煤氣 Towngas

環保生活每一天
Go Green Every Day

Renewable Energy Initiatives from Towngas

07 Nov 2019

Mr. Victor Kwong
General Manager – Corporate Sustainability

Corporate Profile

Founded in 1862, provided public lighting in Central, 1st public utility in HK.

1860s – 1960s
Our services expanded to heating and cooking business

1990s – 2000s
Business took off on mainland China

Now
Hong Kong Business
Mainland Business
New Energy Business

Aspire to be Greenest HK Based Company

港華燃氣 Towngas

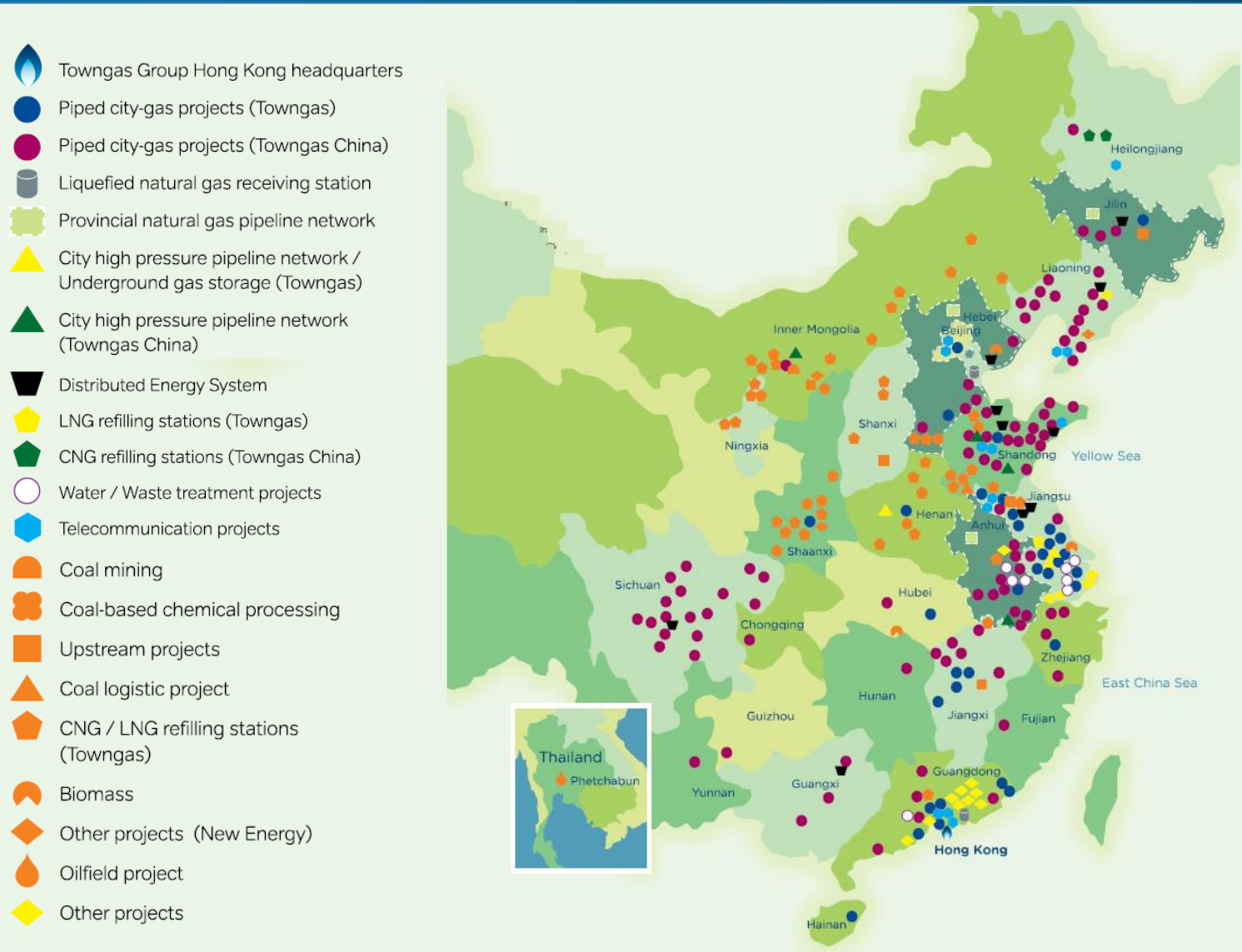
易高 ECO

As at the end of 2018

- Underground pipeline
  - > 3,650 km in HK
  - > 106,500 km in mainland China
- Projects in China and overseas
  - 255 nos.
- No. of customers
  - > 1.9 M in HK
  - > 27.5 M in China
- No. of employees
  - Total > 52,000 (~2,400 in HK)

Vision and Mission

- Major businesses include gas supply & associated services and telecom services
- Business took off to mainland China in 90s
- As at 31 Dec 2018, there are **255 projects** in **26 provinces** in China



Emerging risk – Climate Change

A Environmental - General Disclosure

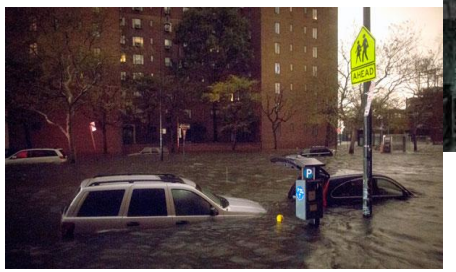
New aspects: Climate Change

Climate change disclosures:

a) **Policies on measures to identify and mitigate the significant climate-related issues which have impacted, and those which may impact the issuer**

b) **Description of the significant climate-related issues which have impacted, and those which may impact the issuer, and the actions taken to manage them**

- Earth's temperatures in recent years were **warmest** since modern recordkeeping began in 1880.
- Climate change could have a domino effect on key infrastructures and utilites e.g. Hurricane Sandy (2012).
- Climate change is largest challenge of our time and local utilities must take leading role and active steps on adapting to climate change risk.



1st Climate-change Bankruptcy

- Pacific Gas and Electric Company (PG&E)
  - California largest utility
  - 20K employees; 5.4 m electricity customer; 4.3m gas customers
  - provide 40% of power
  - Filed for bankruptcy
    - potential liabilities > $30b from large wildfires
      - "November Camp Fire" in 2018
      - killed 86 persons
      - burned 14,000 houses
      - caused $7b damages
- Largest utility bankruptcy in US history.
- Extreme drought and hot weather that lead to more frequent and intense fires
- A spark from damaged electric pole and powerline may be ignition source.
- PG&E was not well prepared for climate change risk (too little too late).

Source: WSJ and Bloomberg

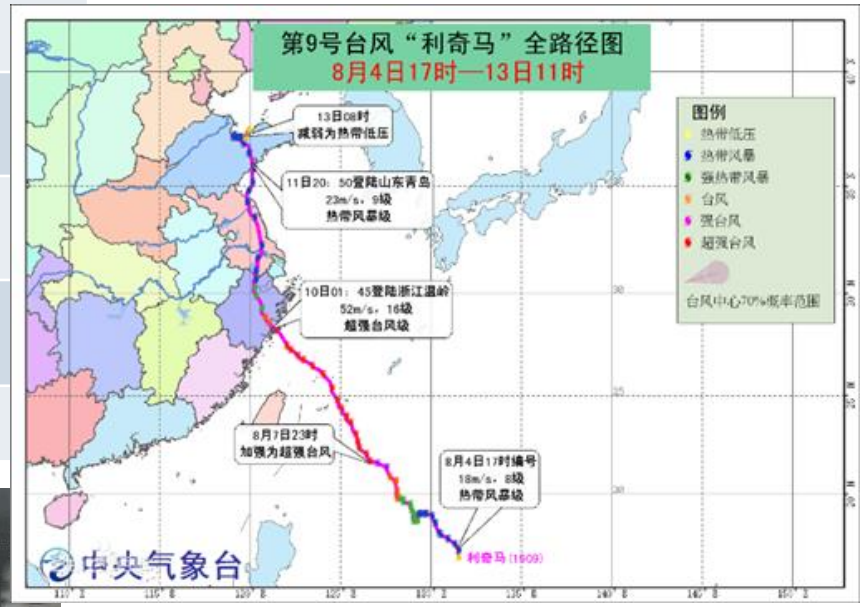
First Climate-change Bankruptcy, But it won't be the Last

Landslide @ Keelung, Taiwan

Super Typhoon Lekima

Major affected provinces	Hebei, Liaoning, Jilin, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Shandong
Number of people affected	140 million
Number of people died /missing	56 people died, 14 people missing
Population transfer/ resettlement	21 million
Housing damage	16,000 houses collapsed 134,000 houses suffered from varying degrees of damage
Direct economic loss	RMB 54 billion

Source: 中国天气官网及新京报网 (2019.8.14)



Hangzhou Bay Bridge

Port of Ningbo-Zhoushan

Wenling, Zhejiang Province

Taizhou, Zhejiang Province

Super Typhoon Mangkhut

- Typhoon signal No. 10
- Wind Speed = 256 km/h
  (Max. gust peak speed from HKO)
- Severe Storm Surge
- Estimated physical damage of HK$4b

Towngas was well prepared
- Minor damage to several facilities
- No gas leakages or personal injuries

Fatalities	Hato	Mangkhut
Mainland	11	4
Macau	12	0
Hong Kong	0	0

Power outage to 20,000 households at Macau

Flooding in Heng Fa Chuen

Damage in Whampoa

Recent estimation from HKO that such super typhoon may occur every year

Green Bond

- Bond proceeds to invest in **waste-to-energy projects**
- Milestone for **Towngas' financial and environmental strategies**

Towngas is the first energy utility in Hong Kong to issue Green Bond

Green Bond

- Towngas issued its inaugural Green Bond in 2017
  - HK$600 million
  - ¥2 billion

Strong investor response

- Obtained **post-issuance stage certification** from the HKQAA under its Green Finance Certification Scheme

Responsible to our Stakeholders

March 2019

Green Bond waste-to-energy projects

In Operation

Hydrotreated Vegetable Oil

Upgrade inedible waste oil in Zhangjiagang

South East New Territories Landfill

Landfill Gas Utilisation

Trial Operation

- Natural gas
- Oil products and solid fuel
- Fertilisers

Food waste processing and utilisation in Suzhou

Under Development

- Green chemicals such as furfural and paper pulp

Convert agricultural waste

Clean Energy for Gas Production

70s

Replacing Coal & Heavy Oil by using high quality Naphtha

1999

Landfill gas from Shuen Wan Landfill site was utilized for town gas production

2006

Natural gas was introduced as production feedstock of town gas

2007

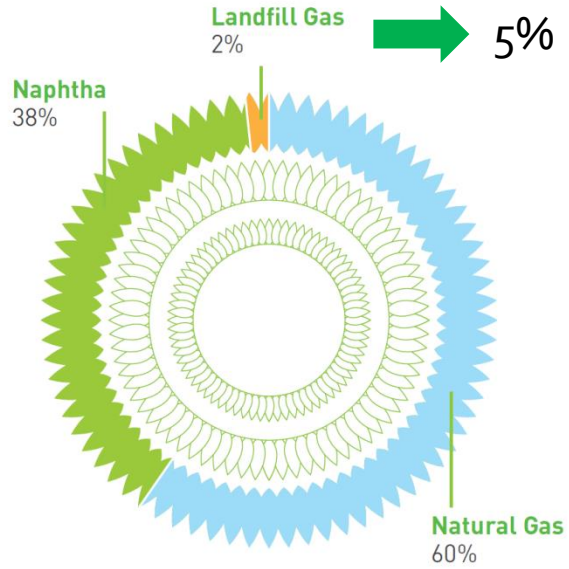
Landfill gas from NENT was utilized

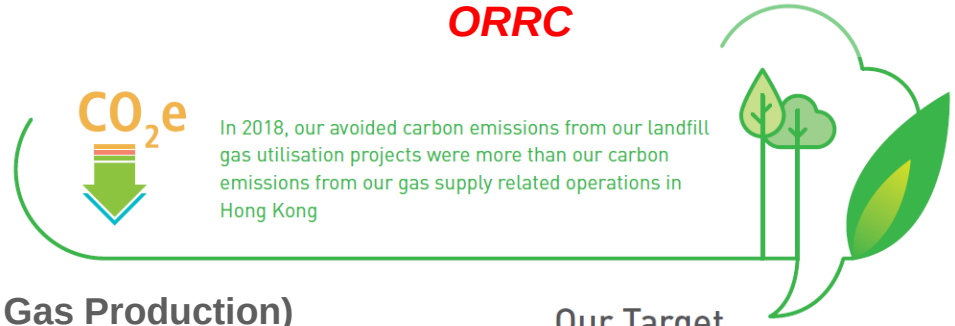
2017 onwards

Utilisation of Landfill gas from SENT

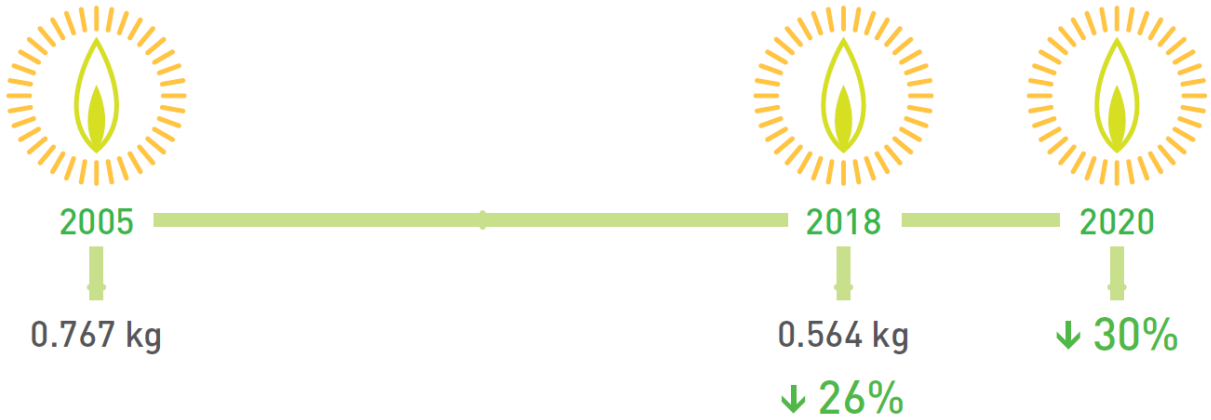
Exploring Biogas from ORRC

2017 Fuel Mix for Town Gas Production





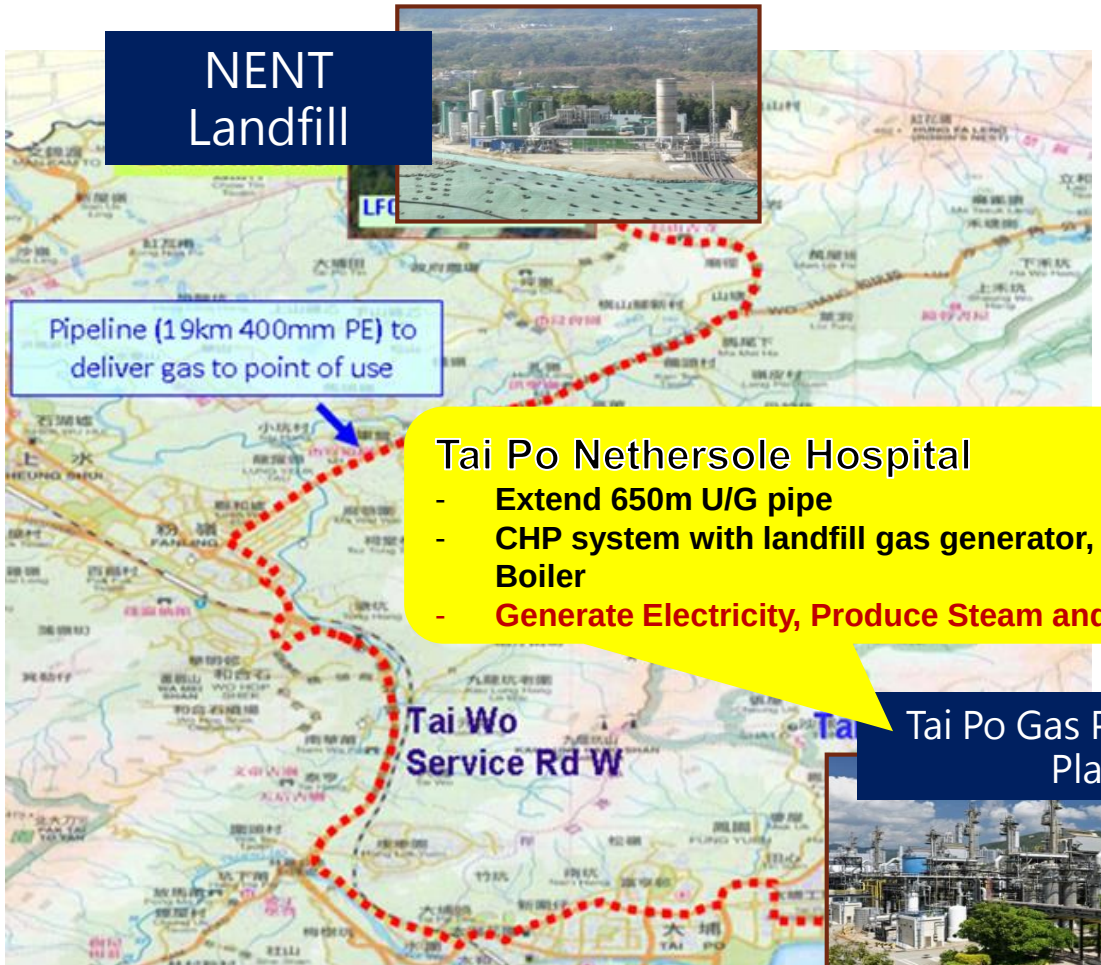
Carbon Intensity (for Gas Production)



LFG CHP in Nethersole Hospital

Landfill gas utilization at Tai Po Nethersole Hospital since 2016

1st Commercially Viable CHP Project in HK and one of lowest carbon project among the world

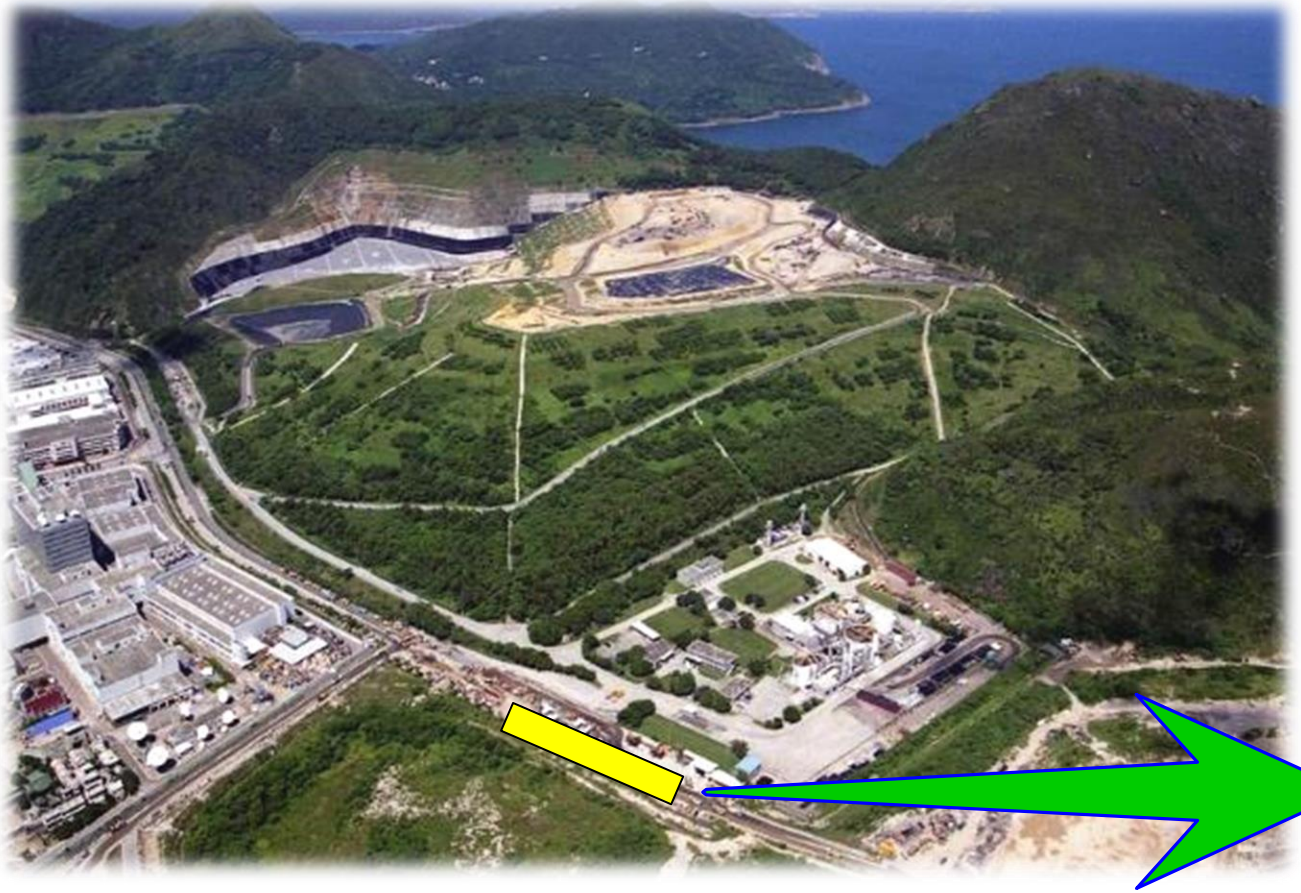


Tai Po Nethersole Hospital
- Extend 650m U/G pipe
- CHP system with landfill gas generator, Waste Heat Steam Boiler
- Generate Electricity, Produce Steam and Hot Water

Energy efficiency can reach to **~87%**

Reduce carbon emission
~ 4,500 tCO_2e annually

Waste-to-Energy from SENT



Tseung Kwan O South East New Territories (SENT) Landfill Gas Utilisation Project

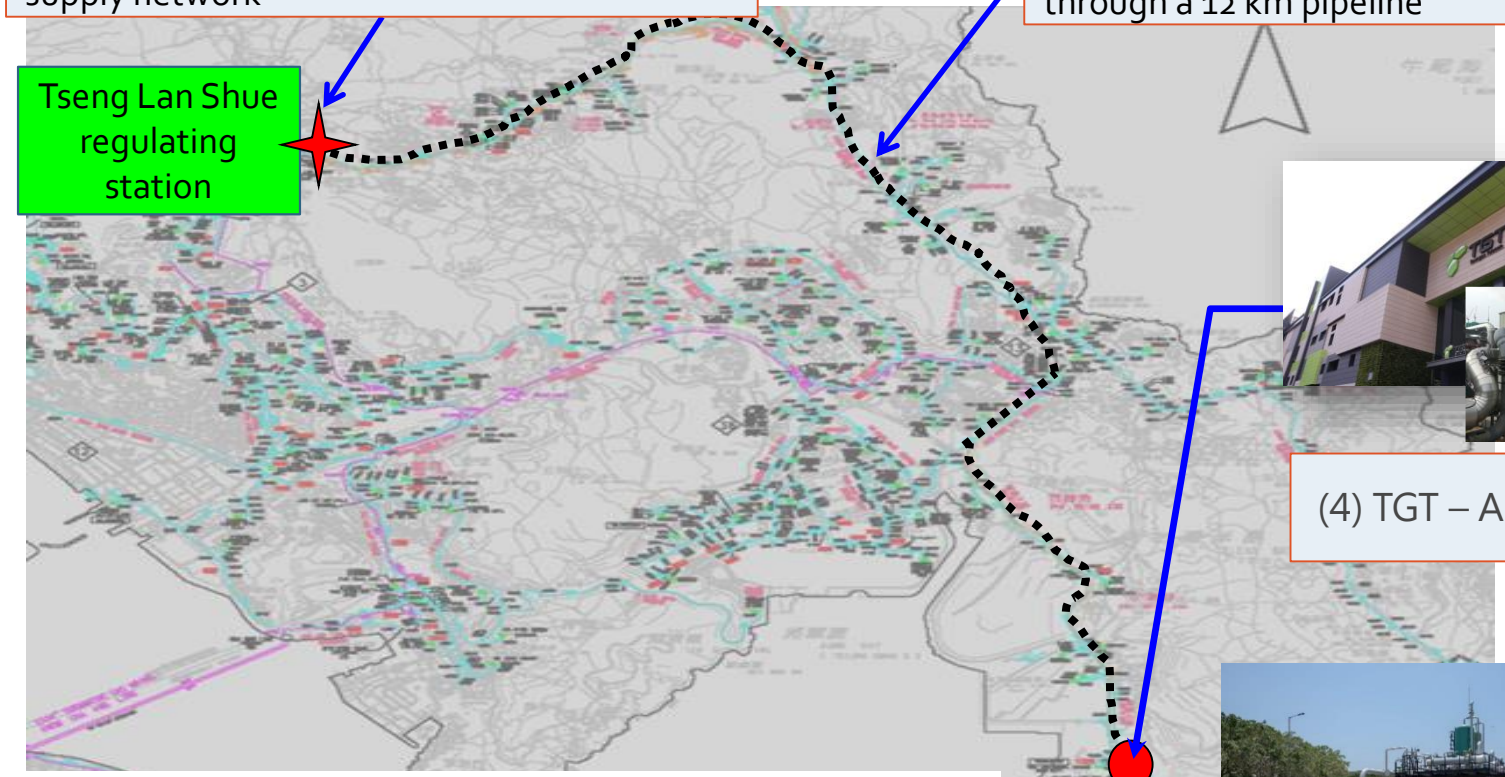
- Avoid energy waste and carbon emission by directly being flared in the landfill
- Operate at Nov, 2017
- Largest landfill gas conversion facility of its kind in Asia
- 20 year contract with SENT contractor from Dec,2014
- An investment of approximately HK$350 million.

Tseung Kwan O South East New Territories (SENT) Landfill Gas Utilisation Project

(3) Synthetic natural gas integrated into gas supply network

(2) Transmitted to Tseng Lan Shue regulating station through a 12 km pipeline

Tseng Lan Shue regulating station



(4) TGT – Absorption Chiller

(1) Turn landfill gas into synthetic natural gas

Turn landfill gas into synthetic natural gas (SNG) and transmit to Tseng Lan Shue regulating station through a 12 km pipeline and then integrated into gas supply network.

Estimated GHG Emission Reduction
~ 56,000 tonnes per year
(Equivalent to 2.4 million trees' CO_2 absorption per year)

Innovative Renewable Energy Solutions

ECO Environmental Investments Limited

- Founded in 2000
- New energy business

Waste and Low-value Feedstock → High Value Clean Fuels, Chemicals & Materials


Clean Coal Chemical Business


Natural Gas/CBM Business


Industrial and Bio Grease Business


Agricultural Waste Business

Opportunity → Innovation → Sustainable Business

2nd Generation Biodiesel (HVO) Project

Waste and Residues in Palm Oil Mills

Used Cooking Oil

100% waste and residues

Feedstock Collection& Pretreatment

Hydrotreating (Technological Innovations)

End User

- Innovative Green Technology
- Biofuels promote a closed system of carbon to reduce carbon emission
- Market and recognition from all countries

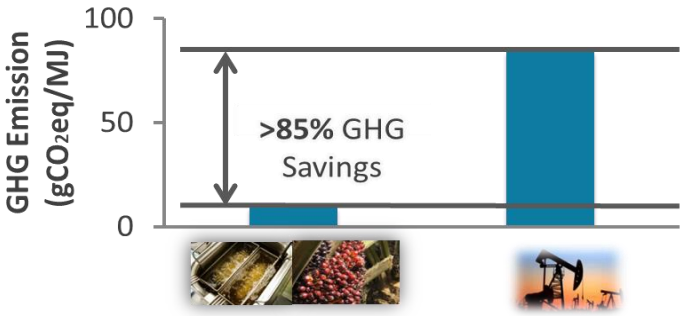
2nd Generation Bio-diesel (HVO)

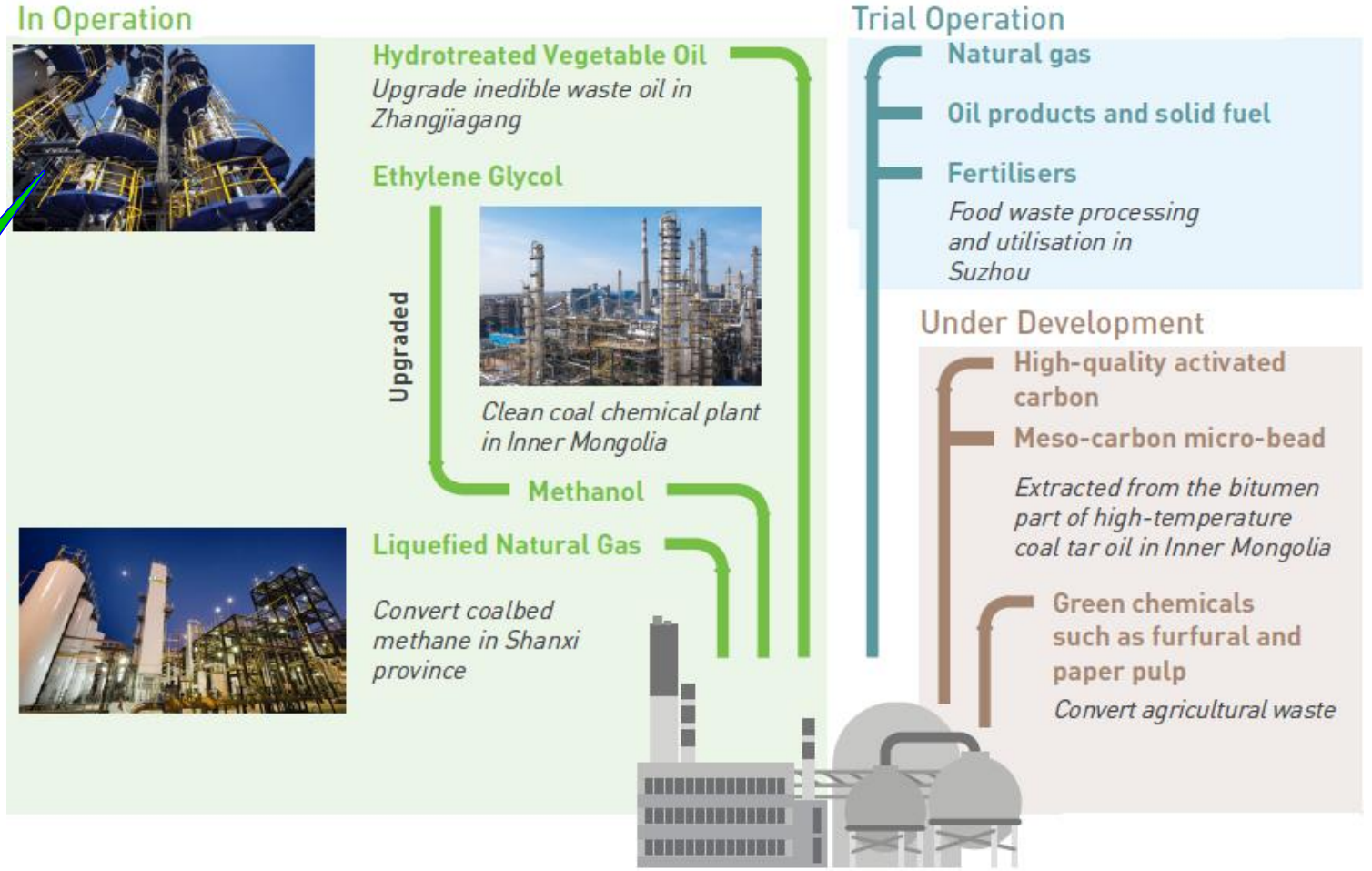
To turn high-value products from low-grade feedstock

vs.

1st Generation Biodiesel: 7%

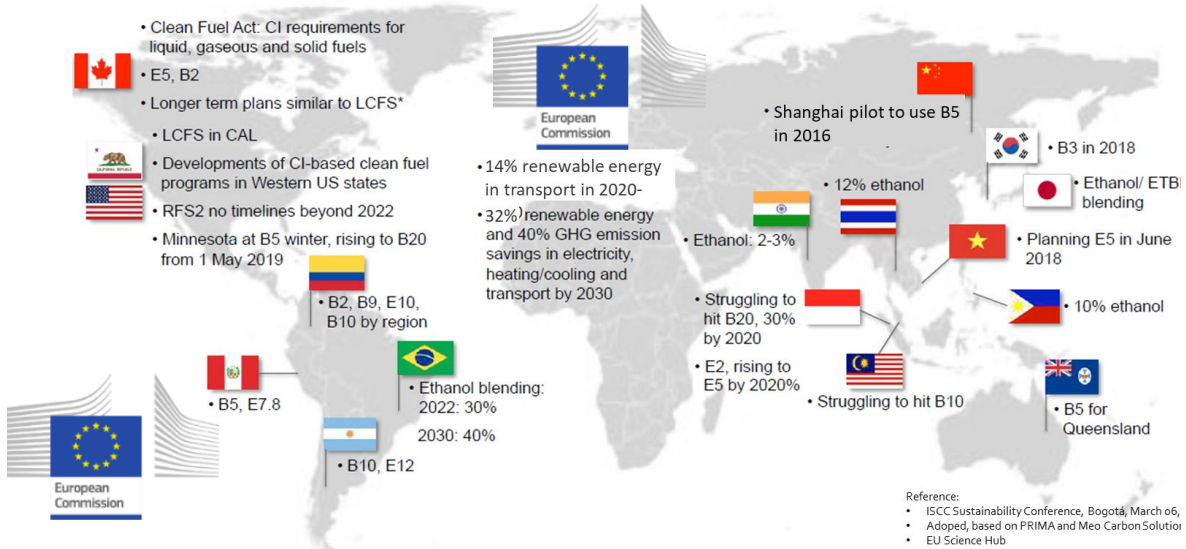
HVO: 100%





Hydrotreated Vegetable Oil (HVO) Plant

Biofuel Mandates in the World



- **Min. 14%** in transportation, whereas **3.5%** is **advanced biofuels**

	Fossil Diesel	1st Gen	Towngas HVO
Cetane Number	≥51	≥51	>70 ✓
Energy Value (MJ/kg)	42	38	44 ✓
Sulphur Content (ppm)	≤10	10	5 ✓

Biodiesel Production Plant in China

1st gen. biodiesel FAME

VS

2nd gen. biodiesel HVO

Production Capacity
120,000 ton/yr

Patent Design

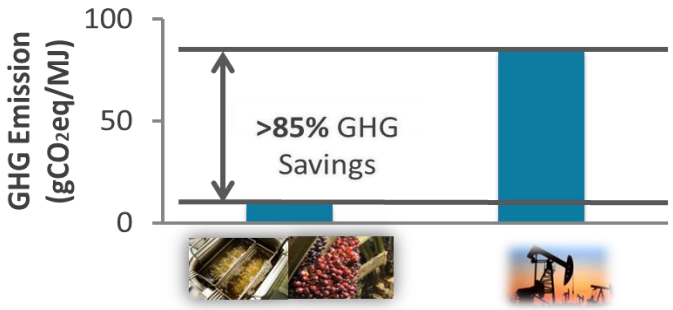
Much lower Carbon Emission than Diesel

Carbon Emission

ISCC International Sustainability & Carbon Certification

Holland Market

Dutch Double Counting



European Commission **RED II**

380,000 ton CO_2/yr

Air Pollutants

*$B100_{HVO}$ VS Diesel

- CO ~40%
- HC ~30%

	1st Gen. Biodiesel	2nd Gen. Biodiesel
NO_x	↑ 9%	↓ 6-16%

Feasibility Study in HK

煤氣 Towngas X X IVE Member of VTC Group

Long-term Decarbonization Strategy

Proposed Adaptation in HK

GHG Saving (Feedstock, Production & Transportation)

Proposed Mandate **5% Advanced Biodiesel (B5)*

180,000 tonnes

CO_2/yr

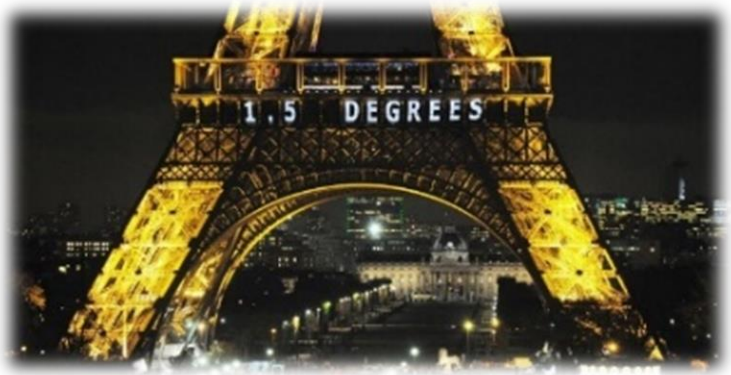
from HK Diesel

Proposed Mandate **1% Bio-jet fuel*

220,000 tonnes

CO_2/yr

from HK Jetfuel



Food Waste Recycling Center at Suzhou

Sewage Treatment

Organic Fertilizer

Liquid

Solid

De-watering

Digestate

Food Waste

Expired Food

Size Reducer

Oil / Grease Removal

Anaerobic Digestion

Biogas

Natural Gas

Food Waste Recycling Center

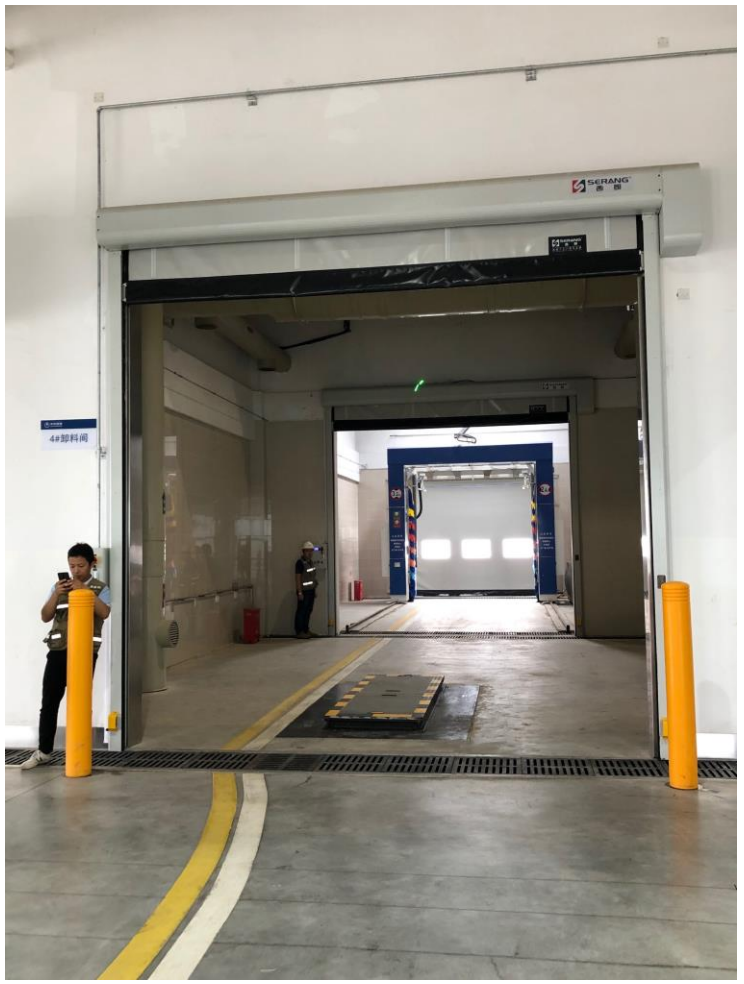
Waste steam from nearby power plant

Wood Biofuels

Oil / Grease

HVO

Food Waste Recycling Center at Suzhou Industrial Park



Waste to Energy

- Bio-methane from food waste plant help L" Oreal factory to achieve carbon neutral in June 2019
- Use bio-methane as fuel source for CHP system to generate steam and electricity
- Earn Carbon Credits thro' national carbon emission trading system
- Yard waste to fuel sources for furnaces

L'ORÉAL PARIS

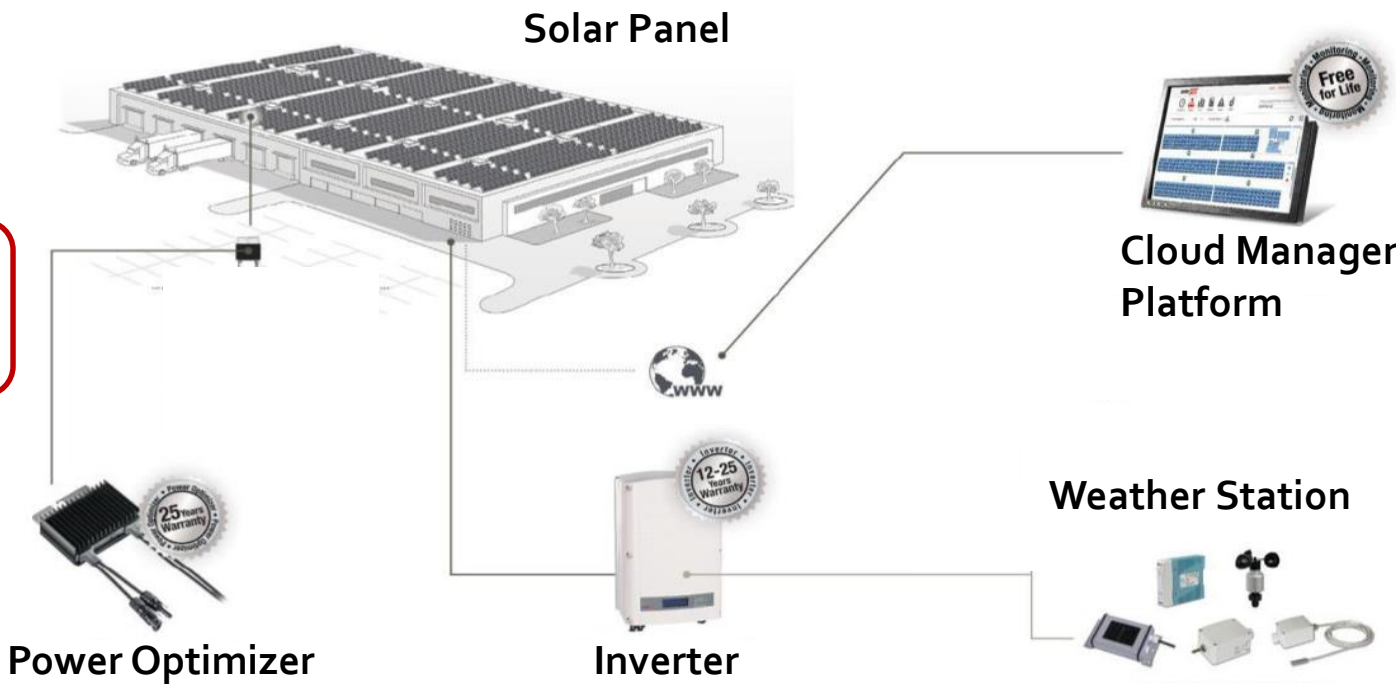
Agricultural Waste Utilization Projects

Project Location	Tangshan	Cangzhou
Feedstock	Corn stalk/corn cob, 240k tons/year	Corn cob, 240k tons/year
Total Capacity	25k tons furfural/year 80k tons paper pulp/year	25k tons furfural/year 25k tons bio ethanol/year 6k tons xylose/year
Commissioning	4Q 2019	4Q 2020

Solar Power Generation Project

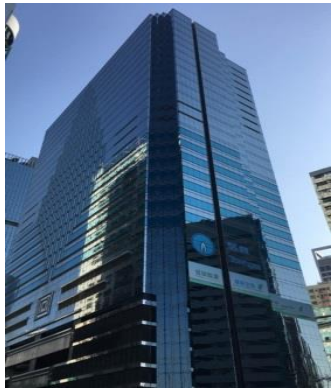
Renewable Energy Feed-in Tariff

Capacity of the renewable energy system	FIT rate (per kwh)
⩽ 10 kW	$5
> 10 kW - ⩽ 200 kW	$4
>200kW - ⩽ 1 MW	$3



PV Installation at Our Premises

NPB Headquarter



Tai Po Plant

Offtakes & Pigging Stations

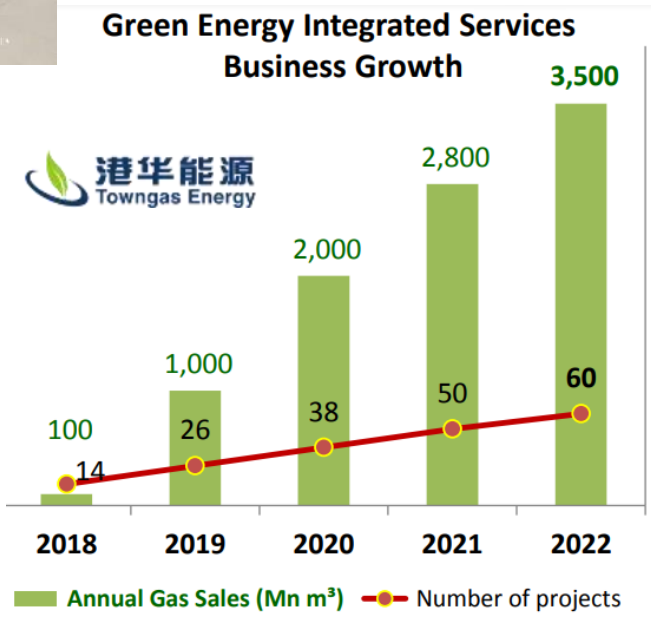
Expected Annual Energy Yield

~ 300,000 kWh

Distributed Energy System (DES) Strategies

- Green Energy Integrated Services
- Reduce energy costs
- Enhance energy efficiency
- Reduction carbon emission
- Projects
  - Central **space heating**
  - Central **steam supply** for industrial parks
  - **Air-conditioning**
  - **Electricity**
- Pipelines for steam supply from existing power plants
  - Boost up efficiency **from 50% to >70%**
- Target: one project per JV

DES Project at Tangshan (space heating)



Promote Voluntary Carbon Trading in HK

Hong Kong's FIRST Carbon Trading Platform

- Blockchained Technology
- Target launch in coming months
- Eligible projects:
  - Type 1: Hong Kong Special Projects (verified by HKQAA / SGS)
  - Type 2: Hong Kong Designated Projects (verified by REA)
    - Motors / Chillers / Boilers / Lifts replacement
  - Type 3: Outside Hong Kong Projects (verified by HKQAA / SGS)

Towngas Role

- Co-founder
- (First Seller) of Local Carbon Credits in Hong Kong

  ~30,000 tonnes per year

Guide to
Hong Kong Blockchained Carbon Trading Platform (BCTP)

Co-founder

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Preparing for The Future

Cultivating Existing Gas Market

Distributed energy

Coal/oil to gas conversion

Extended Business

Telecommunication

Manufacturing Business

Gas appliances & Kitchen solutions

Waste-to-Energy Projects

Other Biogas Opportunities
e.g. ORRC in Hong Kong

Bio ethanol products from
agri-wastes in Hubei

In-house technology development

Research institute
“Bringing Green
Technology to Reality”

Continue to be Asia’s leading clean energy supplier and quality service provider

End