To be or LNG?

Gas, a bridge to nowhere!

- Ireland Speakers Tour, June 2018 -
1. Climate change, gas and global warming - a real hot issue!
CO2 main climate change driver

BUT: fossil methane 87 times (96?) higher global warming potential than CO2 (20 year timescale) – IPCC

Non-fracked gas: could be up to almost 4% methane leakage rate

Fracked gas: could be up to almost 12% methane leakage rate

→ Need to urgently tackle CO2 AND CH4 (methane) emissions

Source: Howarthlab.org
Some key findings:

- **Current levels of emissions will use up the EU’s 2 °C carbon budget in under nine years**

- **Methane emissions and atmospheric concentrations are observed at the top end of IPCC scenarios**

- **Recent empirical studies of fossil fuel producing areas have found official inventories reported by governments to be under estimates for the areas surveyed**

- **Fossil fuels (including natural gas) have no substantial role in an EU 2 °C energy system beyond 2035**
2. Expansion of gas infrastructure
– despite the need to end fossil addiction -
North American LNG Import/Export Terminals

Approved

**Import Terminals**

**U.S.**
- APPROVED - UNDER CONSTRUCTION - FERC
  1. Corpus Christi, TX: 0.4 Bcf/d (Cheniere - Corpus Christi LNG) (CP12-507)
- APPROVED - NOT UNDER CONSTRUCTION - FERC
  2. Salinas, PR: 0.6 Bcf/d (Aguirre Offshore Gas Port, LLC) (CP13-133)
- APPROVED - NOT UNDER CONSTRUCTION - MARAD/Cost Guard
  3. Gulf of Mexico: 1.0 Bcf/d (Frontier U.S. Marine) (CP12-506)
  4. Gulf of Mexico: 1.4 Bcf/d (TORP Technology-Sienna LNG)

**Export Terminals**

**U.S.**
- APPROVED - UNDER CONSTRUCTION - FERC
  5. Sabine Pass, LA: 0.7 Bcf/d (Cheniere/Sabine Pass LNG) (CP11-72 & CP14-12)
  6. Hackberry, LA: 2.1 Bcf/d (Sempa-Cameron LNG) (CP13-25)
  7. Freeport, TX: 2.14 Bcf/d (Freeport LNG Dev/Freeport LNG Expansion/LNG Liquefaction) (CP12-502) (CP12-506)
  8. Cove Point, MD: 82 Bcf/d (Dominion–Cove Point LNG) (CP13-131)
  9. Corpus Christi, TX: 2.14 Bcf/d (Cheniere – Corpus Christi LNG) (CP12-507)
  10. Sabine Pass, LA: 1.4 Bcf/d (Sabine Pass Liquefaction) (CP13-552)
  11. Elba Island, GA: 0.35 Bcf/d (Southern LNG Company) (CP14-103)
- APPROVED - NOT UNDER CONSTRUCTION - FERC
  12. Lake Charles, LA: 2.2 Bcf/d (Southern Union – Lake Charles LNG) (CP14-120)
  13. Lake Charles, LA: 1.08 Bcf/d (Magnolia LNG) (CP14-347)
  15. Sabine Pass, TX: 2.1 Bcf/d (ExxonMobil – Golden Pass) (CP14-317)
  16. Port Hawkesbury, NS: 0.5 Bcf/d (Bear Head LNG)
  17. Kitimat, BC: 3.23 Bcf/d (LNG Canada)
  18. Squamish, BC: 0.29 Bcf/d (Woodfibre LNG Ltd)
  19. Prince Rupert Island, BC: 2.74 Bcf/d (Pacific Northwest LNG)

* Trains 5 & 6 with Train 5 under construction

As of May 1, 2017
325 new petrochemicals investment projects – about $194 billion worth – are underway or planned (40% already completed or underway)

Demand for polyethylene, the most used plastic, is set to rise at a similar rate, meaning total consumption will rise to 118 million metric tons in 2022 (according to IHS Markit)

- Appalachia, Pennsylvania, could turn into largest gas-producing region in US (accounting for 37% by 2040)
  - MoU between China Energy Invest. Corp. & U.S. for US$83.7 billion Appalachian hub inked
  - Shell working on US$6 billion ethane cracker in Pennsylvania
All EU LNG terminals: Utilization rate of lousy 22% - 23% (between January 2012 – Mid-March 2018)

Over €3bn of the €4.7bn foreseen for gas and electricity PCIs from 2014-2020 still remains unspent.
3. LNG terminals for Ireland?
– despite fracking ban & need to reduce emissions -
All other sources/references available on request

Shannon LNG
Jetty capable of taking 265,000 m³ LNG tanker (Q-Max)
500 MW CHP Plant
4 LNG Tanks (200,000 m³ LNG storage each)

Re-gasification (send-out) capacity: about 10 bcm/a

Cork LNG
Re-gasification (send-out) capacity: 3.85 bcm – 4.38 bcm/a

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**Gas interconnection**

**North-South gas interconnections in Western Europe**

**Definition**

5.1.1 - Physical reverse flow at Moffat interconnection point (IE/UK)

**Definition**

5.1.3 - Development of the Islandmagee Underground Gas Storage (UGS) facility at Larne (Northern Ireland)

**Cluster**

PCI 5.1.3 - belonging to cluster 5.1: Cluster to allow bidirectional flows from Northern Ireland to Great Britain and Ireland and also from Ireland to United Kingdom
<table>
<thead>
<tr>
<th>Shannon</th>
<th>LNG Terminal planned</th>
<th>Cork</th>
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<tbody>
<tr>
<td><strong>Yes</strong> (the exact site in the Shannon Estuary is now an EU Special Protected Area)</td>
<td>PCI - eligible for EU funds</td>
<td><strong>No</strong></td>
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<td>Shannon LNG Ltd. &amp; Hess Corporation (former owner), PWC is looking for a new owner (as advisor for current owner, Sambolo Resources)</td>
<td><strong>Companies/Investors</strong></td>
<td>NextDecade Global Solutions, FLEX LNG (Oslo Børs: FLNG), NextDecade, LLC, Port of Cork</td>
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<td>€500 million</td>
<td>Planned investment</td>
<td>€338 million?</td>
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<td>Re-gasification (send-out) capacity: up to 28.3 million standard m³ per day (MMscm/d) – about <strong>10 bcm/a</strong></td>
<td>Planned capacity (twice the amount of current Irish consumption and equal to expected annual flow of EU COM’s most ambitious PCI-project, ie. mega-pipeline $45bn Southern Gas Corridor – EIB invest of €1.5bn)</td>
<td>Re-gasification capacity: 3 mtpa (million ton LNG/a)vi – about <strong>3.85 bcm – 4.38 bcm/a</strong></td>
</tr>
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<td>LNG storage tanks: Up to 4 tanks of 200,000 m³ capacity each</td>
<td>Floating Storage and Regasification Unit (“FSRU”)</td>
<td>Associated LNG import terminal infrastructure</td>
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<td>LNG tankers: Up to 266,000 m³ cargo capacity</td>
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<td>Connection pipeline: 26 km 30 inch pipeline &amp; connection to national gas grid approved</td>
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<tr>
<td>Shannon LNG Terminal</td>
<td>Timeline / History</td>
<td>Cork LNG Terminal</td>
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<td><strong>Mar 2008</strong></td>
<td>Terminal planning permission – An Bord Pleanála – 40 conditions. 2nd of 40 conditions allowed 10-year planning permission for the terminal to be built; will expire in 2018. Shannon LNG applied to alter condition.</td>
<td><strong>Dec 2016</strong></td>
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<td><strong>Oct 2013</strong></td>
<td>EU Project of Common Interest (1st PCI list)</td>
<td><strong>July 2017</strong></td>
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<td><strong>Dec 2013</strong></td>
<td>High Court rejects challenge to natural gas transmission network charges (Bord Gáis Éireann) – Hess ordered to contribute as much as €50 million/a to support infrastructure including cost of interconnectors linking Irish gas network to supplies from the UK</td>
<td><strong>End 2019 / early 2020</strong></td>
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<td><strong>Nov 2015</strong></td>
<td>Hess sells Shannon LNG to shelf company Sambolo Resources Ltd. – despite a €67 million investment</td>
<td><strong>2022</strong></td>
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<td><strong>Feb 2018</strong></td>
<td>An Bord Pleanála, decides that extending the expiring planning permission is a &quot;Material Change&quot; and then, 26 days later, changes its mind</td>
<td><strong>May 2018</strong></td>
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<td><strong>March 2018</strong></td>
<td>EU Parliament votes for 3rd PCI list (Shannon LNG &amp; connected projects “on board”)</td>
<td><strong>May 2018</strong></td>
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4. Impacts of LNG terminals and opposition
Reference case, utilizes methane leakage rate of 1.77% across supply chain = total lifecycle emissions of over 36.8 million metric tons (MMT) of CO$_2$e/a = equivalent to over 15.4 times the 2016 emissions from Oregon’s only remaining coal plant, or annual emissions from 7.9 million passenger vehicles (4% leakage = 22 times coal plant CO2e)!
LNG/NGL facilities (incl. pipelines, coastal terminals, and ships) are growing components of the overall fracking infrastructure.

- LNG is created and transported through capital-intensive and energy-intensive processes.

- LNG/NGL plants have a high environmental, security and public safety/health risk.

- Greenhouse emissions are 30 percent higher than conventional gas due to refrigeration, venting, leaks, and flaring, used to control pressure during regasification.

- LNG plants are source of toxic air pollutants.
Saving the RGV from LNG: The smoggy landscape

HEALTH CONCERNS

Throughout the night, community members—not the TCEQ and certainly not the Rio Grande LNG—would be the ones to bring up the tons of pollutants expected to be emitted by the LNG terminal. Time after time, they cited NextDecade’s company reports for the Rio Grande LNG.

The estimates included 606 tons of volatile organic compounds, 3,142 tons of Carbon Monoxide, 2,059 tons of Nitrogen Oxide, 382 tons of Particulate Matter, 30 tons of Sulfur Oxide, 8,144,636 tons of greenhouse gases, and 54 tons of Hazardous Air Pollutants. Many of these pollutants can have grave respiratory and health impacts. They have been tied to, among other things, asthma, heart disease, and even premature death. Some, including the volatile organic compounds and hazardous air pollutants, are considered highly carcinogenic and neurotoxic.

5. Way forward for the „Green Island“
Figure 4: Gas Competes with Wind and Solar More than Coal

Source: Lazard 2017™

In his speech, European Commissioner for Climate Action & Energy Miguel Arias Cañete listed the main objectives:

“Promoting energy self-reliance through an increased penetration of renewable energies such as solar, wind, marine energies, as well as new storage solutions, in the buildings, transport and industry sectors, and promoting a wide uptake of energy efficiency measures; At the same time, we will reduce the dependency on costly fossil fuel imports, easing the strain on public budgets.”


Horizon 2020: budget of €5.68 billion for secure, clean and efficient energy (2014-2020)
Horizon Europe EU-COM proposal: €100 billion for research and innovation (2021-2027)
CEF Budget proposal (2021-2027): €8.7 billion for completion of Energy Union and clean energy transition
A fossil free path for the future is not only a vision to have ... it is a very feasible goal to achieve!