Paving the way to the Future of Energy Efficiency: innovation case studies for the industries

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Agenda

- GDF SUEZ CRIGEN and COFELY South East Asia: *Who we are?*
- Energy Transition on Industrial Markets: *a general context that fosters innovative solutions*
- First example: *Optimization of operating conditions and set points by statistic data analysis & monitoring.*
- Second example: *Innovative technologies for heat recovery in industrial plants.*
### GDF SUEZ Organization & Businesses

#### Energy Europe
- **28,000 employees.**
- Supply of natural gas and electricity in Europe
- Power production in Europe
- Energy services for individuals and professionals in France.

#### Energy International
- **10,750 employees.**
- 6 business areas: UK; North America; Latin America; Middle East - Turkey & Africa; Asia; Australia.
- Power production.
- Supply of natural gas and electricity.

#### Global Gas & LNG
- **1,940 employees.**
- Exploration & Production. Of gas and oil
- Supply and Shipping of LNG

#### Infrastructures
- **17,300 employees.**
- Natural-gas transmission network.
- LNG terminals in France.
- Storage activities in and outside France.
- Gas distribution networks in France.

#### Energy Services
- **76,200 employees.**
- Management of urban networks in and outside France.
- Management of industrial and tertiary electrical installations.
- Global multitechnical offers.

#### SUEZ Environment
- **80,500 employees.**
- Water and sanitation services.
- Water-treatment engineering.
- Waste management.

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Power / Gas / Energy Services

![Cofely](image)

Water / Waste

*Commercial / R&D synergies towards markets and partners*
Cofely South East Asia – 27 Years in the region

Activities

- Energy Services
- Energy Efficiency Performance Contracts (EEPC)
- Integrated Facilities Management
- Operation & Maintenance
- Data Centre Design, Build and Maintain
- Utilities Management
  - District Cooling Systems, Cogenerations,
  - Steam, Compressed Air, Chilled Water, Hot Water

Cofely Singapore (Regional HQ)
- 200 employees

Cofely Thailand
- 120 employees

Cofely Philippines
- 30 employees

Cofely Malaysia
- created in 2012
- 28 employees
Strategy based on Energy & Environmental Efficiency

Energy savings, with an equivalent comfort and service level and a reduced environmental footprint

Energy Audits
Consumption Management
Energy Performance Contracts
Local energy networks and production
Renewable Energies

ACCREDITED ESCO

Authorized by National Energy Agency (NEA) to conduct Investment Grade Energy Audits
GDF SUEZ Research & Technologies

- Our technologies and technological know-how are supporting the Group’s three main missions for our customers

  - Operational excellence oriented research (Research to Business)
    - Respond to business lines’ client needs (short and medium term), for example
      - Energy Efficiency for Industrial Customers
    - Continuously improve operational performance of our industrial assets and technology

  - 11 R&D entities all over the world…
    - …including CRIGEN R&D Center (representative office in Singapore)

  - 5 strategic corporate R&D programs

  - An active technology watch, prioritizing technologies into our technology panorama

Provide competitive energy with lower emissions levels

A better utilization of energy at customer level

Allow our clients to better visualize and pilot their energy use and environmental impact
Energy transition in Industrial Markets – Context

- Energy & Environmental efficiencies are key criteria of profitability of industrial activities
- Energy & environmental European directive reinforce drastically the needs of reduction on Energy consumption & pollutant emissions

GDF SUEZ Methodology:
- Energy & Environmental efficiencies improvement on process lines
  - Optimization of operating conditions and set points by statistic data analyze & monitoring
  - Implementation of innovative technologies

This methodology needs to think with new systemic approach
Energy efficiency in industrial processes:

Optimization of operating conditions and set points by statistic data analysis & monitoring
Is a digital platform…

… to save energy in the industry

A team at your service:
Tanguy – Gonzague – Elodie – Antoine – Mickaël – Jérôme – etc!
### Conditions de filtrages

<table>
<thead>
<tr>
<th>Variable</th>
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### Modèle

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1er quartile = 369.91  Médiane = 515.14  3ème quartile = 788.23

### Graphiques

![Graphiques](image-url)
Energy efficiency in industrial processes:
Heat recovery in industrial plants - Innovative technologies
Energy Efficiency in industrial processes: a large potential & 2 main targets

*Industrial plants - Thermal Heat Losses*

**Ex: Year Energy consumption in French industries**

- Natural gas: 46%
- Fuel-oils: 30%
- Coal: 14%
- Biomass: 8%
- Others: 2%

~300 TWh

**Energy recovery resources at high level of temperature**

~100 TWh per year

50 to 60% Average energy efficiency of industrial processes (without Power prod.)

**Energy losses of industrial processes**

~140 TWh

**Energy recovery resources at low level of temperature**

- Gaseous form: 1100°C to 300-250°C
- Liquid and/or Gaseous: 25°C to 250°C

25% to 60% Average energy efficiency of industrial processes (without Power prod.)
Heat recovery from process Heat losses:
2 main Strategies

1- Heat recovery on High temperature heat losses (>250°C)

- Combustion Air pre-heating
- Load pre-heating
- Heat recovery ==> steam networks
- Heat Recovery on process.
  Potential win 10 to 50 %
  Potential win 5 to 20 %
  Potential win 5 %
  Potential win 5 to 15%

2- Heat recovery on low temperature heat losses (50°C à 250°C)

- High temperature Heat Pumps
- Energy Conversion to electricity (ORC, Stirling…)
- Thermo electrical systems
  Potential win 15 to 30 %
  Potential win 15 to 20%
  Potential win 5 to 10%
High Temperature Heat Recovery: Combustion Air Preheating Technology

- Best practices for Energy heat recovery
  - Preheating combustion air with waste gases exhausted
  - Reduction of heat losses by use of oxy-combustion technologies

<table>
<thead>
<tr>
<th>Preheating combustion air</th>
<th>Central Heat exchanger</th>
<th>Self recuperative burner</th>
<th>Regenerative burner</th>
<th>Self regenerative burner</th>
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<tr>
<td>High efficiency of combustion</td>
<td>300-600°C</td>
<td>500-700°C</td>
<td>1000-1200°C</td>
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<td>50-65%</td>
<td>60-70%</td>
<td>75-85%</td>
<td>75-80%</td>
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Example: Heat recovery from DFF steel lines
Implementation of heat recovery boiler in order to produce steam for surface treatment bath

- Innovative approach of heat recovery
  - Energy efficiency audits
  - Detail benchmark of several solutions
  - Compliance with customers needs & regulation
  - New design of furnace OFA system

- After energy audit & specific study, CRIGEN has proposed to implement heat recovery boilers in order to heat surface treatment baths

- Final implementation on ACELORMITTAL Desvres galvanization line

- Technical support during the commissioning

- Results after revamping of the plant:
  - CAPEX: ~ 600 k€
  - 15% reduction of energy consumption
  - 15% reduction of CO2 (2 600 t/an) emissions,
  - ROI ~2 years.
Low Temperature Heat Recovery: two possible ways

**Industrial Heat Pumps**

- Heat transmitted to the hot stream
- Condenser
- Valve
- Heat recovered from waste heat
- Evaporator

**Organic Rankine cycle (ORC)**

- Power (from gas engine or electrical engine)
- Condenser
- Regenerator
- Evaporator
- Power production

**Heat production**

**Power production**

Waste heat
Example: Low temperature Heat recovery by ORC implementation on Cupola furnace-Foundry FMGC France

→ Local production of electricity with fatal energy
→ Internal valorization or on the Electric grid
→ Enhanced ROI
→ Capex (~1400 to 1900€/kW(e))
Valenthin project: A GDF SUEZ R&D project to develop innovative solutions for low temperature heat losses

1st application Case
VALLEE DE LA CHIMIE - LYON

3 topics for these developments:
- Industrial High Temp° Heat Pumps
- Heat Pumps coupling with thermal Storages
- Conversion of heat losses to electricity
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