Global LNG-based natural gas trade: The role of the US and Louisiana

Energy Summit – 2018

Louisiana's Place in the Global Energy Economy

LSU Center for Energy Studies
Baton Rouge, Louisiana
October 24, 2018

Ronald D. Ripple, PhD

Mervin Bovaird Professor of Energy Business and Finance

ron-ripple@utulsa.edu

Outline

- Confusion - What is LNG; What is LNG not?
- Where have we come from?
- Where may we be going?
- What are the competitive challenges?
- Uncertainties?

Confusion – What is LNG; What is LNG not?

- LNG is NOT a fuel.
- LNG is NOT a commodity.
- LNG is NOT distinct from natural gas.
- LNG does NOT compete with natural gas.
- NO process uses the -162 °C (-260 °F) liquid as an input.

- LNG is a transportation and/or storage phase for natural gas.
- LNG is always re-gasified for use.

- Natural gas is the fuel/commodity.
- The markets are for natural gas.

Confusion – What is LNG; What is LNG not?

- Why does this matter?
- The confusion can lead to bad policy and regulation.
- Indeed, this has occurred!
- The WTO found against a claim by Russia, with the WTO saying that LNG is distinct from natural gas in the gaseous form, and therefore differences in treatment could not be claimed to be discriminatory.
  - See, WTO, *EU Energy Package* (Panel Report), WT/DS476/R, 10 August 2018; www.wto.org/english/tratop_e/dispu_e/cases_e/ds476_e.htm
  - See, "A False Dichotomy Between LNG and Natural Gas? A Comment on Recent Practices at the World Trade Organization," by M. Wüstenberg, K. Talus and R.D. Ripple, *OGEL*, October 2018; www.ogel.org/journal-advance-publication-article.asp?key=581

Where have we come from?

Year-on-year Growth global LNG trade

2015-2016 9.6%

2016-2017 10.2%

US LNG exports accounted for 25% of the global increase 2015-2017

36% of 2016-2017 increase

Natural gas imports and exports

[Source: BP Statistical Review of World Energy 2017-2018]

Gas Trade in 2015, 2016, and 2017

Billion cubic metres	2015				2016				2017				LNG import and export shares					
	Pipeline imports	LNG imports	Pipeline exports	LNG exports	Pipeline imports	LNG imports	Pipeline exports	LNG exports	Pipeline imports	LNG imports	Pipeline exports	LNG exports	2015		2016		2017	
													exports	imports	exports	imports	exports	imports
US	74.4	2.6	49.1	0.7	79.5	2.4	58.6	4.3	80.7	2.2	66.1	17.4	0.2%	0.8%	1.2%	0.7%	4.4%	0.5%
Canada	19.2	0.6	74.3	†	21.1	0.3	79.5	†	24.0	0.4	80.7	†		0.2%		0.1%		0.1%
Mexico	29.9	7.3	†	-	37.5	5.9	†	-	42.1	6.6	†	-		2.2%		1.7%		1.7%
Trinidad and Tobago	-	-	-	16.9	-	-	-	14.3	-	-	-	13.4	5.2%		4.0%		3.4%	
Other S. & Cent. America	19.9	19.8	19.9	5.1	16.2	15.6	16.2	6.4	15.4	13.8	15.4	5.8	1.6%	6.1%	1.8%	4.4%	1.5%	3.5%
France	31.8	6.8	-	0.6	32.2	9.1	-	1.5	33.5	10.8	-	1.0	0.2%	2.1%	0.4%	2.5%	0.3%	2.7%
Germany	102.3	-	32.7	-	95.6	-	9.1	-	94.8	-	7.1	-						
Italy	55.7	5.4	0.2	-	60.5	5.9	-	-	53.8	8.4	-	-		1.7%		1.7%		2.1%
Netherlands	33.6	2.1	47.1	1.3	36.8	1.3	46.8	0.9	40.9	1.6	43.3	0.8	0.4%	0.6%	0.2%	0.4%	0.2%	0.4%
Norway	†	-	109.6	5.9	†	-	109.4	6.0	†	-	109.2	5.8	1.8%		1.7%		1.5%	
Spain	15.2	13.1	0.5	1.8	15.5	13.8	0.6	0.2	14.4	16.6	0.1	0.1	0.5%	4.0%		3.9%	0.0%	4.2%
Turkey	38.4	7.7	0.6	-	36.9	7.8	0.6	-	42.8	10.9	0.6	-		2.4%		2.2%		2.8%
United Kingdom	29.0	13.1	13.4	0.3	35.2	11.0	9.7	0.6	39.4	7.2	10.8	0.3	0.1%	4.0%	0.2%	3.1%	0.1%	1.8%
Other Europe	94.7	6.9	13.8	1.5	94.8	7.9	13.9	1.3	103.7	10.2	21.6	0.2	0.5%	2.1%	0.4%	2.2%	0.1%	2.6%
Russian Federation	21.8	-	179.1	14.0	18.1	-	200.1	14.6	18.9	-	215.4	15.5	4.3%		4.1%		3.9%	
Ukraine	17.3	-	-	-	10.5	-	-	-	13.3	-	-	-						
Other CIS	27.0	-	72.3	-	29.3	-	68.5	-	30.1	-	67.5	-						
Qatar	-	-	20.0	101.8	-	-	18.5	107.2	-	-	18.4	103.4	31.3%	0.0%	30.0%		26.3%	
Other Middle East	29.6	10.2	8.4	18.8	25.8	13.7	8.0	18.8	22.2	13.0	12.5	19.1	5.8%	3.1%	5.3%	3.8%	4.9%	3.3%
Algeria	-	-	26.3	16.6	-	-	38.1	15.8	-	-	36.4	16.6	5.1%		4.4%		4.2%	
Other Africa	9.0	3.7	11.0	30.0	8.3	10.7	8.6	30.0	7.6	8.2	8.7	38.9	9.2%	1.1%	8.4%	3.0%	9.9%	2.1%
Australia	6.4	-	-	38.1	6.4	0.1	-	59.2	5.8	-	-	75.9	11.7%		16.6%		19.3%	
China	33.6	25.8	-	-	36.0	35.9	-	-	39.4	52.6	-	-		7.9%		10.1%		13.4%
India	-	-	-	-	-	23.6	-	0.1	-	25.7	-	-				[illegible]		[illegible]
Japan	-	110.7	-	-	-	113.6	-	-	-	113.9	-	-		34.0%		31.8%		29.0%
Indonesia	-	-	9.3	20.7	-	-	8.2	22.2	-	-	8.0	21.7	6.4%		6.2%		5.5%	
South Korea	-	43.8	-	0.2	-	45.7	-	0.1	-	51.3	-	0.1	0.1%	13.4%		12.8%	0.0%	13.0%
Other Asia Pacific	20.3	46.0	21.4	51.4	18.1	32.5	20.0	53.4	17.7	40.0	18.8	57.2	15.8%	14.1%	15.0%	9.1%	14.6%	10.2%
Total World	**709.0**	**325.5**	**709.0**	**325.5**	**714.4**	**356.7**	**714.4**	**356.7**	**740.7**	**393.4**	**740.7**	**393.4**						

Source: Includes data from FGE MENAgas service, IHS.

† Less than 0.05.

Note: As far as possible, the data above represents standard cubic metres (measured at 15°C and 1013 mbar) and has been standardized using a Gross Calorific Value (GCV) of 40 MJ/m3.

2016 US LNG-based natural gas exports

Country	Mcf	Share (%)
Chile	29,405,233	16.0%
Mexico	27,469,823	14.9%
China	17,220,633	9.4%
India	16,915,408	9.2%
Argentina	16,661,029	9.1%
Japan	11,137,261	6.1%
South Korea	10,166,100	5.5%
Jordan	9,870,110	5.4%
Brazil	9,196,380	5.0%
Turkey	8,762,481	4.8%
Kuwait	7,067,798	3.8%
Portugal	3,700,091	2.0%
Egypt	3,606,162	2.0%
U.A.E.	3,391,066	1.8%
Italy	3,328,199	1.8%
Dominican Rep	2,944,980	1.6%
Spain	2,930,435	1.6%
Total	183,773,189	
Bcf/d	0.585	

Number of countries
2016 - 17
2017 - 25
2018 - 23

2017 US LNG-based natural gas exports

Country	Mcf	Share (%)
Mexico	140,321,287	19.9%
South Korea	130,185,448	18.4%
China	103,409,855	14.6%
Japan	53,298,599	7.5%
Jordan	36,321,482	5.1%
Spain	29,328,728	4.2%
Chile	25,745,690	3.6%
Turkey	24,854,835	3.5%
India	20,919,137	3.0%
Kuwait	20,213,124	2.9%
Portugal	19,522,724	2.8%
Brazil	17,647,879	2.5%
Argentina	16,276,094	2.3%
U.A.E.	13,408,114	1.9%
Taiwan	9,003,520	1.3%
Dominican Rep	8,690,714	1.2%
Lithuania	6,844,298	1.0%
Egypt	6,781,414	1.0%
Italy	6,492,590	0.9%
Poland	3,439,976	0.5%
United Kingdom	3,410,241	0.5%
Pakistan	3,165,927	0.4%
Thailand	3,112,643	0.4%
Netherlands	3,041,576	0.4%
Malta	867,346	0.1%
Total	706,303,241	
Bcf/d	1.935	

2018 US LNG-based natural gas exports - through August

Country	Mcf	Share (%)
Mexico	147,206,547	21.6%
South Korea	141,918,849	20.8%
China	76,155,297	11.2%
Japan	68,007,705	10.0%
India	37,436,780	5.5%
Brazil	35,645,036	5.2%
Chile	30,558,278	4.5%
Jordan	27,737,665	4.1%
Argentina	27,559,510	4.0%
Taiwan	13,307,418	2.0%
Pakistan	12,955,558	1.9%
Kuwait	9,980,691	1.5%
Turkey	6,992,293	1.0%
Egypt	6,553,756	1.0%
United Kingdom	6,266,742	0.9%
Dominican Rep	5,835,053	0.9%
Portugal	5,543,846	0.8%
Colombia	5,100,938	0.7%
Panama	3,518,379	0.5%
Israel	3,270,275	0.5%
Netherlands	3,252,599	0.5%
Spain	3,229,573	0.5%
Malta	2,926,992	0.4%
Total	680,959,780	
Bcf/d	2.80	

2018

Sabine Pass

23 countries

87.5%

Cove Point

13 countries

12.5%

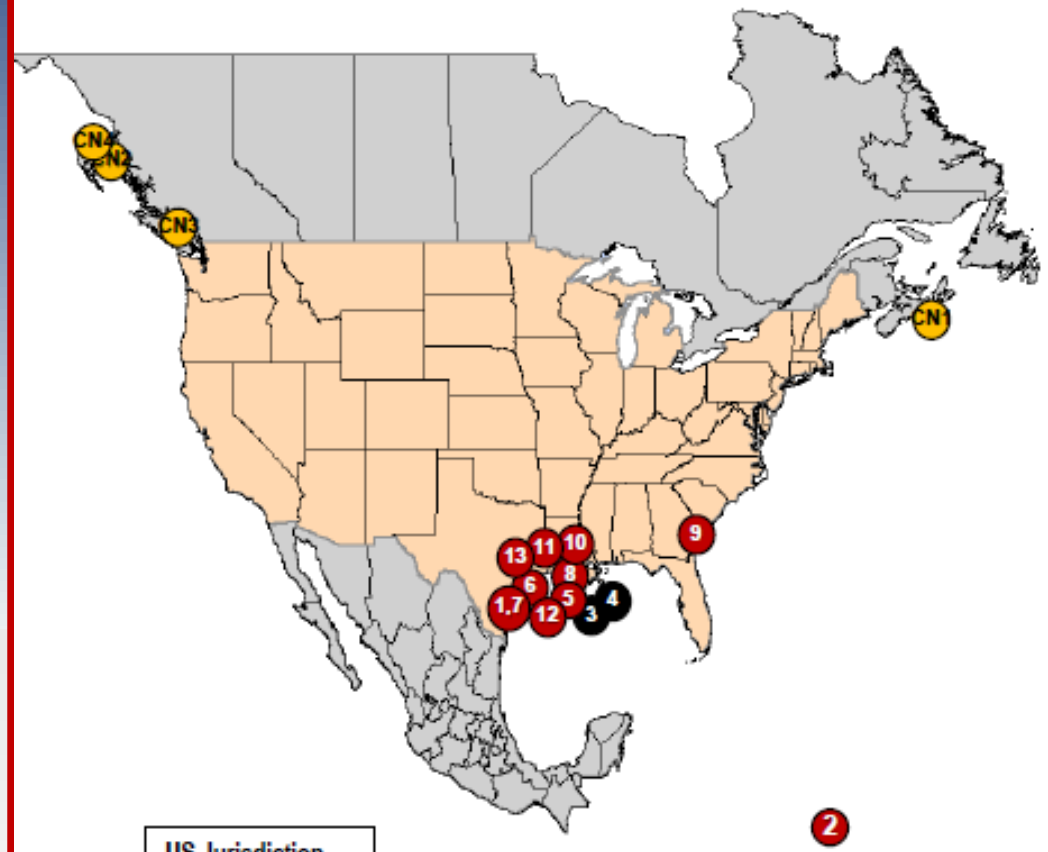
China LNG-based imports from the US: 2017 vs 2018

- 2017 - total imports of 130,409,855 Mcf
  - Imports through August 2017 amounted to 24,461,696 Mcf, or just 24% of the total for the year.
  - There were just 7 cargoes through the first 8 months.
  - There were 23 cargoes during September through December.
- 2018 total imports, through August, amounted to 76,155,297 Mcf, on 21 cargoes, or over 3 times the 2017 import volumes for the same period.

Where are we going?

North American LNG Import/Export Terminals

Approved



As of July 2, 2018

Import Terminals

U.S.

APPROVED - UNDER CONSTRUCTION - FERC

1. **Corpus Christi, TX**: 0.4 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)

APPROVED – NOT UNDER CONSTRUCTION - FERC

2. **Salinas, PR**: 0.6 Bcfd (Aguirre Offshore GasPort, LLC) (CP13-193)

APPROVED - NOT UNDER CONSTRUCTION - MARAD/Coast Guard

3. **Gulf of Mexico**: 1.0 Bcfd (Main Pass McMoRan Exp.)
4. **Gulf of Mexico**: 1.4 Bcfd (TORP Technology-Bienville LNG)

Export Terminals

U.S.

APPROVED - UNDER CONSTRUCTION - FERC

5. **Hackberry, LA**: 2.1 Bcfd (Sempra–Cameron LNG) (CP13-25)
6. **Freeport, TX**: 2.14 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction) (CP12-509) (CP15-518)
7. **Corpus Christi, TX**: 2.14 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)
8. **Sabine Pass, LA**: 1.40 Bcfd (Sabine Pass Liquefaction) (CP13-552)
9. **Elba Island, GA**: 0.35 Bcfd (Southern LNG Company) (CP14-103) ★

APPROVED – NOT UNDER CONSTRUCTION - FERC

10. **Lake Charles, LA**: 2.2 Bcfd (Southern Union – Lake Charles LNG) (CP14-120)
11. **Lake Charles, LA**: 1.08 Bcfd (Magnolia LNG) (CP14-347)
12. **Hackberry, LA**: 1.41 Bcfd (Sempra - Cameron LNG) (CP15-560)
13. **Sabine Pass, TX**: 2.1 Bcfd (ExxonMobil – Golden Pass) (CP14-517)

Canada

APPROVED – NOT UNDER CONSTRUCTION

CN1. Port Hawkesbury, NS: 0.5 Bcfd (Bear Head LNG)
CN2. Kitimat, BC: 3.23 Bcfd (LNG Canada)
CN3. Squamish, BC: 0.29 Bcfd (Woodfibre LNG Ltd)
CN4. Prince Rupert Island, BC: 2.74 Bcfd (Pacific Northwest LNG)

★ Trains 5 & 6 with Train 5 under construction

US LNG export projects - FERC

Existing Capacity	Bcf/d	Sponsor
Cove Point, MD	0.82	Dominion
Sabine, LA	2.8	Cheniere
Kenai, AK	0.2	Conoco-Phillips
Subtotal	3.82	
Approved - Under construction		
Hackberry, LA	2.1	Sempr-Cameron LNG
Freeport, TX	2.14	Freeport LNG
Corpus Christi, TX	2.14	Cheniere
Sabine Pass, LA	1.4	Sabine Pass Liquefaction
Elba Island, GA	0.35	Southern LNG
Subtotal	8.13	
Approved - Not under construction		
Lake Charles, LA	2.2	Lake Charles LNG
Lake Charles, LA	1.08	Magnolia LNG
Hackberry, LA	1.41	Sempra-Cameron LNG
Sabine Pass, LA	2.1	Golden Pass
Subtotal	6.79	

Proposed to FERC		
Pascagoula, MS	1.5	Gulf LNG
Cameron Parish, LA	1.41	Venture Global LNG
Brownsville, TX	0.55	Texas LNG
Brownsville, TX	3.6	Rio Grande LNG
Brownsville, TX	0.9	Annova LNG
Port Arthur, TX	1.86	Port Arthur LNG
Jacksonville, FL	0.132	Eagle LNG
Plaquemines, LA	3.4	Ventrue Global LNG
Calcasieu, LA	4	Driftwood LNG
Nikiski, AK	2.63	Alaska Gasline
Freeport, TX	0.72	Freeport LNG
Coos Bay, OR	1.08	Jordon Cove
Corpus Christi, TX	1.86	Cheniere
Subtotal	23.642	
Total	**42.382**	

Louisiana accounts for 54% of liquefaction capacity operating and under construction, and 70% of the approved (operating, under construction, and not under construction).
7 projects – 13.09 Bcf/d – implies ~99.5 mtpy

BP Outlook 2035

2017 Outlook

Natural gas

Consumption, production, and balance

Consumption of natural gas										
Million tonnes oil equivale	1990	1995	2000	2005	2010	**2015**	2020	2025	2030	2035
North America	579.0	673.8	720.5	711.5	770.0	**880.7**	992.4	1026.9	1096.4	1123.6
S & C America	52.0	67.7	85.2	111.1	135.8	**157.3**	164.7	172.3	183.6	186.5
Europe	309.4	350.6	420.0	481.7	494.6	**412.2**	459.4	458.5	475.9	492.0
CIS	566.0	472.2	467.7	502.5	509.8	**490.9**	491.5	496.0	499.6	494.6
Middle East	87.4	126.9	171.4	251.4	359.5	**441.2**	501.2	564.9	620.6	682.7
Africa	35.6	42.7	51.8	76.5	96.5	**121.9**	134.4	157.4	185.7	220.0
Asia Pacific	136.5	189.9	268.6	369.8	520.5	**631.0**	800.0	921.6	1032.7	1119.1
Total Natural Gas Consump	1765.9	1923.8	2185.3	2504.5	2886.7	3135.2	3543.7	3797.6	4094.5	4318.5

Production of natural gas										
Million tonnes oil equivale	1990	1995	2000	2005	2010	**2015**	2020	2025	2030	2035
North America	584.0	651.7	693.9	683.0	745.2	**900.4**	1036.6	1128.9	1275.8	1330.7
S & C America	52.3	68.1	91.0	126.5	149.6	**160.6**	159.5	161.7	165.0	168.8
Europe	191.9	218.6	256.3	270.6	256.1	**214.4**	189.8	165.2	135.1	111.6
CIS	672.2	569.1	584.1	651.7	657.0	**676.5**	749.9	824.5	854.9	881.4
Middle East	94.6	134.1	189.6	288.9	446.0	**556.1**	604.7	673.5	733.1	792.8
Africa	62.0	76.8	119.4	159.3	192.0	**190.6**	190.7	211.1	237.2	280.3
Asia Pacific	134.6	187.4	251.3	339.3	448.0	**501.0**	642.5	678.4	708.8	756.0
Total Natural Gas Productic	1791.5	1905.7	2185.5	2519.4	2893.9	3199.5	3573.6	3843.4	4109.8	4321.5

Balance (production minus consumption)										
Million tonnes oil equivale	1990	1995	2000	2005	2010	**2015**	2020	2025	2030	2035
North America	5.0	-22.2	-26.6	-28.5	-24.8	19.7	44.3	102.1	179.4	207.1
S & C America	0.3	0.4	5.8	15.3	13.8	3.3	-5.2	-10.6	-18.6	-17.7
Europe	-117.5	-132.1	-163.7	-211.1	-238.5	-197.9	-269.7	-293.3	-340.8	-380.4
CIS	106.2	96.9	116.3	149.3	147.2	185.6	258.4	328.5	355.3	386.8
Middle East	7.1	7.3	18.2	37.5	86.5	114.9	103.4	108.6	112.4	110.9
Africa	26.3	34.1	67.6	82.8	95.5	68.7	56.3	53.6	51.4	60.3
Asia Pacific	-1.9	-2.5	-17.4	-30.4	-72.5	-130.0	-157.5	-243.2	-323.8	-363.1
Total Natural Gas Balance	25.6	-18.1	0.2	14.9	7.2	64.3	30.0	45.7	15.3	3.0

For context, the 45.7 Mtoe surplus represents about 5 Bcf/d; this is about 1% of production.

Note that while Europe is expected to have a larger shortfall than the Asia-Pacific, the expected surplus in CIS is sufficient to meet it.

The 363.1 Mtoe deficit implies about
39 Bcf/d
403 Bcm/y
297 mtpa

BP Outlook 2035

2017 Outlook

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Europe	309.4	350.6	420.0	481.7	494.6	**412.2**	459.4	458.5	475.9	492.0
CIS	566.0	472.2	467.7	502.5	509.8	**490.9**	491.5	496.0	499.6	494.6
Middle East									20.6	682.7
Africa									35.7	220.0
Asia Pacific									32.7	1119.1
Total Natural Ga									94.5	4318.5
Production of na										
Million tonnes o									030	2035
North America									75.8	1330.7
S & C America									65.0	168.8
Europe									35.1	111.6
CIS									64.9	881.4
Middle East									33.1	792.8
Africa									37.2	280.3
Asia Pacific									08.8	756.0
Total Natural Ga									09.8	4321.5
Balance (production minus consumption)										
Million tonnes oil equivale	1990	1995	2000	2005	2010	**2015**	2020	2025	2030	2035
North America	5.0	-22.2	-26.6	-28.5	-24.8	19.7	44.3	102.1	179.4	207.1
S & C America	0.3	0.4	5.8	15.3	13.8	3.3	-5.2	-10.6	-18.6	-17.7
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CIS	106.2	96.9	116.3	149.3	147.2	185.6	258.4	328.5	355.3	386.8
Middle East	7.1	7.3	18.2	37.5	86.5	114.9	103.4	108.6	112.4	110.9
Africa	26.3	34.1	67.6	82.8	95.5	68.7	56.3	53.6	51.4	60.3
Asia Pacific	-1.9	-2.5	-17.4	-30.4	-72.5	-130.0	-157.5	-243.2	-323.8	-363.1
Total Natural Gas Balance	25.6	-18.1	0.2	14.9	7.2	64.3	30.0	45.7	15.3	3.0

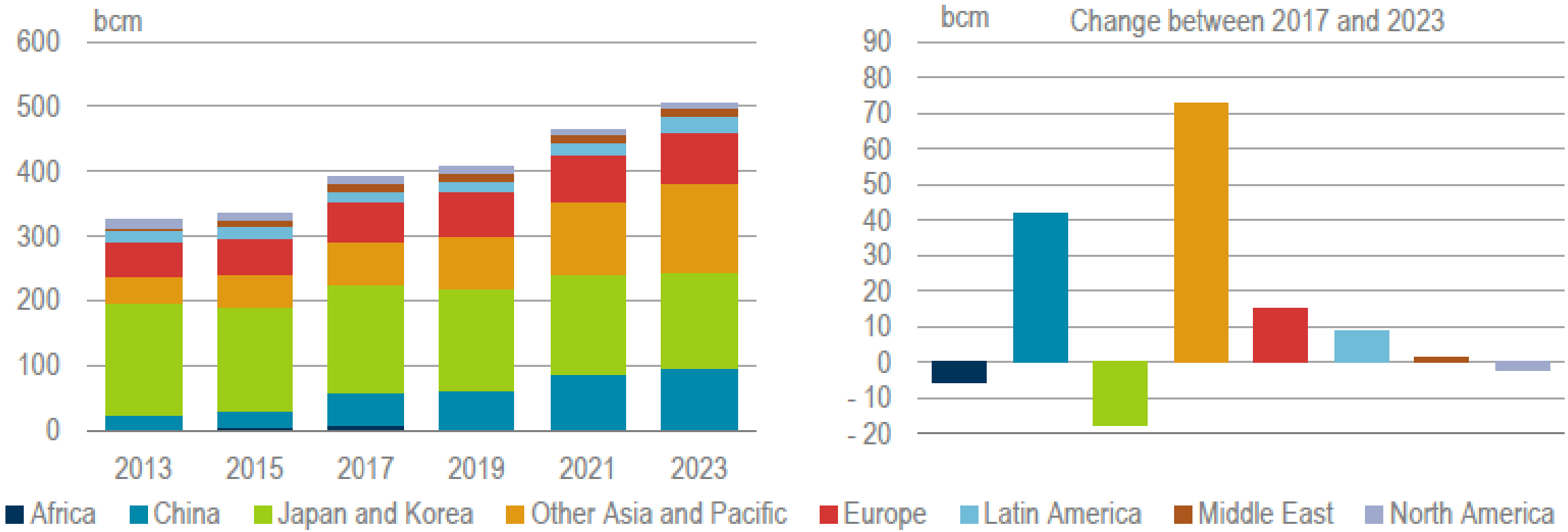
Note that Australia is already accounted for within the Asia-Pacific, so the shortfall must be met from outside the region.

For context, the 45.7 Mtoe surplus represents about 5 Bcf/d; this is about 1% of production.

Note that while Europe is expected to have a larger shortfall than the Asia-Pacific, the expected surplus in CIS is sufficient to meet it.

The 363.1 Mtoe deficit implies about
39 Bcf/d
403 Bcm/y
297 mtpa

Figure 3.4 World LNG imports by region, 2013-23



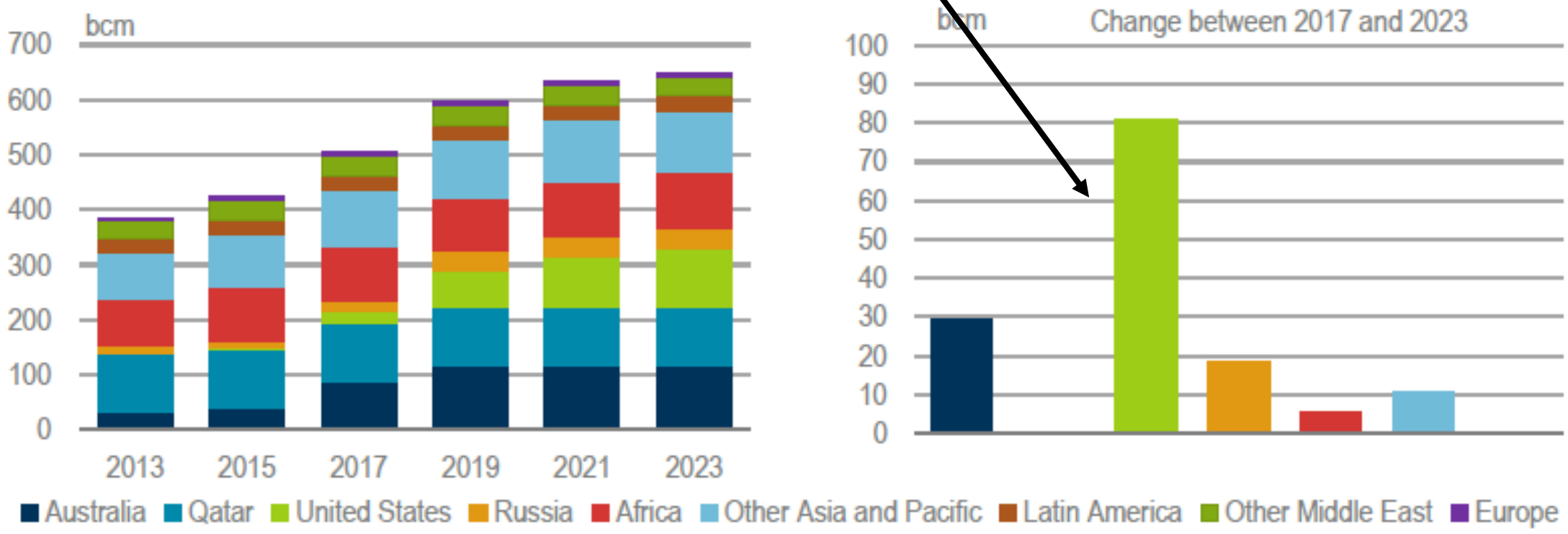
IEA Gas Market Report-2018, p. 111

Liquefaction capacity - [GIIGNL]

- At the end of 2017, nameplate capacity was 365 mtpa (48.0 Bcf/d or 496.4 Bcm)
- At the end of 2017, about 89 mtpa (11.7 Bcf/d) of new capacity was under construction, with 49 mtpa (6.4 Bcf/d) in the US and 17 mtpa (2.2 Bcf/d) in Australia.
- During 2018, about 38 mtpa (5.0 Bcf/d) of new capacity will come on line, with 13 mtpa (1.7 Bcf/d) being in the US.
- Given exports of 393.4 Bcm (38.1 Bcf/d) in 2017, this implies a 79.3% capacity utilization rate.

Roughly in line with US projects currently under construction

Figure 3.5 LNG nameplate liquefaction capacity, 2013-23



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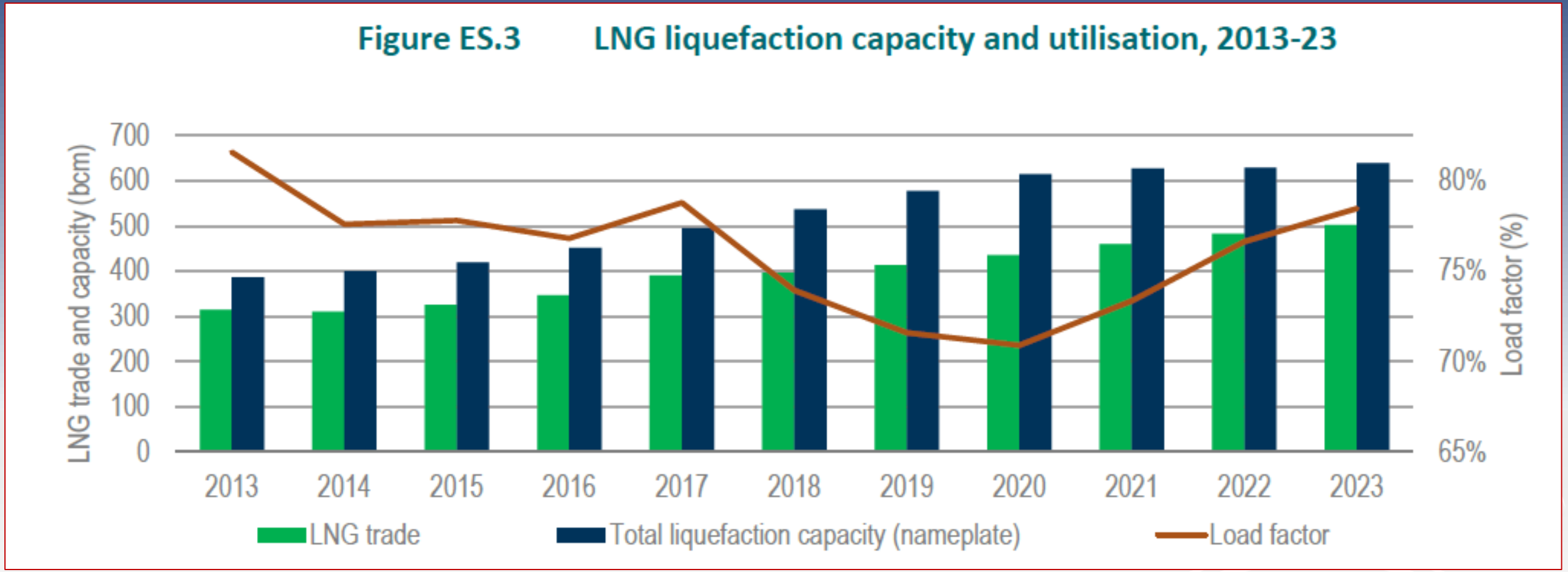
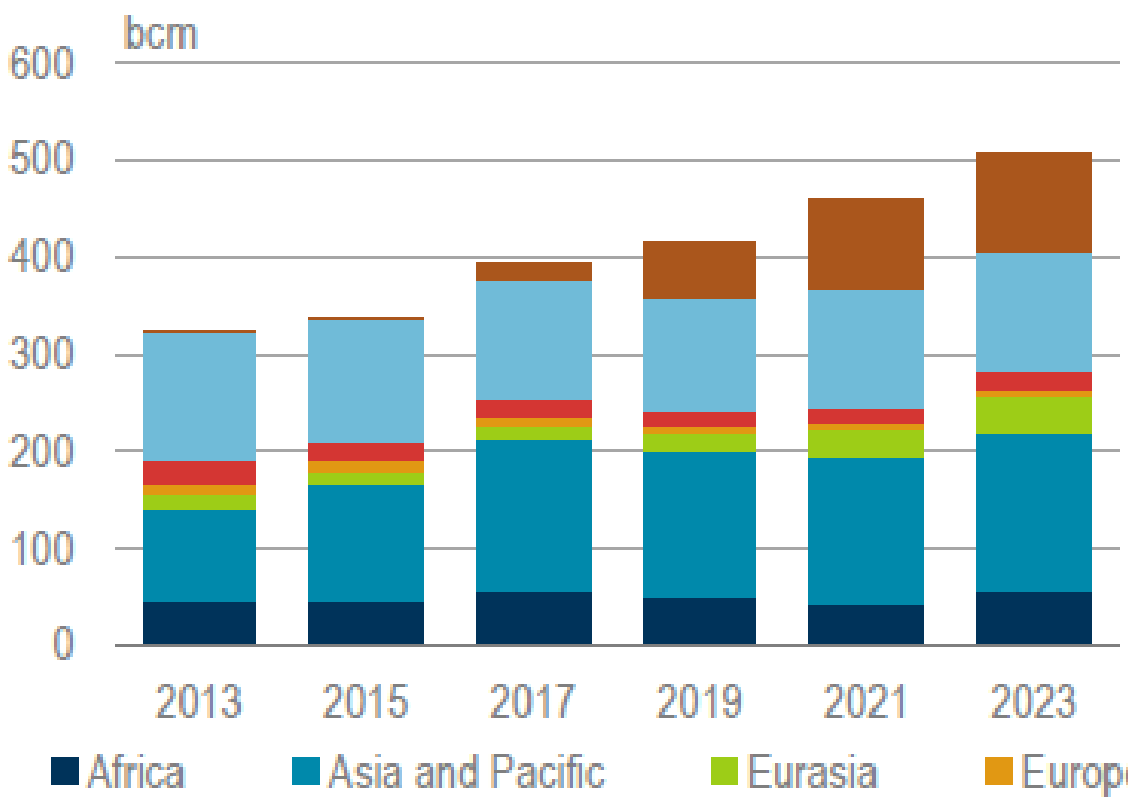
IEA LNG liquefaction capacity outlook

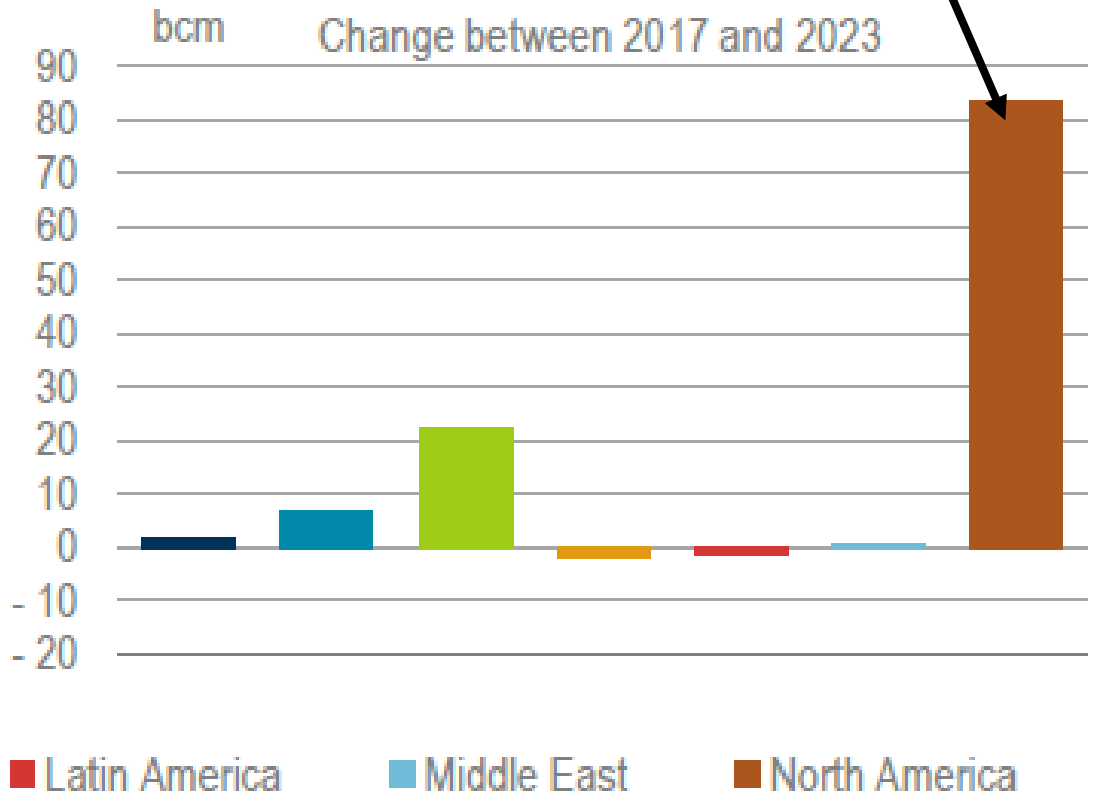


IEA Gas Market Report-2018, p. 14

Approximately 8 Bcf/d

Figure 3.6 World LNG exports by region, 2013-23





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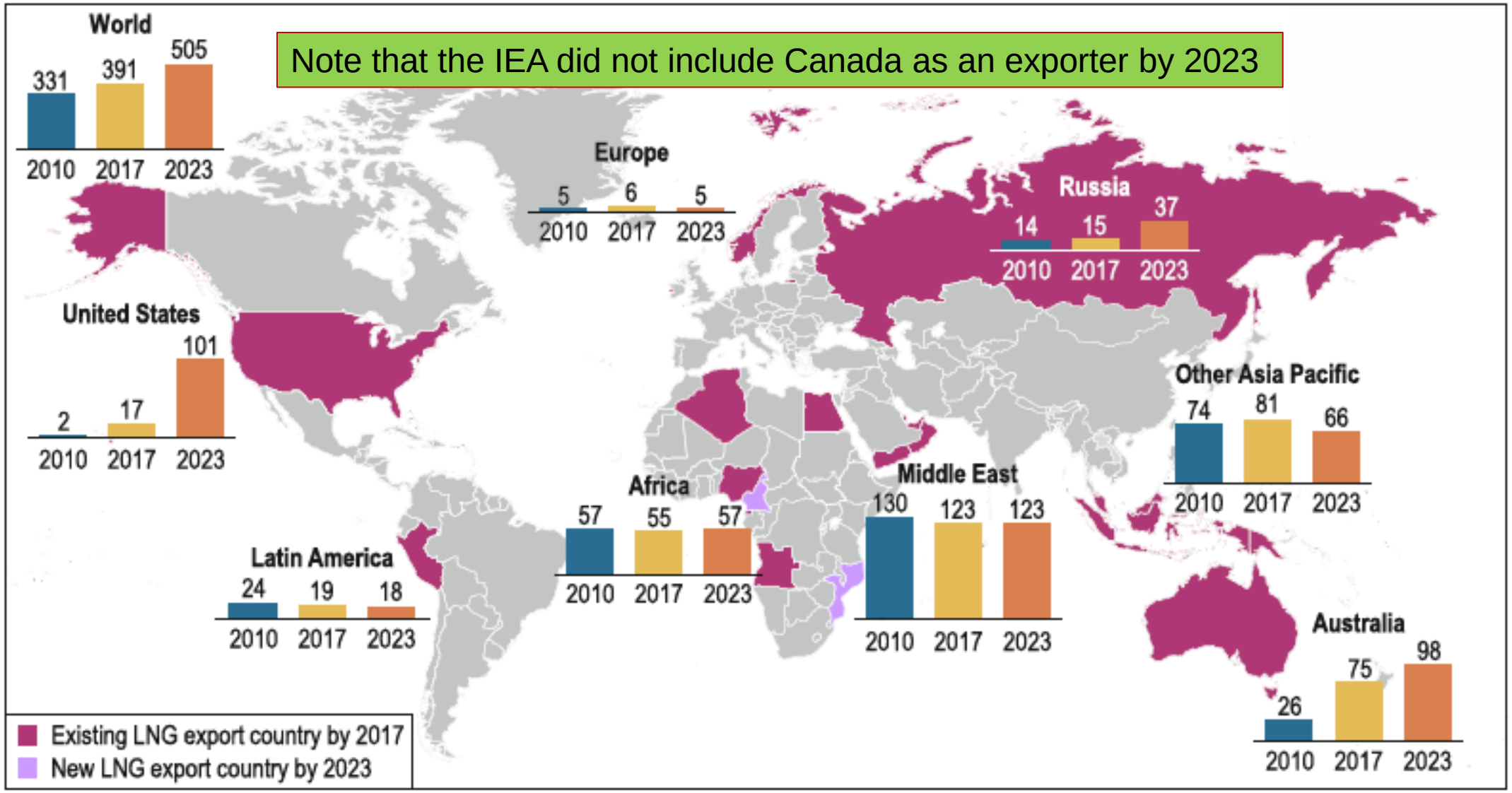
Map 3.2 LNG export countries and LNG export volumes, 2010-23



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

IEA Gas Market Report-2018, p. 115 (Bcm)

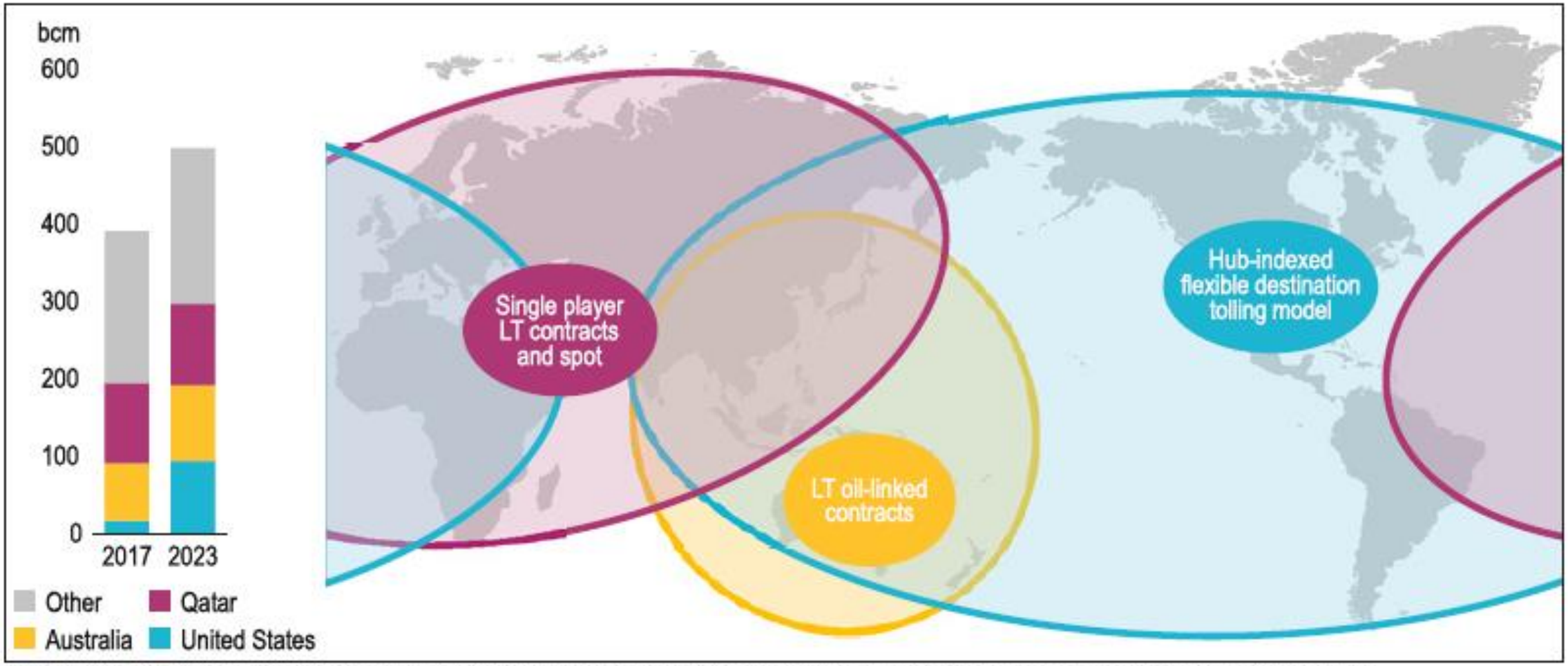
Regasification capacity - [GIIGNL]

- At the end of 2017 nameplate capacity 850 mtpa (111.8 Bcf/d or 1,156 Bcm)
- At the end of 2017, about 103.5 mtpa (13.6 Bcf/d) of new capacity was under construction, with 54.1 mtpa (7.1 Bcf/d) in the Asia. In addition, several FSRU projects were proposed, including in Australia.
- Given exports of 393.4 Bcm (38.1 Bcf/d) in 2017, this implies a 46.3% capacity utilization rate. Europe tends to be below 30% utilization.
- China, at the end of 2017, had 17 LNG regasification terminals, with 76 Bcm/y (>7 Bcf/d) sendout capacity, with expansions and additional terminals under construction.
- China, during 2017, imported 52.6 Bcm of LNG-sourced gas, implying a utilization rate of 74%.

Pricing

- Different business models
- Evolution toward more spot and short-term trade

Map 3.3 The three major LNG export players and their respective business models



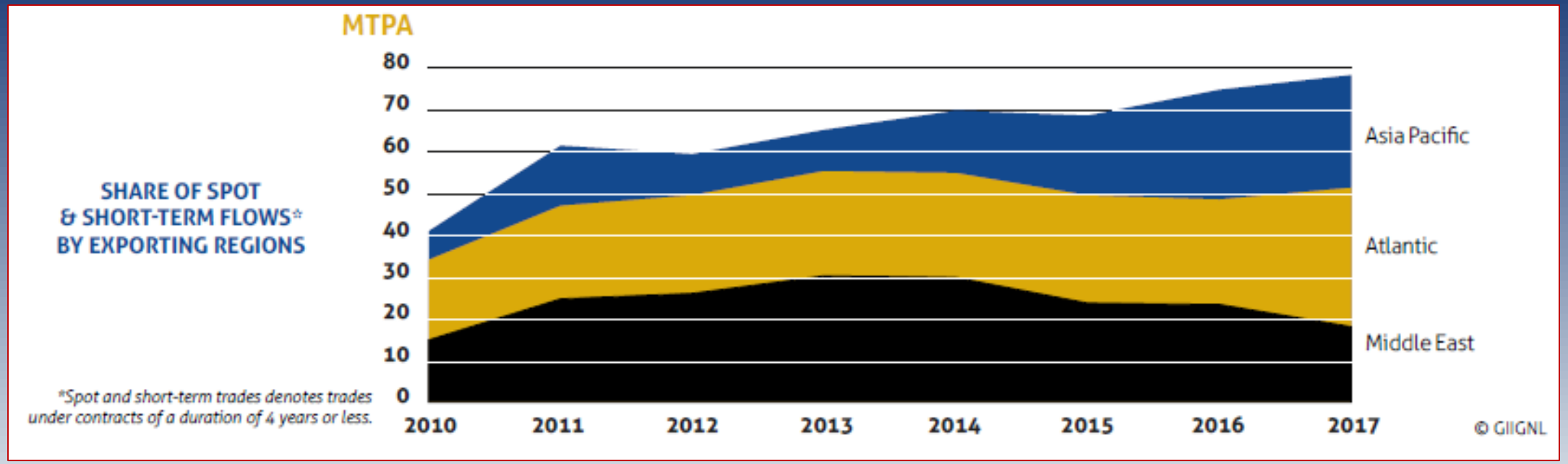
This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

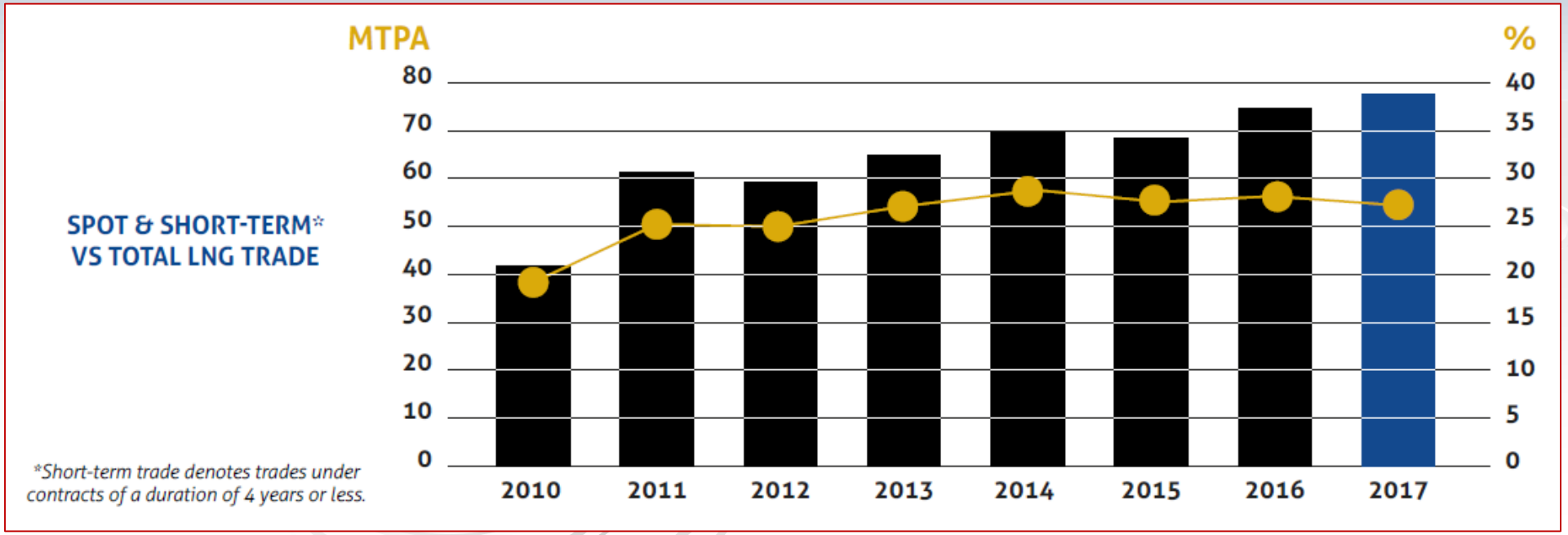
Note: LT = long-term.

Note that Cheniere is NOT a tolling operation.

IEA Gas Market Report-2018, p. 115

Pricing terms are evolving; increased spot and short-term trading





GIIGNL-2018

Table ES.1 • Contract evolution by volume, before 2014, 2015-17

	Signed before 2014	Signed in 2015	Signed in 2016	Signed in 2017
Short-term (up to 1 year)	8%	16%	2%	24%
Flexible destination	39%	41%	42%	22%
Average contract duration (y)	16	10	9	4
Average contract volume (bcm/y)	1.7	1.0	1.2	1.0

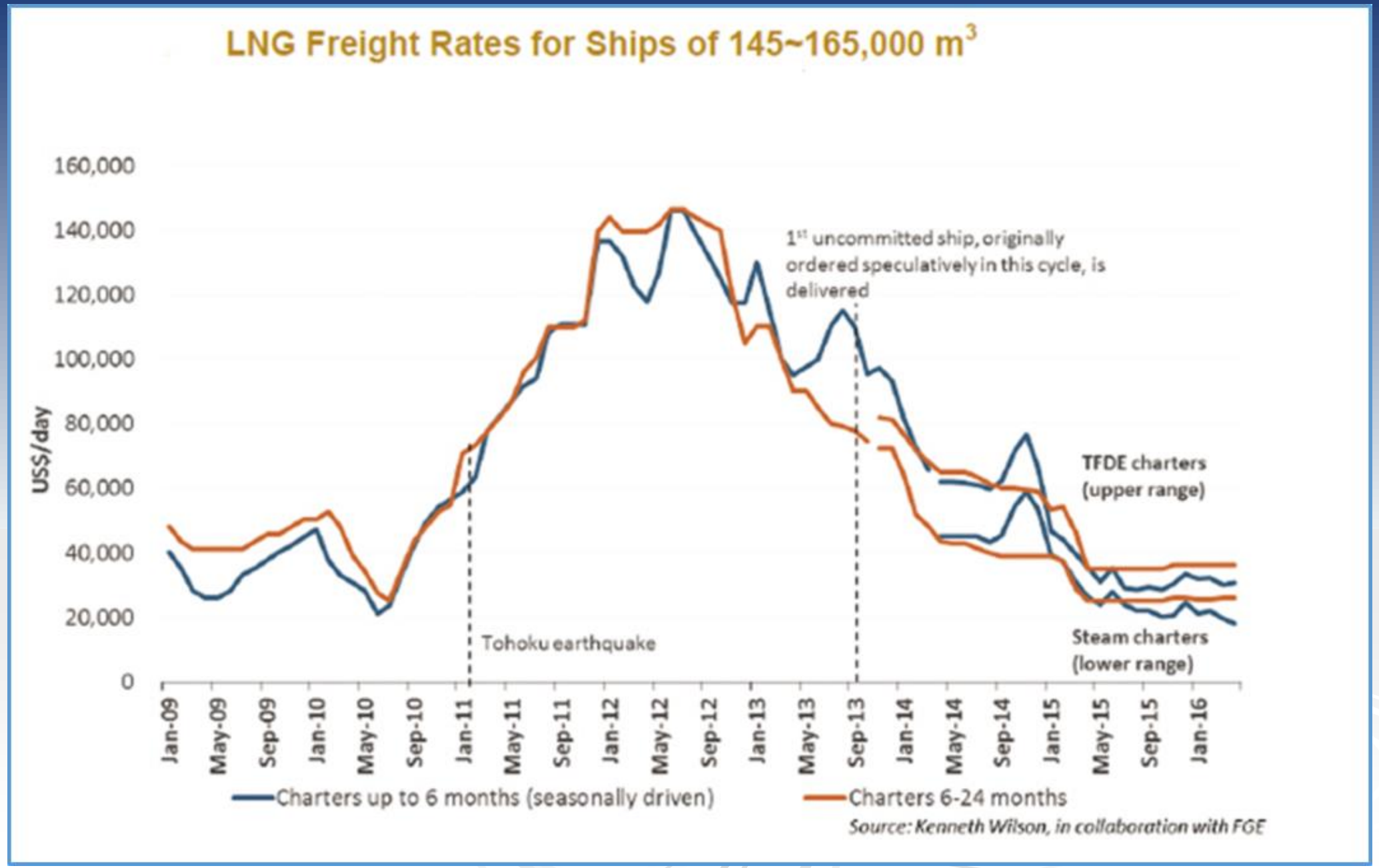
Notes: Short-term excludes single spot transactions; y = year.
Source: IEA analysis based on ICIS (2018), *ICIS LNG Edge* (*subscription required*).

IEA, Global Gas Security Review, 2018

Shipping costs

- LNG tanker rates are variable and based on complex supply and demand conditions
- Supply is impacted by observations and expectations for future demand
- These observations and expectations are affected by investment decisions for liquefaction capacity.
  - Delays in liquefaction FIDs and construction lead to delays in new tanker orders, which impact available tanker supply/capacity.

LNG tanker rates (2009-2016)



LNG tanker rates (2018)

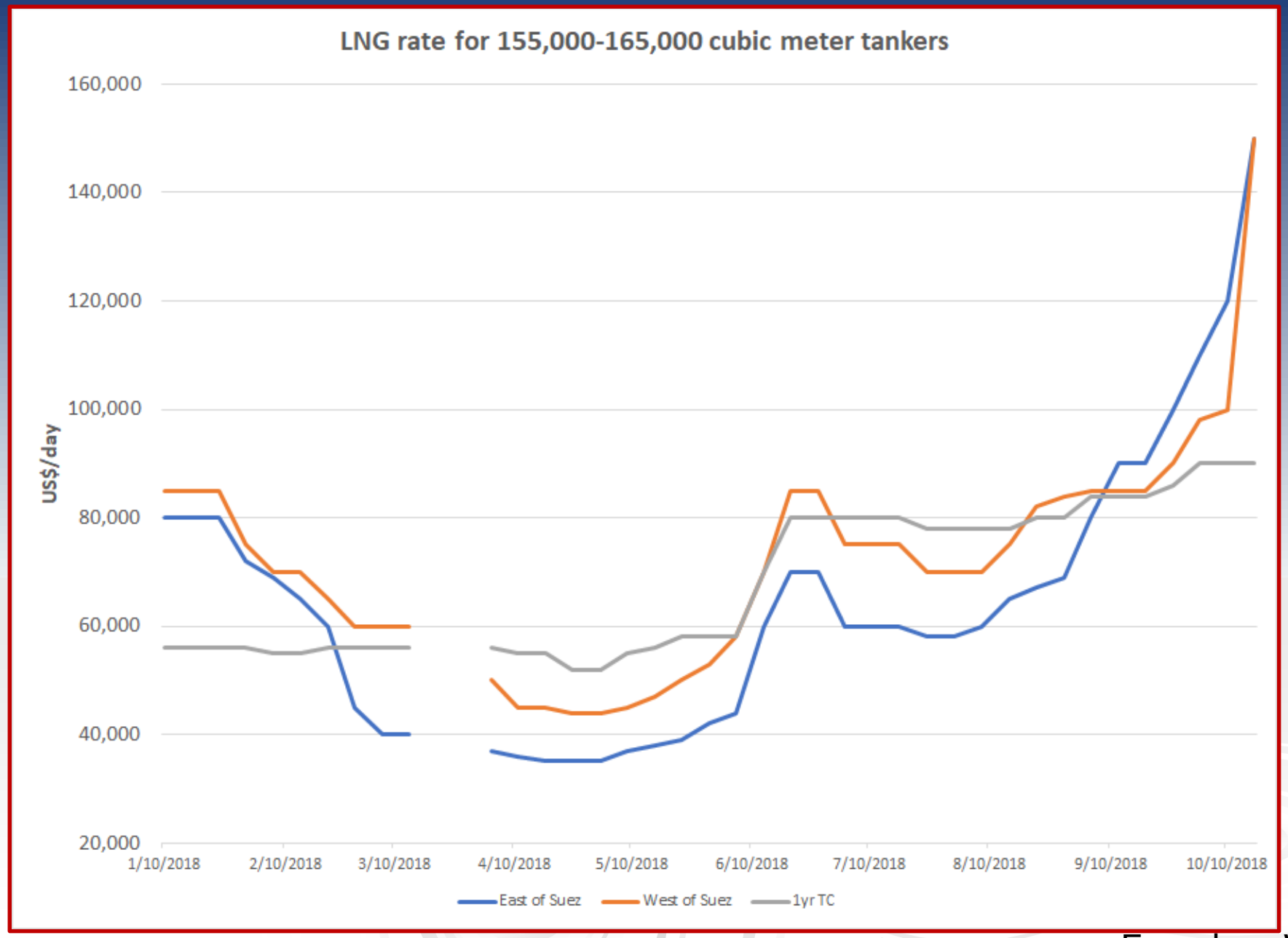
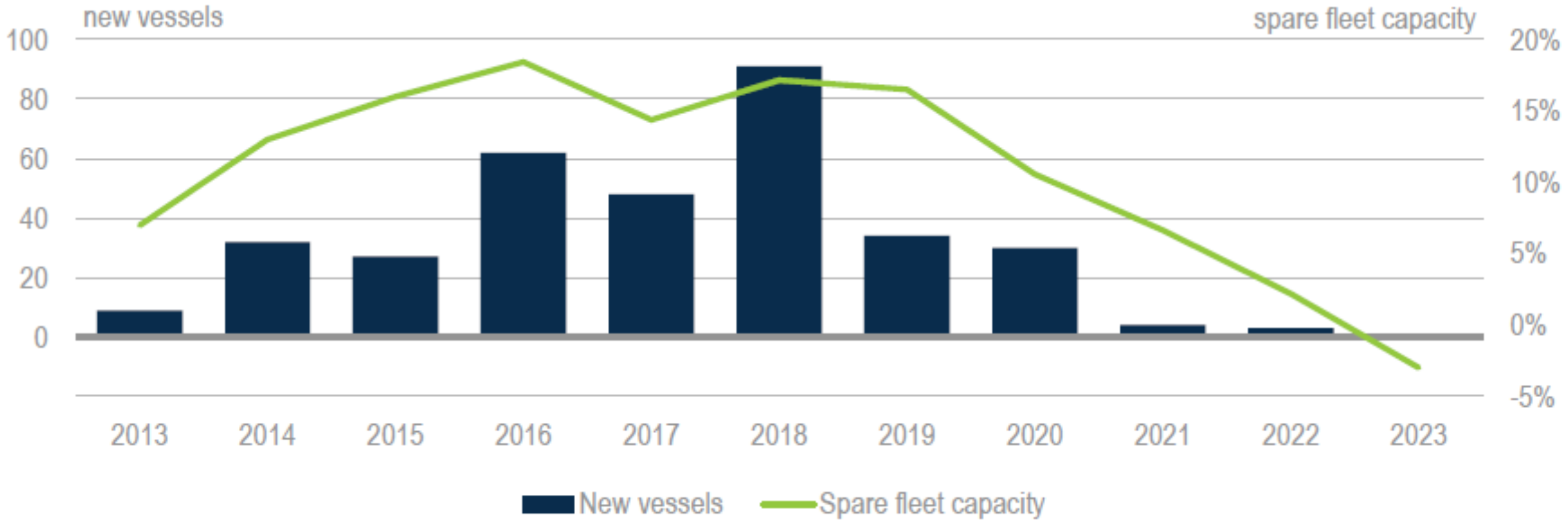


Figure ES.2 • LNG carriers additions and utilisation, 2013-23



IEA, Global Gas Security Review, 2018

LNG shipping cost estimates – A month ago

LNG Carrier shipping cost comparison between XXX and YYY

160,000 m3 tanker => ~ 3,500,000 MMBtu

Accounts for round trip, includes 2 additional days for loading and unloading, $35/nm fuel cost, $0.21/MMBtu for Panama, $150,000 each for port costs, $30,000 insurance, and $79,000 working capital charge

						Day rate	
		Appr. Distance	Fuel	18 knots		$ 70,000	
Port-to-Port		nautical miles		Days	Hours	18 knots	Cost/MMBtu
Sabine	Zeebrugge	4861	$ 340,248	13	6	$ 2,135,000	$ 0.96
	Tokyo (S.Afr.)	15825	$ 1,107,755	36	12	$ 5,390,000	$ 2.29
	Tokyo (Panama)	9209	$ 644,630	21	8	$ 3,266,667	$ 1.64
Dampier	Tokyo	3762	$ 263,319	8	12	$ 1,470,000	$ 0.71

For tanker day rates of +/- $20,000 around the $70,000

Zeebrugge $0.76 - $1.16
Shanghai (Panama) $1.42 - $2.09

LNG shipping cost estimates – This week

LNG Carrier shipping cost comparison between XXX and YYY

160,000 m3 tanker => ~ 3,500,000 MMBtu

Accounts for round trip, includes 2 additional days for loading and unloading, $35/nm fuel cost, $0.21/MMBtu for Panama, $150,000 each for port costs, $30,000 insurance, and $79,000 working capital charge

						Day rate	
		Appr. Distance	Fuel	18 knots		$ 150,000	
Port-to-Port		nautical miles		Days	Hours	18 knots	Cost/MMBtu
Sabine	Zeebrugge	4861	$ 340,248	13	6	$ 4,575,000	$ 1.77
	Tokyo (S.Afr.)	15825	$ 1,107,755	36	12	$ 11,550,000	$ 4.34
	Tokyo (Panama)	9209	$ 644,630	21	8	$ 7,000,000	$ 2.88
Dampier	Tokyo	3762	$ 263,319	8	12	$ 3,150,000	$ 1.27

Netback values based on a Cheniere-type business model

10/22/2018									www.xe.com quotes											
				Northern European values					0.76425	GBP/USD			CME/NYMEX quote							
									0.86647	EUR/USD			HH		HH+15%					
	ICE natural gas quotes												$3.20		$3.68					
															Net of liquefaction				Net of shipping	
													Net of HH+15%		BG $2.25		$3.00		$1.77	
NBP	71.2	pence per therm		7.12	pounds sterling per MMBtu				$ 9.32	US$ per MMBtu			$ 5.64		$ 3.39		$ 2.64		**$ 1.62**	**$ 0.87**
TTF	26.45	euros per MWh		7.74985	euros per MMBtu				$ 8.94	US$ per MMBtu			$ 5.26		$ 3.01		$ 2.26		**$ 1.24**	**$ 0.49**
									Asia oil linked values											
													Brent crude oil price							
						Net of liquefaction							76.57							
						BG $2.25		$3.00			Net of HH+15%									
						$ 6.83	$	6.08			$ 9.08		$ 12.76	heat rate parity based on 6 MMBtu per barrel						
														0.166667	implied slope					
						$ 6.24	$	5.49			$ 8.49		$ 12.17	using Brent*0.1485 + 0.8						
						Japan spot values														
				Japan spot																
			What if:	$10.50		Net of liquefaction					Net of shipping									
						BG $2.25		$3.00			$2.88									
		Japan spot - HH+15%		$6.82		$4.57		$3.82			**$1.69**	**$0.94**								

Breakeven netbacks
Northern Europe – 58.39 pence per therm and 22.59 euros per MWh ($7.64/MMBtu)
Japan/Asia - $8.44 per MMBtu

Uncertainties

- Japan's nuclear restart
- China's domestic production and pipeline imports
  - 2017 production was 14.4 Bcf/d; up from 9.3 Bcf/d in 2010, and an 8.5% increase over 2016
  - Production projections for 2030 range from 18 – 29 Bcf/d
  - 2017 pipeline imports were 3.8 Bcf/d; only slightly higher than 2016
  - 2017 was the first time in several years that LNG-based imports exceeded pipeline imports, and this occurred while there was excess import pipeline capacity (the 2017 utilization rate was about 75%)
- FLNG success
- China's import tariffs

Summary

- Global natural gas has been affected by the evolution of the energy price environment.
- Asia-Pacific is expected to be in production-consumption deficit for the foreseeable future, as is Europe.
- Substantial supplies of natural gas from LNG and pipeline sources will be available, keeping downward pressure on prices.
- Australia maintains an advantage over the US for Asia-Pacific natural gas markets due to geographic location, large capacity, and sunk costs.
- BUT, Asia-Pacific remains in consumption-production deficit even with Australia's contribution.
- Japan's nuclear re-start uncertainty clouds it's level of demand.
- China's role as an LNG-based natural gas importer is unclear, with potential competition from pipeline imports and domestic production.
- At current relative prices, and expected LNG shipping costs, margins from the US to Asia are likely to remain superior to those for Europe.

Thank you!

Questions - Comments

Ronald D. Ripple, PhD
ron-ripple@utulsa.edu