Feasibility Studies with the Aim of Developing a Bilateral Offset Credit Mechanism FY2011

Studies for Project Exploration and Planning

Gas turbine cogeneration system for factories in Republic of South Africa

New Energy and Industrial Technology Development Organization (NEDO)
Hitachi, Ltd.

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Gas turbine cogeneration system for factories in Republic of South Africa

February, 2012

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Outline

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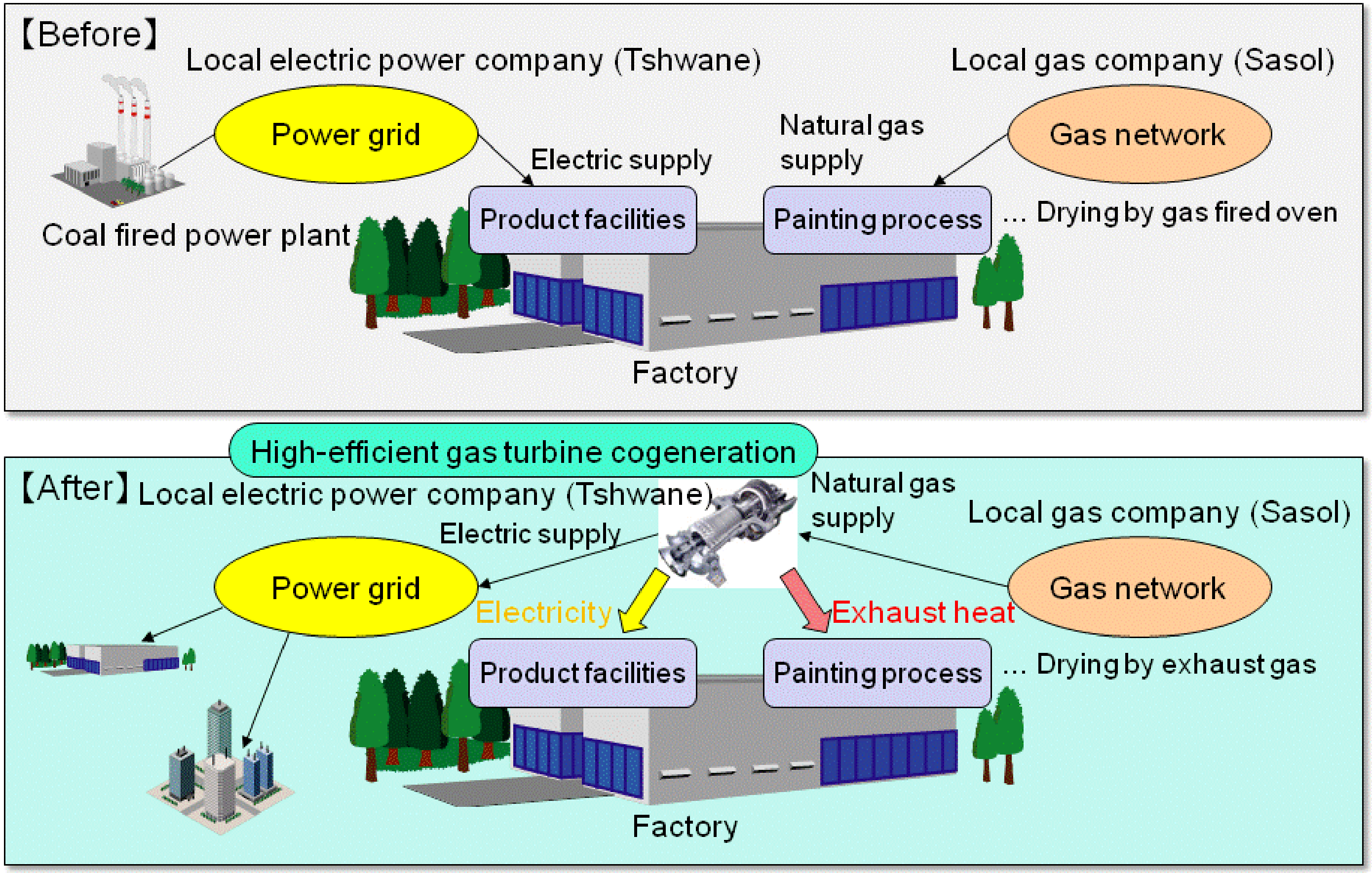
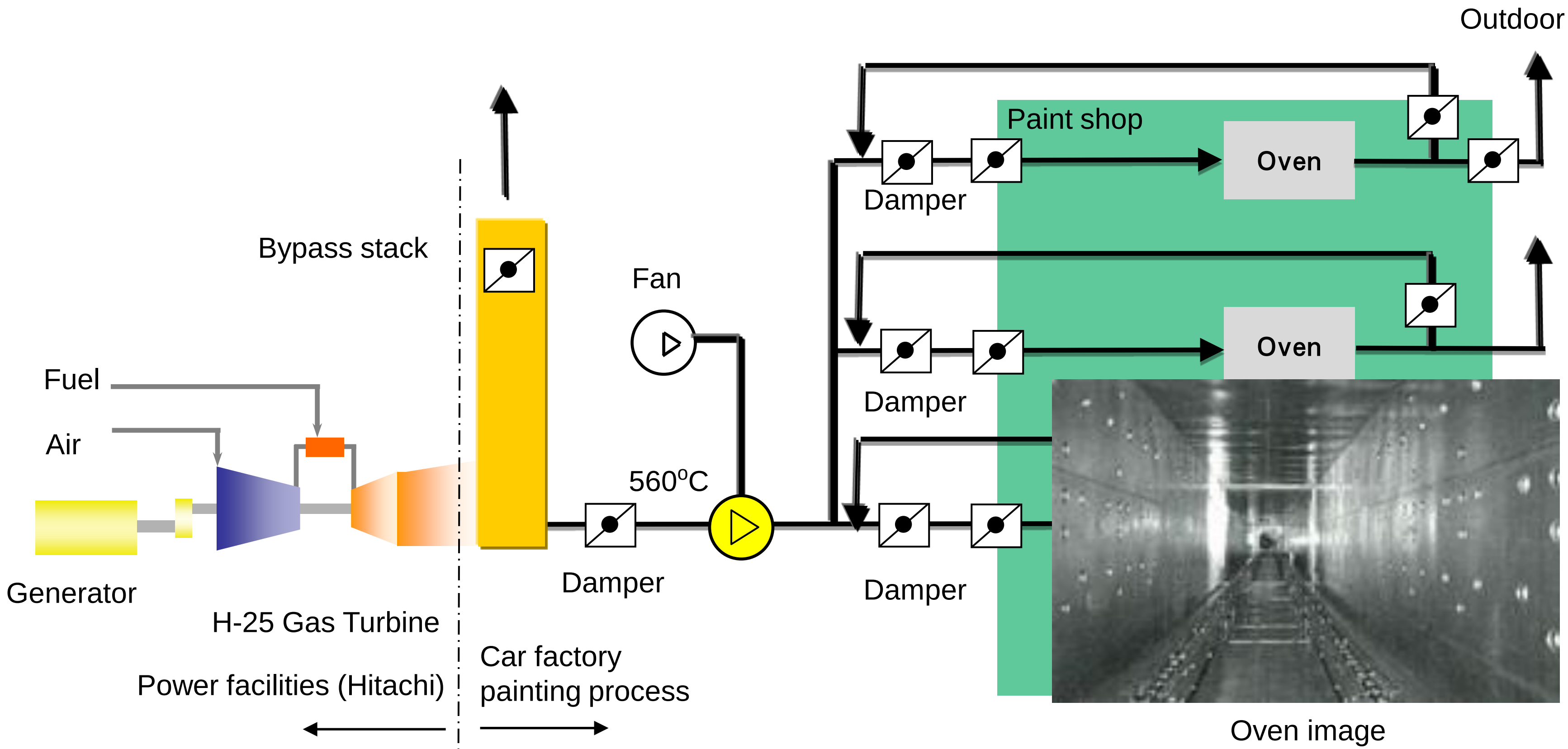
- Install high efficiency gas turbine cogeneration systems to the automotive industry in South Africa
- Contribute to the green house gas reduction by saving energy at factories



System Image

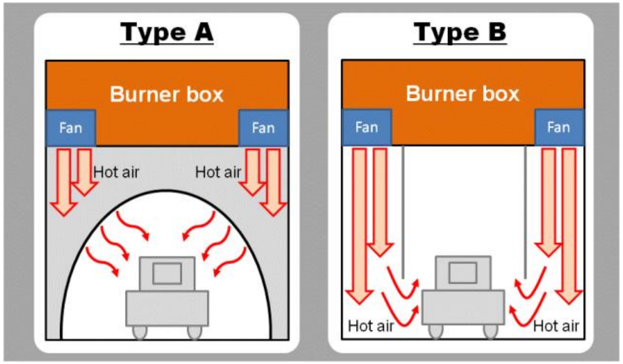


Oven image

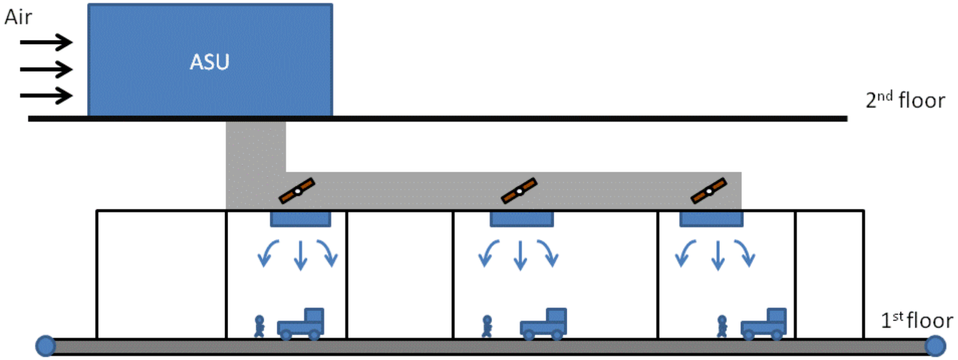
CO_2 reduction potential

Specification of the facilities in automobile factory

- Image of Ovens and ASU (Air Supply Unit)



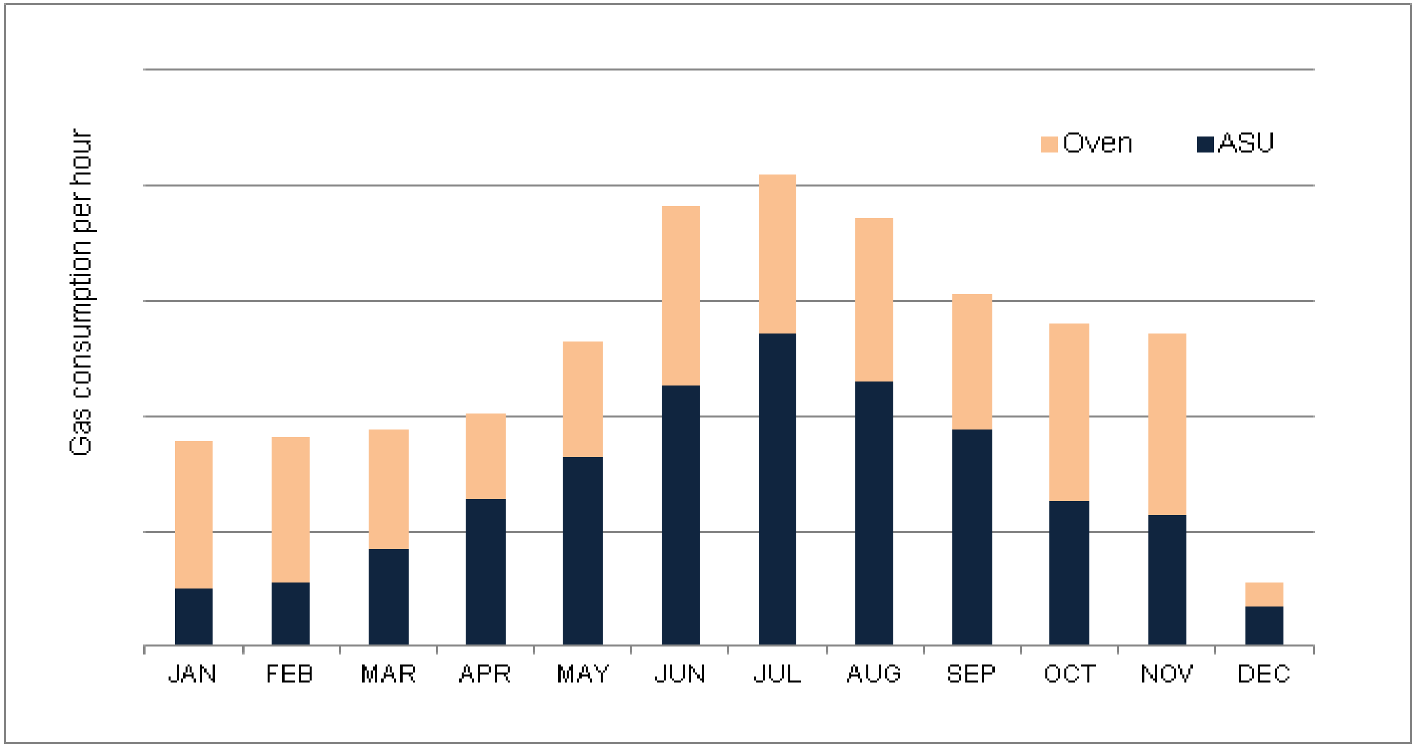
Oven



ASU

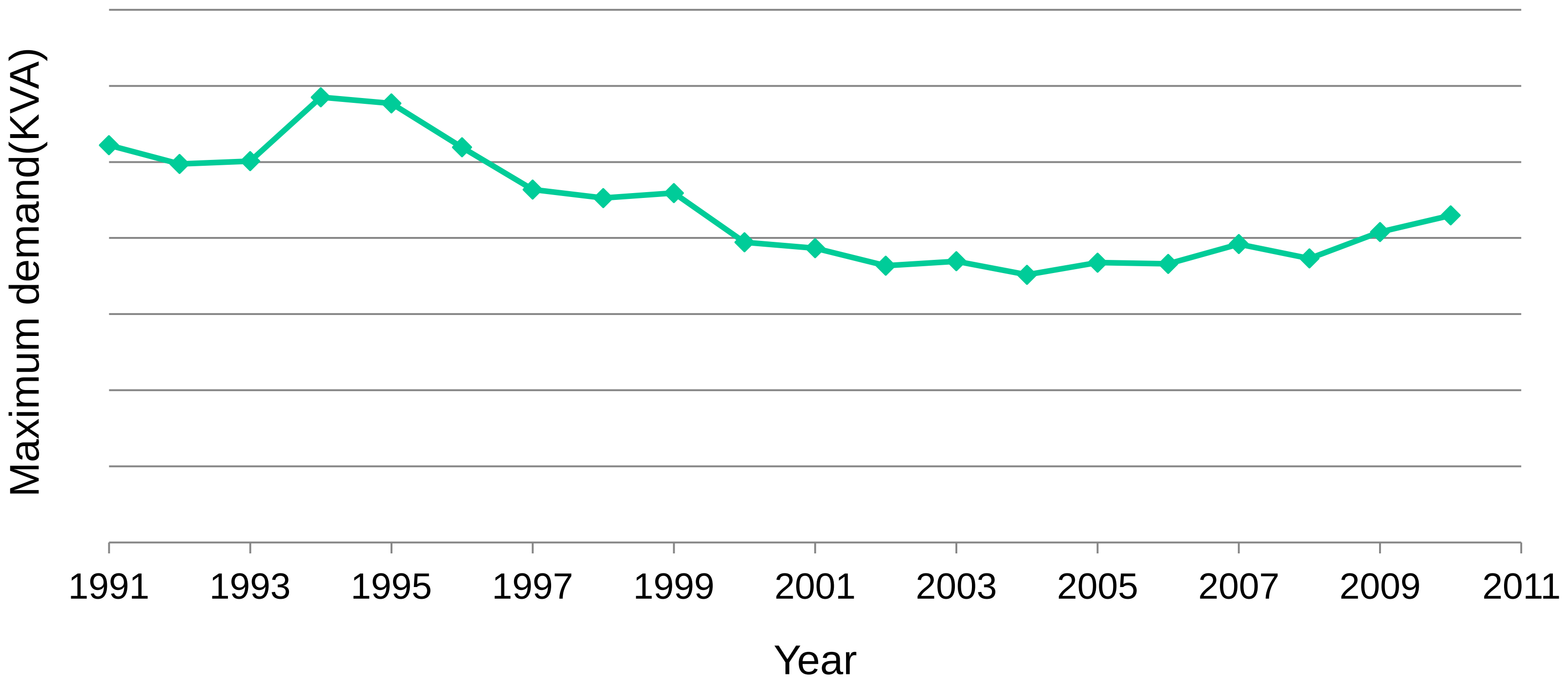
CO_2 reduction potential

Natural Gas Demand



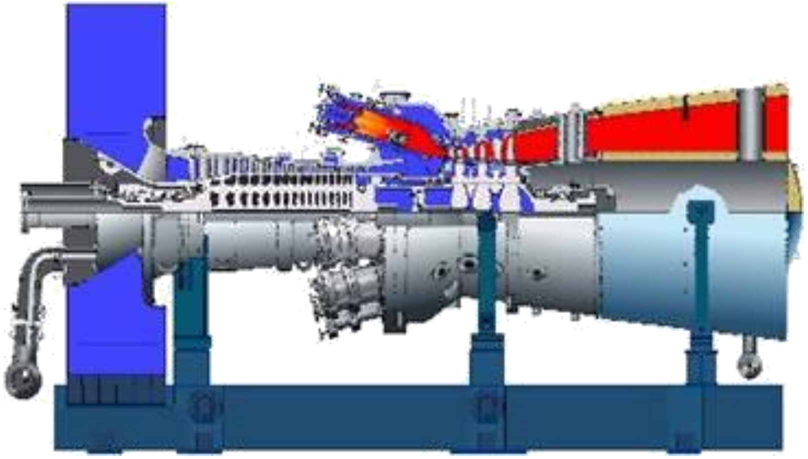
CO_2 reduction potential

Electricity Demand



Cogeneration System

Gas Turbine Image



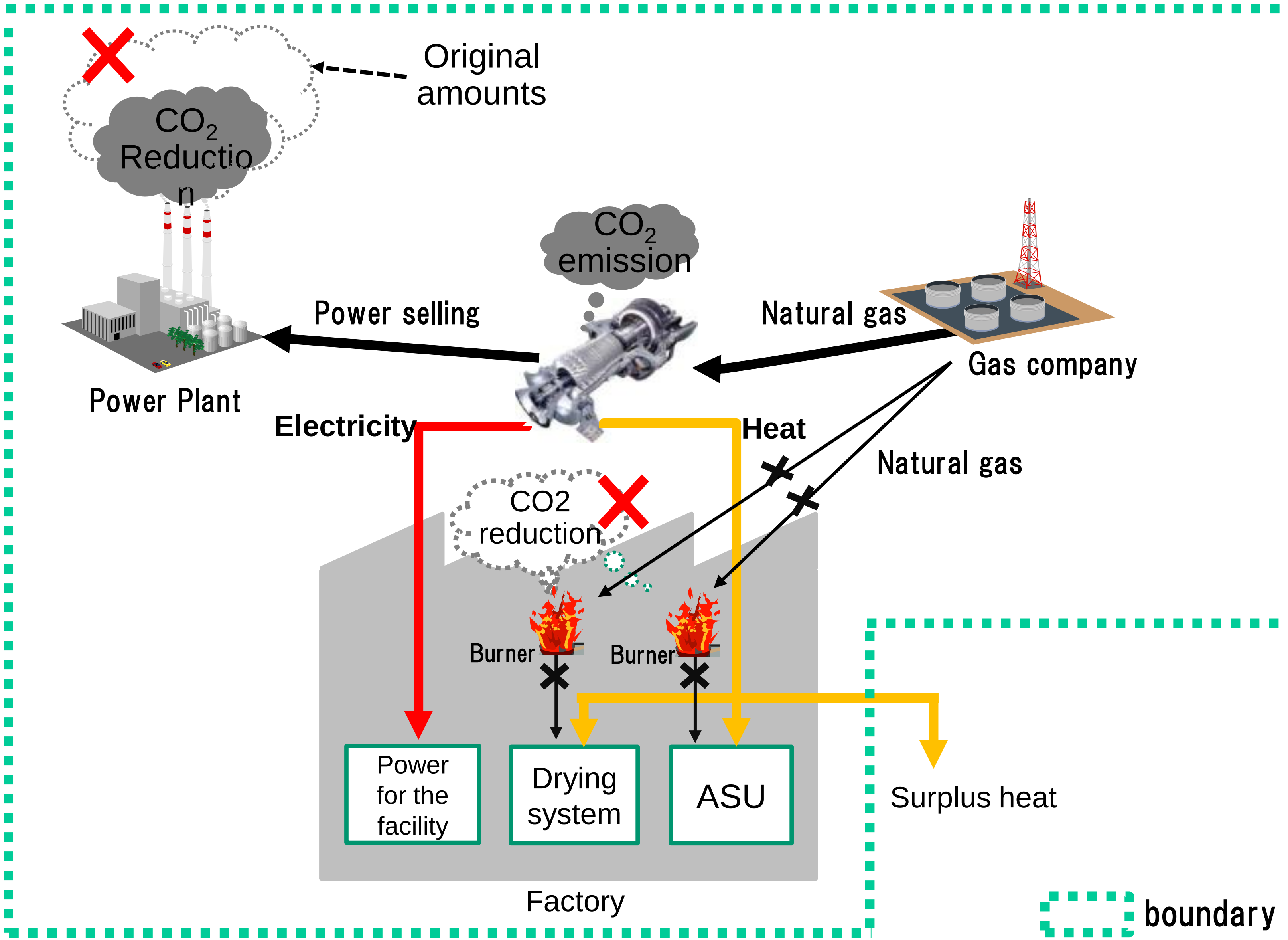
Inside Cut Model

Completion Image

Project outline and eligibility for MRV

“Installation of cogeneration system”	
Project outline	The project is CO_2 reduction project with installing or replacing of cogeneration system operation and satisfied all eligibility.
Eligibility	Condition1: Install cogeneration equipment and replace heat supply from existing heat supply equipment.
	Condition2: Heats (exclude unutilized energy) from cogeneration system such as exhaust heat, steam, etc. should be used own facility or supplied nearby facilities.
	Condition3: Generated electricity should be used for own facility. However, surplus electricity can be sold to the grid.
	Condition4: Demonstrate additional by investment analysis or common practice analysis

MRV boundary



Calculation of CO_2 emission reduction

<Emission reductions>

$$ER_y = BE_y - PE_y$$

ER_y Emission reductions during the year y[t-CO_2/year]
BE_y Baseline emissions during the year y[t-CO_2/year]
PE_y Project emissions during the year y[t-CO_2/year]

<Prject emissions>

$$PE_{PJ,y} = FC_{PJ,y} \times CV_{PJ,y} \times EF_{PJ,y}$$

$PE_{PJ,y}$ Project emissions during the year y [t-CO_2/year]
$FC_{PJ,y}$ Quantity of project flue combusted during the year y [m^3/year]
$CV_{PJ,y}$ Net calorific value of the project fuel combusted during the year y [GJ/m^3]
$EF_{PJ,y}$ CO_2 emission factor of the project flue combusted in the year y [t-CO_2/GJ]

<Base line emissions>

$$BE_y = BE_{heat,y} + BE_{elec,y}$$

BE_y Baseline emissions during the year y[t-CO_2/year]
$BE_{heat,y}$ Baseline heat emissions during the year y [t-CO_2/year]
$BE_{elec,y}$ Baseline emissions from electricity generation during the year y [t-CO_2/year]

Calculation of CO_2 emission reduction

(a) Baseline heat emissions

(i) Calculation from the efficiency of the equipment

$$BE_{heat,y} = HG_{PJ,y} \times \frac{100}{\eta_{BL}} \times EF_{BL,y}$$

$BE_{heat,y}$ Baseline heat emissions during the year y [t-CO_2/year]
$HG_{PJ,y}$ Utilized waste heat amounts which supplied from cogeneration equipment during the year y [GJ/year]
η_{BL} Energy efficiency of heat supply equipment in the baseline [%]
$EF_{BL,y}$ CO_2 emission factor of a fuel which is used for the equipment in the baseline [t-CO_2/GJ]

(ii) Calculation from Quantity of production(if heats are used all over the plant)

$$BE_{heat,y} = PD_{PJ,y} \times FC_{BL/Pr,y} \times FC_{BL,y} \times EF_{BL,y}$$

$BE_{heat,y}$ Baseline heat emissions during the year y [t-CO_2/year]
$PD_{PJ,y}$ Quantity of production in the project activity during the year y [units/year, t/year]
$FC_{BL/Pr,y}$ Unit fuel consumption of a product in the baseline [m^3/t or unit]
$FC_{BL,y}$ Net calorific value of the fuel in the baseline [GJ/m^3]
$EF_{BL,y}$ CO_2 emission factor of a fuel which is used for the equipment in the baseline [t-CO_2/GJ]

Calculation of CO_2 emission reduction

(b) Baseline electricity emissions

$$BE_{elec,y} = EL_{PJ,y} + EF_{BL,y}$$

$BE_{elec,y}$ Baseline emissions from electricity generation during the year y [t-CO_2/year]

$EL_{PJ,y}$ Baseline emissions during the year y [t-CO_2/year]

$EF_{BL,y}$ Baseline emissions from electricity generation during the year y [t-CO_2/year]

Monitoring data / parameter (Reference)

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<Activity amounts>

Data/Parameter	$HG_{PJ,y}$: Utilized waste heat amounts which supplied from cogeneration equipment during the year y [GJ/year]
Measurement Procedures	・measure heat use by measuring instruments(e.g. flow meter, thermometer) ・Calculate from measured data(exhaust gas flow rate, temperature, etc.) ・Calculate from waste heat recovery efficiency of cogeneration equipment
Monitoring frequency	Continuously (during operation)

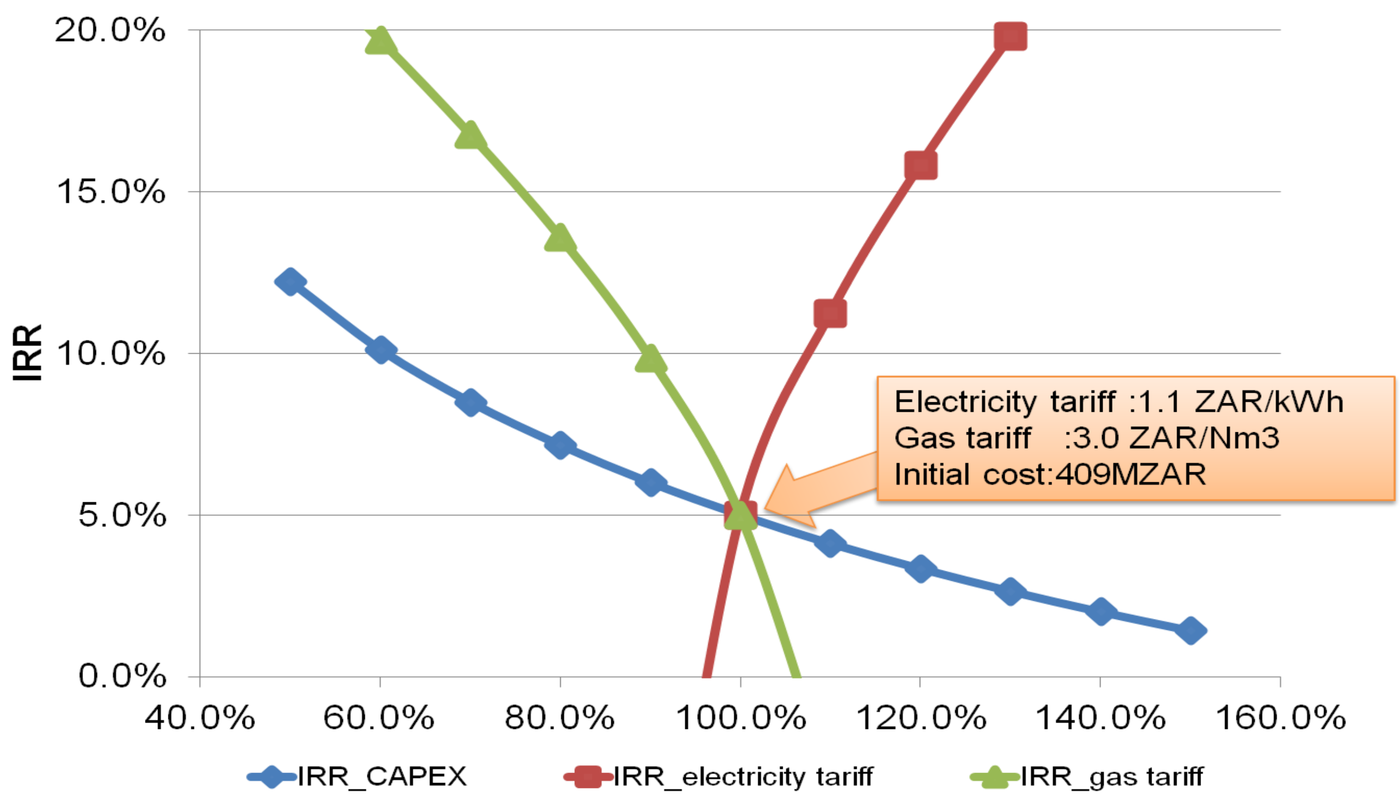
<Fossil fuel consumption>

Data/Parameter	$FC_{Pj,y}$: Quantity of project flue combusted during the year y [m3/year]
Measurement procedures	Measure by measuring instruments. Use purchase slip
Monitoring frequency	On a voluntary basis

Project evaluation

■Electricity tariff and gas tariff is highly affected to the IRR

■Carbon credits would contribute to the project IRR



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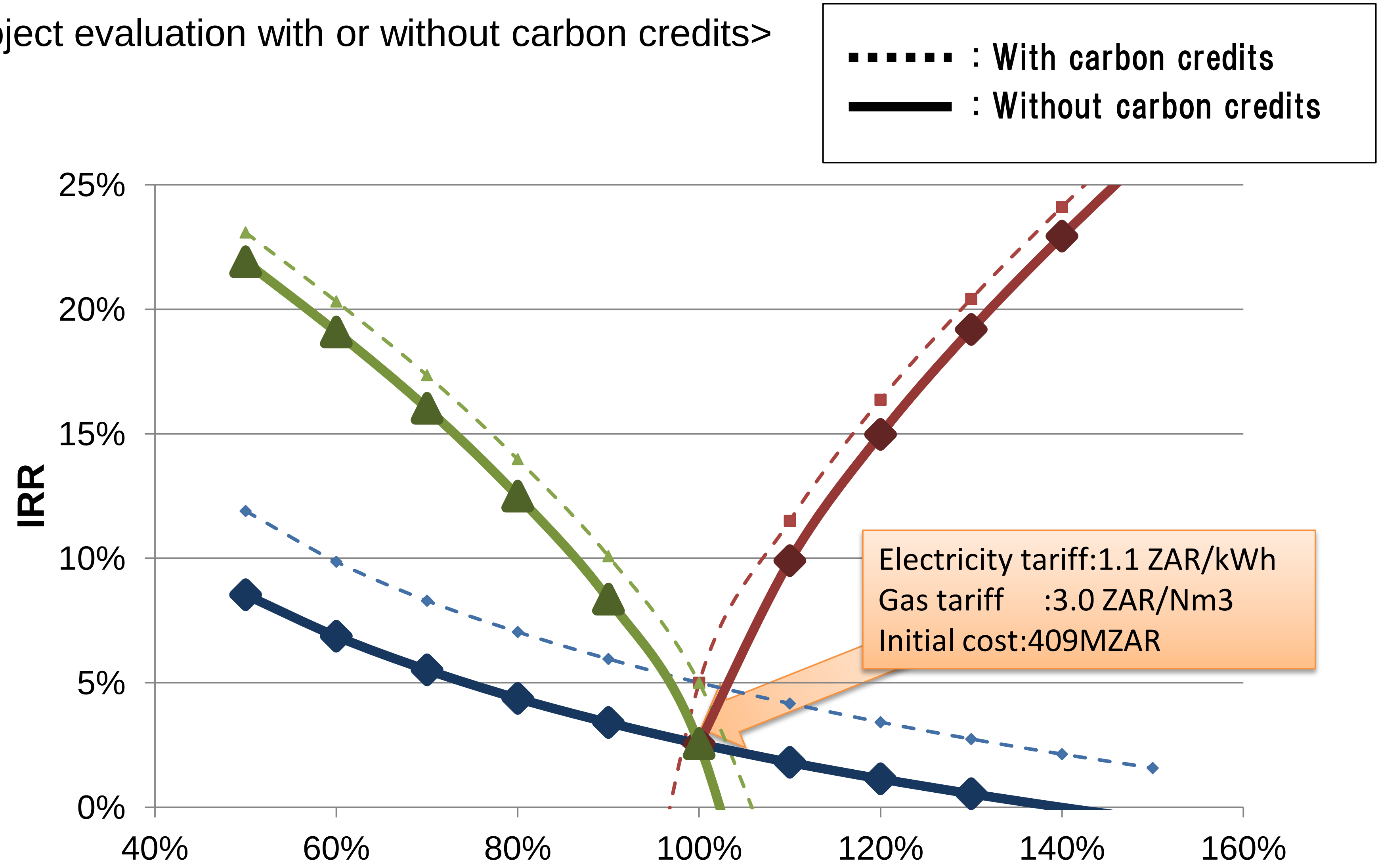
<Project evaluation with or without carbon credits>



Conclusion

- Installation image of cogeneration plant is designed in car factory
- CO_2 reduction is calculated 86,000 t/year for installation of cogeneration plant
- Electricity tariff and fuel price are strong impact parameter for feasibility of the project
- Bilateral offset credit can support the realization of the project