



NATURAL GAS EUROPE 

ABENGOA

Efficient energy generation in South Stream

Mr. Guillermo Bravo
VP Strategic Relations
Abeinsa

July 11th, 2013

1

Introduction

2

Configurations in generation

3

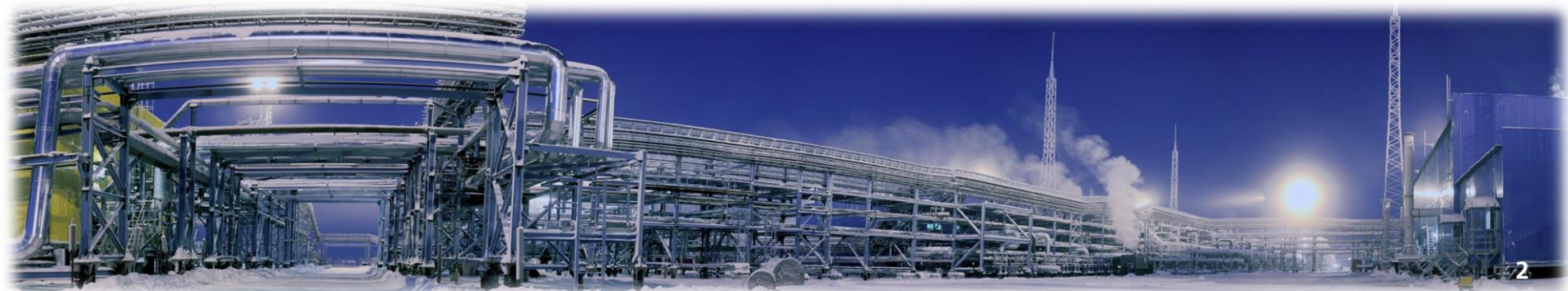
Potential beneficiaries of natural gas

4

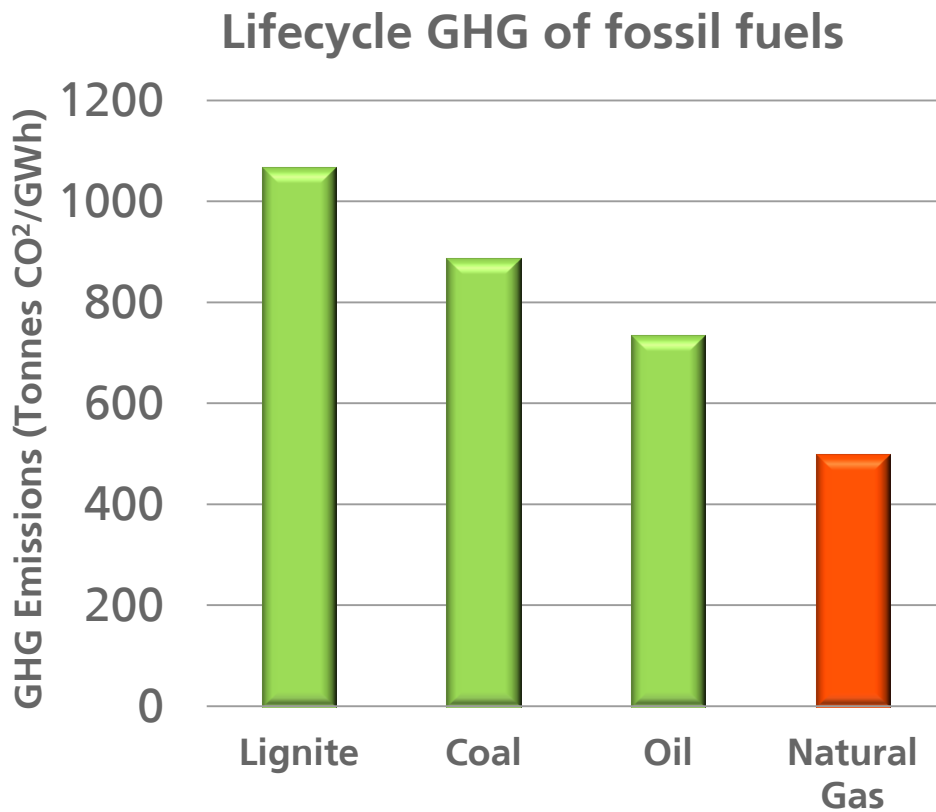
Abengoa experiences

Natural gas has an increasing importance in the energy mix

- ✓ **Gas is the most environment friendly fuel, and it is substituting coal in many countries.**
- ✓ **Gas consumption is increasing for different uses, being electricity generation one of the fastest growing.**
- ✓ **New sources of gas have been discovered (e.g. shale gas, ...), and it is an easily accessible fuel.**



Natural gas has numerous advantages from other sources



Source: Comparison of Lifecycle Greenhouse Gas Emissions of Various Electricity Generation Sources, World Nuclear Association. Nuclear and renewable not included in the graph.

Why natural gas?



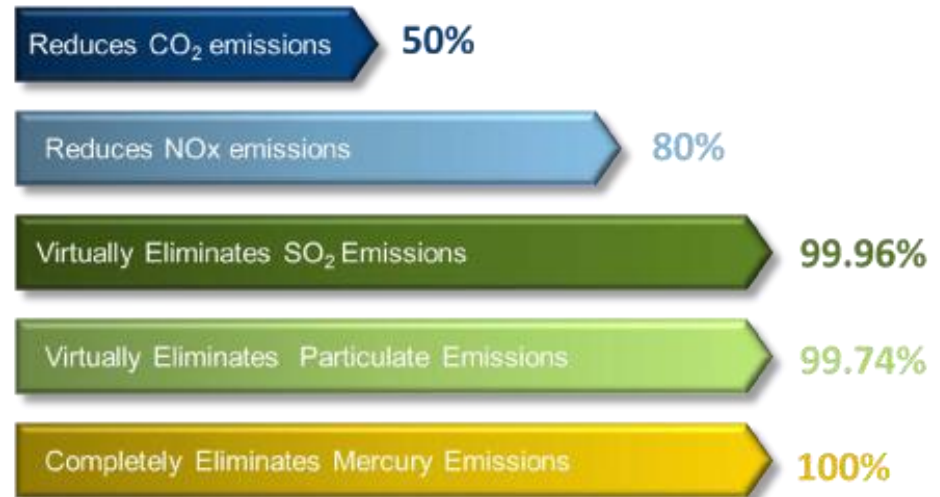
Natural gas burns cleaner than other fuel sources, with less pollutants and no mercury

Emissions Comparison

(Pounds per Billion BTU of Energy Input)

	Natural Gas	Coal
Carbon Dioxide	117,000	208,000
Carbon Monoxide	40	208
Nitrogen Oxides	92	457
Sulfur Dioxide	1	2,591
Particulates	7	2,744
Mercury	0	0,016

Natural Gas = Fewer emissions



Source: Nat Gas 101. American Natural Gas Alliance, 2012.

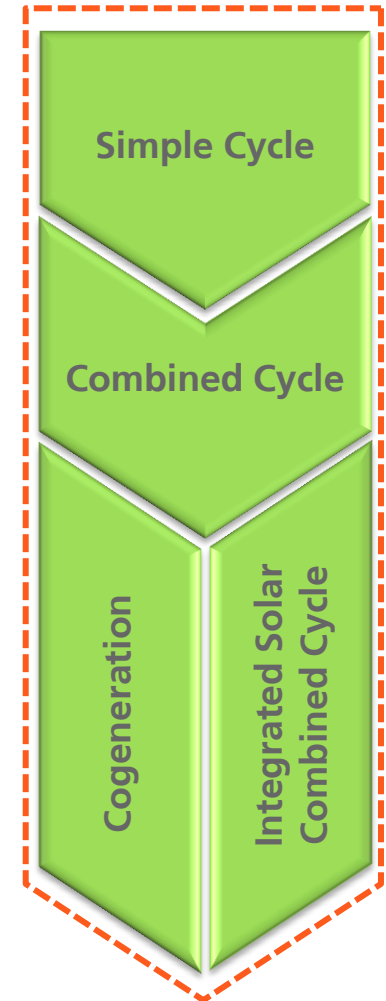
Positive impacts of the South Stream

- ✓ South Stream will strengthen the European energy security.
- ✓ Economic benefits for the countries involved.
- ✓ Natural gas is essential for reaching EU environmental targets.

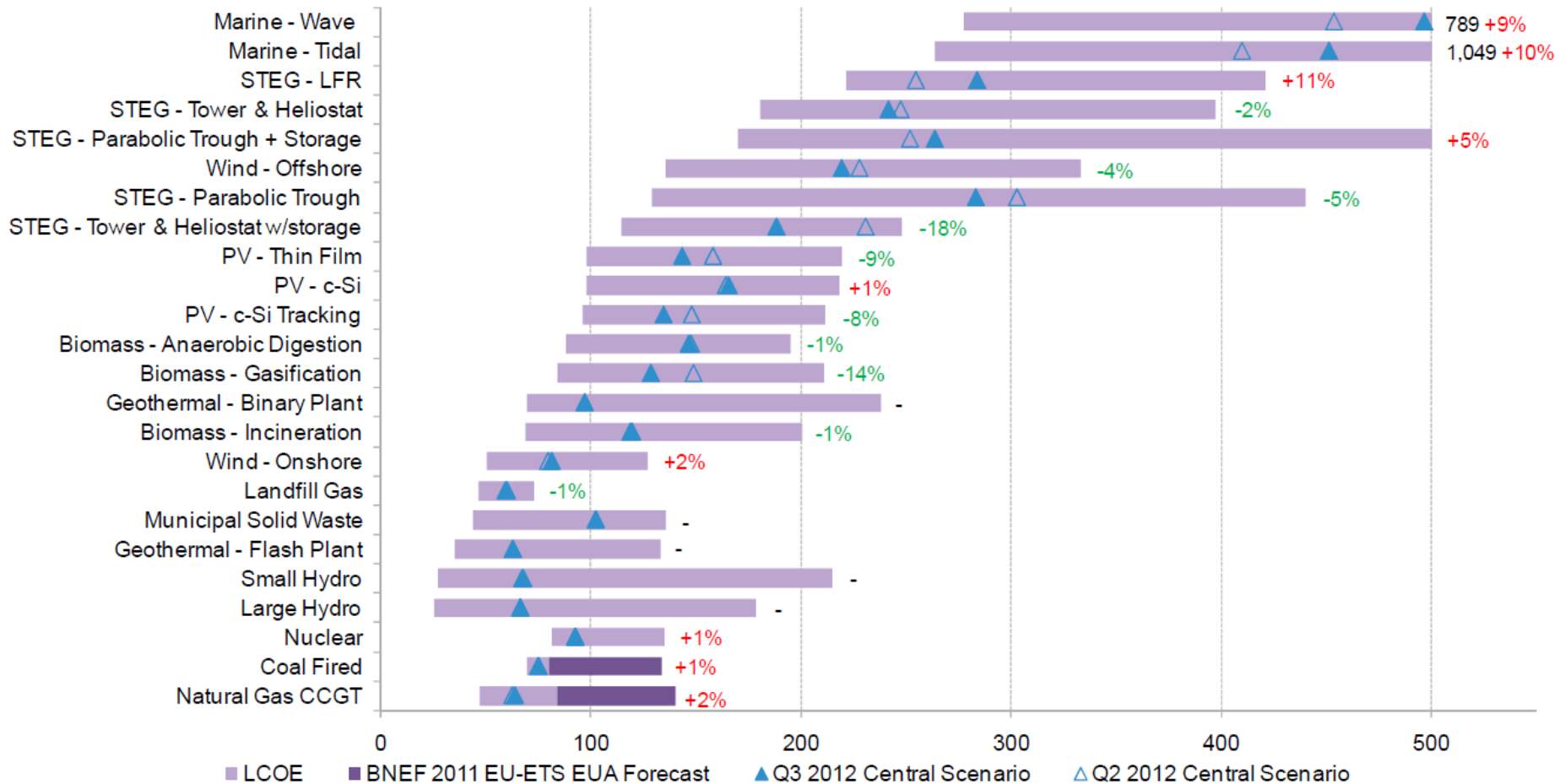


The history of a successful evolution...

- ✓ Energy markets liberalization.
- ✓ Climate Change - Environmental impacts.
- ✓ Modernization and structural changes in electricity generation.
- ✓ Efficiency improvements (EU directives).
- ✓ Development of new technologies/configurations.
- ✓ New players coming to the generation market (gas distributors, industrial companies and power & heat distributors).



Natural Gas is one of the most competitive technologies in terms of cost (\$/MWh)



Simple Cycle

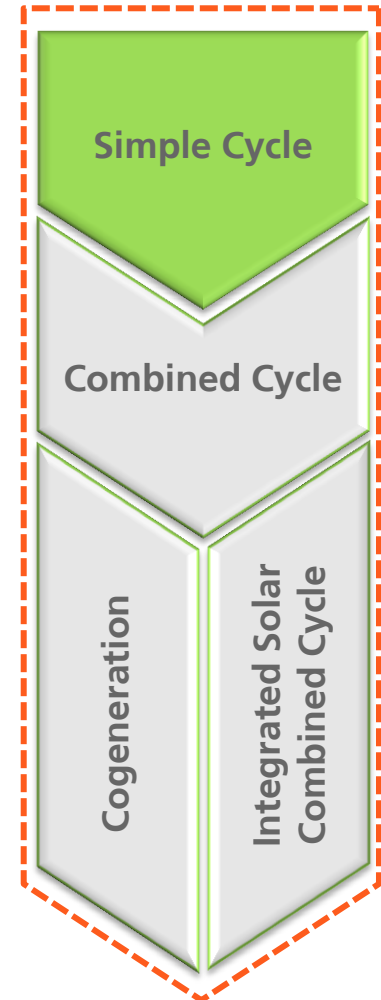
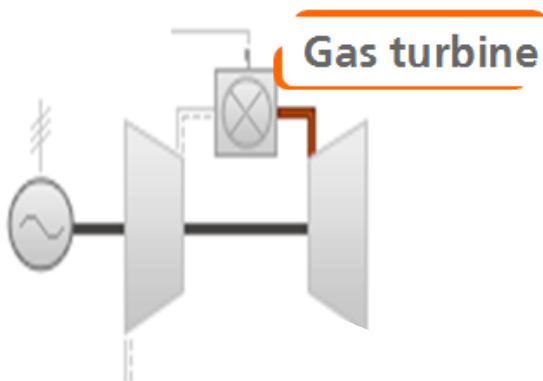
- The simplest configuration to produce energy from gas. Electricity generation using a single gas turbine.

Production of : Electricity

Average Performance Data:

- **Power range:** 1 – 375 MWe
- **Efficiency:** up to 45%
- **Performance:** 91 – 93 %
- **Availability:** 84 – 98 %
- **Reliability:** 96 – 99 %
- **Average construction time:** 22 – 27 months

Diagram:

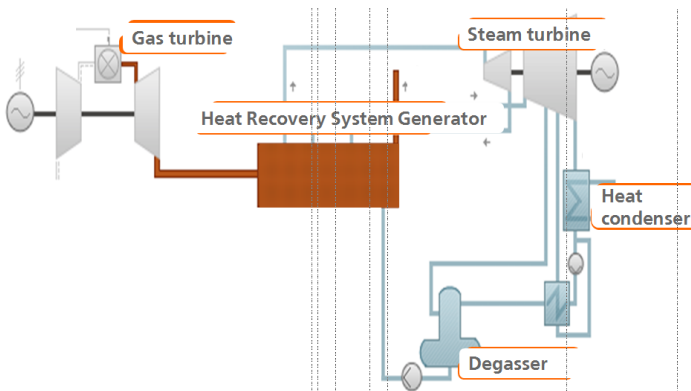


Combined Cycle

- An optimal configuration to produce more electricity with a reduced consumption of gas. Electricity is generated from the Gas Turbine plus generation from a Steam Turbine (using exhaust from the TG).

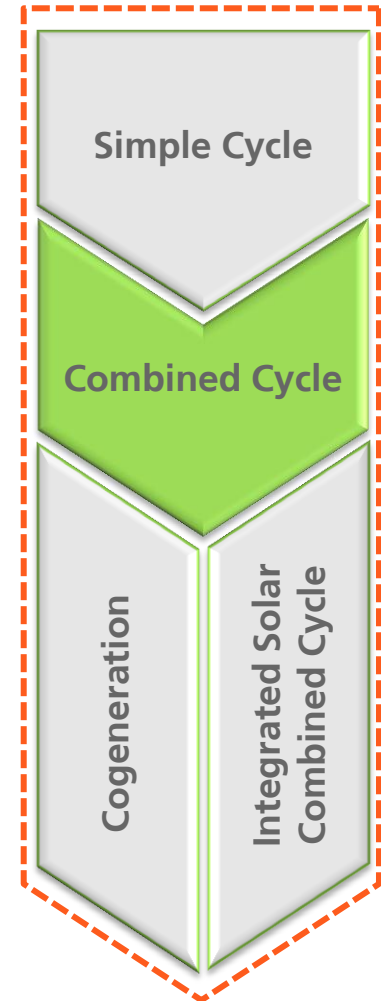
Production of: Electricity (and partially Steam).

Diagram:



Average Performance Data:

- **Power range:** 1 – 2,000 MWe
- **Efficiency:** up to 65 %
- **Performance:** 91 – 93 %
- **Availability:** 84 - 90%
- **Reliability:** 94 - 96%
- **Average construction time:** 28 - 32 months.
- **Increase from 45 % to 65 % of efficiency from Simple Cycle to Combined Cycle.**

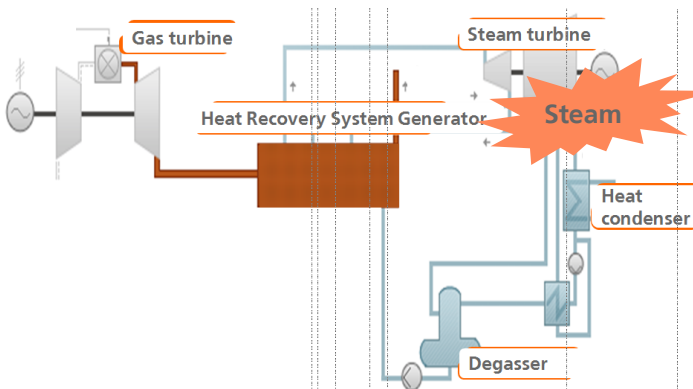


Cogeneration

- Similar configuration of a Simple Cycle, adding production of Steam to be used in industrial processes (Industries, District heating,...)

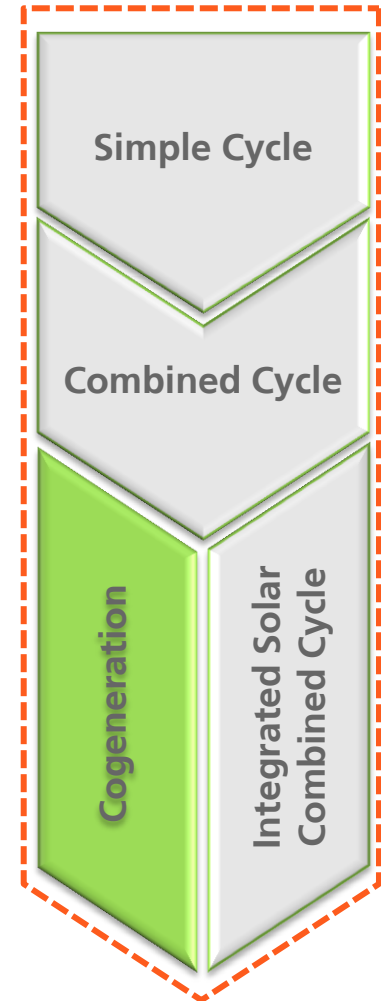
Production of : Electricity and Steam (both to be consumed in the specific industrial premise where constructed).

Diagram:



Average Performance Data:

- **Power range:** 1 – 2,000 MWe
- **Efficiency:** up to 80%
- **Performance:** 91 – 93 %
- **Availability:** 84 – 98 %
- **Reliability:** 96 – 99 %
- **Average construction time:** 28 – 32 months.
- **Increase from 65 % to 80 % of efficiency from Combined Cycle to Cogeneration.**

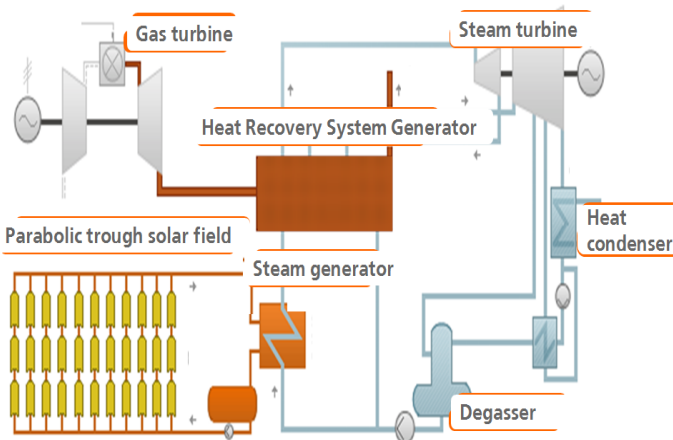


Integrated Solar and Combined Cycle

- Hybrid configuration using thermal-solar and gas energy. It reduces the gas consumption for a similar electricity and steam production.

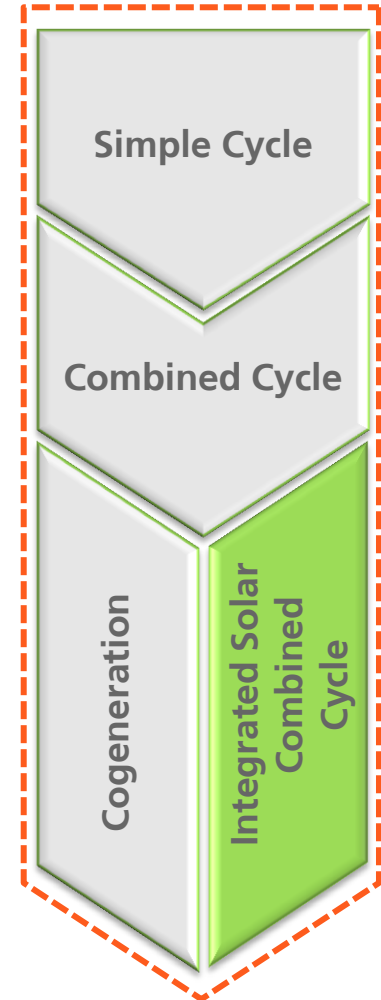
Production of : Electricity and Steam.

Diagram:



Average Performance Data:

- **Power range:** 1 – 1,000 MWe
- **Efficiency:** up to 70%
- **Performance:** 91 – 93 %
- **Availability:** 84 – 98 %
- **Reliability:** 96 – 99 %
- **Average construction time:** 28 – 32 months.
- **Solar contribution up to 20 %**



There are clear beneficiaries for Natural Gas

Power and/or heating distributors

- ✓ Shorter construction periods
- ✓ Energy mix: flexibility in production
- ✓ Lower cost per installed MW
- ✓ Efficiency, environmental impact, ...

Gas distributors

- ✓ Added value to their core business
- ✓ Additional services to their costumers
- ✓ New business in a growing sector

Industry

- ✓ Intensive electricity consumers (refineries, mining, steel, desalination, ...)
- ✓ Own facilities, reliability and availability
- ✓ Additional services: steam & power

End users

- ✓ Improvement in energy supply
- ✓ Lower electricity costs
- ✓ Additional gas uses for heating and cooking

Stalowa Wola

Largest CCGT plant in Poland

- **Description:**
 - 450 MW with 270 MW thermal for District Heating
- **Location:** Poland
- **Client:** Elektrociepłownia Stalowa Wola
- **Status:** under construction



Key facts

- ✓ **Developer:** Tauron (electricity company) + PGNIG (gas distributor)
- ✓ **District heating plant:** the first facility using NG to provide power and heating for a city in Poland.
- ✓ **One of the relevant projects to substitute coal-fuel to gas-fuel in Poland.**
- ✓ **Adaptation to the EU directives.**

Nuevo Pemex

1st cogeneration in Pemex

- **Description:**
 - 300 MW cogeneration plant
- **Location:** Mexico
- **Client:** Petróleos Mexicanos (PEMEX)
- **Status:** under construction



Key facts

- ✓ **Developer:** Abengoa + GE
- ✓ **Construction company:** Abengoa
- ✓ **Cogeneration Plant:** Installed in a Pemex refinery using the full production of electricity and steam for the operation of the refinery, improving the availability, reliability and cost of the services.
- ✓ **Final customer:** Pemex (Mexican oil & gas company)

ISCC Hassi R'Mel

First IPP* hybrid solar-gas plant

- **Description**
 - 150 MW (20 MW from solar field)
- **Location:** Algeria
- **Client:** New Energy Algeria (NEAL), Sonatrach and Cofides
- **Status:** in operation since 2011



Key facts

- ✓ **Developer:** Abengoa + Neal (Sonatrach)
- ✓ **Construction company:** Abengoa
- ✓ **Final customer:** Sonelgaz
- ✓ **The installed capacity of renewable energy is 15% out of total, however the requirement of renewable energy production is 5% and the energy produced over this value will have a bonus.**