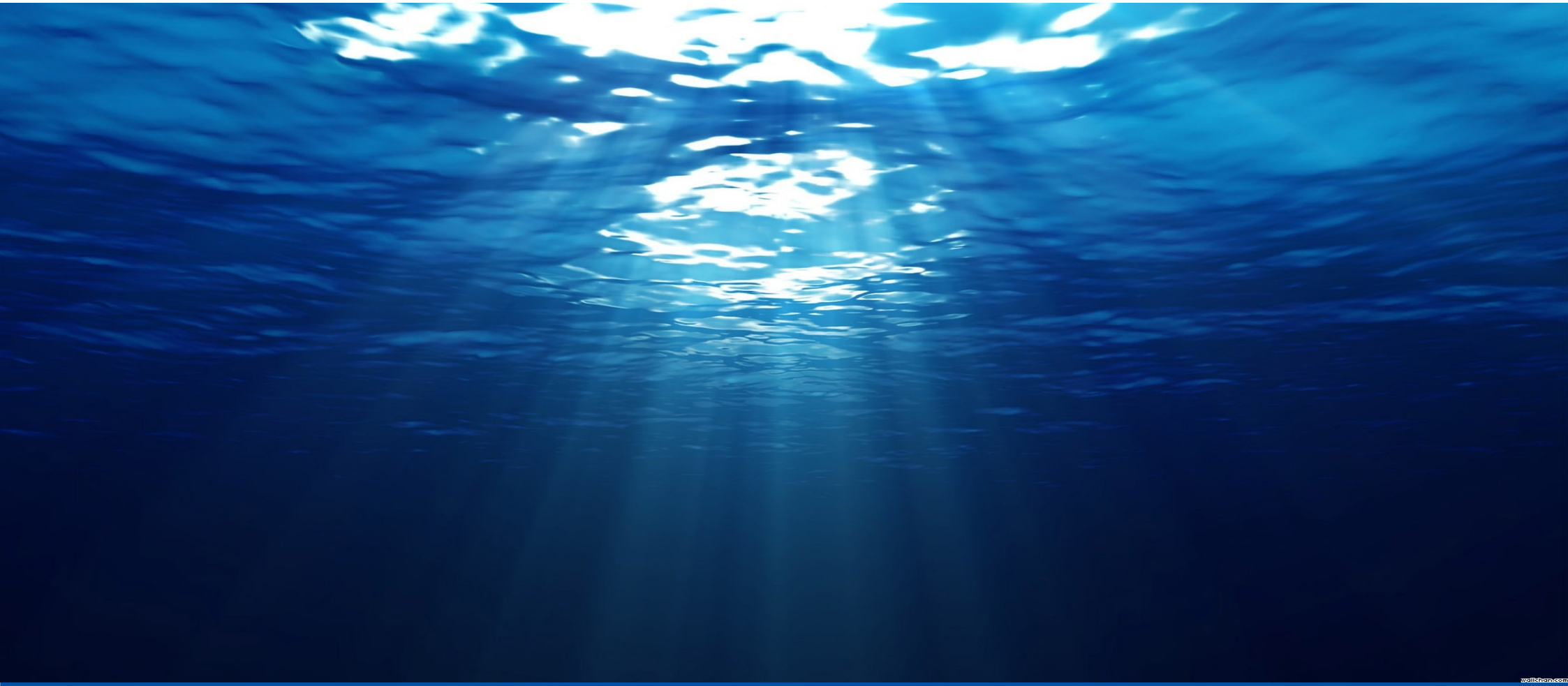


Overview of Natural Gas in Singapore

CitiOG
Gas Energy Services

A City Gas And Osaka Gas Business Venture.

Content

1. Brief Introduction of City-OG
2. Overview of NG, LNG and NG gas network in Singapore.
3. Application and usage of NG (feedstock, vehicles, boilers, furnaces, etc.)
4. Advantages of using NG
5. NG constraints and issues encountered
6. NG project implementation and processes

Introduction of City-OG Gas Energy Services

City-OG Gas Energy Services is the business venture between CITY GAS and OSAKA GAS SINGAPORE to market and sell natural gas to industrial customer

大阪ガス
Osaka Gas Co., Ltd.
Natural Gas Provider in Japan
Est. 1897

100% Subsidiary

OSAKA GAS SINGAPORE

- **Long-Time Experience in Gas Sales Development**
- **High Expertise in Energy Saving Solutions**

City-OG Gas Energy Services

CITYGAS
Warming hearts in the city

City Gas Pte., Ltd.
Town Gas and Natural Gas
Retailer in Singapore Est. 1861

- **Established Local Network and Foundation**
- **Pipeline Natural Gas Supply Capacity**



Introduction of City-OG Gas Energy Services

Some of the work and services that we provide for our customers

1 Energy audit



Conduct a diagnosis on customers' equipment (furnaces, boilers, etc.) and analyze energy flows.

2 Energy consulting



Provide quantitative evaluation and propose efficiency improvement measures.

3 Energy monitoring and modification



Verify the enhancement of energy efficiency and the reduction of energy cost and maintain the target level of efficiency.

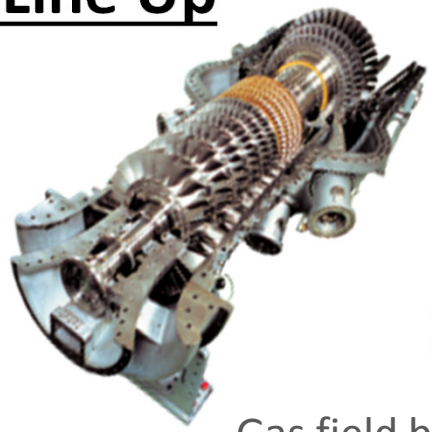
Introduction of City-OG Gas Energy Services

Energy Consulting Line Up

1 Cogeneration systems

Highly efficient in producing heat and electricity by utilizing the exhaust heat of the system.





3 Boilers

Gas field boiler that is more efficient than the oil field boilers.

2 Gas cooling and heating systems

Gas air conditioners that contribute to the reduction of electricity consumption.

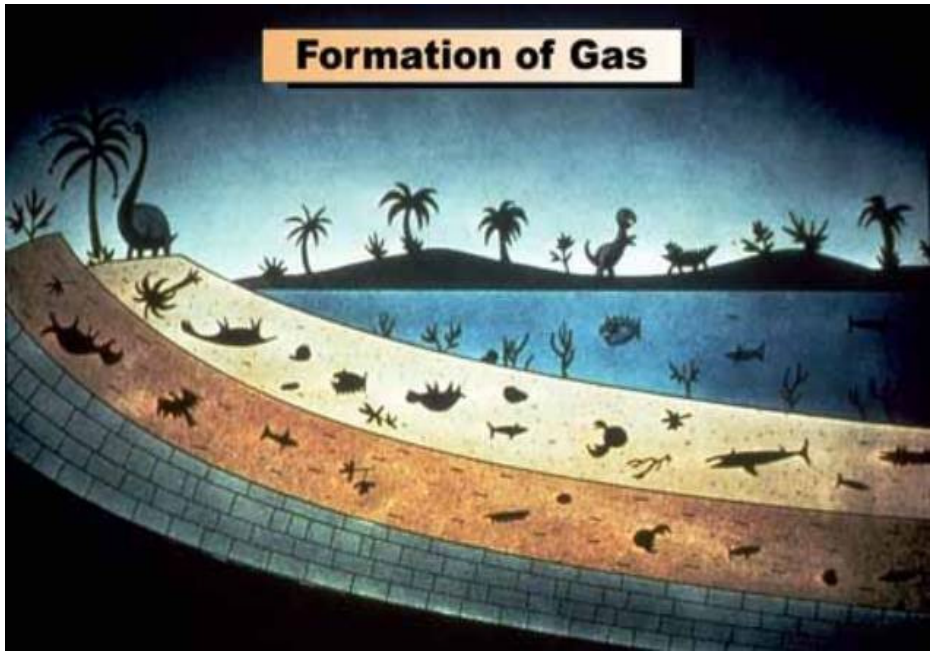


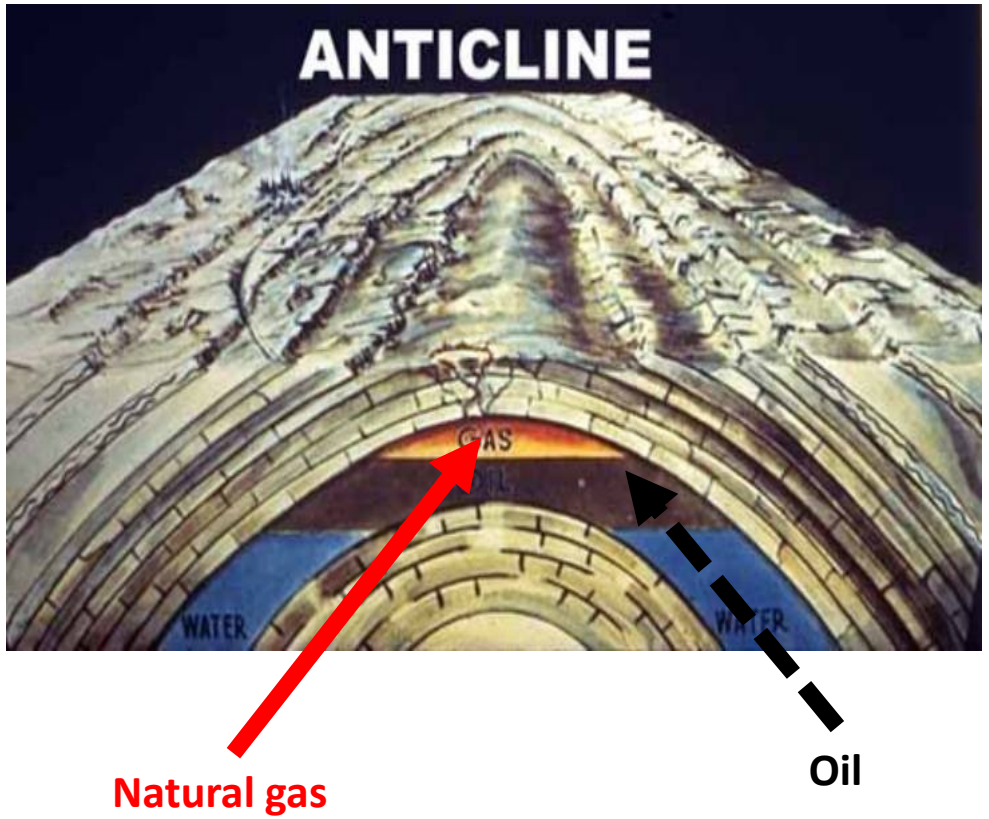






Natural Gas





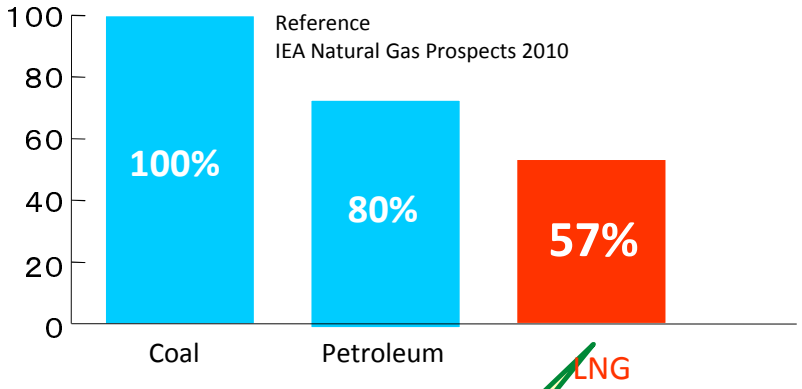
•Due to the intense pressure and heat present in the rock formation, organic materials transform into petroleum products

Liquefied Natural Gas (LNG)

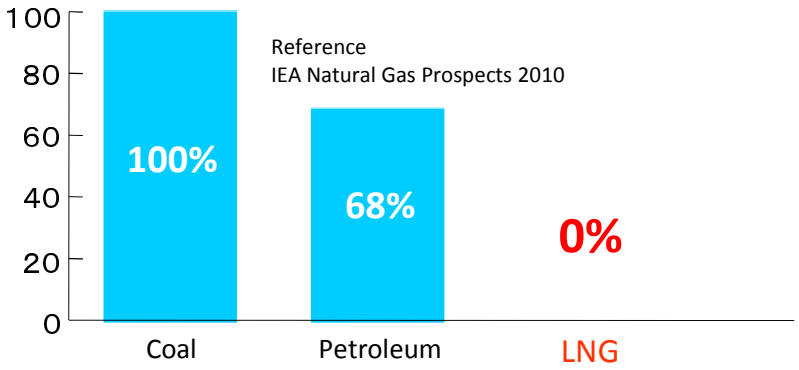
- LNG is converting the gaseous natural gas into liquid form for easy storage or transportation.

- The liquefaction process of the gaseous natural gas involves purification of the gas by removing impurities such as water, oil, mud, mercury, CO_2 and H_2S and multi-stage cooling until it is liquefied at about -162 deg C. Thus, LNG has the lowest CO2 emission rate within fossil fuel and emission of Particulate Matter and SOx are almost zero.

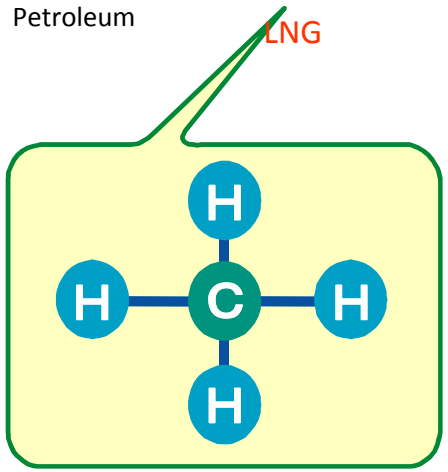
➢ CO_2 emission rate



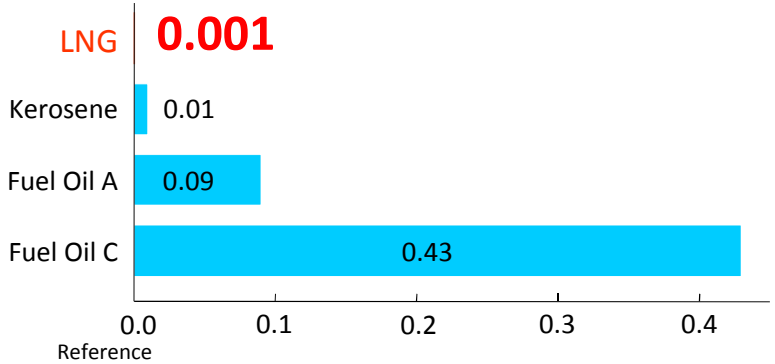
➢ SOx emission rate



Main composition of LNG is methane (CH4) and it has lowest carbon ratio compared to other hydrocarbon fuels. This is reason why LNG can archive low CO2 emission rate.



➢ Measured value of Particulate Matter from boiler



Liquefied Natural Gas (LNG)

- The volume of the LNG is about 600 times the volume of natural gas in gaseous state. Thus, allowing the ease of transportation.

- Heating value of the LNG is about 45-50MJ/kg or about 20-22MJ/litre or about 60% of diesel.

- LNG / Piped Natural Gas Used in Singapore complying with the Singapore Gas Spec mentioned in Gas Supply Code.

- The LNG in Singapore is stored tanks operated by SLNG, which will then be re-gasified and injected into the gas network.

- SLNG has three storage tanks and two jetties which can handle 6 million tonnes per annum (MTPA). A 4th tank is under construction to bring capacity to 9 MTPA.

NG Specifications from Gas Supply Code

7 CHARACTERISTICS OF GAS SUPPLY TO CONSUMERS

7.1 Gas Specification

Gas supply to consumers at gas pressure not exceeding 30 mbars shall comply with the following specification limits as applicable:

(a) Natural Gas

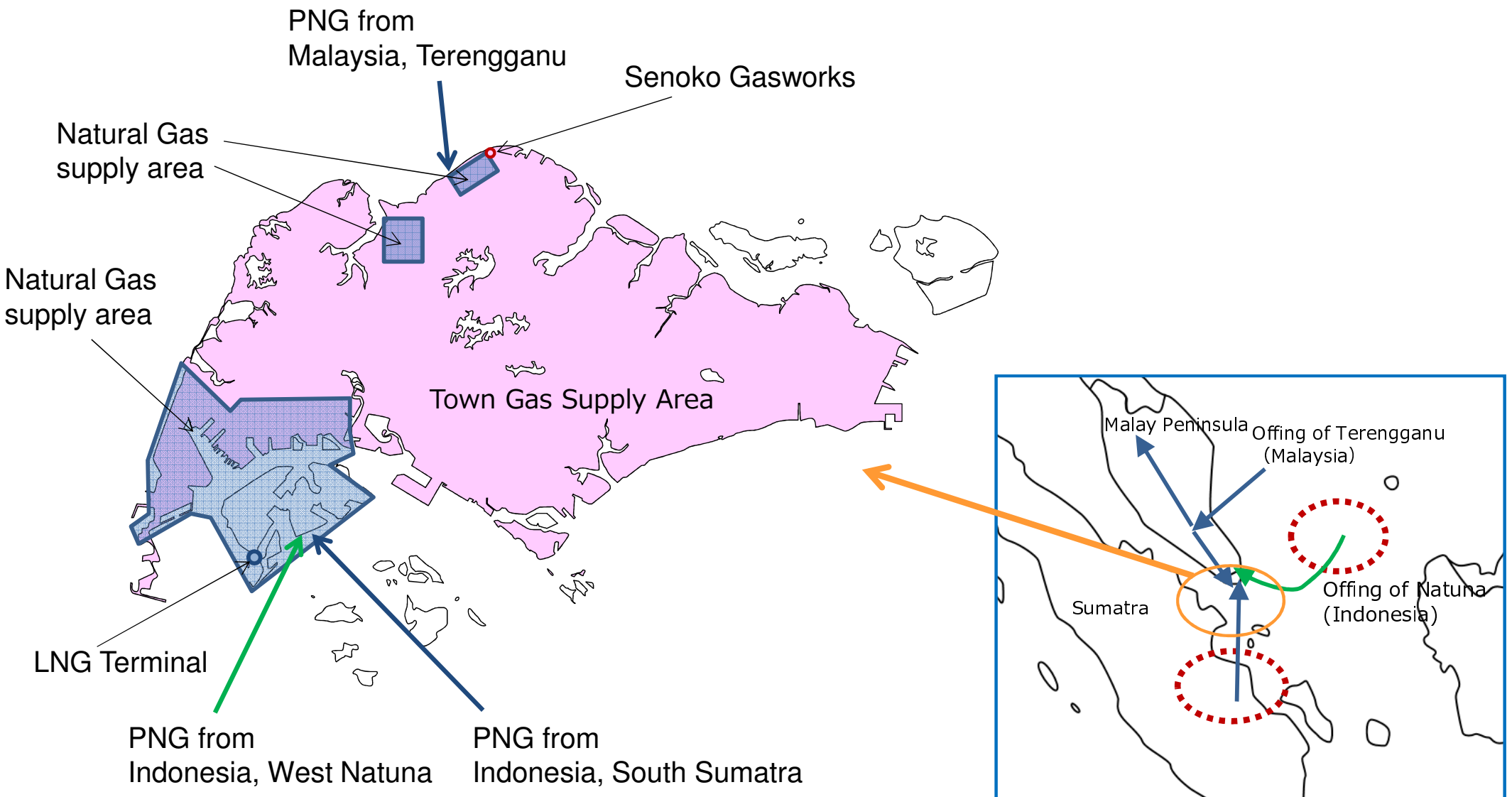
Wobbe Index (WI)	:	45.2 – 52.0 MJ/m^3
Gross heating value	:	35.3 – 50.3 MJ/m^3
Hydrocarbon dewpoint	:	12.8 °C @ 50 bar
Free liquids	:	zero (0)
Oxygen (max)	:	0.1 % by volume
Hydrogen sulphide (max)	:	8 ppm by volume
Total sulphur (max)	:	30 ppm by volume

Specifications of LNG

- Examples of LNG composition

Production area		Alaska (Kenai)	Brunei (Lumut)	Indonesia (Bontang)	Indonesia (Arun)	Australia (NWS)	Malaysia (Dua)	Qatar (Ras Laffan)
Composition	CH_4	99.81	89.62	90.45	89.61	87.51	89.33	89.92
	C_2H_6	0.07	5.25	6.18	8.03	8.28	5.57	6.60
	C_3H_8	0.00	3.40	2.47	1.55	3.30	3.46	2.25
	$i\text{-}C_4H_{10}$	0.00	0.71	0.45	0.34	0.39	0.80	0.41
	$n\text{-}C_4H_{10}$	0.00	0.96	0.43	0.40	0.46	0.68	0.64
	C_5H_{12}	0.00	0.03	0.01	0.03	0.01	0.00	0.00
	N_2	0.12	0.03	0.01	0.04	0.05	0.00	0.18
Density (kg/m^3)		420.0	463.7	455.0	454.3	464.5	464.2	457.4
GHV(MJ/m^3N)		39.7	45.2	44.2	44.0	45.2	45.1	44.2

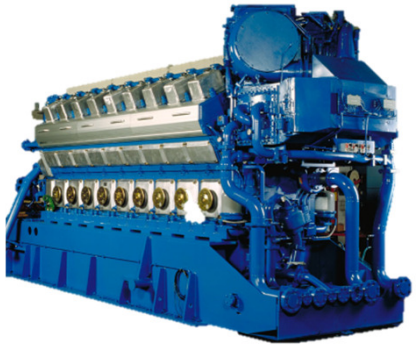
Natural Gas Supply Area in Singapore



Applications & Usage of Natural Gas



Power Generation



Co-Generation
District cooling



Feedstock for processes





Replacement of Diesel/LPG

Boiler, Furnace, Process Heating



Hydrogen generator



Fuel Cell



Metal cutting



Heating/Cooking

THE BUSINESS TIMES

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'GLOCAL' CUISINE
Decent attempt at Singapore fusion from COO Bistro
DINING OUT / 29



MARKETS

	Weekly	Change
STI	2,869.47	12.52
KL Comp	1,652.55	-18.44
Nikkei 225	16,449.84	-304.18
Hang Seng	23,297.15	-389.33
Shenzhen B	1,186.23	-3.67
Dow	18,308.15	46.70

DAILY DIGEST

e US stock market finished htly higher on the week as ary Clinton's commanding bate performance and an ec production deal offset opean banking fears.
STORIES / 2

e industrial Internet of ngs is being tapped for ety benefits. Fuel and icant additives nufacturer Chevron Oronite started a pilot project using Data and sensing nology in its Jurong Island t for personnel tracking and ety purposes. TOP STORIES / 2

de funding gaps in the vices sector are shaping up e an opportunity for HSBC.
STORIES / 2



Land Transport Authority oking at buses with a third and two staircases for oved passenger flow and to

FUTURE MANUFACTURING

S'pore looks to cogen facilities, IoT to improve petchem energy efficiency

EDB is starting to explore the possibility of developing a carbon chain on Jurong Island

By Andrea Soh
sandrea@sph.com.sg
@AndreaSohBT

Singapore

THE Republic, which in July set a new energy efficiency target for its manufacturing sector to cut greenhouse gas emissions, will look to cogeneration facilities and the industrial Internet of Things (IoT) as the main ways to achieve this within the petrochemical industry, said the Economic Development Board (EDB).

Cogeneration plants allow petrochemical firms to generate their own electricity and therefore improve energy efficiency.

While a few of the larger facilities on Jurong Island have already taken the cogeneration route, there is scope for more, said EDB energy and chemicals director Damian Chan.

"There are still some of the larger companies with some opportunities for cogen," he told *The Business Times*. "That will result in some significant energy savings."

He added: "The next one after that is in terms of IT, and specifically using Internet of Things to improve efficiency."

US engineering and technology firm Emerson had previously estimated that total energy savings across the chemical plants on Jurong Island could add up to US$150 million a year, if its data analytics and sensing technology was used to monitor steam traps.

The group late last year rolled out its data analytics technology, termed Pervasive Sensing, for chemical companies in Singapore. The technology integrates complex machinery with networked sensors and software, and analyses data from these in real time, enabling companies to optimise their operations, said Emerson.

The Singapore government is hoping to achieve improvements in energy efficiency in the manufacturing sector by one to 2 per cent a year from 2020 to 2030, according to the Climate Action Plan released in July. This compares with the 0.7 per cent energy efficiency improvement rates that 160 energy-intensive manufacturers – accounting for more than half of Singapore's total energy use – clocked in in 2014 and last year.

The industry sector accounted for 59 per cent of Singapore's greenhouse gas emissions in 2012; the petroleum refining, chemicals and semiconductor sectors made up the bulk of these emissions.

In the longer term, carbon capture and utilisation (CCU) technologies could become an option for Singapore, Mr Chan added.

Much will depend on how technology evolves, he said. "Hopefully there will be some breakthrough in terms of carbon capture and sequestration (CCS) and CCU."

"Of course Singapore is a bit more limited in terms of sequestration because we don't have the space to store (carbon dioxide), so the one that can potentially make a lot more difference for Singapore will be utilisation."

The EDB is therefore starting to explore the possibility of developing a carbon chain on Jurong Island.

For example, French chemicals group Novocap said in June that it is building a sodium bicarbonate plant on Jurong Island which will capture carbon emissions from neighbouring industries for use in its manufacturing process.

"If we can do that more extensively that will also help in terms of reducing carbon emissions," said Mr Chan. "But it takes time."

He added: "If we can see more applications for carbon dioxide which we can build in a sustainable and competitive way on Jurong Island it's something which we'll definitely be very keen on. It's still very early stage for us in studying that chain."

☛ Chevron Oronite turns to IoT to boost safety at chemical plant, Page 2



In the longer term, carbon capture and utilisation technologies could become an option for Singapore, said Mr Chan.

Advantages of Natural Gas

- **Non Pollutive** (compared with Diesel)
- **Large Flammable Inventory** (compared with Diesel & LPG i.e. saves Land Premium)
- **Regulatory compliance cost** (eg. Storage license, bunker tank etc.)
- **Land Space and Cost** (Without storage of fuels, space is free up for other use)
- **Better Safety Record** (compared with LPG i.e. Lighter than Air)
- **Higher Efficiencies** (turn-down rate and carbon stick at boiler tube)
- **Lower maintenance cost** (as boiler cleaner as compared to diesel fired)
- **Energy, asset and maintenance saving (**from diesel pump & LPG vaporizer.)
- **Operational effectiveness** (manpower cost in procurement and verification and even downtime)

Constraints of Natural Gas

- **Gas Network Availability**
- **Infrastructure Cost**
- **Regulatory compliance** (e.g. Single user only.)

Issues Encountered

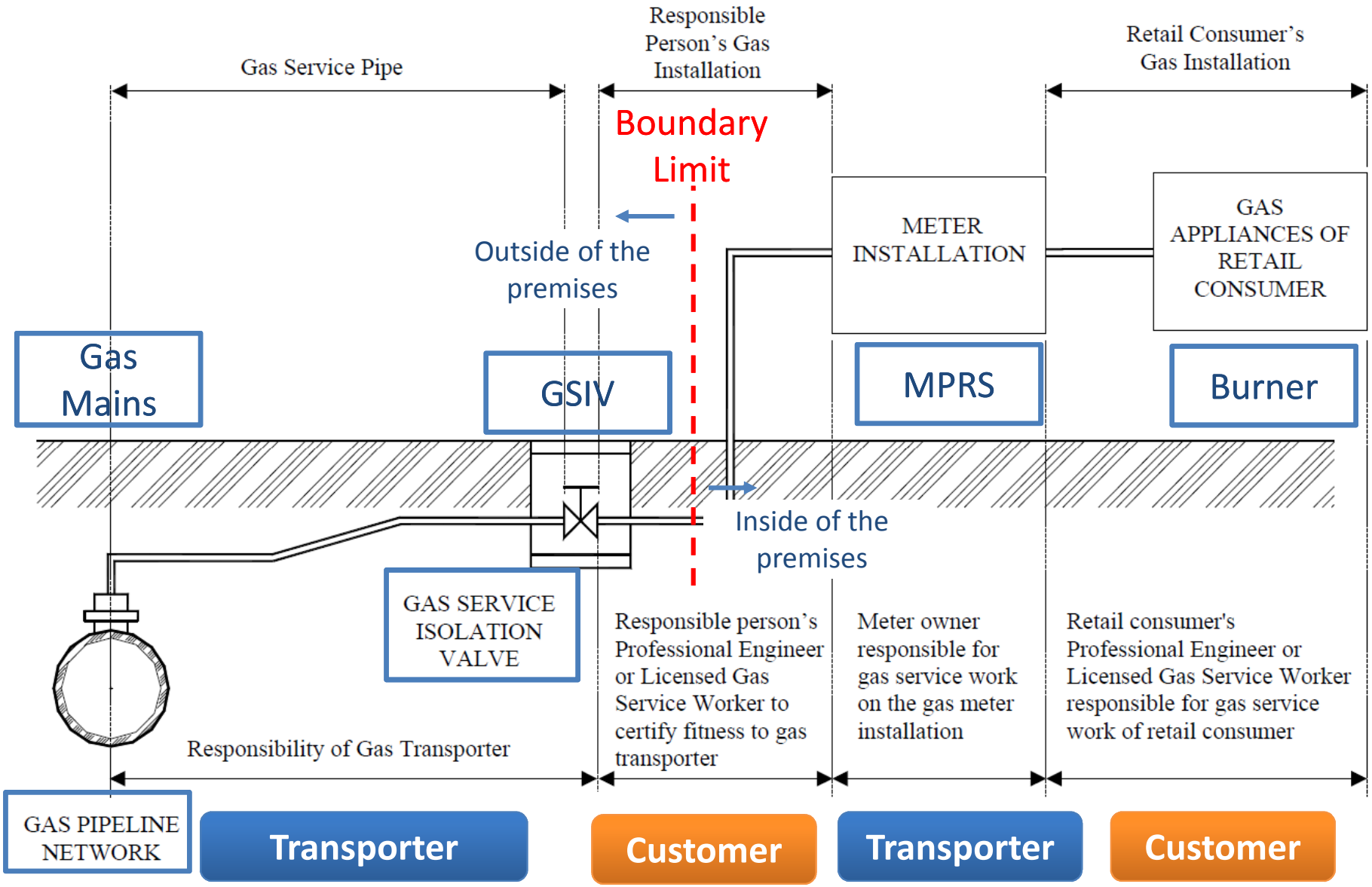
- **Fuel Indexing**
- **Payment Currency**
- **Gas Pressure**
- **Flowrate design (don’t have to be always at max.)**
- **Documentation (use of wrong PG forms)**
- **Monetary issues**

NG Project Implementation and Process

- Enquiry / Canvassing
- Submit PowerGas form GDP 102
- Site survey
- Costing and Proposal (1 – 2 months)
- Contract Signing (1 week to 9 months)
- Making Full Payment (1 – 2 months)
- Project confirmation
- First Site Meeting
- Pipe Laying and Meter Construction (min. 6 months)
- Final Pressure Test
- Gas turn-on

Flowchart and forms are available at www.city-og.com.sg
under City-OG handbook

Demarcation of Responsibility of Gas Service Work from Gas Supply Code



THE END

THANK YOU