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MOVE THE WORLD FORW>RD MITSUBISHI HEAVY INDUSTRIES GROUP

HEAT TO ELECTRICITY

Utilizing temperature drop upstream SCR systems for power generation

Turboden S.p.A.
A Group Company of MITSUBISHI HEAVY INDUSTRIES

FROM COOLING TO POWER GENERATION

Selective Catalytic Reduction (SCR) + Water-Free Combined Cycle Solution for Gas Turbines

Energy waste:

The Selective Catalytic Reduction (SCR) system decreases emissions from gas turbines but requires the exhaust gases to be cooled. Traditionally, this cooling is achieved using electric fans that consume energy, increasing operating costs and generating waste.

The recovery of heat:

Utilize the drop in gas turbine exhaust upstream the SCR for power generation in a water-free combined cycle solution otherwise known as Organic Rankine Cycle (ORC).

STARTING POINT

Reducing the exhaust gas temperature before SCR requires high energy consumption.

→ **Cooling exhaust gases requires a lot of energy**

Selective Catalytic Reduction (SCR) systems require that gas turbine exhaust gases be cooled prior to treatment to function properly.

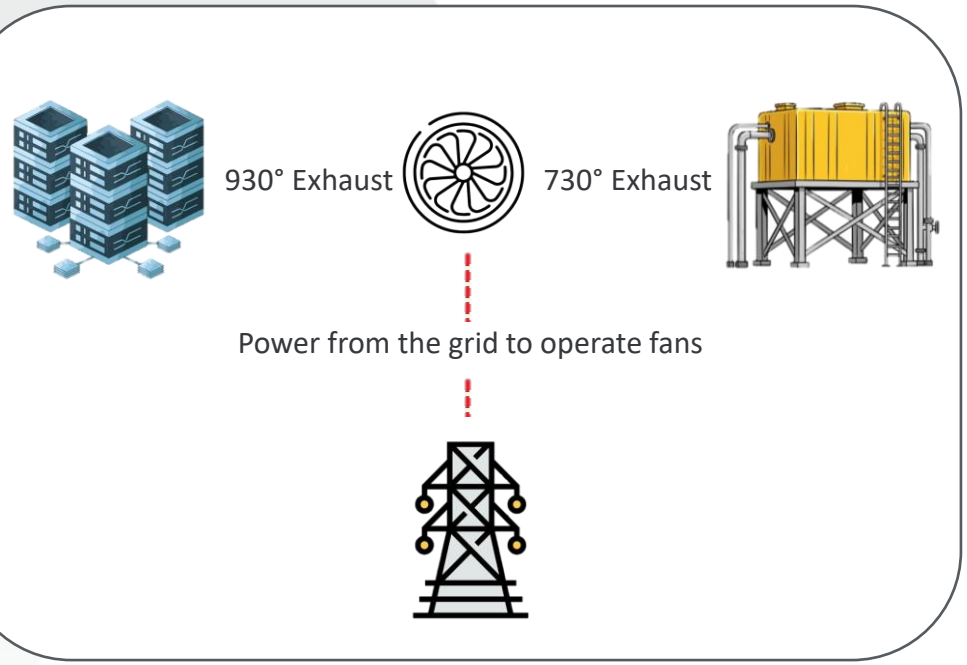
Today, this cooling is normally achieved by electric fans, which lower the temperature of the gases to levels compatible with the catalyst.

→ **Increased costs and less energy available**

Although technically effective, this solution has some consequences:

- additional electricity consumption due to large ventilation systems;
- a reduction in net available power, when energy is used internally instead of fed into the grid or destined for the data centre.

→ In both cases, the result is an increase in operating costs or a reduction in potential revenues.



An unexploited opportunity

For power plants serving data centers, where efficiency, business continuity, and cost control are essential, dissipating energy just to cool down represents a missed opportunity. That heat could be enhanced, instead of simply being dispersed.

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THE TURBODEN SOLUTION

How It Works

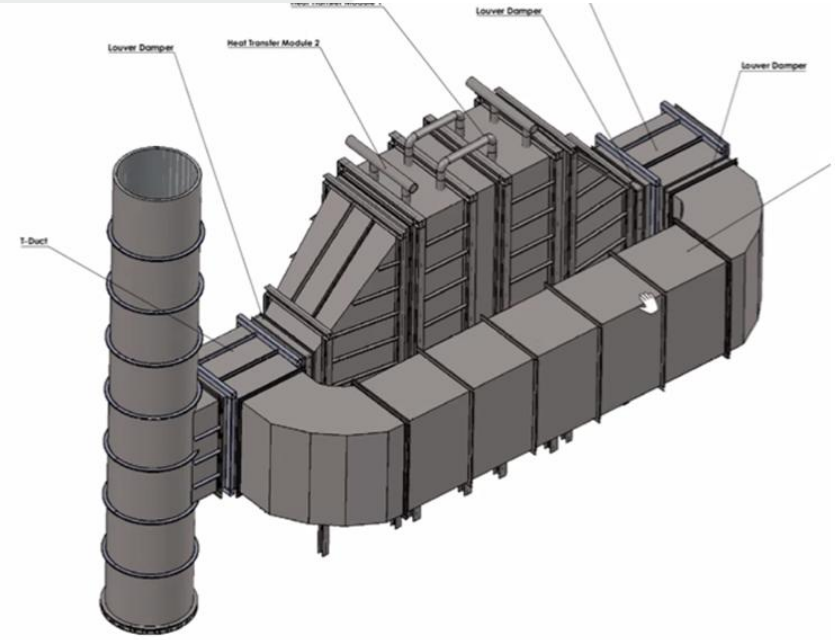
Turboden and its SCR partner offer a waterless combined cycle solution, placing the Turboden Heat to Power system upstream of the SCR to recover energy from turbine exhaust.

→ Benefits

- Reduces or eliminates the energy load of fans;
- Recover thermal energy and convert it into clean electricity;
- Provides exhaust gas to the SCR at the optimum temperature.

→ Results

- Additional power of several MW from energy that would be wasted;
- Lower operating costs due to the elimination of fans;
- Increased plant efficiency and increased revenues.



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ADVANTAGES

From energy consumption to electricity production

→ **Combined cycle without water**

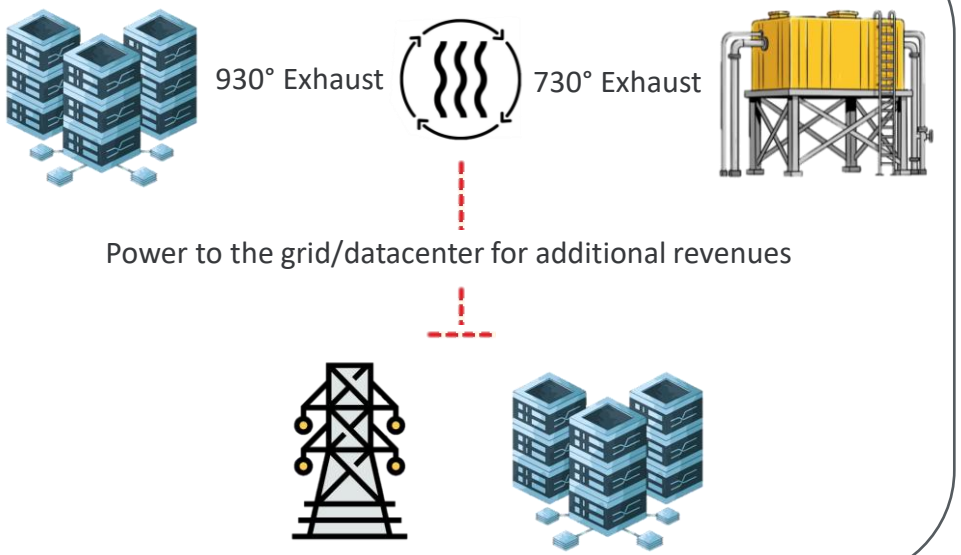
The addition of a combined cycle without water transforms the need to reduce temperature into a valuable and continuous production of electricity.

→ **Conversion of exhaust gases into electrical energy**

By integrating a water-free combined-cycle technology upstream of the SCR, thermal energy is recovered from the exhaust gases and transformed into clean, reliable electricity.

→ **Lower costs and higher revenues**

By increasing plant efficiency, producing emission-free energy, and reducing the need for fan power, the power plant increases revenues and reduces operating costs.



CASE STUDY – $83,000,000 IN ADDITIONAL REVENUES *

* Assuming $100 / MWh power rates

LM2500 GT – Transforming exhaust temperature reduction into electrical power

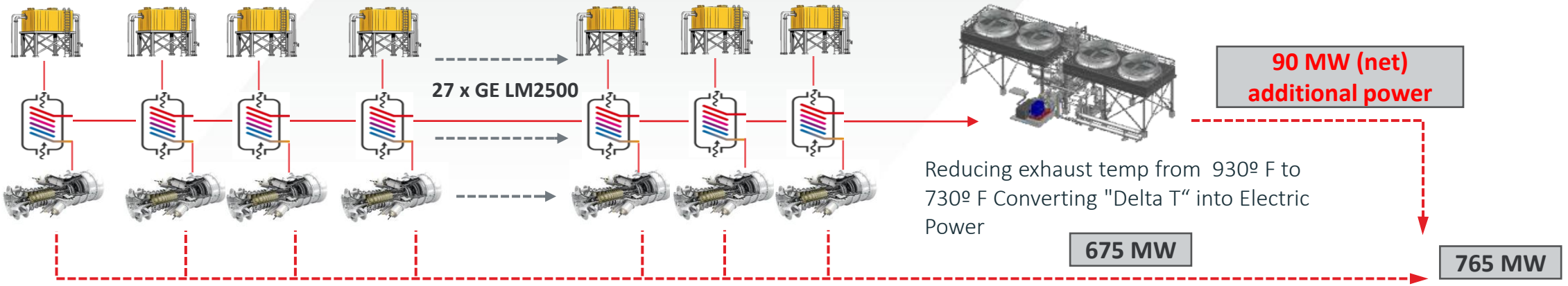
Turboden offer an **integrated combined cycle + SCR solution** to optimize **power generation in data center power plants**, maximizing efficiency and cost return.

How it works:

- → Each SCR draws exhaust gases from the LM2500 gas turbine and removes harmful pollutants, such as NOx.
- → To ensure effective treatment, the temperature of the exhaust gases must be reduced.
- → This is where the SCR Provider + Turboden solution comes in: the exhaust gases are conveyed to the ORC heat exchanger where the heat is recovered and converted into electricity.

The Results:

- → Gas temperature optimized for SCR
- → Production of additional power without extra fuel
- → Up to $83 million in incremental revenue
- → Increased overall plant efficiency and reduced emissions



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GLOBAL AND PROVEN EXPERIENCE

Supply reliable power for over four decades.

→ 25 thousand GWh produced
→ 19 million cumulative operation hours
→ 98+% average availability

50+ countries

470+ plants

In **2013** Turboden became part of **Mitsubishi Heavy Industries group** that strongly supports Turboden in the development of innovative solutions.

In **November 2024**, **Turboden America LLC** was established to support large-scale projects and promote closer collaboration with our US partners.

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