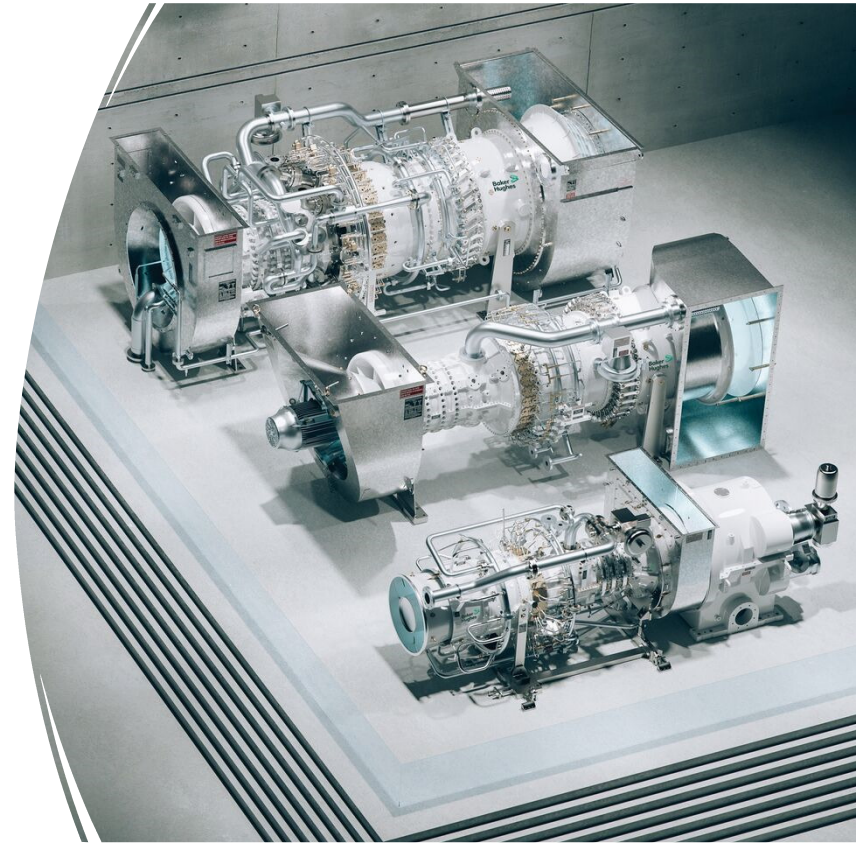
- Porcari's paper mill CHP:
  - Under construction
  - Commissioning planned for end 2021
  - **Nova LT12** Gas Turbine (12.6MW ISO)
- Both CHP plants can burn blend of NG and Hydrogen



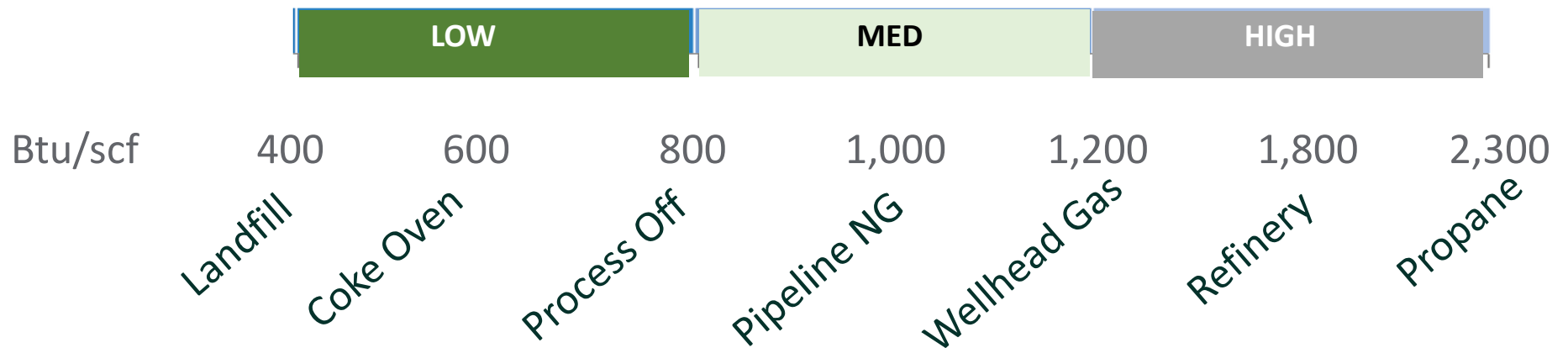


# Hydrogen Roadmap

- **NovaLT** Gas Turbines inherently designed for Hydrogen
- 5% to 100% Hydrogen blend capability



# Hydrogen Roadmap



**Liquid fuel...** both as backup or primary source



**DLN Natural Gas Solutions...** 9ppm NOx with pipeline quality gas



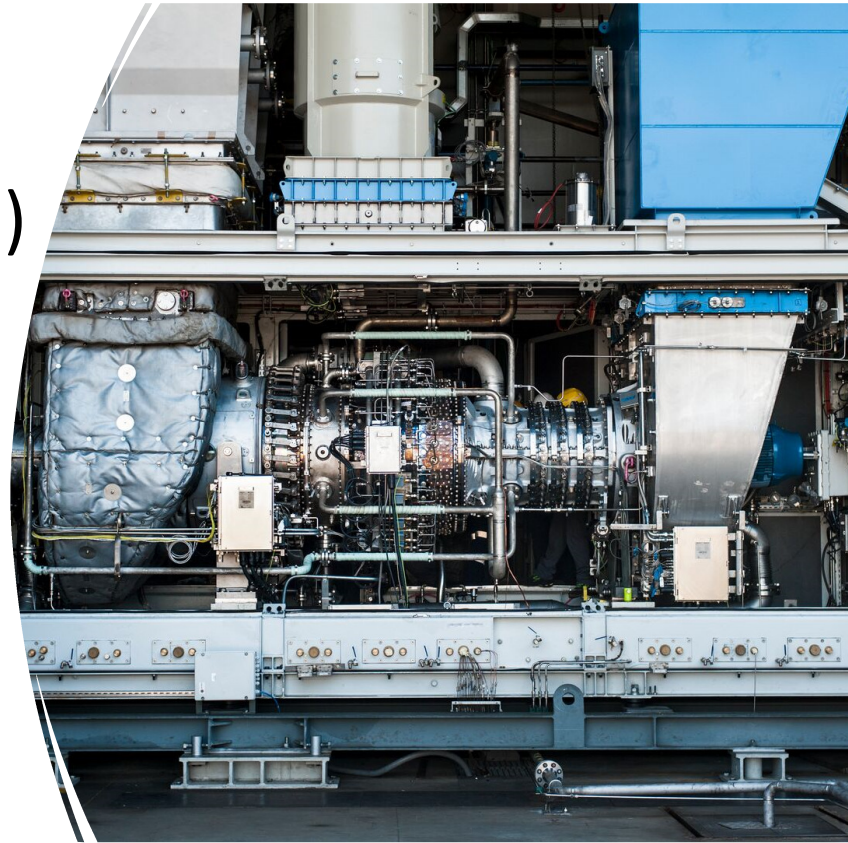
**Inert Rich Gasses...** Coke oven, bioGas



**High Reactive Gasses...** Refinery gas w/Hydrogen, C2+ hydrocarbon

# Solution: Hydrogen Roadmap

- Baker Hughes & Snam test first “hybrid” Hydrogen GT (NovaLT12)
- Snam tested compression, pipeline and fuel gas blend
- Test completed successfully in July 2020



# Hydrogen Roadmap

- Test process & facilities:
  - Virtual Lab test (CFD) for thermo fluid-dynamics
  - SingleCup atmospheric and pressurized testing
  - Full scale annular rig and multican rig test
  - Full engine testing



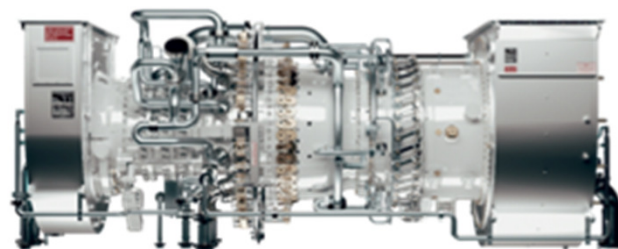


# Solution: Hydrogen Roadmap

- Test results:
  - Full unit NovaLT-12 tested (standard configuration)
  - Up to 10% Hydrogen blend
  - Dry Low Emissions (DLE)  $\text{NO}_x \leq 15$  ppm
  - Power, load and efficiency not affected
  - Combustor tested 100% Hydrogen (WLE)



# Hydrogen Roadmap



## Today – 100% H<sup>2</sup> Wet Combustion

- Start up & burn gas blends up to 100% H<sub>2</sub>
- Auto-switch from NG to gas blends up to 100% H<sub>2</sub> *while operating*

## 2020 H<sup>2</sup> NG Blend DLN Combustion

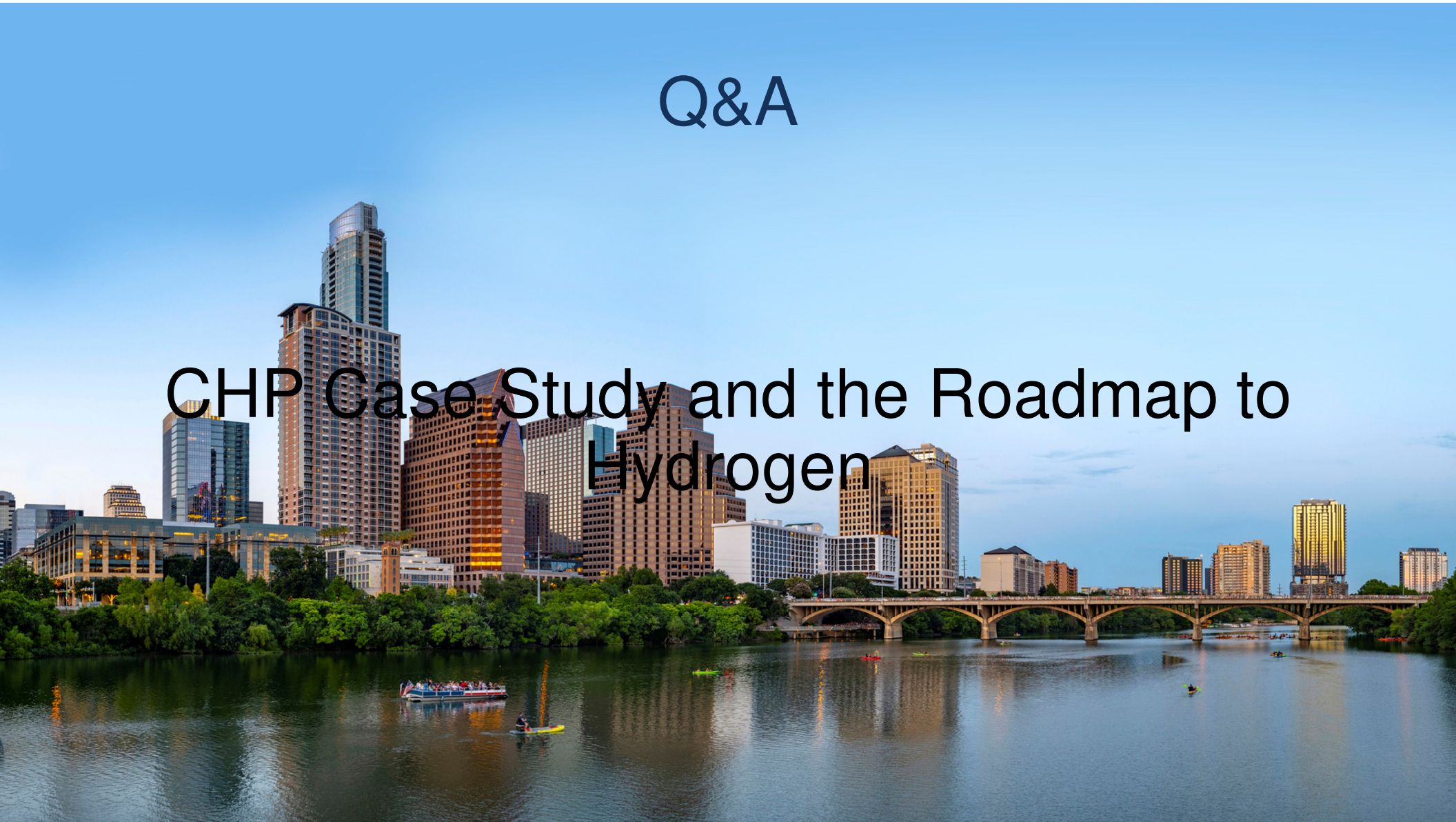
- NOx emission reduction strategy based on multi-fuel burner
- Preliminary tests for DLN combustion system

## Next – 100% H<sup>2</sup> DLN Combustion

- Full annular rig verification
- Engine test verification

Q&A

# CHP Case Study and the Roadmap to Hydrogen



# Thank You!

**Roberto Garcia**

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