



24<sup>th</sup> World Gas Conference  
ARGENTINA | 2009  
5-9 October

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ARGENTINA 2009

The Global Energy Challenge:  
Reviewing the Strategies  
for Natural Gas

# WOC 5.1: Industrial Utilisation

## CHP - Sharing on Gas District Cooling (GDC) in Malaysia

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One of the energy solutions using natural gas is CHP

## What is CHP ?

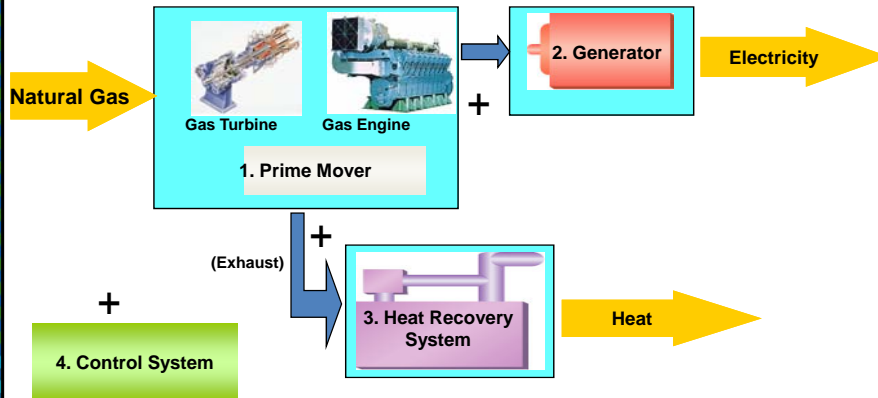
Combined Heat & Power (CHP)

**CHP or Co-generation** is a *simultaneous* production of electricity and usable thermal energy from a single fuel source.

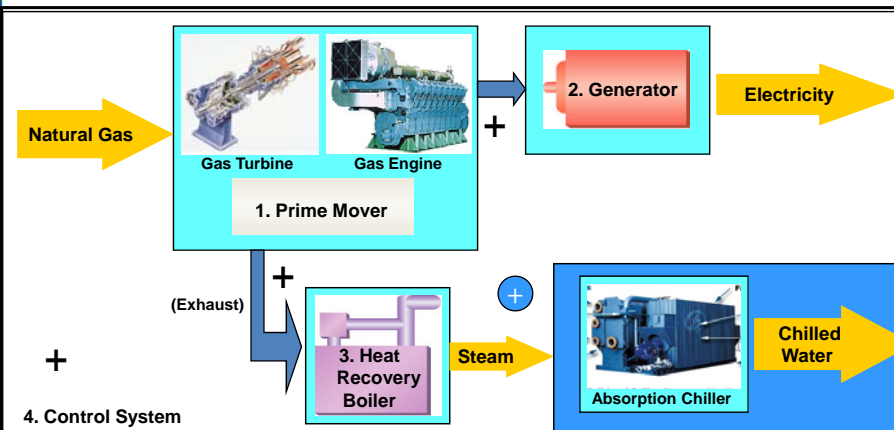


### CHP Plant consists of 4 basic elements

1. A Prime Mover (Engine).
2. An Electricity Generator.
3. A Heat Recovery System.
4. A Control System.



### For tropical climate countries, recovered waste heat is use to generate steam to drive steam turbine chiller for the production of chilled water



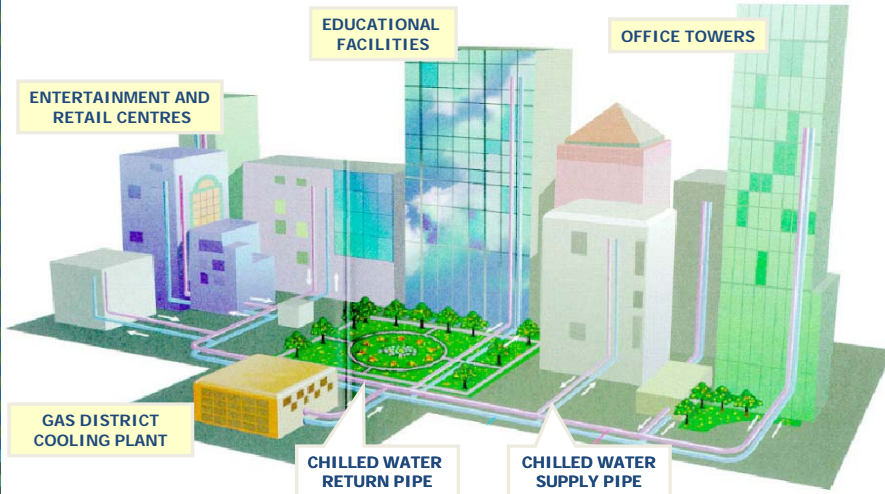


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### Typical layout of Gas District Cooling System

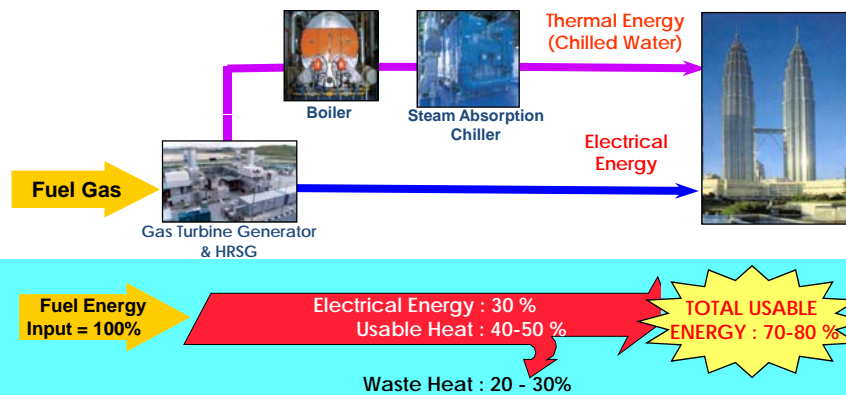


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### Joint energy production efficiency of a GDC Plant with co-generation can reach 70% to 80%



Note: Typically, the efficiency of a power plant is only 30 – 60 % (depending on the type of power plant)



### Advantages of GDC/Co-generation System (1/2)

- ☑ **Savings in Capital Investment to Building Owners**
  - Save on cost for chillers and cooling towers
  - Minimise number of spare equipment
  - Size of electrical system can also be reduced
- ☑ **Savings in operating cost to Building Owners**
  - Save on operating and maintenance cost, through reduced electricity and manpower costs
- ☑ **Higher Energy Efficiency**
  - Cogeneration system efficiency of up to 80% against about 60% for conventional combine-cycle power plant
- ☑ **Higher System Reliability**
  - Higher degree of reliable power and chilled water supply as two power supply sources are available; internal generation and back up from power grid



### Advantages of GDC/Co-generation System (2/2)

- ☑ **Environmental Friendly**
  - Clean natural gas as fuel, thereby minimising SO<sub>x</sub> and NO<sub>x</sub> emission
  - Absorption chillers uses non-CFC based refrigerant
- ☑ **Optimisation of building space by building owners**
  - Alternative use for plant space to generate more revenue, either rent or sell
- ☑ **Enhanced building aesthetics**
  - Wider choice for building design, could enhance property value





### Examples of system application in Malaysia

Project	Customer Type	Capacity
GDC Kuala Lumpur City Centre	Offices, Hotel, Retails, Convention Center, Apartments	30,000 RT 28.6 MW
GDC Kuala Lumpur International Airport	Airport	30,000 RT 40 MW
GDC Putrajaya (1-4)	Government Administration Center	33,000 RT (Total)
GDC Universiti Teknologi PETRONAS	University	7,000 RT 11 MW



### EXAMPLES OF SYSTEM APPLICATION

PROJECT	LOCATION	COOLING CAPACITY (RT)
New Shinjuku Metropolitan District	Tokyo	59,000
New Makuhari Metropolitan District	Tokyo	28,000
Shibaura Metropolitan District	Tokyo	10,200
Kansai International Airport	Osaka	30,000
John F. Kennedy International Airport	New York	28,000
New Tokyo International Airport	Narita	33,000
Denver International Airport	Colorado	12,450
Kuala Lumpur International Airport	Kuala Lumpur	30,000
Kuala Lumpur City Centre	Kuala Lumpur	30,000



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*Thank You*



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**Back up slides**



## Gas Engine - CHP Application in the industry for power & steam



### INFORMATION

Capacity : 2.13 MW and 1.5 t/hr steam @10 bar.g.

Model: 2 x 1065 kW – V 20 GE Jenbacher Gas Engine with steam recovery.

Gas Consumption : 480 Sm<sup>3</sup>/ hour.

Application : To provide electricity and steam for process requirement.



## Absorption Chiller

Parameter	Value
NG Consumption	0.28 Sm <sup>3</sup> /hr/ RT*
Turndown ratio	10 - 100 %
Range per unit	5 – 2500 RT

### INFORMATION

Gas Consumption : 222.1 Sm<sup>3</sup>/ hour

Electrical Consumption : 12 kW/ hour

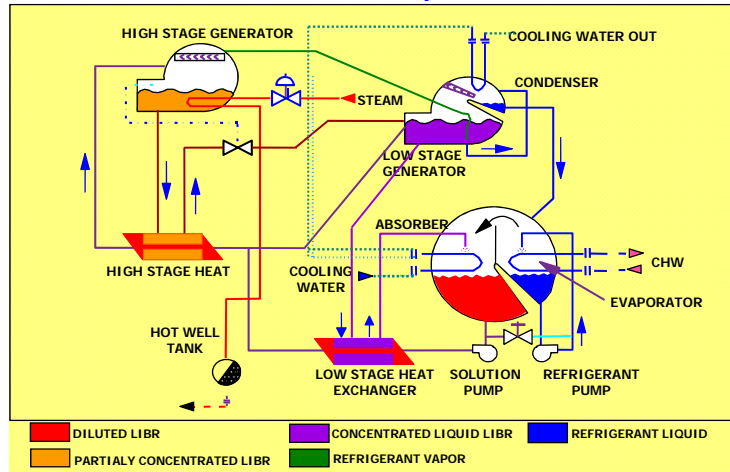
Application : To provide chilled water supply for manufacturing process

Note :  
\* RT = Refrigeration Ton  
1 RT = 3024 kcal/hr  
1 RT = 1.2 hp

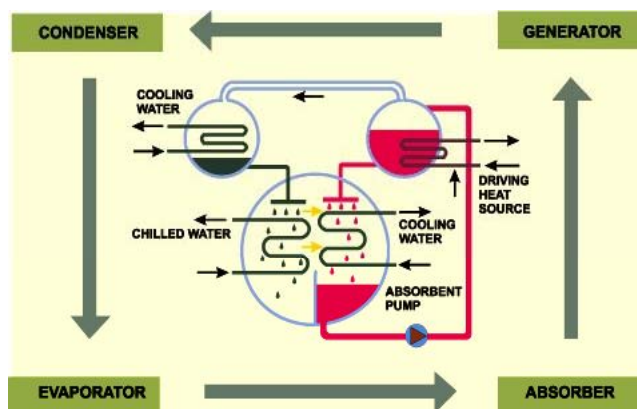




### Process flow for steam absorption chiller



### Absorption Chillers – Technology



**Absorbent:**  
Lithium Bromide

**Refrigerant:**  
Water





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## Absorption Chillers – Technology

- Suitable for industry, hotels and commercial complex.
- Operates on low pressure fuel  $\sim < 1$  psig.
- Weighs about 40 kg / RT (heavy) but minimal vibration.
- Operates using low pressure steam/hot water/gas-fired/hot air (exhaust).
- Use minimal electricity.
- Capital is about RM 1100 per Refrigerant Ton (RT).



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## Absorption Chillers - Application in the manufacturing process



### INFORMATION

Gas Consumption : 222.1 Sm<sup>3</sup>/ hour

Electrical Consumption : 12 kW/ hour

Application : To provide chilled water supply for  
manufacturing process



## Economic Analysis Gas Absorption Chiller

Utility	Generation (RT)	Operational Cost (RM/year)	Investment (RM)
Direct Fired Absorption Chiller	1,000	936,837	1,100,000
Centrifugal Chiller	1,000	1,162,480	900,000
Net Investment			200,000
Saving	-	225,643	
Payback Period	-	0.89	



## Government Incentives (1/2)

**Companies which incur capital expenditure for conserving energy for own consumption:**

1. Import duty and sales tax exemption for equipment used in energy conservation, which are not produced locally. Equipment purchased from local manufacturers is given sales tax exemption.
2. Investment Tax Allowance of 100% on the qualifying capital expenditure incurred within a period of 5 years with the allowance to be set-off against 100% of statutory income for each year of assessment
3. Effective for applications received by Malaysian Industrial Development Authority (MIDA) from 8 September 2007 until 31 December 2010



## Government Incentives (2/2)

### Companies Providing Energy Conservation Services:

1. Import duty and sales tax exemption for equipment used in energy conservation, which are not produced locally. Equipment purchased from local manufacturers is given sales tax exemption
2. Investment Tax Allowance of 100% on the qualifying capital expenditure incurred within a period of 5 years with the allowance to be set-off against 100% of statutory income for each year of assessment or; Pioneer status with tax exemption of 100% of statutory income for 10 years
3. The ESCO's company required to implement the project within one year from the date of approval and the incentive has been extended until 31 December 2010