IGRC Seoul 2011
International Gas Union Research Conference

Life Cycle Greenhouse Gas Emissions of LNG and City Gas 13A

Osaka Gas Co.,Ltd.
Tomohito Okamura

Osaka Gas's Profile

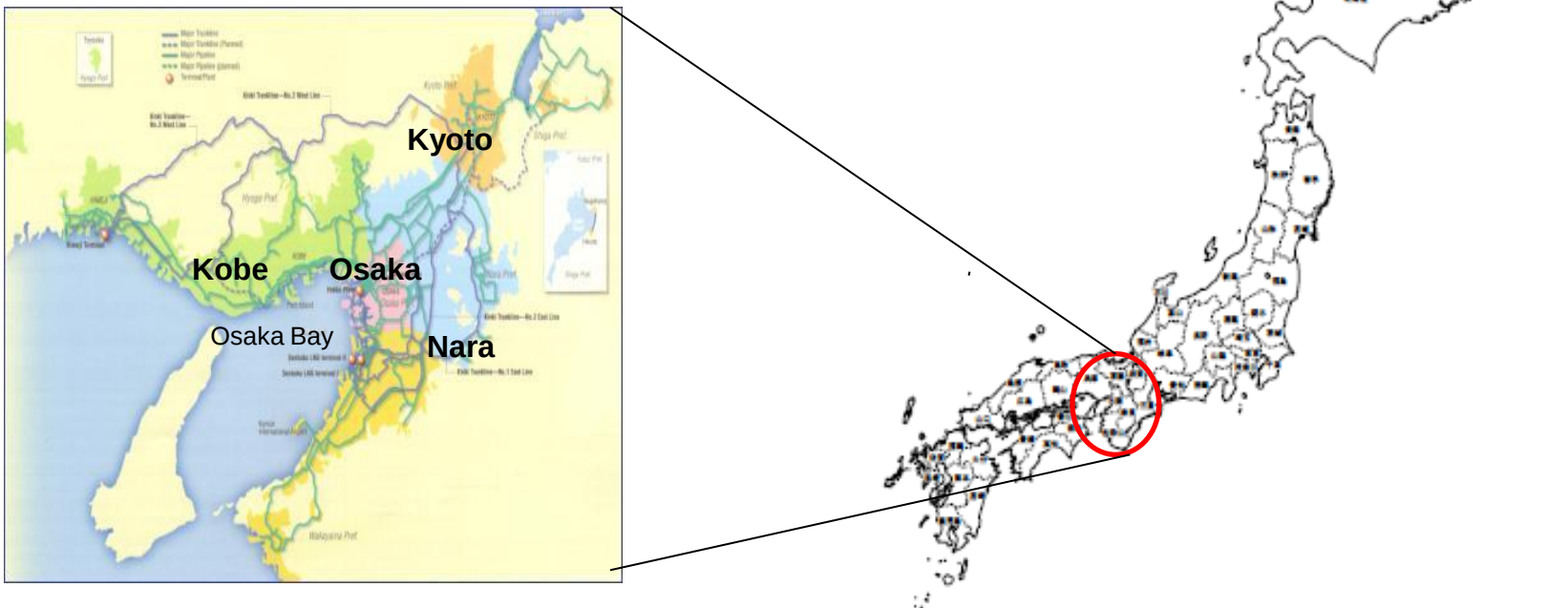
Number of Customers : approx. 7 million

LNG Purchase Volume : approx. 7.7 Million tons per year

Gas Sales Volume : approx. 8,500 million m^3 per year

Pipeline Length : approx. 60 Thousand km

Service Area



Introduction

$LCCO_2$ Analysis of LNG and City Gas（1997～2003）

- On-site surveys of gas fields/liquefaction terminals

  Southeast Asia, Oceania, the Middle East

- Gathering actual, representative and reliable data at each stage

- Establishing the LCA methodology for LNG

- Demonstrating the environmental-friendly nature of LNG

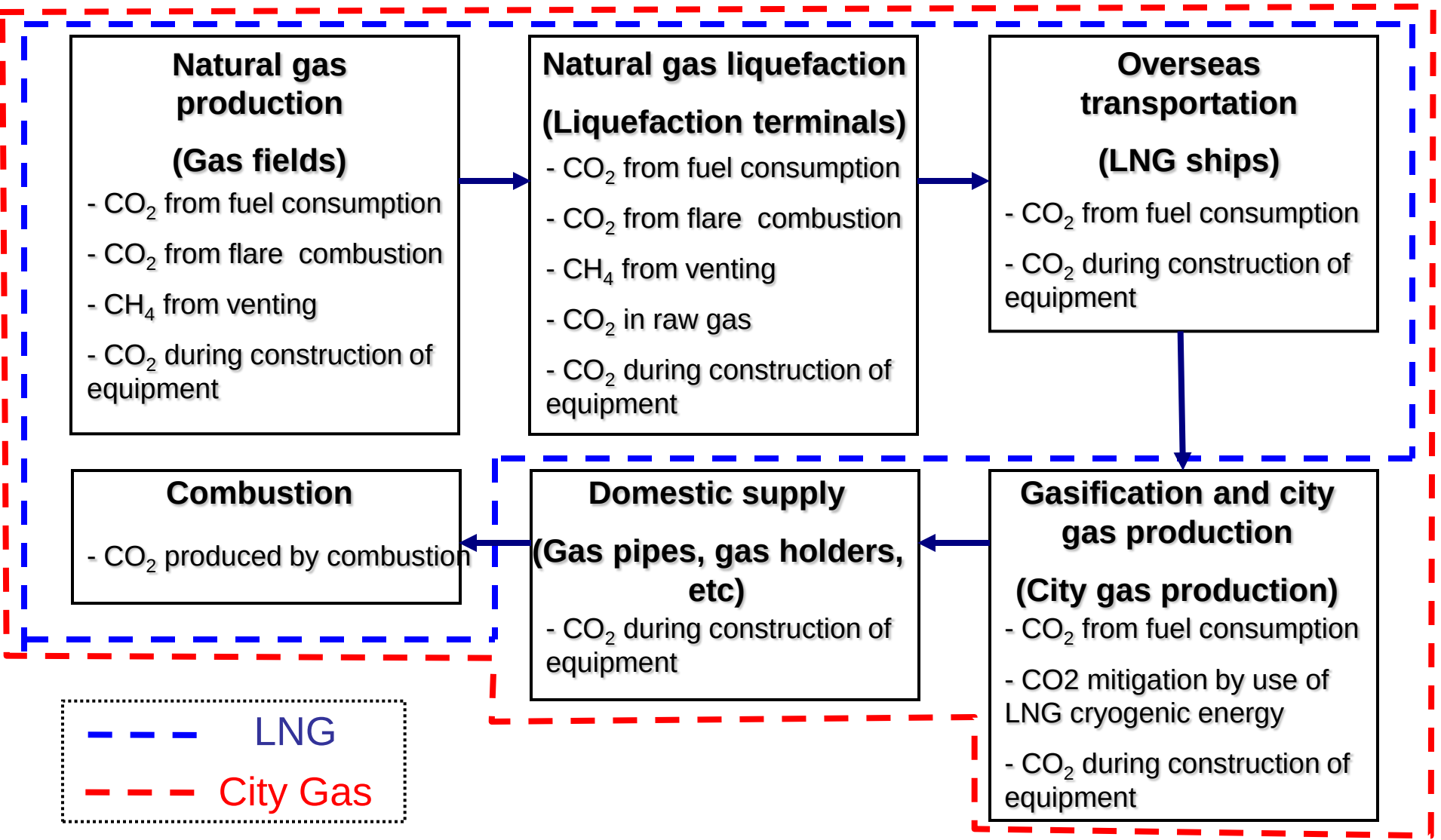
- Providing basic data used in examining the reduction of GHGs by the effective utilization of LNG

IGRC Seoul 2011
International Gas Union Research Conference

Field Studies

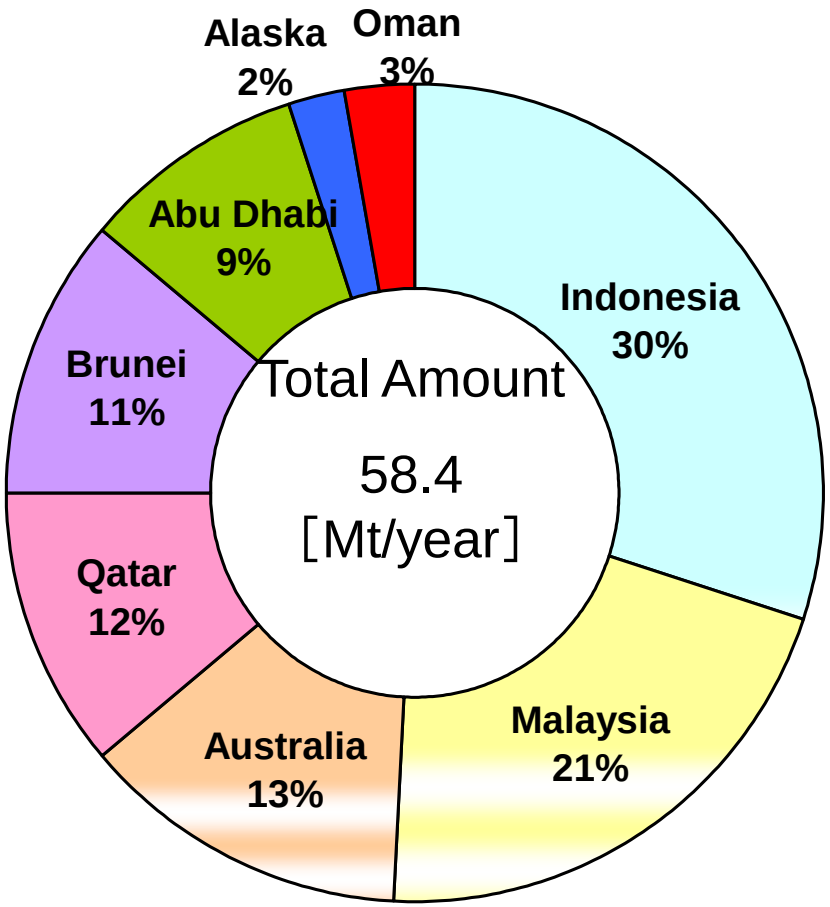
Project	Investigation summary
Indonesia	■ Implementation in 1998 ■ Used result of the field study at Baduk gas field
Malaysia Brunei	■ Implementation in 1998
Qatar Oman	■ Implementation in 2003
Australia Alaska	■ Use of the 2003 data for CO_2 and CH_4 emissions at the production and liquefaction stages obtained by letter investigation
Abu Dhabi	■ Use of the 1998 data only for the analysis of CO_2 in raw gas

Scope & Methodology of the Assessment

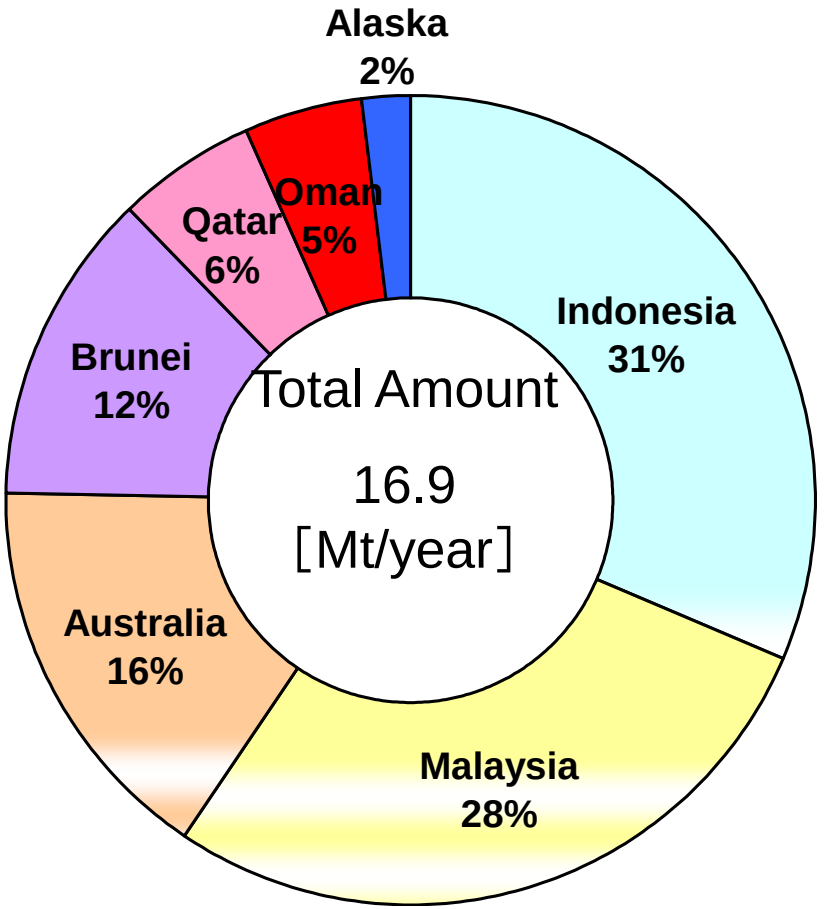


LNG Import to Japan(2003)

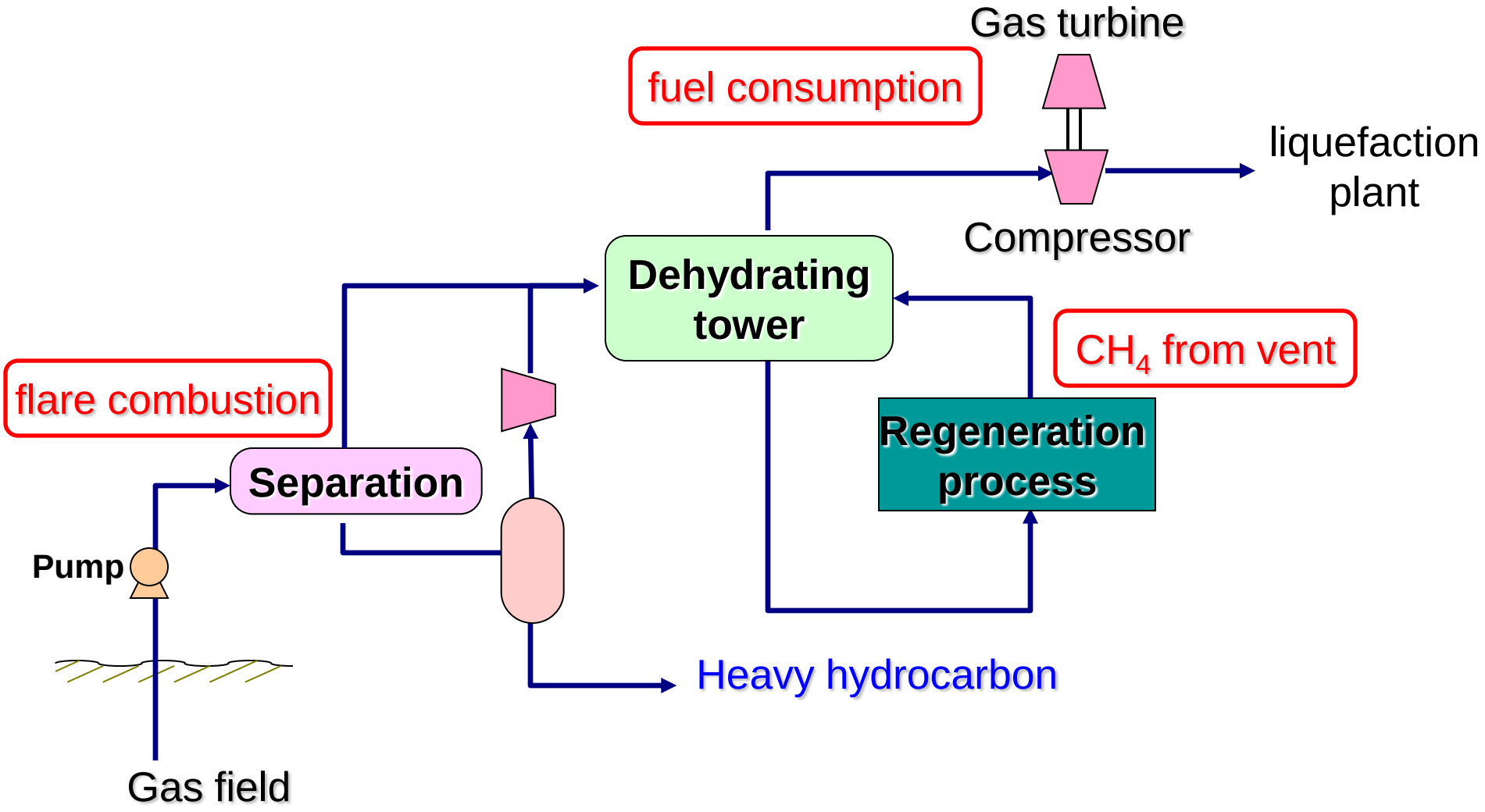
Total LNG Import to Japan



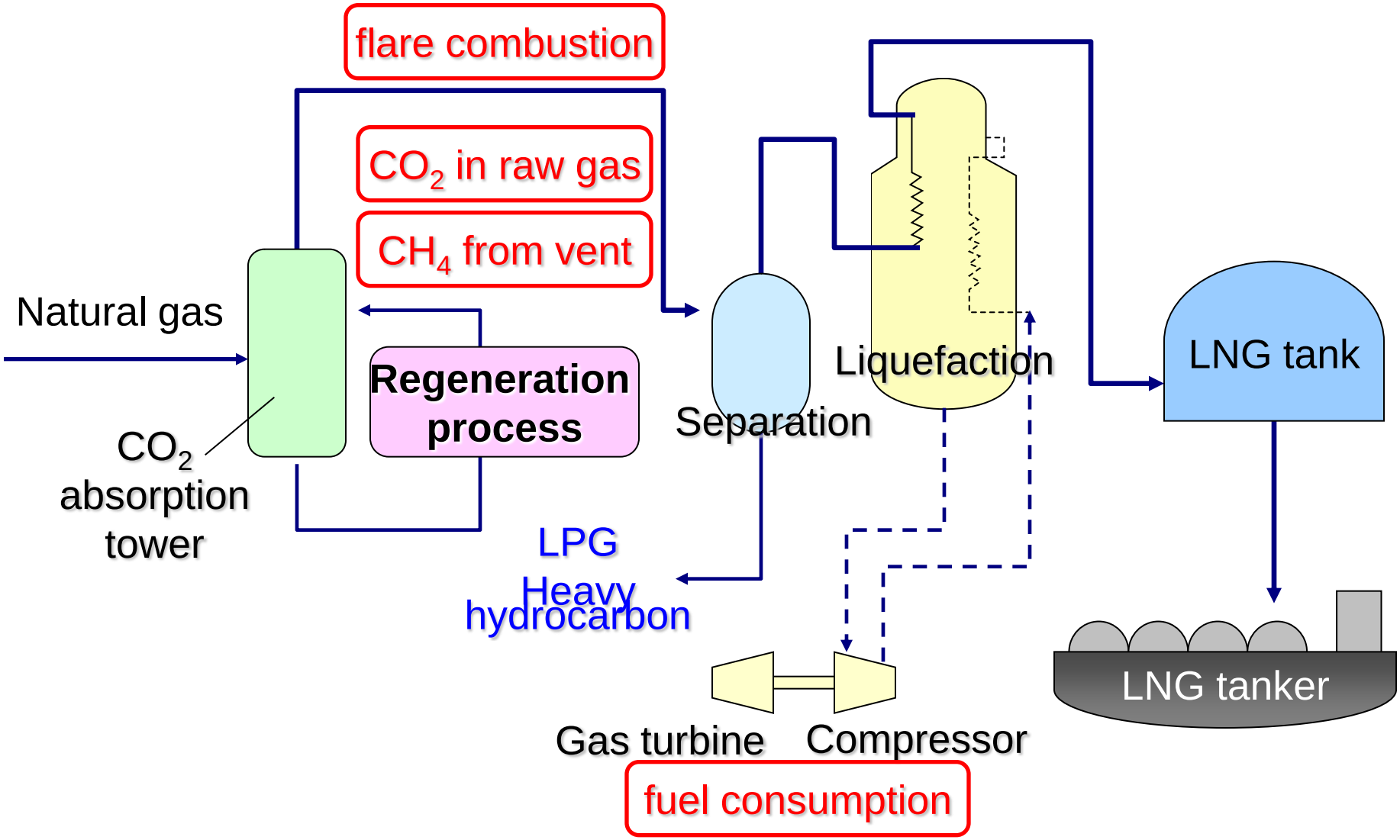
LNG Import for major three city gas companies in Japan



Natural Gas Production Stage



Liquefaction Stage



Emissions at the production and liquefaction stages

HHV Standard

【g-CO_2/MJ】

Items		Average	Min	Max
Production	Fuel consumption CO2	0.47	0.02	1.37
	Flare combustion CO2	0.13	0.04	0.27
	CH4 from vent	0.19	0.00	1.28
Liquefaction	Fuel consumption CO2	5.43	4.58	8.22
	Flare combustion CO2	0.41	0.07	1.04
	CH4 from vent	0.46	0.00	1.76
	CO2 in raw gas	1.81	0.07	5.66

Emissions at the LNG Transportation Stage

Total average of the Transportation Ships

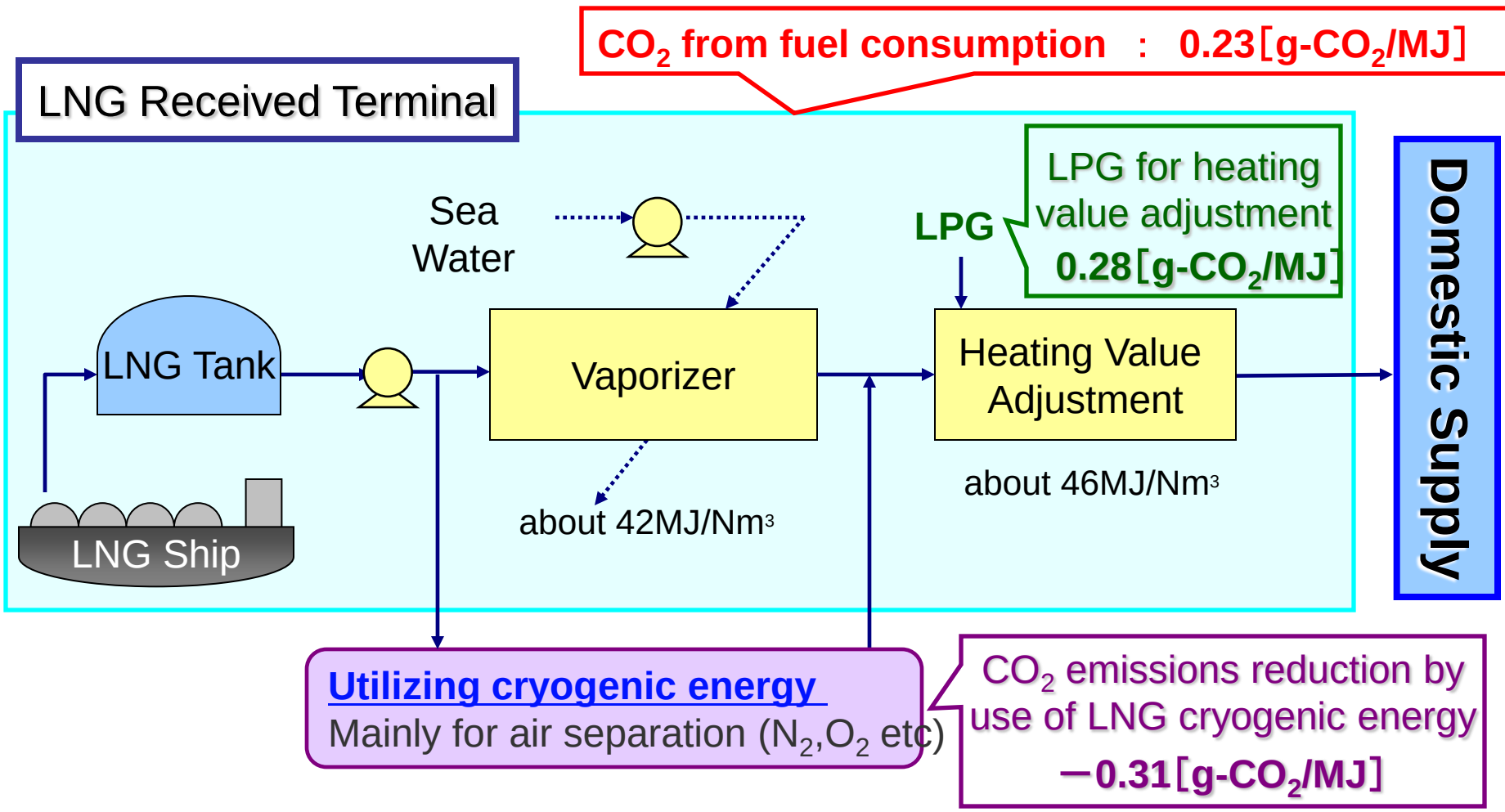
Item	Weighted Average Value
Boil off Gas Consumption	1,202 t
Bunker Fuel Oil Consumption	657 t
LNG Cargo Capacity	53,592 t
Transportation Distance	6,174 km

Transportation Energy Intensity：8.17［g-CO_2/(t･km)］

CO_2 Emissions Intensity at the LNG Transportation Stage

Item	LNG	City Gas 13A
Weighted Average Transportation Distance［km］	6,620	5,630
CO_2 Emissions Intensity ［g-CO_2/MJ］	1.97	1.67

Emissions at the Gasification and City Gas Production Stage



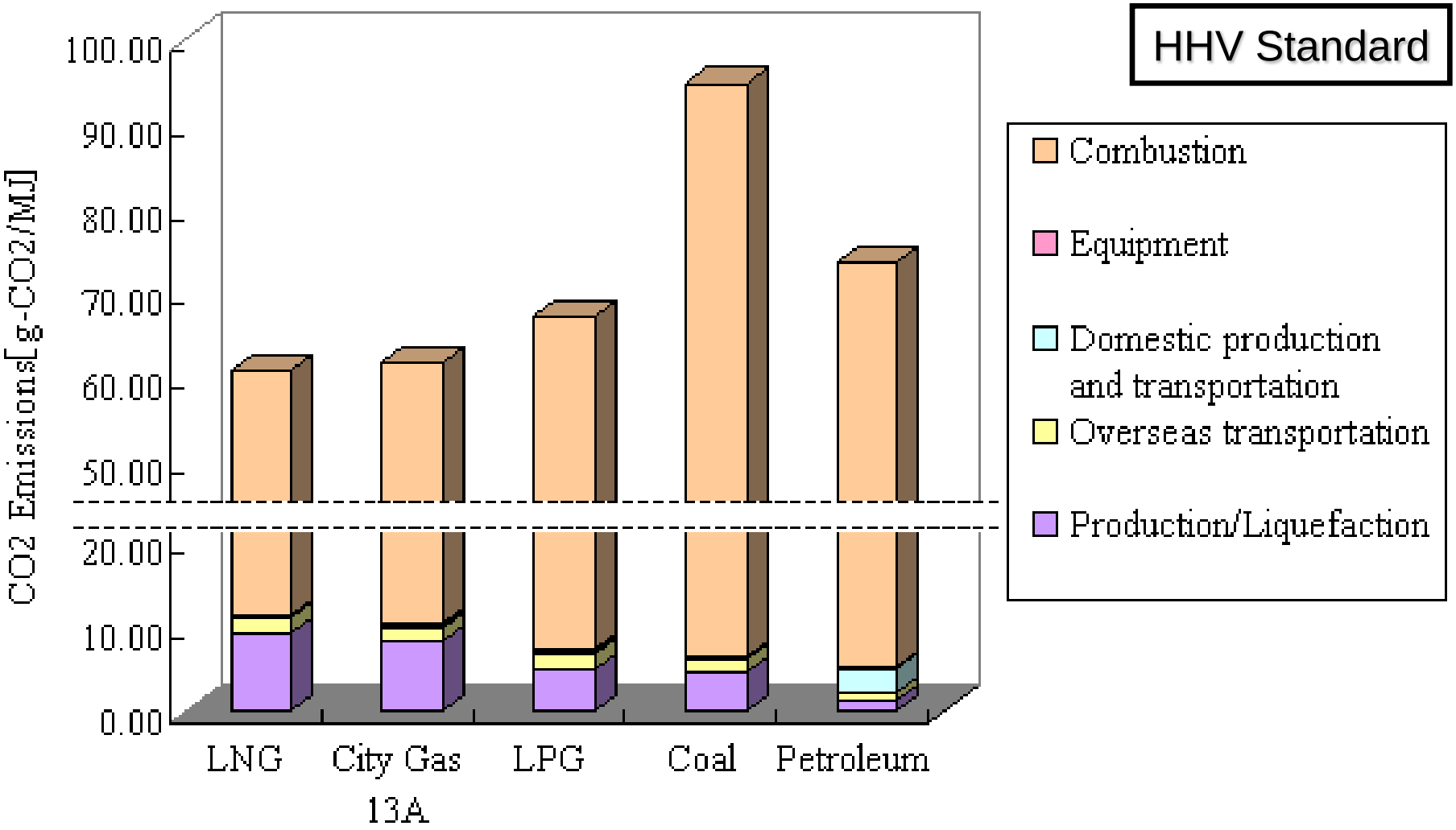
LNG and City Gas 13A Life Cycle CO_2 analysis Results

Items		LNG	City Gas 13A
Production	Fuel consumption CO2	0.48	0.48
	Flare combustion CO2	0.14	0.14
	CH4 from vent	0.20	0.19
	Subtotal	0.81	0.80
Liquefaction	Fuel consumption CO2	5.60	5.28
	Flare combustion CO2	0.42	0.35
	CH4 from vent	0.47	0.46
	CO2 in raw gas	1.87	1.55
	Subtotal	8.36	7.65
Overseas transportatio	Operation	1.97	1.61
	Subtotal	1.97	1.61
Domestic Production	Production	-	0.24
	Cryogenic energy use	-	-0.29
	LPG heating	-	0.29
	Subtotal	-	0.24
Equipment		0.04	0.38
Combustion		49.4	51.23
Total		60.58	61.91

HHV Standard

【g-CO_2/MJ】

Comparison with Other Fossil Fuels



Challenges for the future

- Addition of the property data of the new natural gas fields
- Taking account of the increase in energy efficiency at the gas fields and liquefaction terminals
- Reflecting the characteristic features of shale gas and coalbed methane
- Taking action to Scope 3 carbon accounting in the supply chain