

The blessings of natural gas for Cyprus

9th Mediterranean Oil & Gas Forum 2018
Nicosia, 27 March 2018
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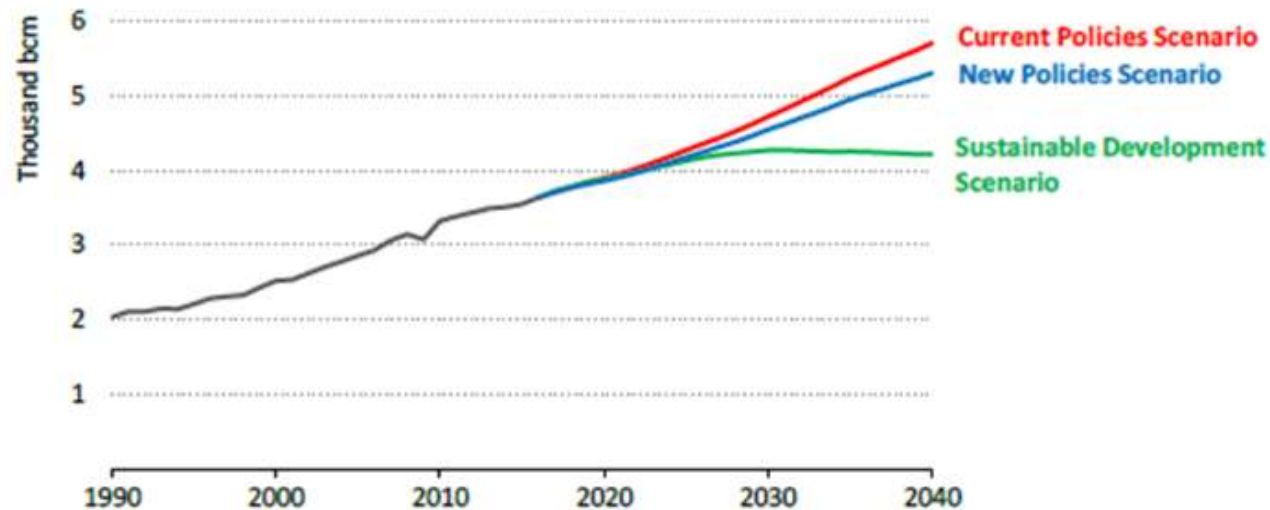


Agenda

- ▶ **A word on gas demand projections**
 - EU underestimates demand & overestimates indigenous production
- ▶ **Global gas market through 'LNG revolution'**
 - Security of supply no longer regional
- ▶ **LNG marginal source of supply for Europe**
 - LNG sets maximum achievable price for pipeline gas
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 - 4th National Energy Efficiency Action Plan of Cyprus 2017
 - Benefits of deploying gas in power generation
 - Further gas benefits e.g. in transport?

IEA WEO 2017: gas only fossil fuel with respectable growth From ~3,600 bcm/a in 2016 to over 5,300 bcm/a in 2040

Figure 8.2 ▶ World natural gas demand by scenario



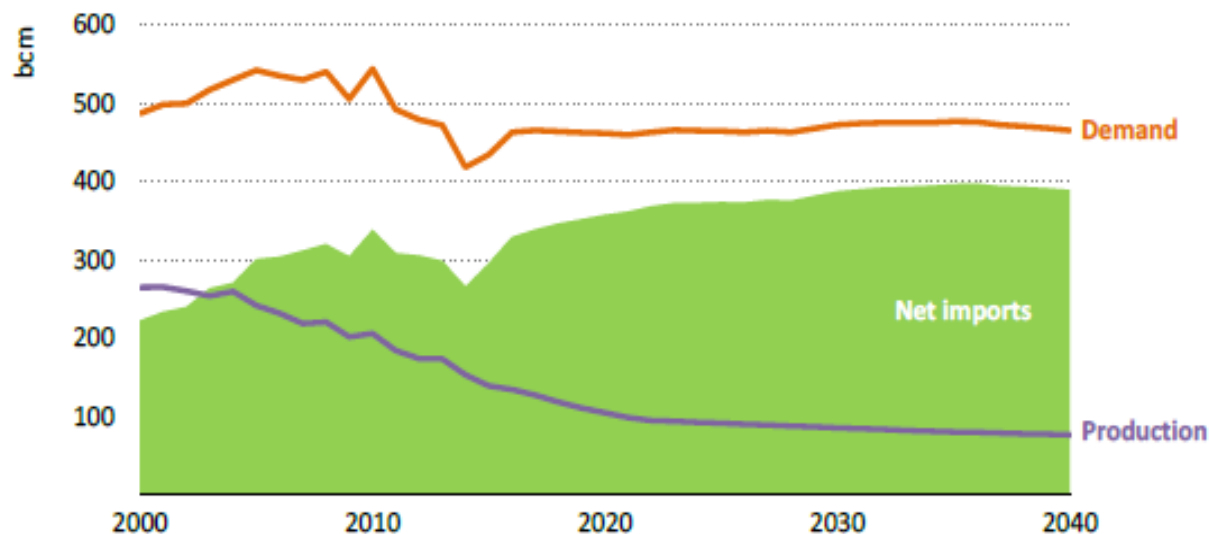
*Gas use is projected to increase by 1.6% per year, on average,
in the New Policies Scenario*

Note: bcm = billion cubic metres.

Source: IEA WEO 2017

IEA WEO 2017: European demand 'flat' (~450 bcm/a in 2040) Indigenous decline renders import requirement of ~390 bcm/a

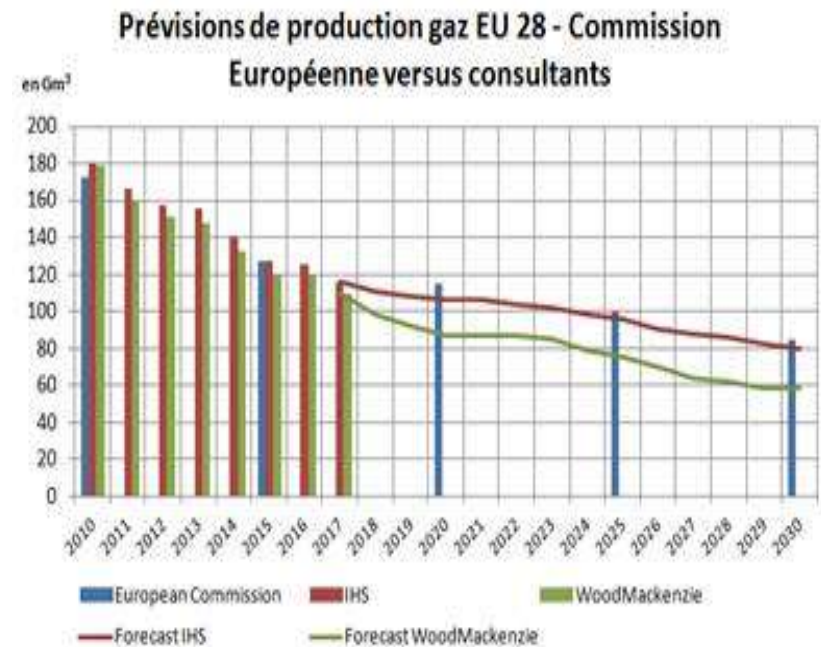
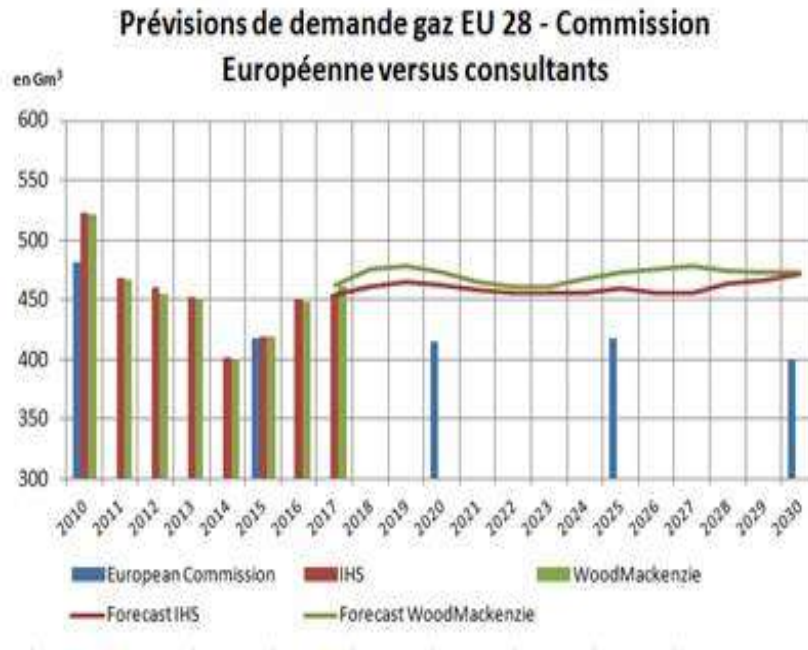
Figure 8.9 ▶ Natural gas balance of the European Union in the New Policies Scenario



Even with a flat demand outlook, the European Union's gas imports increase to 2040 as domestic output continues to decline

Source: IEA WEO 2017

EU underestimates demand and overestimates indigenous supply Deviation from 'consultant's consensus'!



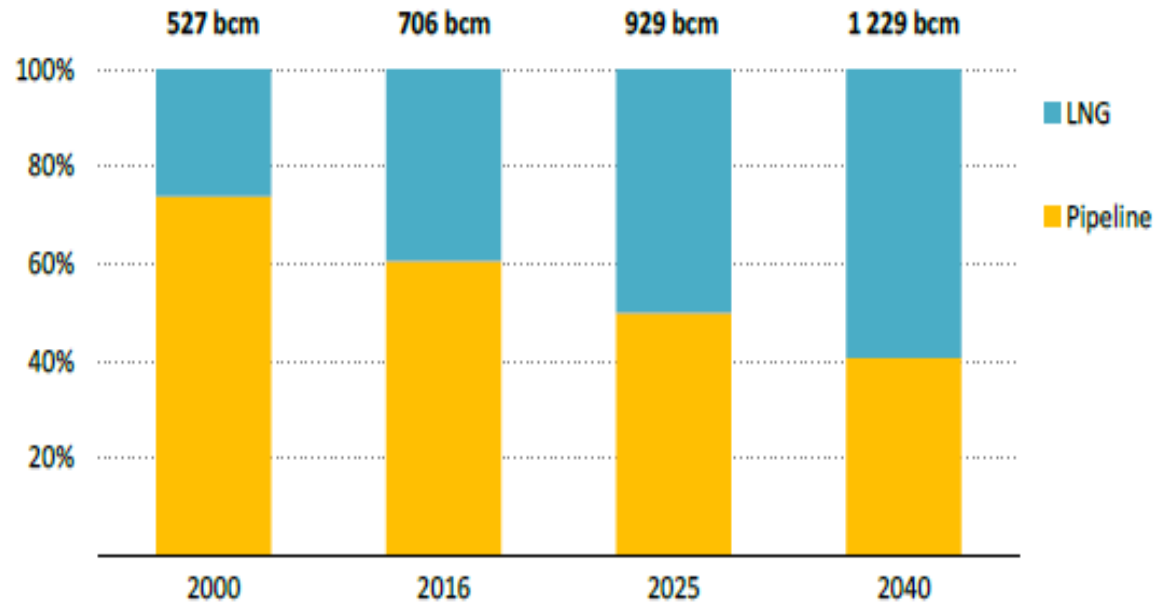
Source: Engie

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IEA WEO 2017: 90% of additional gas trade through LNG

Figure 2.16 ▶ Global gas trade by mode in the New Policies Scenario

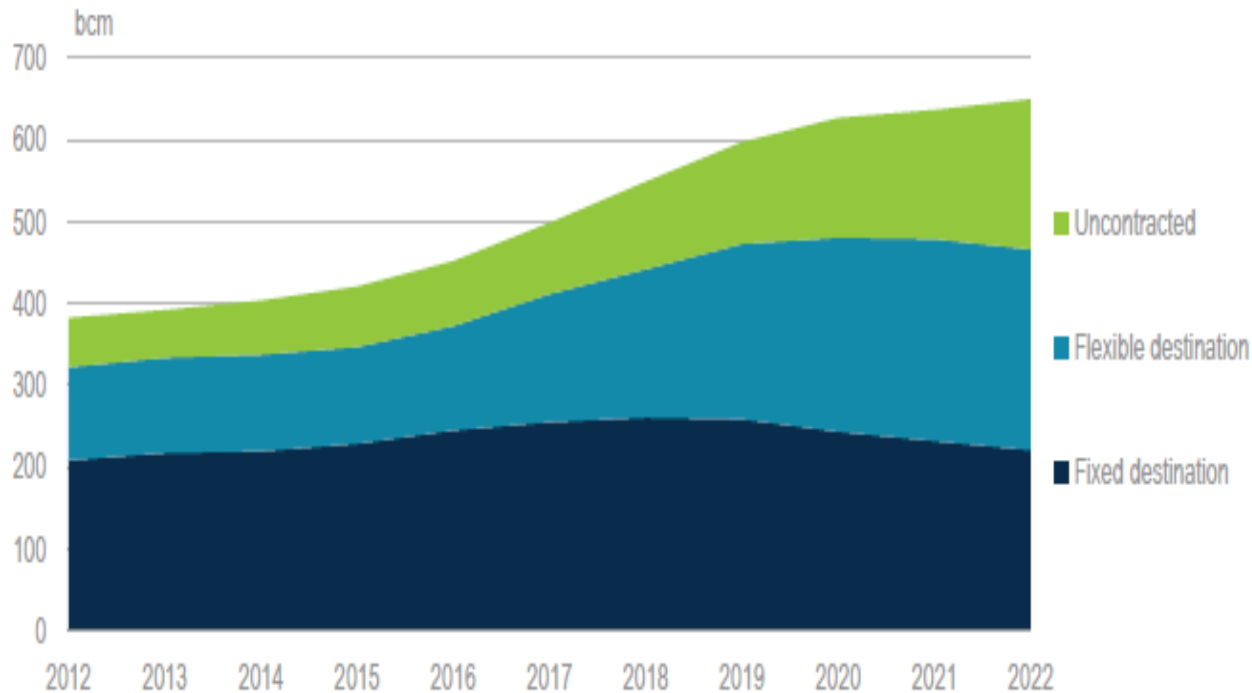


Almost 90% of additional gas trade in the period to 2040 is in the form of LNG

Source: IEA WEO 2017

LNG increasingly 'destination-flexible', responding to price signals

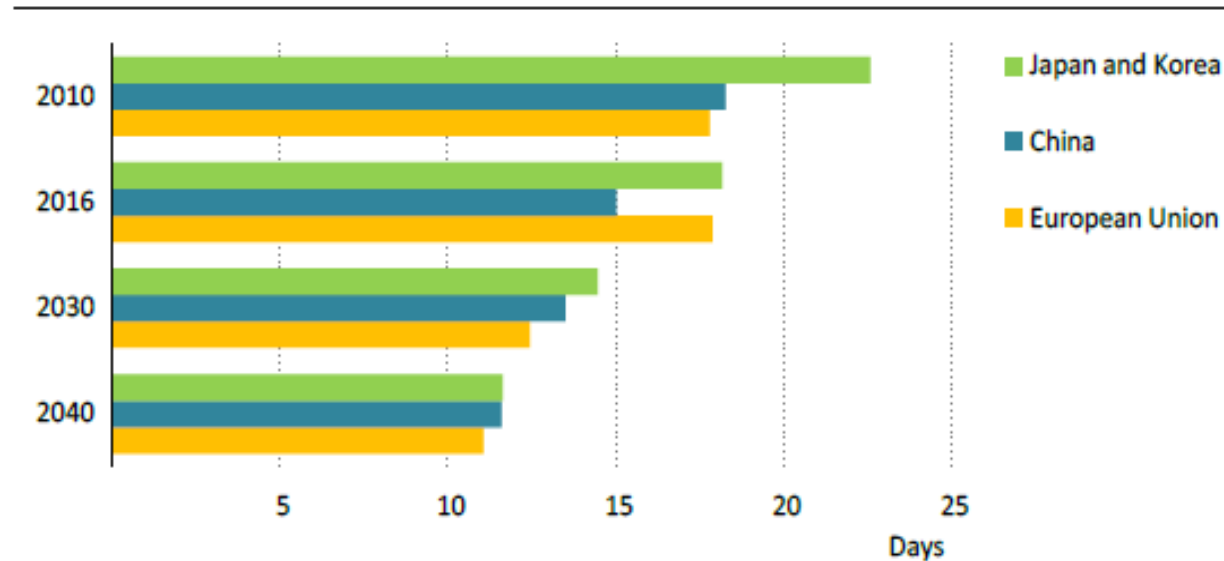
Figure 2.10 • LNG export contract volumes by destination flexibility, 2012-22



Source: IEA Global Gas Security Review 2017

LNG response time in case of price spikes significantly reduced

Figure 9.14 ▶ Estimated average time to procure an extra 10% of LNG import volumes by selected importer in the New Policies Scenario

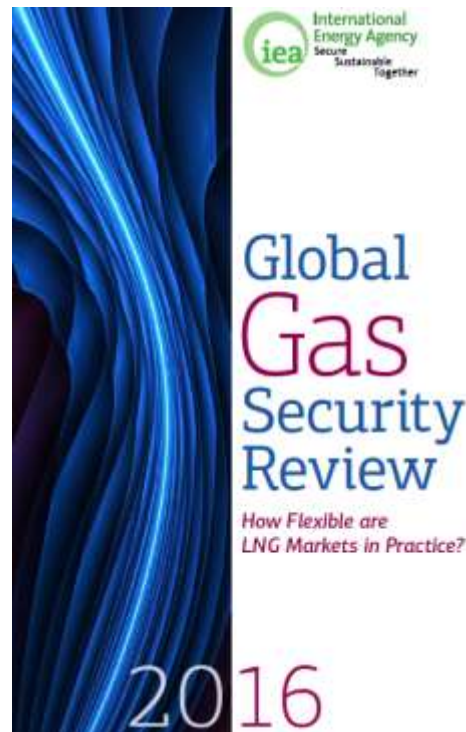


As LNG trade expands and becomes more diversified, major LNG importers are able to meet an unforeseen 10%-spike in their LNG import demand in much less time than today

Source: IEA WEO 2017

LNG revolution mandates re-definition of security of supply

IEA: "As the role of gas ... evolves, a narrow approach to gas security focussing on gas as a stand-alone fuel in an individual region is no longer appropriate."



Source: IEA Global Gas Security Review 2016

**Thanks to LNG, threat of political blackmail gone
Europe should allow as much supplier competition as possible Also
Russian gas (even Nordstream 2) – ‘Putin phobia’ no longer justified**

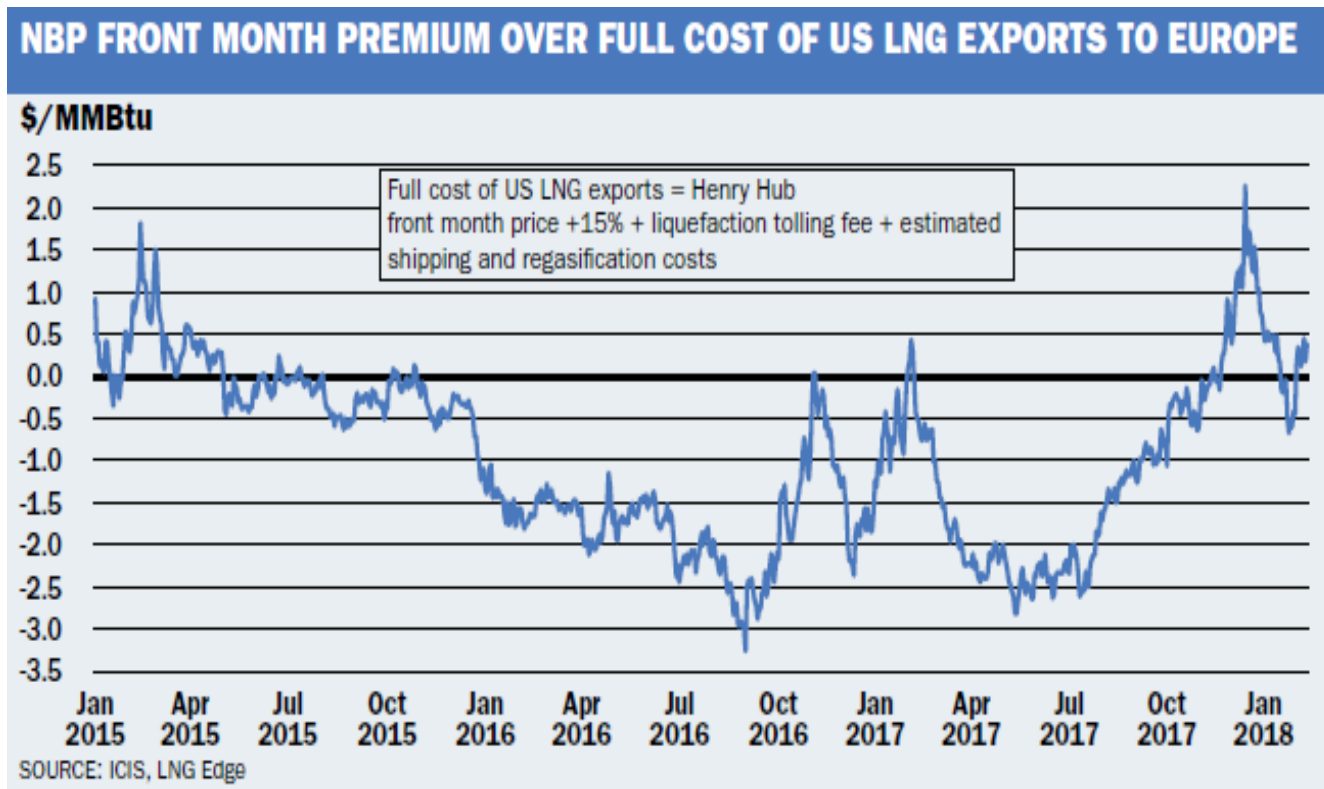


Ukrainian Crisis 2009: Andrej Budajew, “Putin’s recalcitrant bride”

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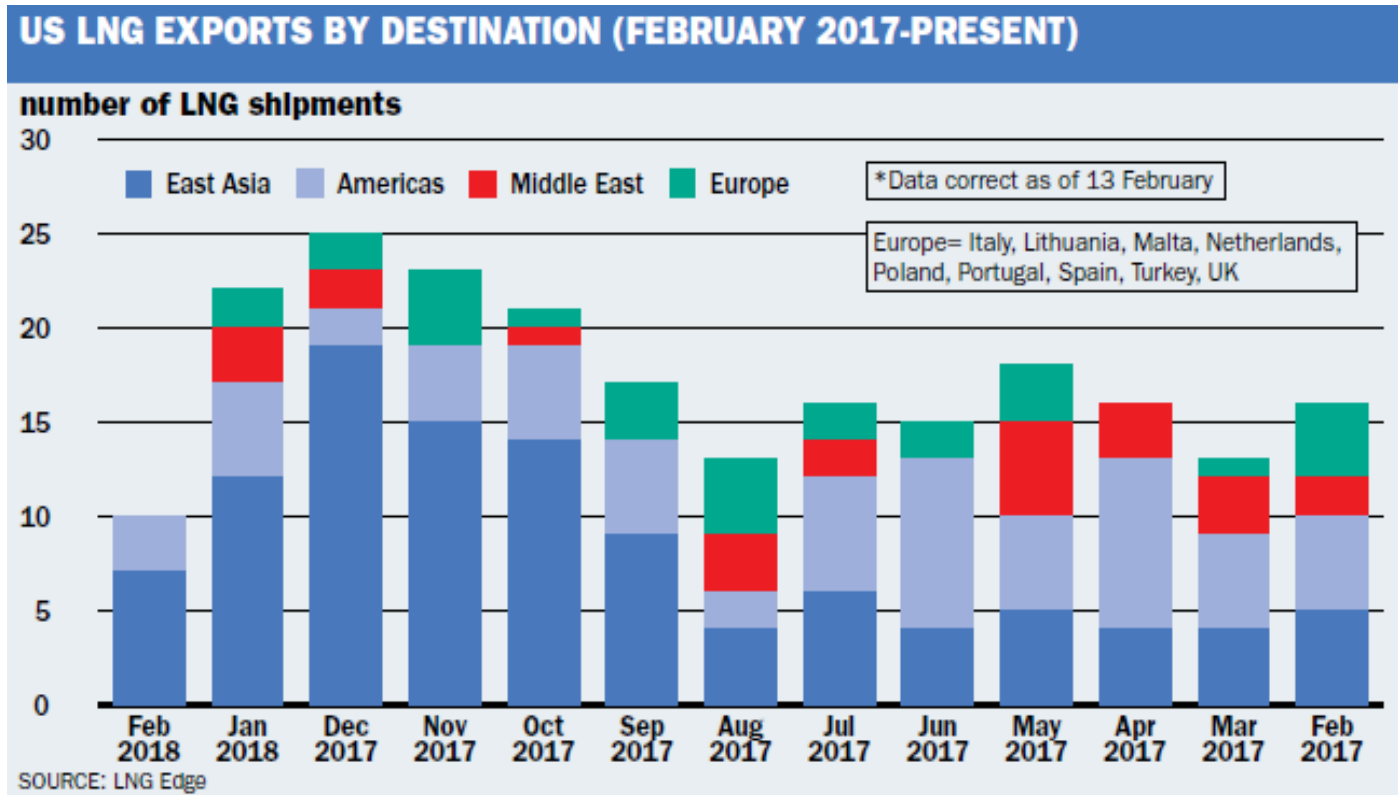
U.S. LNG to Europe: HH/TTF spread of >3.95 \$/MMBtu required
But: not if higher net-backs elsewhere ('money talks')
Hence, 'occasional, not permanent reliance on U.S. LNG'



Source: ICIS Heren, EGM 25.03

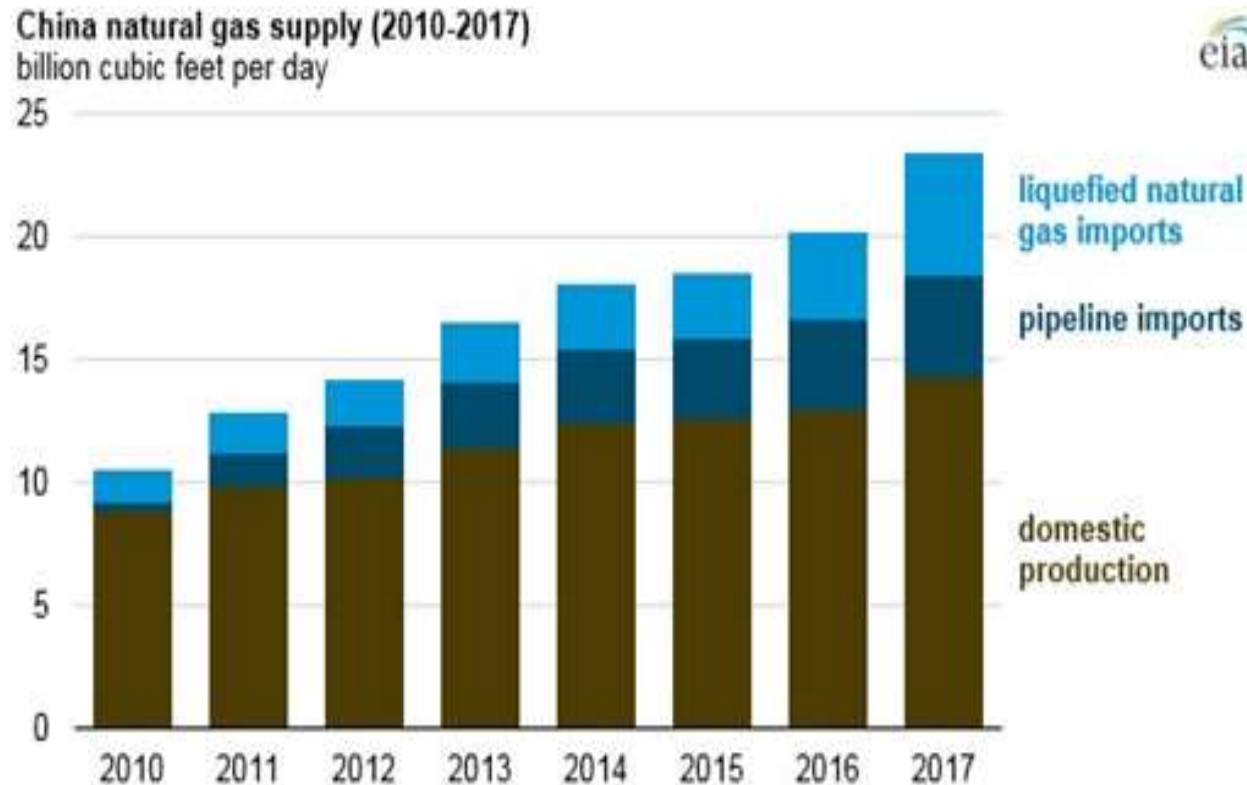
U.S. LNG ‘followed the money’

Since October 2017, 67 out of 101 Sabine Pass cargoes to East-Asia
9 cargoes to Europe, but only Turkey, Spain, Portugal



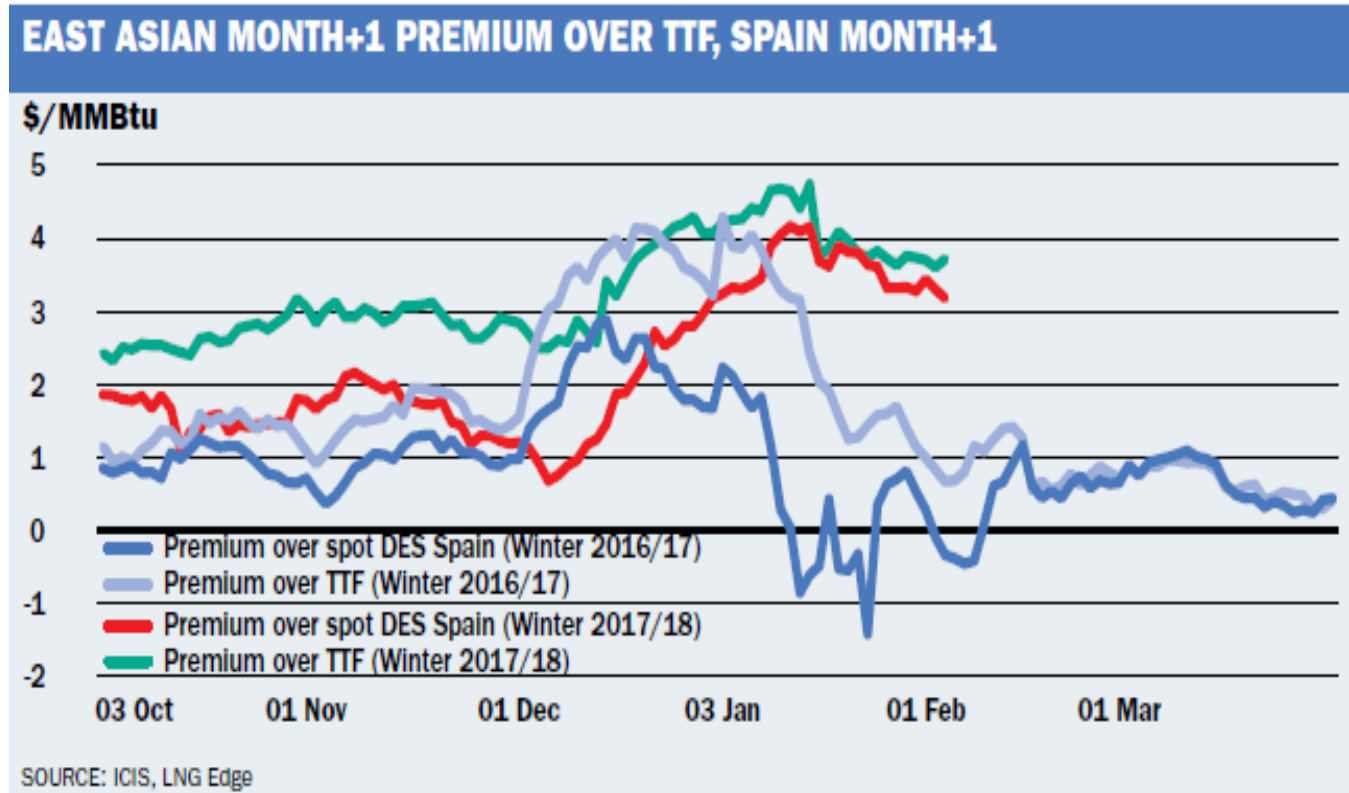
Source: ICIS Heren, EGM 25.03

Exclusive, permanent reliance on U.S. LNG = competing with Asia China's ramp-up of demand due to air pollution problems



Source: EIA

China's ramp-up of LNG demand caused price surge Required premium over TTF January 2018 av. 4.12 \$/MMBtu



Source: ICIS Heren, EGM 25.03

Competing with Asia for LNG would have been costly for Europe
TTF settled price January 2018: 7.077 \$/MMBtu (20.288 €/MWh)
Required TTF price level to compete: 11.197 \$/MMBtu (31.598 €/MWh)
I.e. TTF price level would have had to be >50% higher

KEY OIL AND GAS PRICES 20 DECEMBER 2017		
Contract	€/MWh	\$/MMBtu
ICIS Heren NBP Jan '18	23.184	8.088
ICIS Heren TTF Jan '18	20.288	7.077
ICIS Heren RU-DE Contract Jan '18	17.950	6.200
ICIS Heren NO-DE Contract Jan '18	20.176	6.970
ICIS Heren NL-DE Contract Jan '18	20.887	7.215
ICIS Heren AL-SP LNG Contract Jan '18	17.915	6.189
NYMEX Henry Hub Jan '18	7.717	2.692
ICIS Brent Feb '18	31.651	11.041
NYMEX WTI Feb '18	28.472	9.954
ICIS Gasoil 0.1%	40.396	14.092
ICIS Fuel oil 1%	26.171	9.129

Source: ICIS Heren, EGM 24.22



For further ‘bed-time reading’ on the subject:

**‘Implications of a global gas market for traditional gas
economical paradigms’,
by Wolfgang Peters, in February 2018**

(http://gasvaluechain.com/cms/wp-content/uploads/2018/03/2018-02-20-Implications-Global-Gas-Market...-W.Peters_Gas-Value-Chain.pdf)

Also in: www.naturalgasworld.com

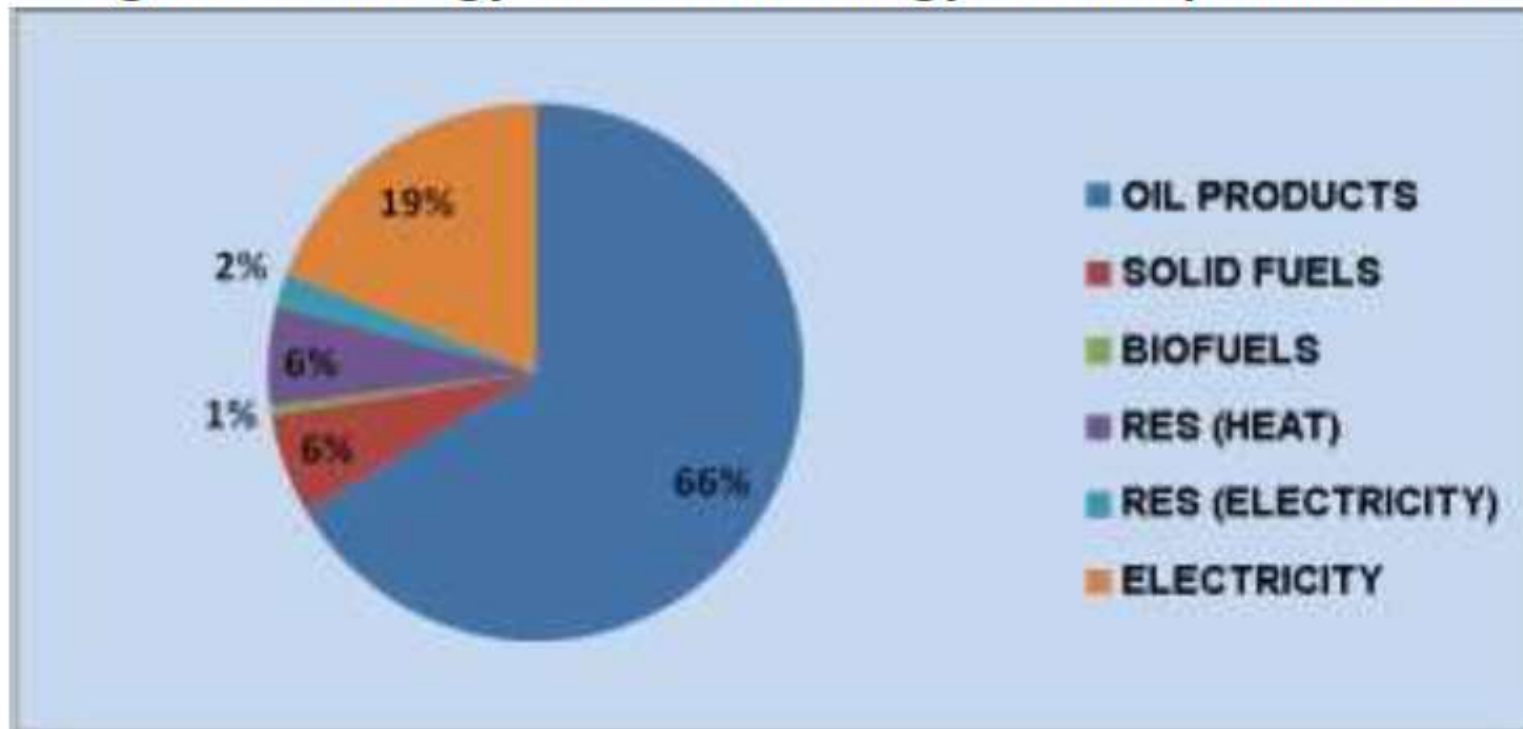
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4th National Energy Efficiency Action Plan of Cyprus 2017

Imported oil products 66% of final energy consumption

Figure 12: Energy mix - final energy consumption 2015.

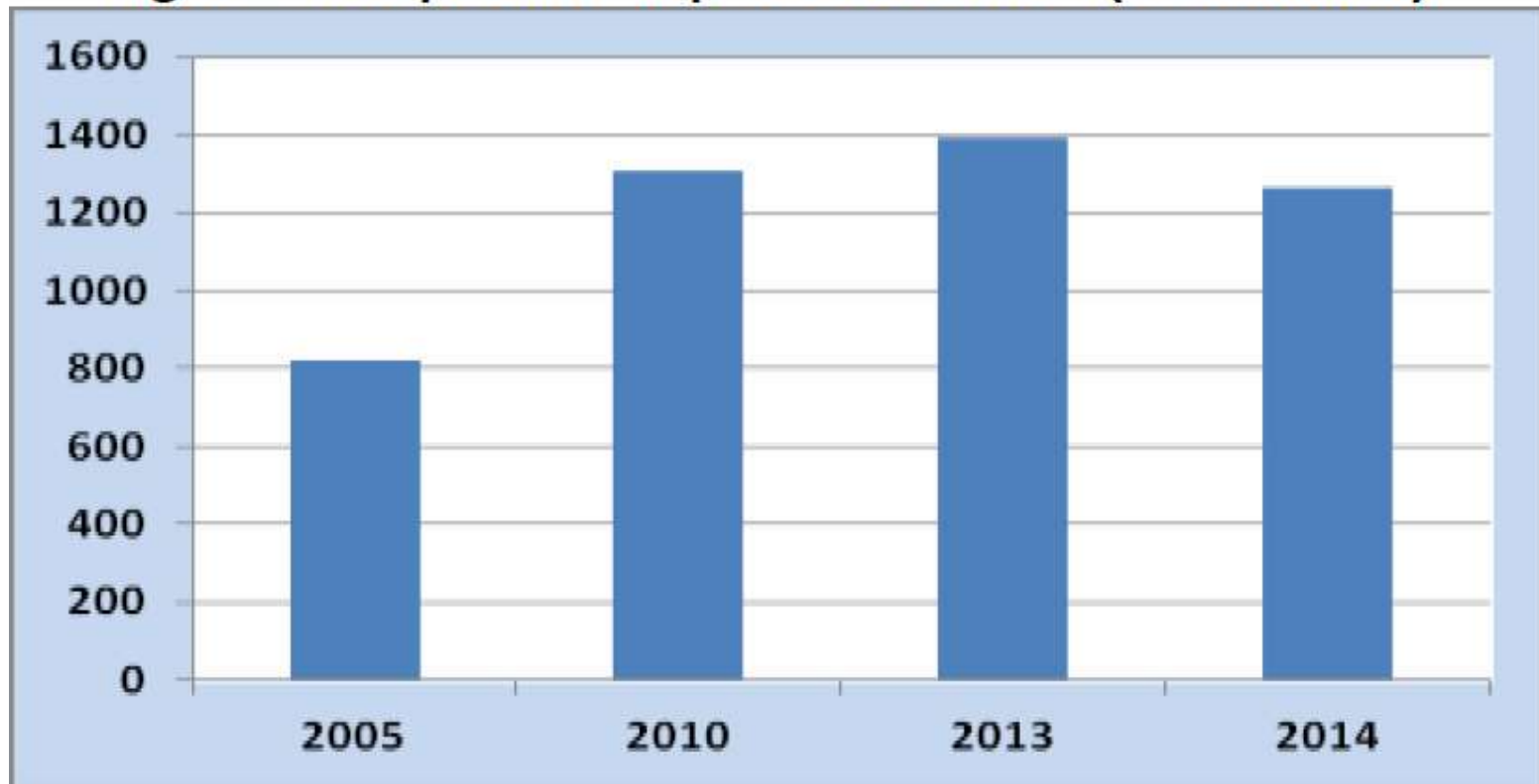


Source: 4th NEEAP of Cyprus 2017

4th NEEAP of Cyprus 2017

Imported oil products > € 1.2 billion = ~8% of GDP

Figure 3: Oil product imports 2005-2014 (EUR million).



Source: 4th NEEAP of Cyprus 2017

4th NEEAP of Cyprus 2017

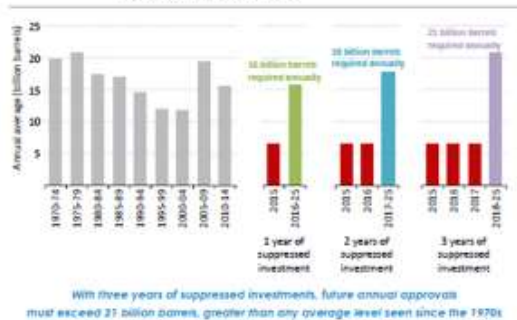
Recall from last year: 'Black Swan Alert' – oil prices might rise

Implications for Cyprus

IEA WEO 2016 on oil supply/price: "Mind the gap"!

Massive underinvestment 2015/16/17 will cause medium term supply gap (with respective price increases)

Figure 2.17 Global conventional crude oil project approvals required to fill supply-demand gap in 2025



Sources: IEA analysis; Rystad Energy for historical levels.

Source: IEA WEO 2016

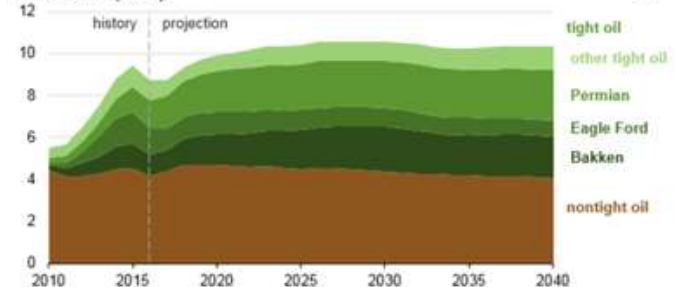
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Implications for Cyprus

US tight oil will not save the day on supply crunch:

EIA expects U.S. tight oil to rise to 6 mm bbl/d over next decade ~6% global demand - supply crunch will be much larger
Potential double impact Cyprus: high oil and high carbon price

U.S. oil production (2010-40)
million barrels per day



Source: EIA

The Gas Value Chain Company GmbH

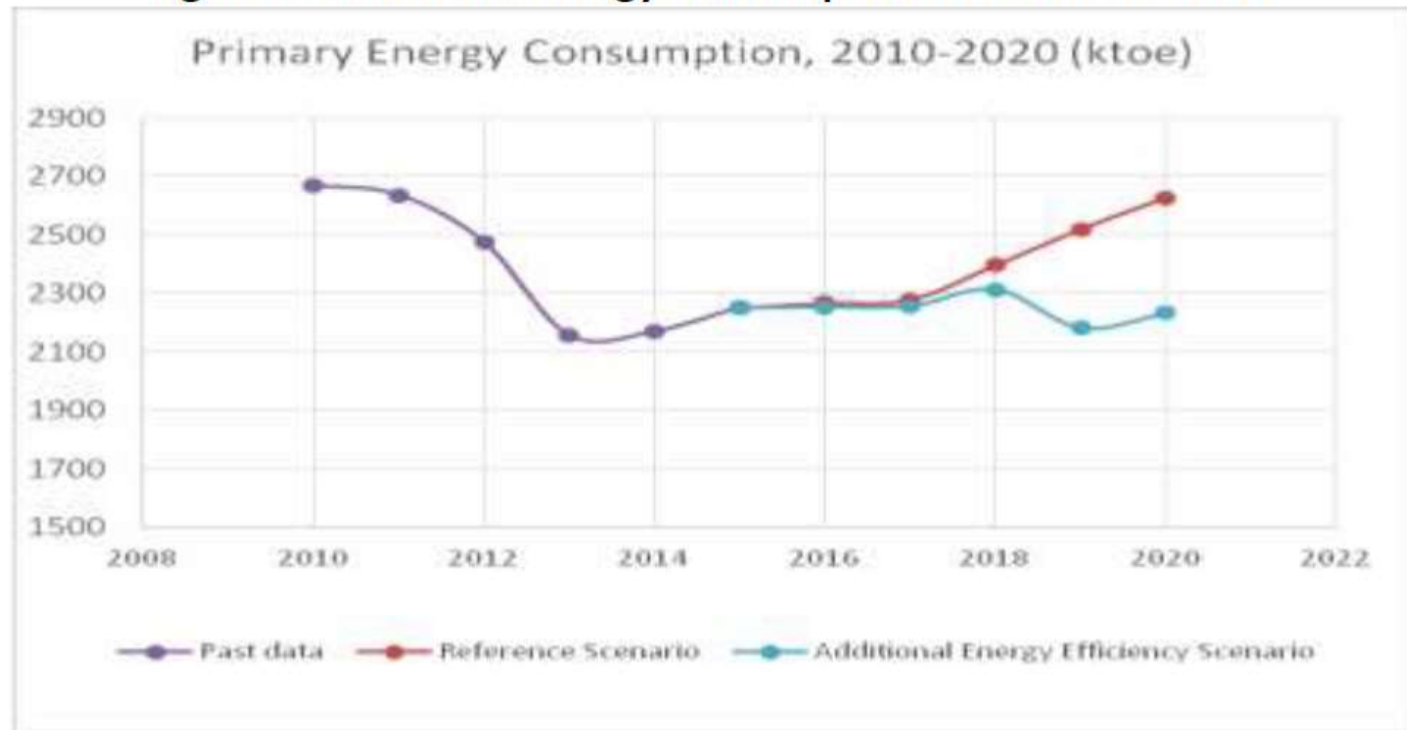
4th NEEAP of Cyprus 2017

Reference scenario: continued use of oil for power generation

Additional energy efficiency scenario: gas for power generation

44% (175 ktoe) of primary energy savings attributable to gas

Figure 17: National energy consumption forecast for 2020.

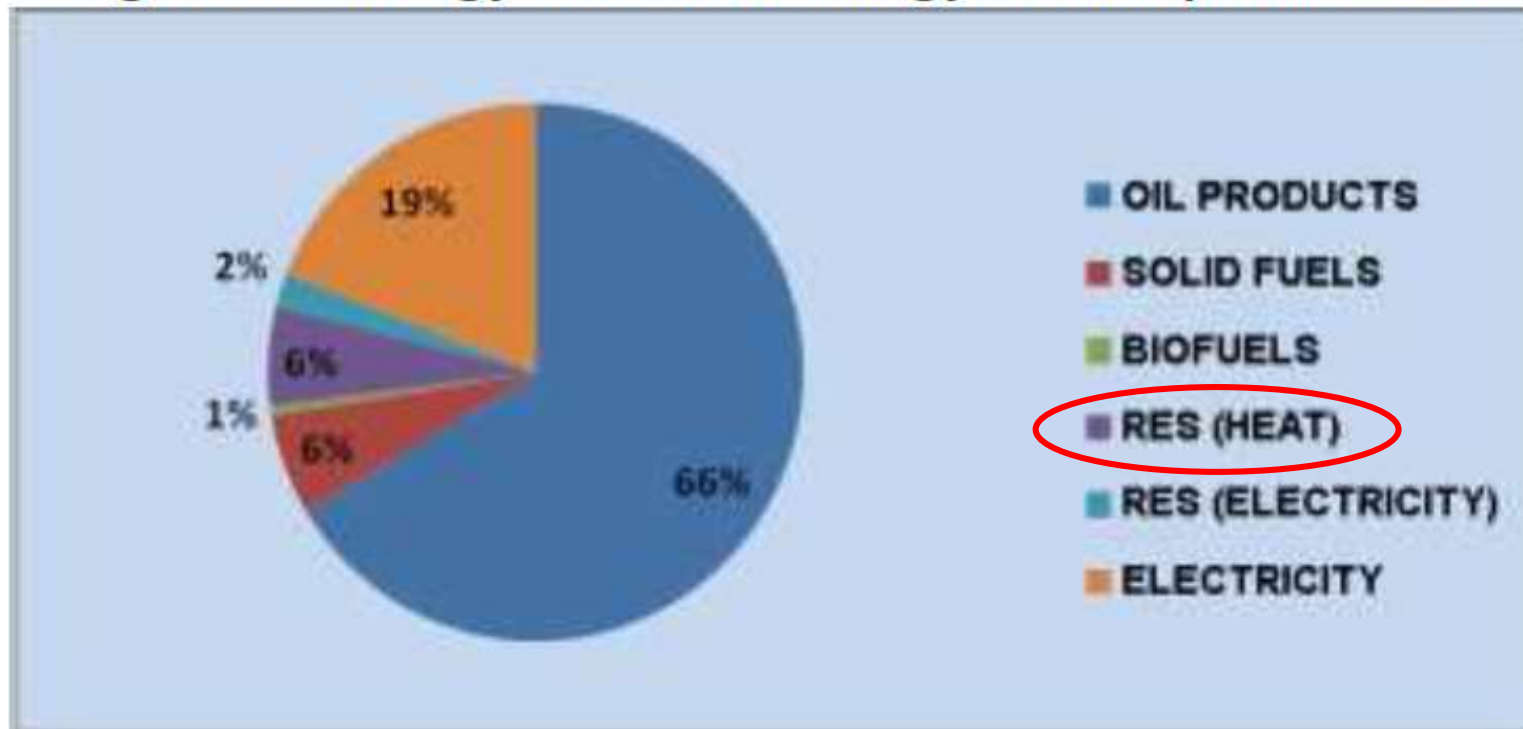


Source: 4th NEEAP of Cyprus 2017

4th NEEAP of Cyprus 2017 on RES

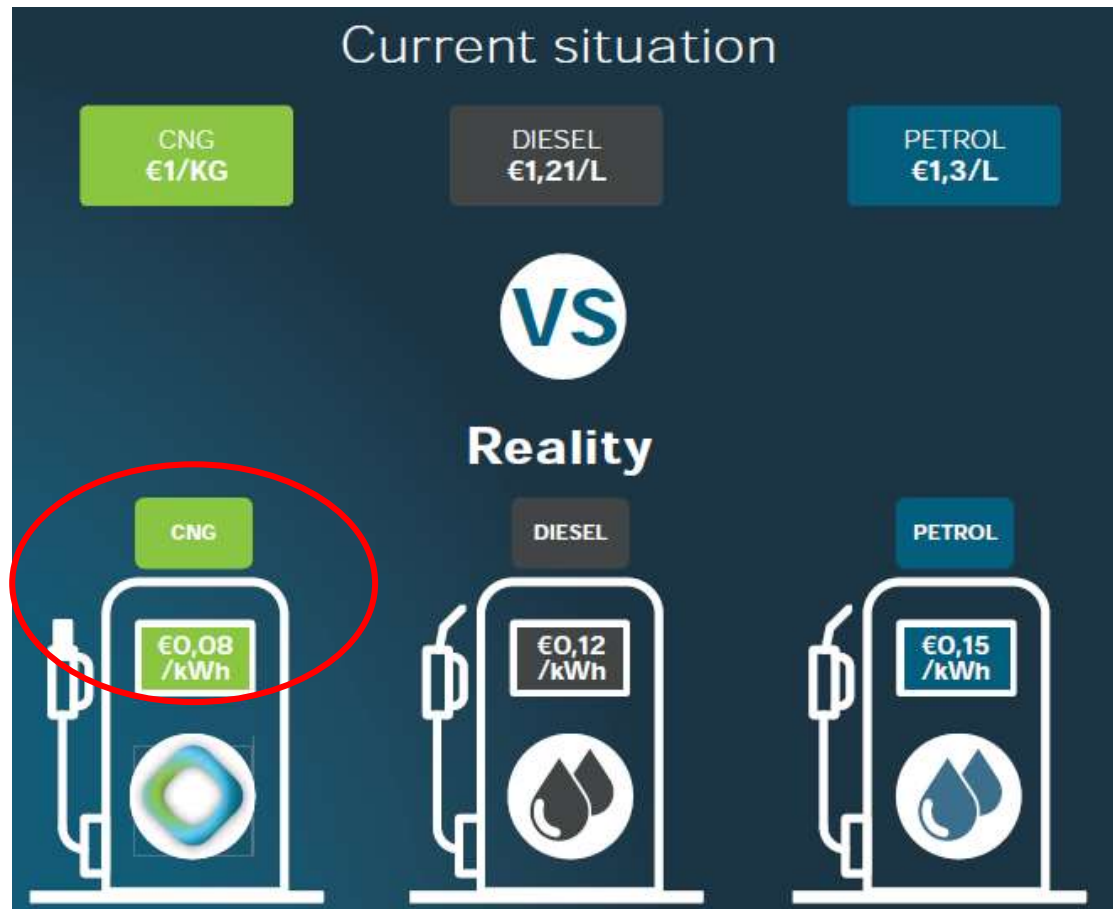
Heat sector: Cyprus solar thermal (6%) 'world class', avoiding German mistakes (only 'Powerwende' with no CO2 impact)

Figure 12: Energy mix - final energy consumption 2015.



Source: 4th NEEAP of Cyprus 2017

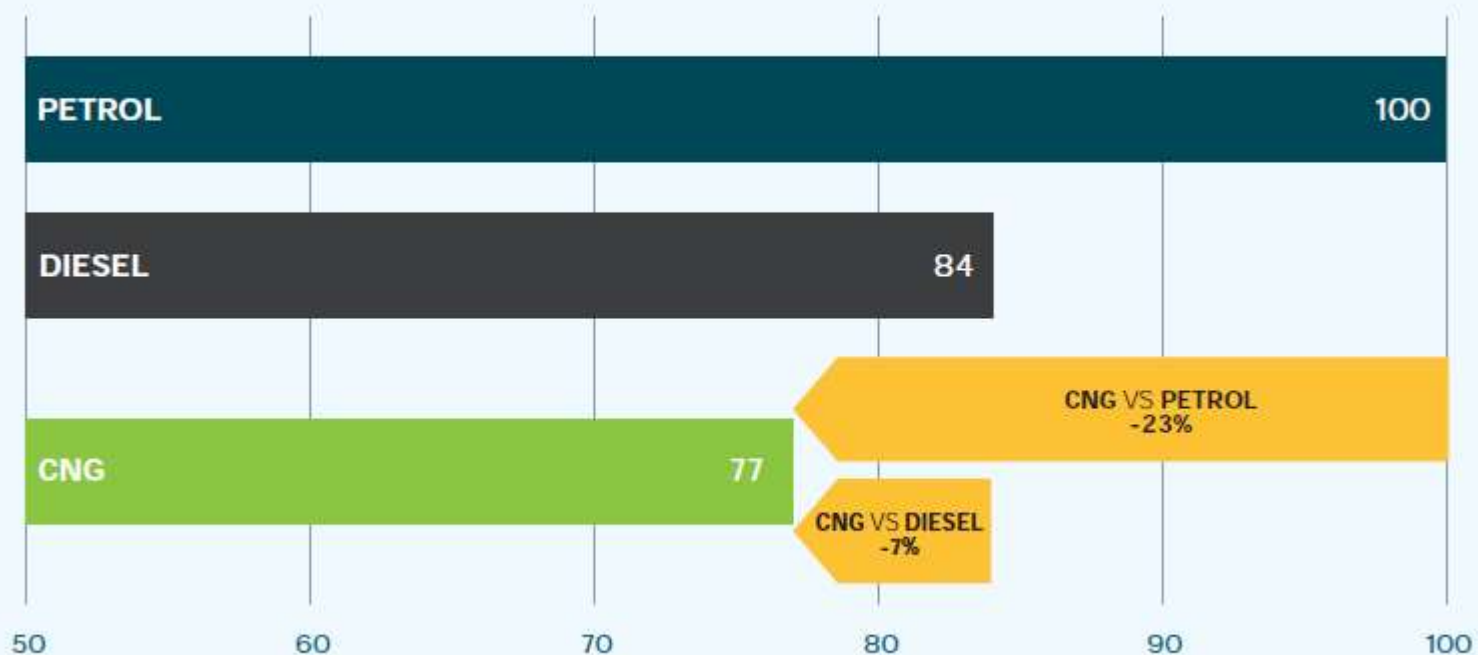
4th NEEAP of Cyprus 2017: Further considerations Transport sector: CNG in passenger cars cheaper



Source: NGVA

4th NEEAP of Cyprus 2017: Further considerations CNG in passenger cars more environmentally friendly

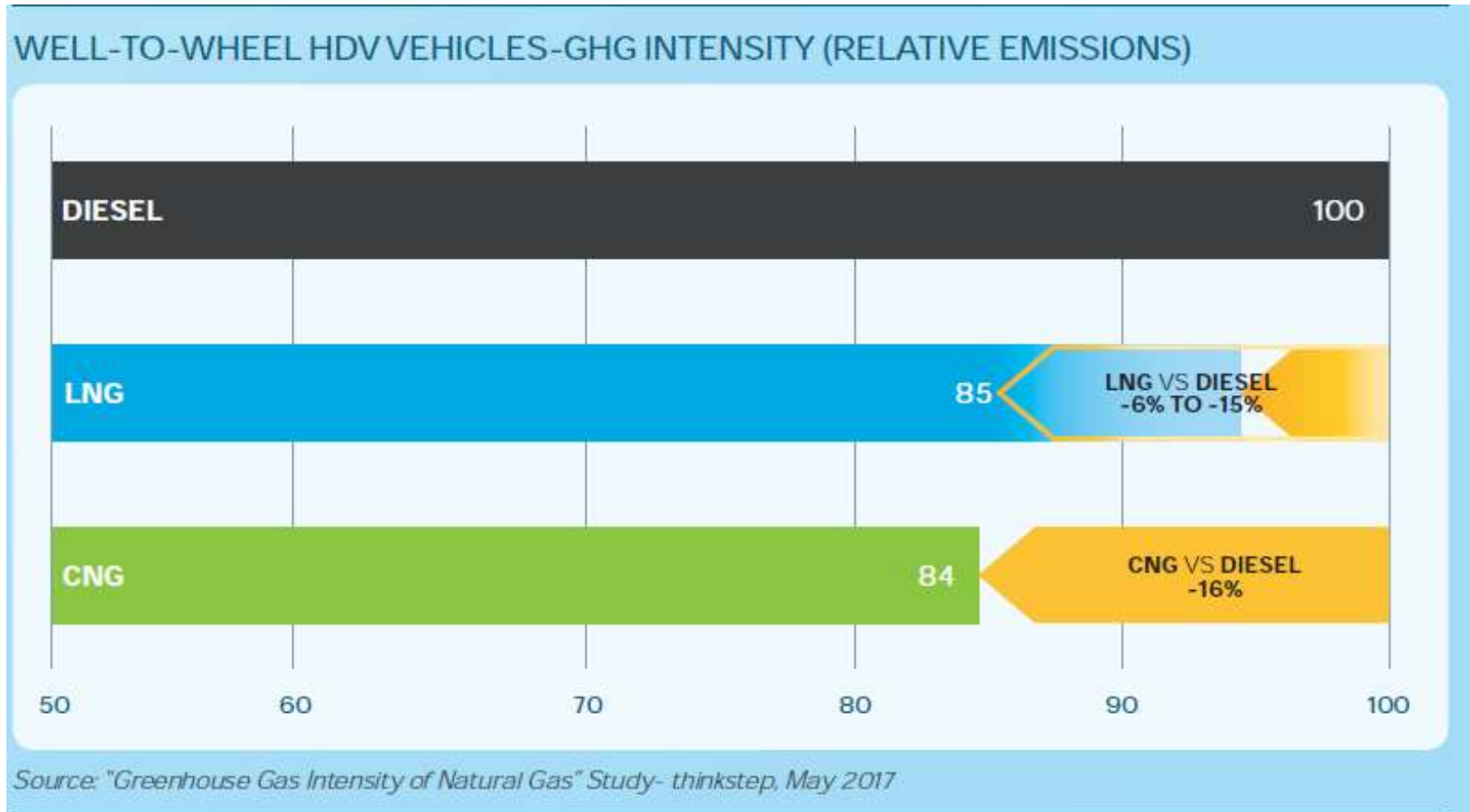
WELL-TO-WHEEL PASSENGER VEHICLES-GHG INTENSITY (RELATIVE EMISSIONS)



Source: "Greenhouse Gas Intensity of Natural Gas" Study- thinkstep, May 2017

Source: Thinkstep 2017

4th NEEAP of Cyprus 2017: Further considerations Transport sector: LNG or CNG in heavy duty trucks



Source: Thinkstep 2017

4th NEEAP of Cyprus 2017: Further considerations Small scale LNG for heavy duty road & maritime transport

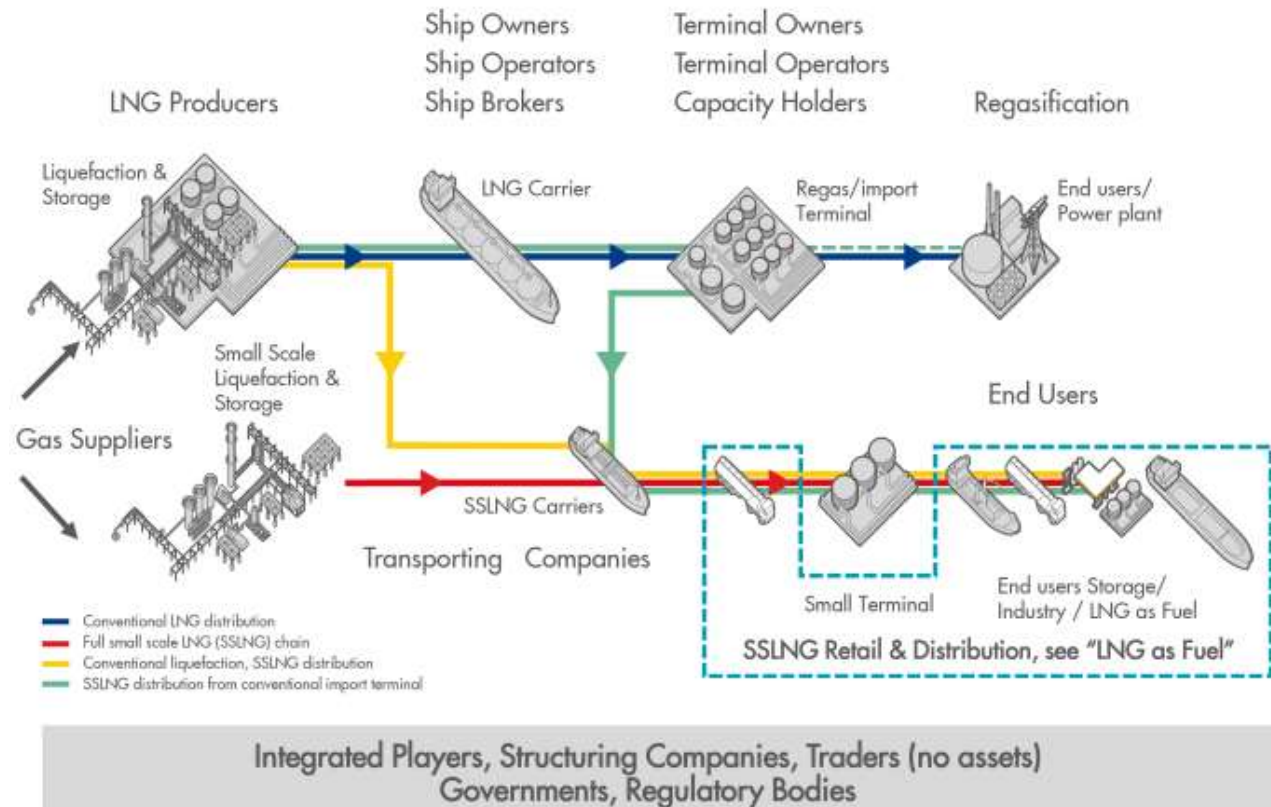
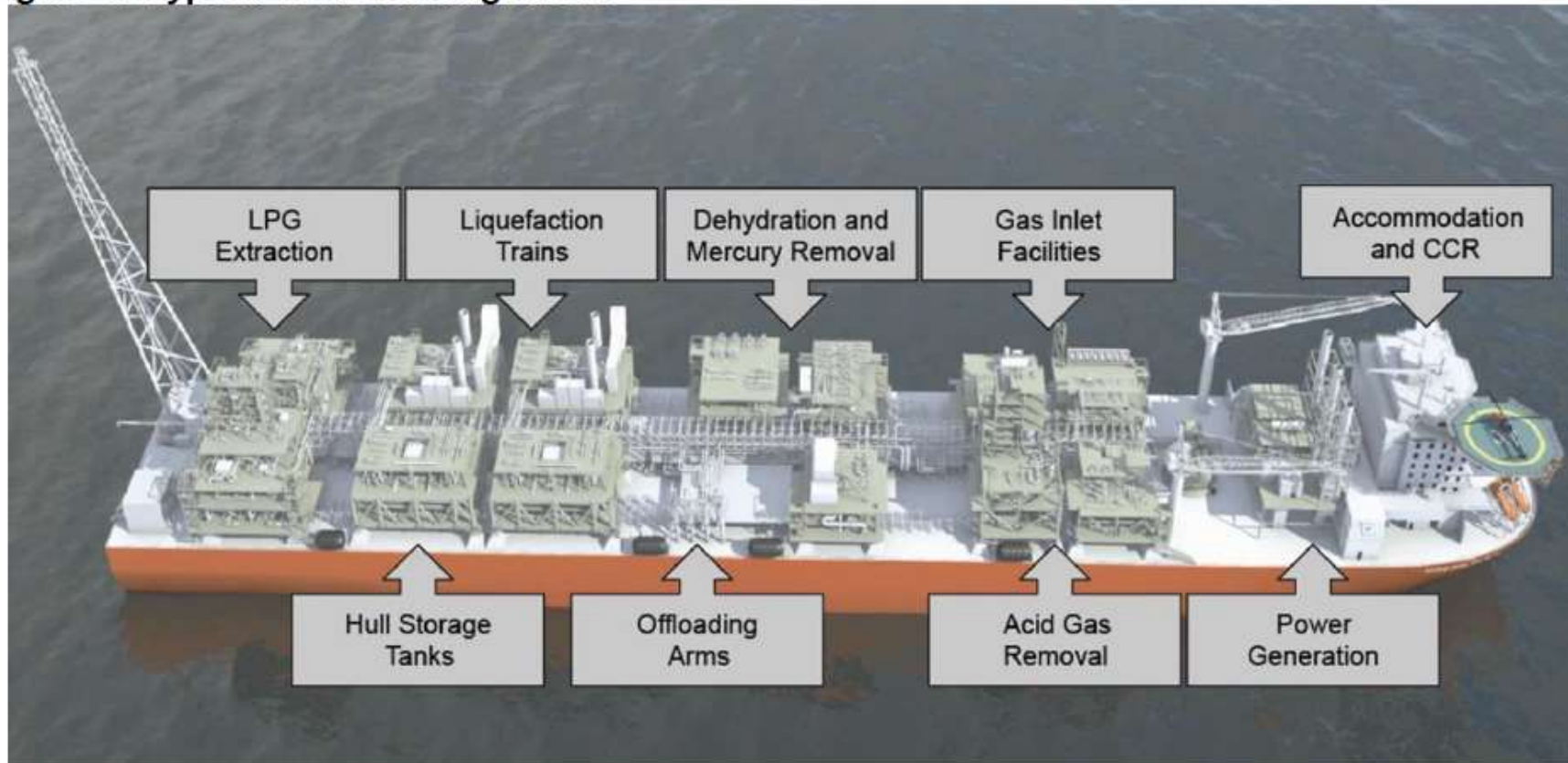


Figure 9 Configurations of the Small Scale LNG value chain. Source: Shell (edited version).

Source: IGU

Technological advancements in LNG open new opportunities Production: FLNG (floating liquefied natural gas)

Figure 3: Typical FLNG Arrangement

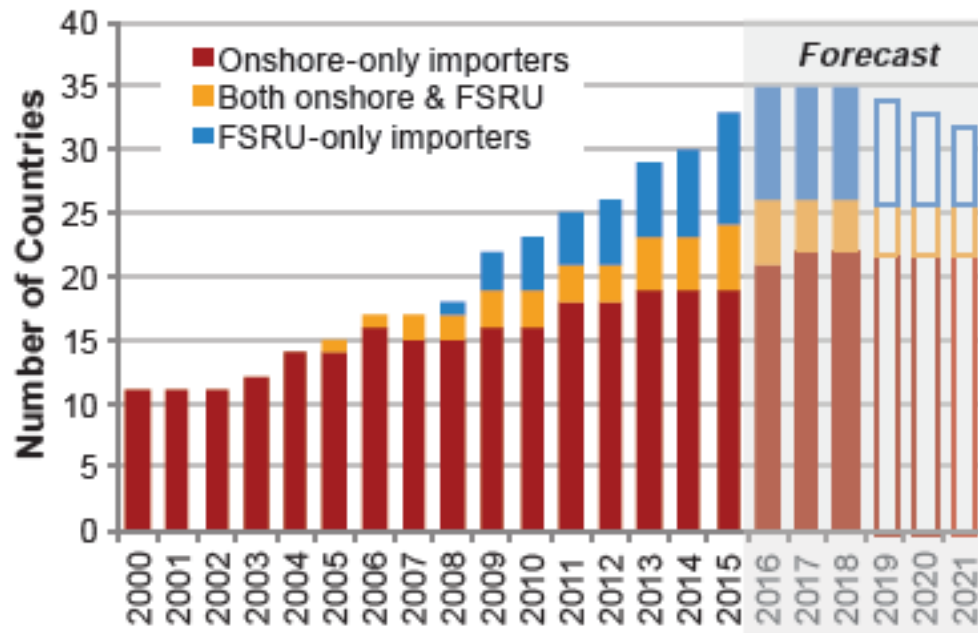


Source: Courtesy Höegh LNG

Source: OIES, NG 107

Technological advancements in LNG open new opportunities Import: FSRU (floating storage & regasification unit)

Figure 6.9: Rise of FSRUs among Import Markets, 2000-2021



Note: The above graph only includes importing countries that had existing or under construction LNG import capacity as of end-2015. Owing to short construction timelines for regasification terminals, additional projects that have not yet been sanctioned may still come online in the forecast period, as indicated by the diagonal bars. The decline in number of countries at the end of the forecast period is the result of short FSRU contract expirations. Sources: IHS, Company Announcements

Source: IGU World Gas LNG Report – 2016 edition

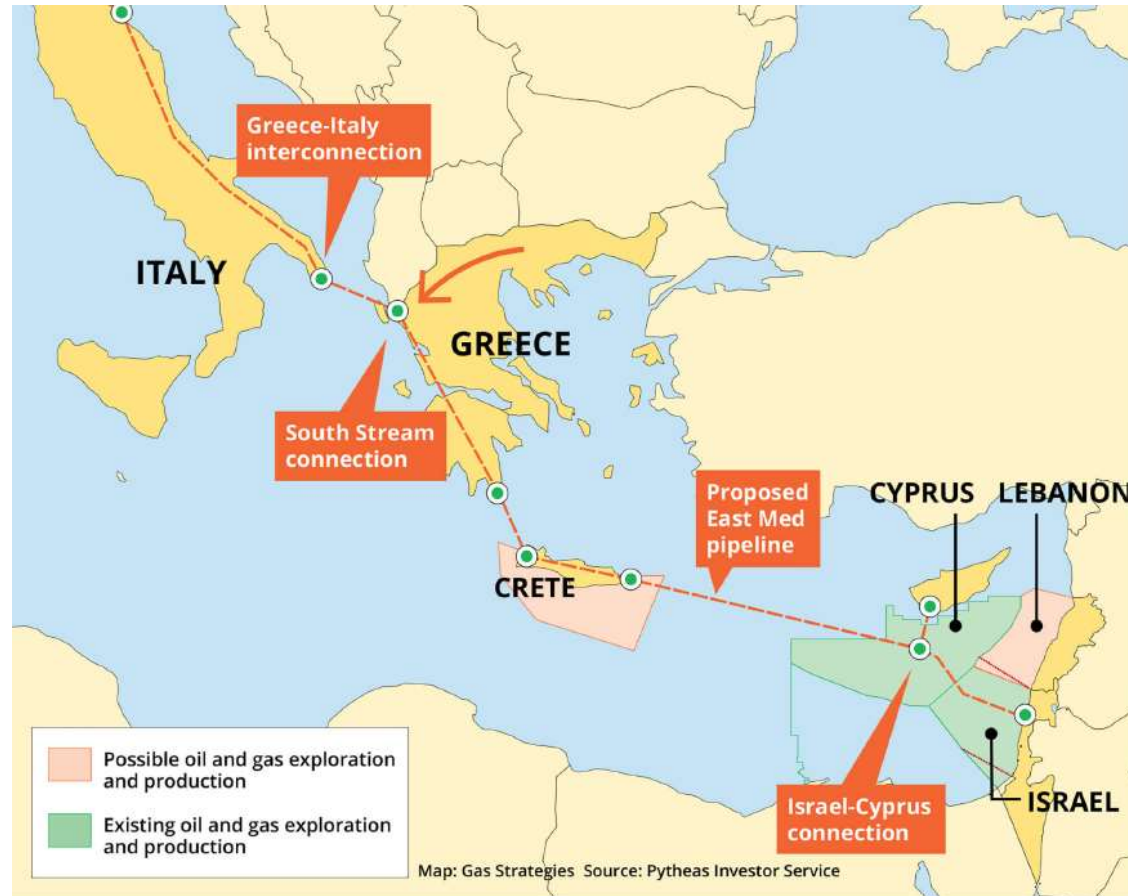
Technological advancements in LNG open new opportunities Import: FSRU (floating storage & regasification unit)

Table 6.2: Onshore Regasification Terminals and FSRUs

Onshore Terminals	FSRUs
Provides a more permanent solution	Allows for quicker fuel switching
Offers longer-term supply security	Greater flexibility if there are space constraints or no useable ports
Greater gas storage capacity	Capable of operating further offshore
Generally requires lower operating expenditures (OPEX)	Generally requires less CAPEX
Option for future expansions	Less land regulations

Source: IGU World Gas LNG Report – 2016 edition

Cyprus blessed with gas discoveries – put to good use it will benefit the economy and the environment



Source: Gas Strategies