

## Minimizing Methane Leakage in Natural Gas Trade

**Creating 'Club Goods' for LNG Exporters, Importers,  
Shippers and Maritime Fuel Users**

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## ***Disclaimers***

Preliminary report, not final report

Views expressed are mine, and not necessarily ICTSD's

# Outline of Comments

1. The problem(s)
2. Existing international arrangements
3. Potential new international arrangements
4. Conclusions

Solutions to methane leakage problems

Political economy of 'club goods'

# 1. The problem(s)

## Methane leakage in LNG trade

### Methane GWP

86 at 20 years and 34 at 100 years  
(IPCC, AR5, WG 1, 2013 report)

### Increases in...

- LNG transported in international shipping
  - LNG as a maritime shipping fuel

# Drivers of increases in LNG in trade

**Shale gas: US and other countries**

**Ukraine crisis: changes in trade patterns**

**IMO: new fuel efficiency regulations**

# How much of a problem?

## Don't know:

- LNG export liquefaction, LNG import regasification
- Shipping – LNG transport and fuel (see studies by ICCT)
- Variations in US studies (see Brewer, ICTSD study)

## Not very big now:

- Only small fraction of total world ghg emissions

## Likely to increase significantly:

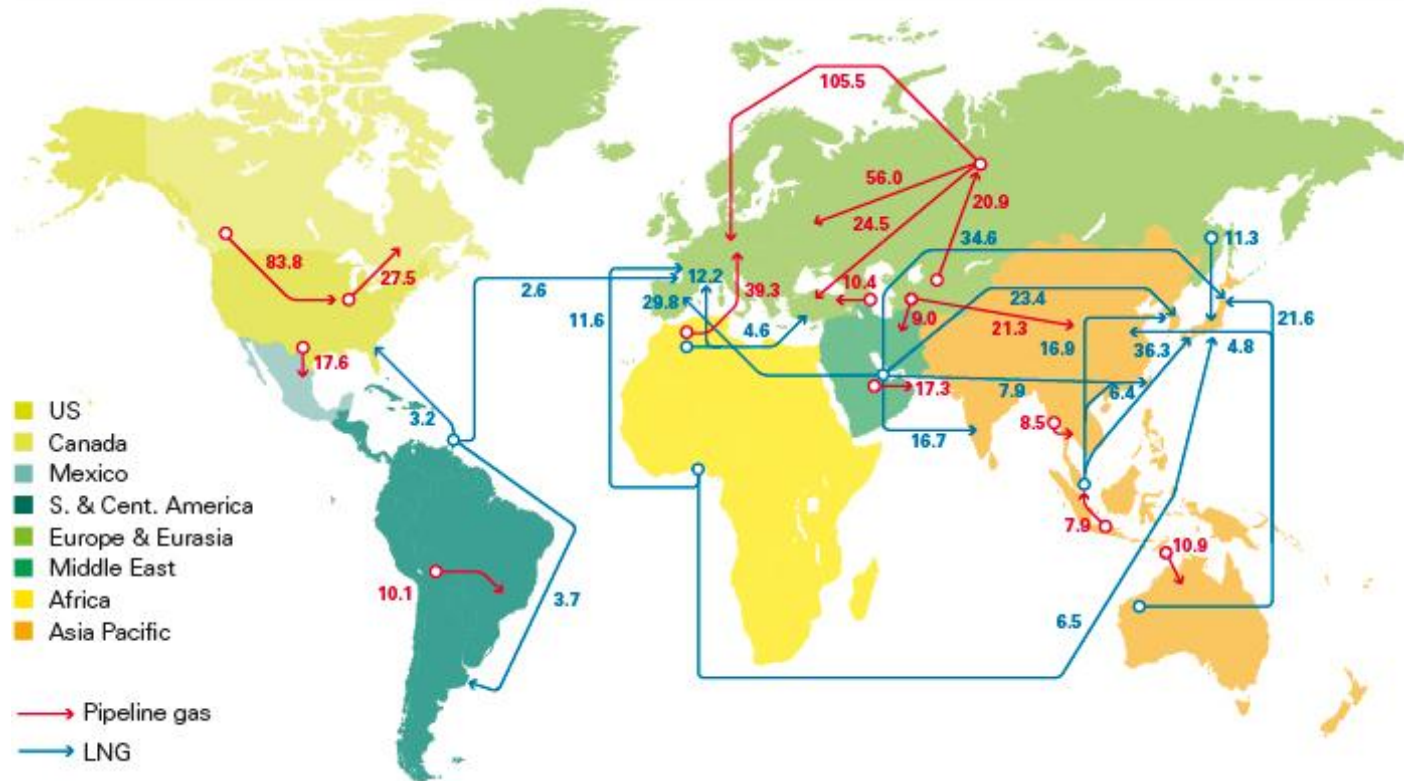
- Natural gas production/consumption (see IEA studies)
- Shale gas deposits and prices (see Brewer, ICTSD study)
- Projections of LNG export and import facilities  
(see Appendices 1 and 2 of this presentation)
- LNG transport ship fleet (see industry projections)

# LNG in trade

Source: www.bp.com - also see Appendix 3

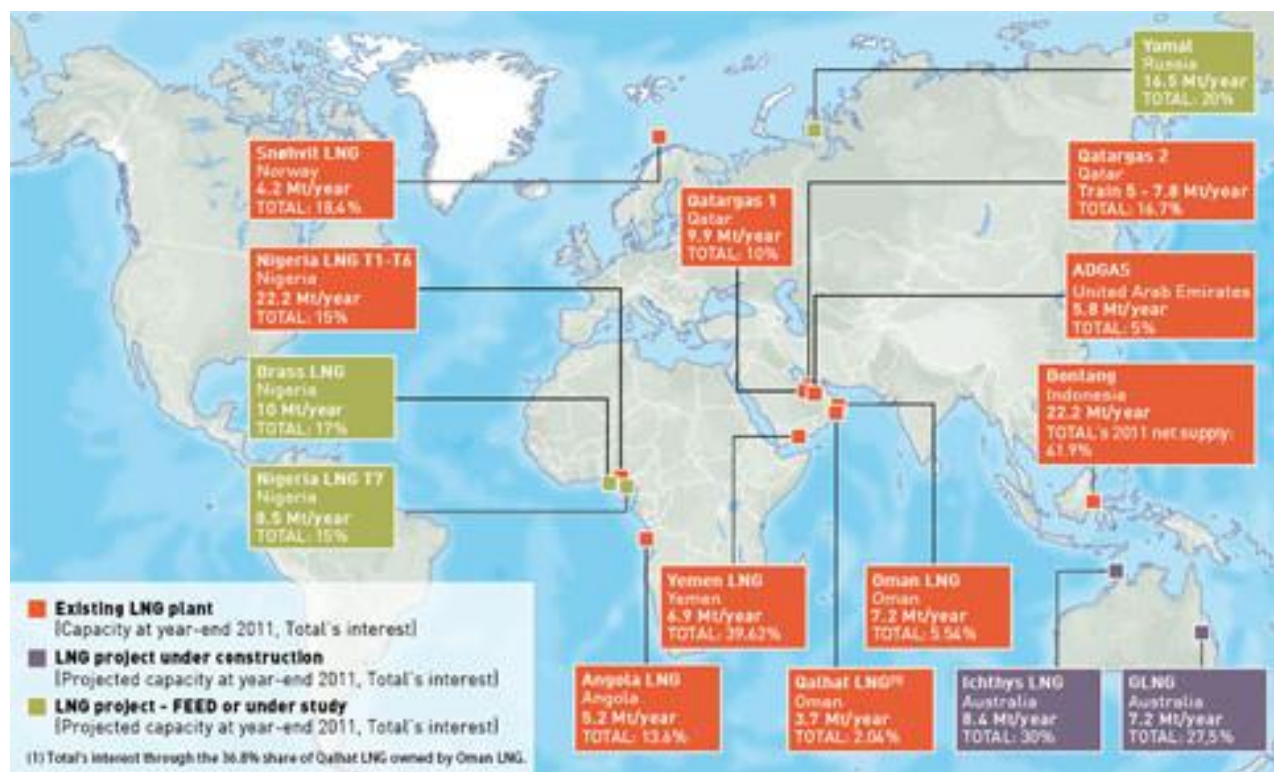
## Natural gas major trade movements 2012

Trade flows worldwide (billion cubic metres)



# Total's LNG export liquefaction facilities

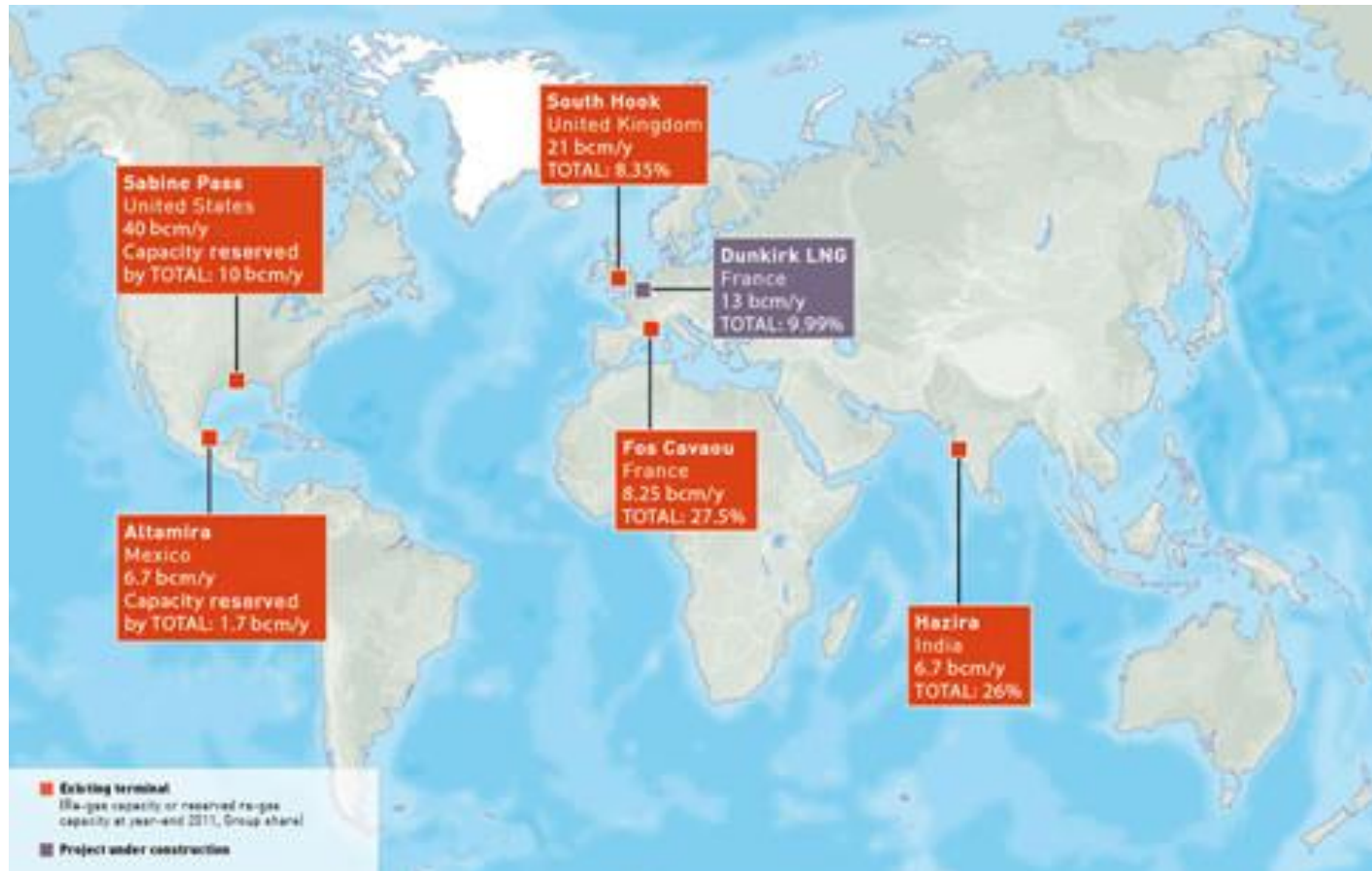
Source: www.total.com





# Total's LNG import re-gasification facilities

Source: [www.total.com](http://www.total.com)



# LNG liquefaction export facility

Statoil: Melkoya, Hammerfest, Norway  
(largest in Europe, developed by Linde of Germany)



# FLNG 'Ship'

(500 meters long; for deployment off coast of Australia)



Re-gasification import facility:  
(largest in Europe, South Hook, Milford Haven, UK, Wales)



## 2. Existing international arrangements

**Climate and Clean Air Coalition (CCAC)/UNEP**

Clean Energy Ministerial (CEM)

Energy Charter Treaty (ECT)

G-8 [7]

Global Methane Initiative (GMI)

**International Energy Agency (IEA)**

**International Maritime Organisation (IMO)**

International Standards Organisation (ISO)

UN Environment Programme (UNEP)

UN Framework Convention on Climate Change (UN FCCC)

UN Inter-governmental Panel on Climate Change (UN IPCC)

World Bank (including GEF)

World Trade Organization (WTO)

# **Needed: Better Methane Monitoring, Reporting, Verification (MRV)**

Export liquefaction facilities

Ships' LNG cargo

Ships' LNG fuel

Import re-gasification facilities

### **3. New international arrangements**

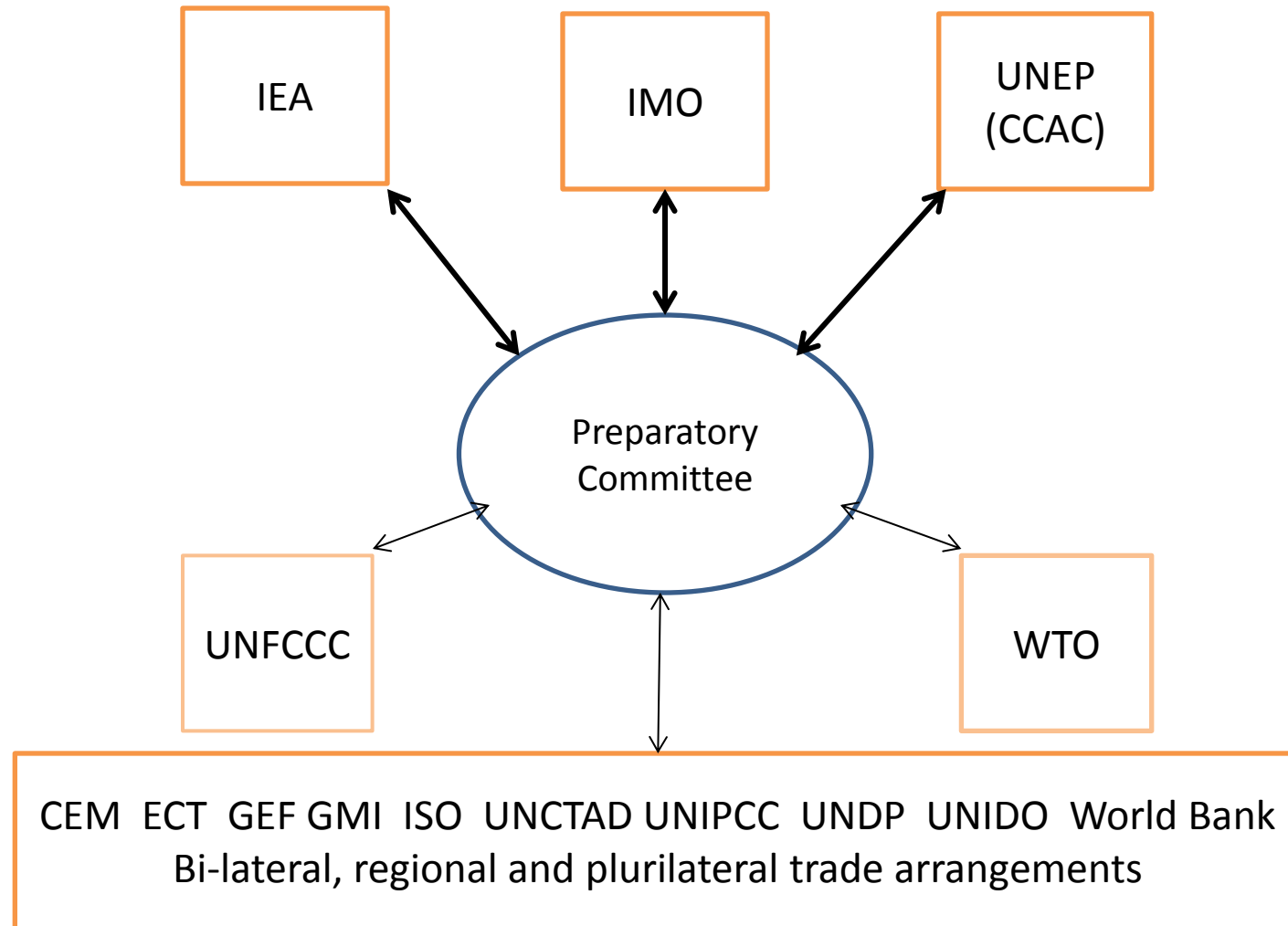
- > Certification/declaration of leakage rates by ...  
exporters, shippers, importers
- > Independent verification
- > In relation to agreed allowable leakage rates

## Next steps

- Expand dialogue in international venues, including but not limited to the IMO, IEA, UNEP/CCAC
- FCCC/COP-21: strengthen methane MRV, including LNG export and import facilities; endorse concept of LNG international trade methane leakage agreement
- Begin creation of Preparatory Committee as prelude to negotiating development of new arrangements



# Illustrative structure



# Illustrative process



## 4. Conclusion

Does it 'have legs' ...

- As solution to LNG methane leakage problem?
- As source of lessons about 'club goods'?

# Methane leakage problems

There are reasons to be concerned.

Problem is only small fraction of total ghg problem.

Cost-effective technical solutions exist.

What about the political economy of participation and compliance? Create 'club goods.'

## Issues about creating 'club goods'

### Conditions that facilitate/inhibit efforts?

Economic: structure of industry

Political: who has how much influence

Cultural: sensitivity to climate change

(The IMO is not the ICAO – see Appendix 4)

### Regulatory capture?

Neglected topic in climate change and other international regime studies

# More issues about creating LNG trade 'club goods'

*Two sets of issues with different national government interests, industries, and international organisations*

## I. LNG export liquefaction and import regasification

Govt: National natural gas systems and regulations

Indus: Natural gas drilling, extracting, refining, distributing firms

IOs: FCCC, WTO, others

## II. Shipping

Govt: National maritime subsidies and trade protection

Indus: Ship building firms and maritime shipping firms

IOs: IMO, WTO, others

## For more information...

Brewer. The Shale Gas Revolution: Implications for Sustainable Development and International Trade. ICTSD Issue Paper, March 2014. [www.ictsd.org](http://www.ictsd.org)

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International Energy Agency. Medium-Term Gas Market Report, 2013. [www.iea.org](http://www.iea.org)

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International Gas Union. International Gas, April-September 2014. [www.igu.org](http://www.igu.org).

International Gas Union. World LNG Report – 2014 Edition. [www.igu.org](http://www.igu.org).

International Maritime Organisation. Energy efficiency and the reduction of GHG emissions from ships. [www.imo.org](http://www.imo.org)

Lowell, Dana, Haifeng Wang, and Nic Lutsey. Assessment of fuel-cycle impact of LNG in international shipping. Washington, DC: International Council on Clean Transportation [ICCT], 2013. [www.theicct.org](http://www.theicct.org)

Wang, Haifang, and Galen Hon. Reducing GHG emissions from ships, Washington, DC: ICCT, 2011. [www.theicct.org](http://www.theicct.org)

Wang, Haifeng, and Nic Lutsey. Long-term potential for increased shipping efficiency. Washington, DC: ICCT, 2013. [www.theicct.org](http://www.theicct.org)

# Appendix 1: LNG Export Liquefaction Facilities

A. In existence as of 2013		B. Under construction as of 2014		In existence or under construction
Total: 69 facilities in 23 countries		Total: 28 facilities in 8 countries (2 new)		Total: 97 facilities in 25 countries
Australia	8	Australia	14	22
Indonesia	9	Indonesia	1	10
Qatar	14	Qatar	-	14
Russia	2	Russia	3	5
US	1	US	4	5
18 other countries	35	4 other countries	6	41 in 20 other countries

Source: Computed by the author from IGU, World LNG Report, 2014; App. I and II



## Appendix 2: LNG Import Re-gasification Facilities

A. In existence as of 2013		B. Under construction as of 2014		A+B
Total: 94 facilities in 26 countries		Total: 26 facilities in 11 countries (4 new)		Total: 120 facilities in 30 countries (26 + 4)
China	9	China	4	13
EU (8)	17	EU (4)	5	22 (EU 8)
Japan	21	Japan	5	26
US	12	-	-	12
15 other countries	35	5 other countries	12	47 in 20 other countries

Source: Computed by the author from IGU, World LNG Report, 2014; App. III and IV

## Appendix 3: LNG trade partners (2013, mtpa, rounded)

Exporters/ Importers	Aus	Indo	Mal	Nig	Qatar	Top 5 Sub- total	Other	Sub- total
China	3	3	3	<1	7	16	3	19
India	-	-	-	1	11	12	1	13
Japan	18	6	15	4	16	59	29	88
Korea	-	6	4	3	14	27	14	41
Taiwan	2	2	3	1	6	13	-	13
Other	1	1	-	6	25	31	33	65
Sub- total	22	17	25	17	77	158	80	238

Source: Computed by the author from IGU, World LNG Report, 2014; Table 3.2. Discrepancies in sub-totals are result of rounding data in the original source.

## **Appendix 4: Excerpts from IMO summary of its activities concerning... *Energy efficiency and the reduction of GHG emissions from ships***

Mandatory measures to reduce emissions of greenhouse gases (GHGs) from international shipping entered into force on 1 January 2013.

The amendments to MARPOL Annex VI Regulations for the prevention of air pollution from ships, which entered into force on 1 January 2013, add a new chapter 4 to Annex VI on Regulations on energy efficiency for ships to make mandatory the Energy Efficiency Design Index (EEDI), for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships.

### Recent work in the Marine Environment Protection Committee

2013 MEPC 65: 2013 guidelines agreed, EEDI extended to other ship types

2012 MEPC 64: Guidance and interpretations approved

2012 MEPC 63: Adoption of four sets of guidelines intended to assist in the implementation of the mandatory Regulations on Energy Efficiency for Ships in MARPOL Annex VI

MEPC 65 - Update of GHG emissions estimate gets go-ahead

MEPC 65 (May 2013) approved the terms of reference and agreed to initiate a study for an updated greenhouse gas (GHG) emissions' estimate for international shipping, following discussion in an expert workshop, which met earlier this year, on the methodology and assumptions to be used.

### Studies and reports

Assessment of IMO-mandated energy efficiency measures for international shipping (2011)

Expert Group (MBM-EG) feasibility study and impact assessment of proposed market-based measures (2010)

Intersessional meeting of IMO's Working Group on GHG from Ships (March 2011) considered the development of suitable MBMs

Second IMO GHG Study 2009

Source: Excerpted by the author from IMO, Energy efficiency and the reduction of GHG emissions from ships. Accessed at [www.imo.org](http://www.imo.org) on 30 April 2014.