ASIA-PACIFIC ECONOMIC COOPERATION (APEC) 
EGNRET 52 Meeting

Waste to Energy in Urbanized Cities

Date: 21 March 2019
First Landfill Gas CHP System in HK Hospital
(Renewable Gas Application)
Our Vision:
To be Asia’s leading clean energy supplier and quality service provider, with a focus on innovation and environmental-friendliness.

願景
以創新和環境保護為本，致力發展成為亞洲首屈一指的潔淨能源供應商及優質服務商

Our Mission:
To provide our customers with a safe, reliable supply of energy and the caring, competent and efficient service they expect, while working to preserve, protect and improve our environment.

使命
為客戶供應安全可靠的能源，並提供親切、專業和高效率的服務，同時致力保護及改善環境
The Hong Kong & China Gas Co. Ltd

Based in HK since 1862

Business in HK:

- 3600 km Gas supply network
- 1.9 M Customer base
- 99.99% Uninterrupted gas supply
- 275,000 Appliances sold per year
The Hong Kong & China Gas Co. Ltd

Extend business to China since 1994

Business in China:

- 256 projects in 26 provinces
- 50,000 Staffs in HK & Mainland
- 3 natural gas filling stations
- 10 Distributed energy projects
- 15 Other businesses
- 143 piped city-gas & midstream projects
- 65 new energy exploration & utilization
- 7 water supply & wastewater treatment
- Tele-communication

Hong Kong, China
Hospital Authority

Since 1990

Caring for our community’s health:

43 Hospitals & institutions
122 Out-patient Clinics
76,000 Workforce
28,000 beds

Putting people first:
With the vision of helping people stay healthy, HA ensures that all members of the community have access to comprehensive, affordable, highly professional and people-centred preventative, curative and rehabilitation healthcare services.
In the past years, HKCG had been working very closely with Hospital Authority:

- **Serving 43** public hospitals and **122** clinics in Hong Kong

- **Total Energy Service Provider** – energy consultancy & design, gas equipment supply, installation and testing & commissioning service

- **Gas utilization includes:** steam generation, water heating, dehumidification, space heating, pool heating, catering & **Combined heat & Power (CHP) Project**
Green Journey of Towngas

1862: Establishment
1910s: Gas Cooking & Heating Supply
2006: Introduced Natural Gas
2017: Landfill Gas Utilization (SENT)

Street Lighting: 1863
Naphtha as Feedstock: 1973
Landfill Gas Utilization (NENT): 2007

Hong Kong, China
Methane has 22 times the Global Warming Potential than carbon dioxide.
On the other hand, Methane is a Clean Fuel for electricity generation.
Nethersole Hospital is close by NENT Pipe Line
Hospital has demand in both Heat & Power

**CHP** is an energy efficient technology that generates electricity while captures the waste heat as thermal energy to produce steam or hot water for space heating, cooling, domestic hot water and industrial processes.

![Diagram of CHP and Conventional Power Plant Energy Utilization](image-url)
CHP System at Nethersole Hospital

Tai Po Nethersole Hospital

2,500 kW Landfill Gas Input (~50 TJ/Yr.)

1 x 999kWe Output Landfill-Gas Generator [MWM Germany]

651 kW Exhaust heat (Eff. = 26%)

524 kW Jacket Hot Water (Eff. = 21%)

Electrical Power 999 kW (Eff. = 40%)

Can reach 87% efficiency at optimal stage

Hong Kong, China
Off Grid (Island Type) Chosen

On Grid Connection

Off Grid Connection (Island Type)
CHP System Installation

Ground Floor Level
- “MWM” Gas-fired CHP Generator
- “Clayton” Waste Heat Steam Boiler
- Gas Pipework & Meter
- Master Control Room
- Ventilation System
- Fire Alarm System

Mezzanine Floor Level
- Potable & Non-potable Hot Water Heat Exchangers
- Water Pump Sets

Roof Floor Level
- Radiators
- Stainless Steel Flue Pipe

Hong Kong, China
Real-Time Monitoring
Landfill Gas
50 TJ/yr

Steam
14 TJ/yr

Hot Water
6 TJ/yr

Electricity
20 TJ/yr*

* ~25% of Total Electricity Usage for Nethersole Hospital

Project Milestones:
Kick Off: 2009
Confirm Deal: Jan 2015
Plant Completion: Jul 2016
Opening: Jan 2017

Deliverables of CHP System
Amount of pollutants generated per unit energy consumption

$\text{CO}_2 (\text{ton/TJ}^*)$

- **Power Company**: 141.7
- **Towngas**: 65.1
- **Landfill**: 0.0

The source of above data:
- Power Company Sustainability Report 2017
- For town gas, Carbon Audit Guidelines by CityU in 2013 and Towngas Sustainability Report 2017

* - 1TJ equivalent to 277,800kWh
Tangible Benefits For Hospital Authority

Saving of $2.7M/yr in Energy Cost

Equivalent to plant 204,000 trees

204,000 trees
4,600 ton/yr

Hong Kong, China
Benefits of CHP System

Utilize Renewable Energy & Reduce Greenhouse Gas Emission [Reduce CO$_2$ emission by 4,600 ton/yr]

Low Running Cost & Commercially Viable [HA & Towngas can recover investment within 5 yr]

Improve Overall Efficiency (>80°o) with Complete Utilization of Electrical & Thermal Energy
More than 300 submissions from 大埔中小學 participated!
CHP System commenced on 27 Jan 17 at Tai Po Nethersole Hospital

The following is issued on behalf of the Hospital Authority:

The Hospital Authority (HA) has been proactive in promoting awareness of environmental protection. A Combined Heat and Power (CHP) plant has recently commenced operation at Alice Ho Miu Ling Nethersole Hospital. The first such system installed in HA premises, it utilises landfill gas to generate electricity and supply steam and hot water at the same time for various hospital facilities. It also helps to reduce carbon emissions and energy costs. To promote energy saving and carbon reduction, a competition was organised earlier in which students in Tai Po were invited to design the mural for the CHP plant room.

The Secretary for the Environment, Mr Wong Kam-sing, today (January 24) officiated at a ceremony to open the facility and present awards of the competition. Addressing the ceremony, Mr Wong said, “One of the real-life examples of practicing waste-to-energy is the beneficial use of landfill gas generated from our three operating strategic landfill in Hong Kong. At present, the strategic landfills utilise some of the landfill gas to generate electricity and heat for use in offices and other infrastructure on-site. Surplus landfill gas, a source of renewable energy, can be exported offshore for other beneficial uses.

"Utilising landfill gas to fuel the newly installed combined heat and power generating system, Alice Ho Miu Ling Nethersole Hospital is the first hospital in Hong Kong to adopt such an environmentally friendly system. The new system not only saves electricity costs for the hospital, but also reduces more effectively its carbon emissions. It also adds another new milestone in the development of renewable energy in Hong Kong. This project is also a timely response to the government’s recently published Hong Kong’s Climate Action Plan 2030+, taking practical action to foster our transformation into a low-carbon society. Mitigating climate change, saving energy and reducing waste are the responsibilities of all of us in the community."

Other officiating guests at the ceremony included the HA Chief Executive, Dr Lam Ping-sing; the Chairman of the Tai Po District Council, Mr Cheung Pak-wai; the Director of Electrical and Mechanical Services, Mr Chan Fan; the Cluster Chief Executive of New Territories East Cluster, Dr Lo Sou-ki; the hospital Chief Executive of Alice Ho Miu Ling Nethersole Hospital and Tai Po Hospital, Dr Huen Chi-on; the Managing Director of Hong Kong and China Gas Company Ltd, Mr Alfred Chan; the Chief Executive Officer of the Environmental Association, Dr Yau Wing-kwong; Representative of the Association of Secondary School Heads, Tai Po District, Ms Caroline Yip, and the Chairman of the Tai Po District Primary School Heads Association, Mr Sin Kit-mui.

According to the hospital spokesperson, combined heat and power is a form of distributed energy supply system. It captures waste heat produced during on-site electric power generation, and converts it into usable steam and hot water, which reduces energy loss and achieves much higher energy efficiency than a conventional, centralised type of electricity generating and supply system. The hospital is working with TUV Austria to transfer landfill gas via underground pipeline to the CHP plant at the hospital. The landfill gas is produced during waste decomposition in the North East New Territories Landfill and is purified before being transferred for use.

Hong Kong, China
This Commercial Viable Project received well-recognition from Local and Overseas
Potential Usage

- Data Center
- Hospital
- Hotel
- Industrial

Hong Kong, China
Thank you!