



# THE GREAT GAS GOLD RUSH

*Cheap and abundant shale gas is changing how the chemical industry makes the ingredients of modern life. Chemists want to ensure that it's change for the better.*

## 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!

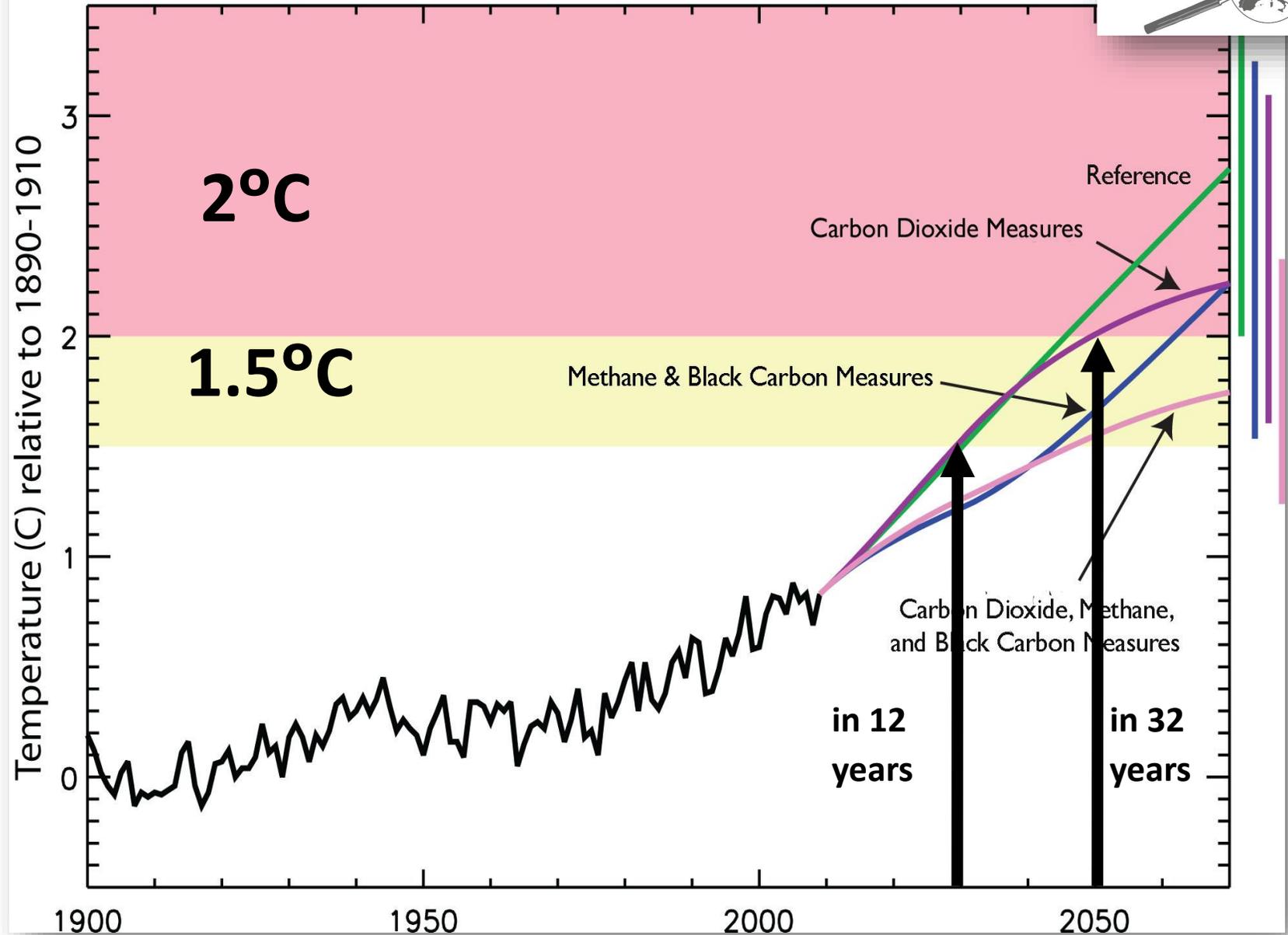
CO2 main climate change driver

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

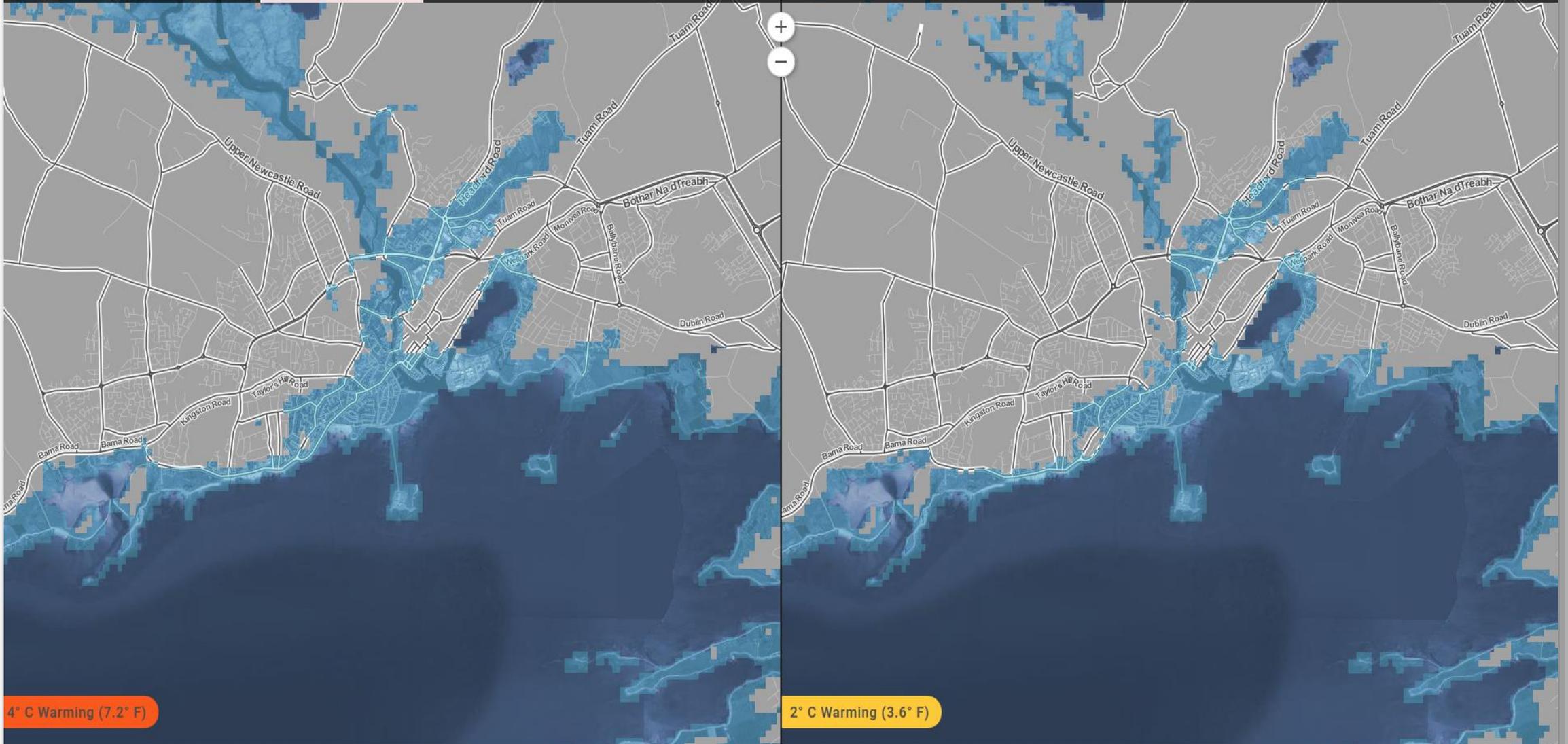


Shindell et al. 2012

Galway, Ireland

Which sea level will we lock in?

When will this happen?



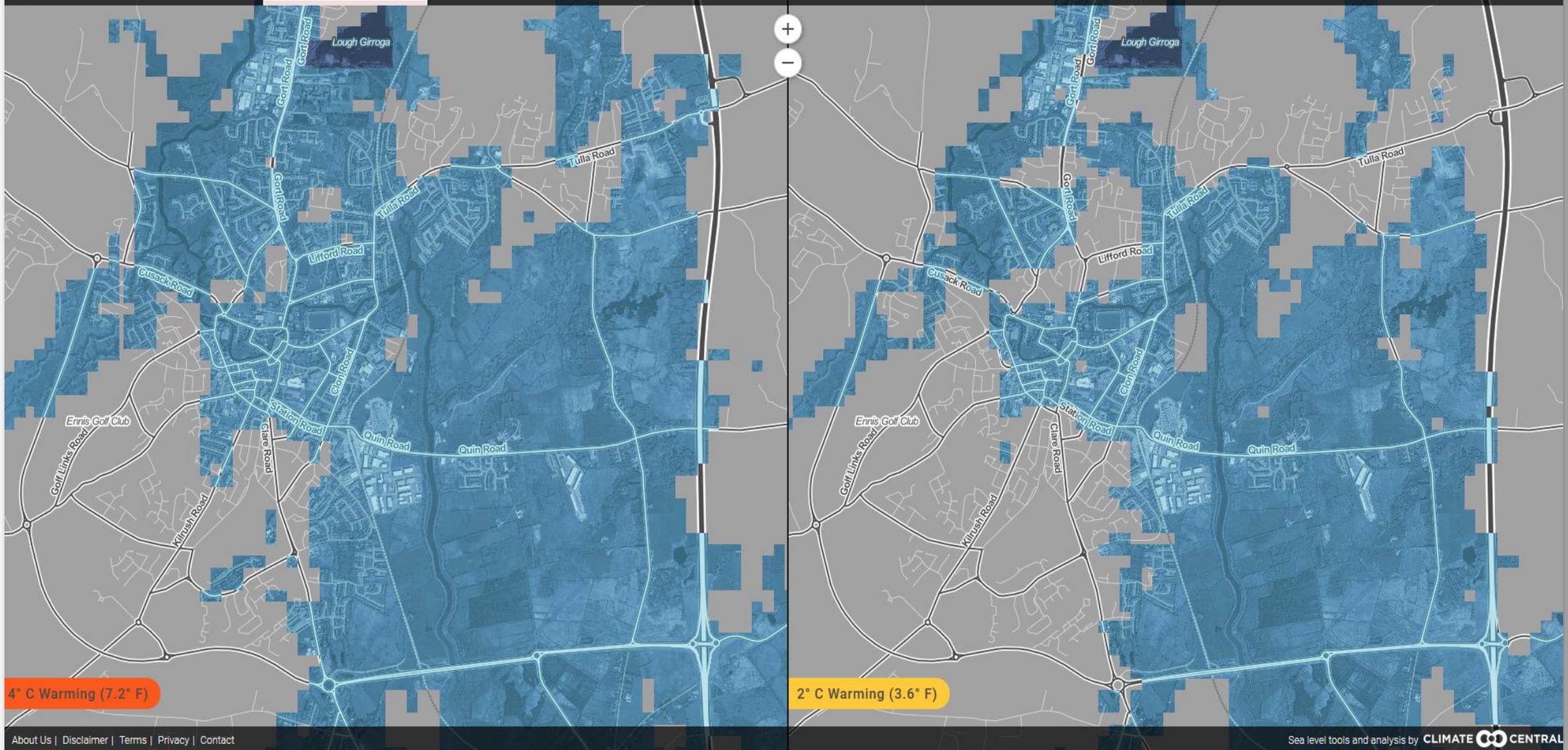
4° C Warming (7.2° F)

2° C Warming (3.6° F)

Ennis, Co. Clare, Ireland

Which sea level will we lock in?

When will this happen?



4° C Warming (7.2° F)

2° C Warming (3.6° F)

Learn About This Map

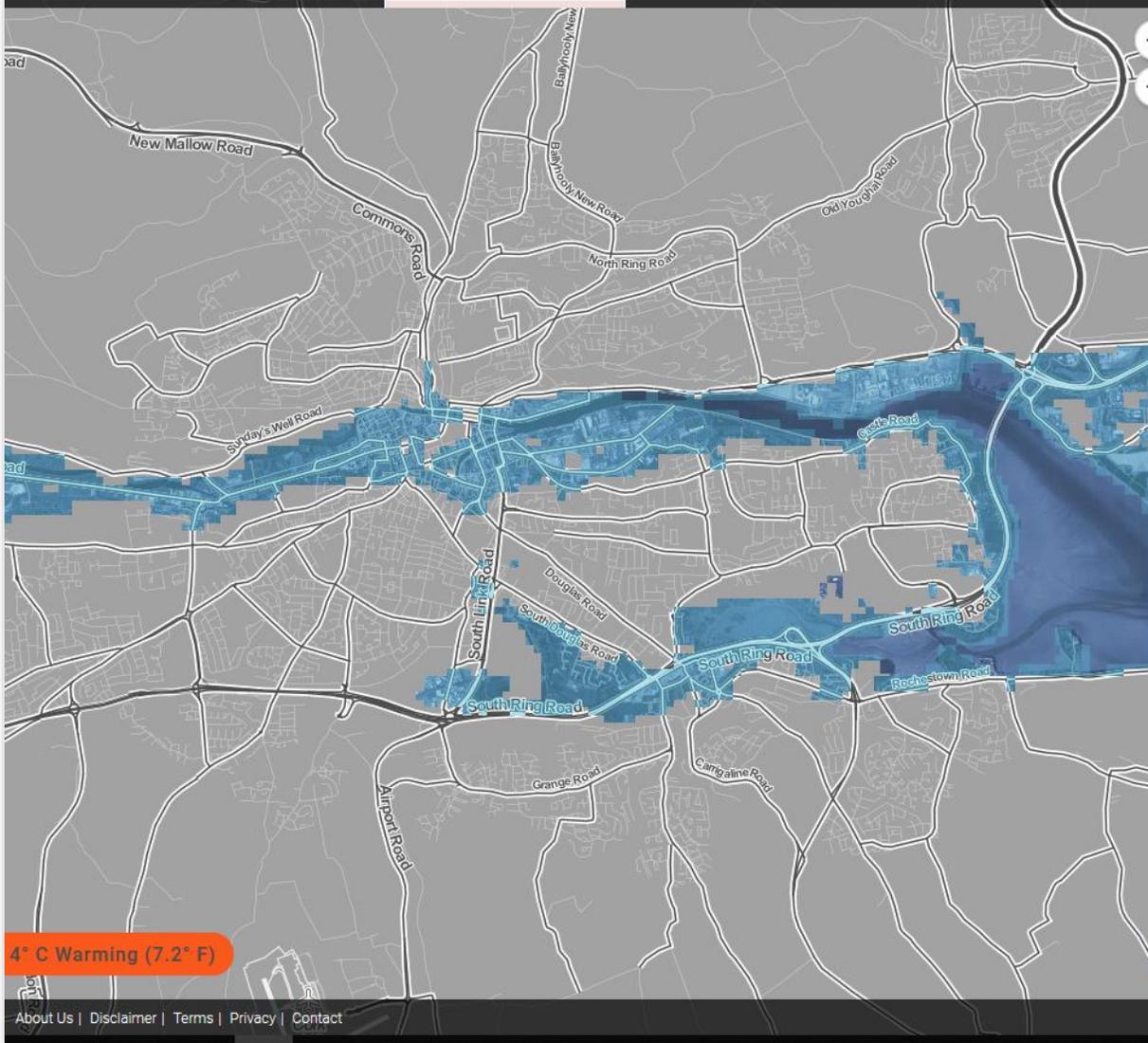
# Surging Seas MAPPING CHOICES



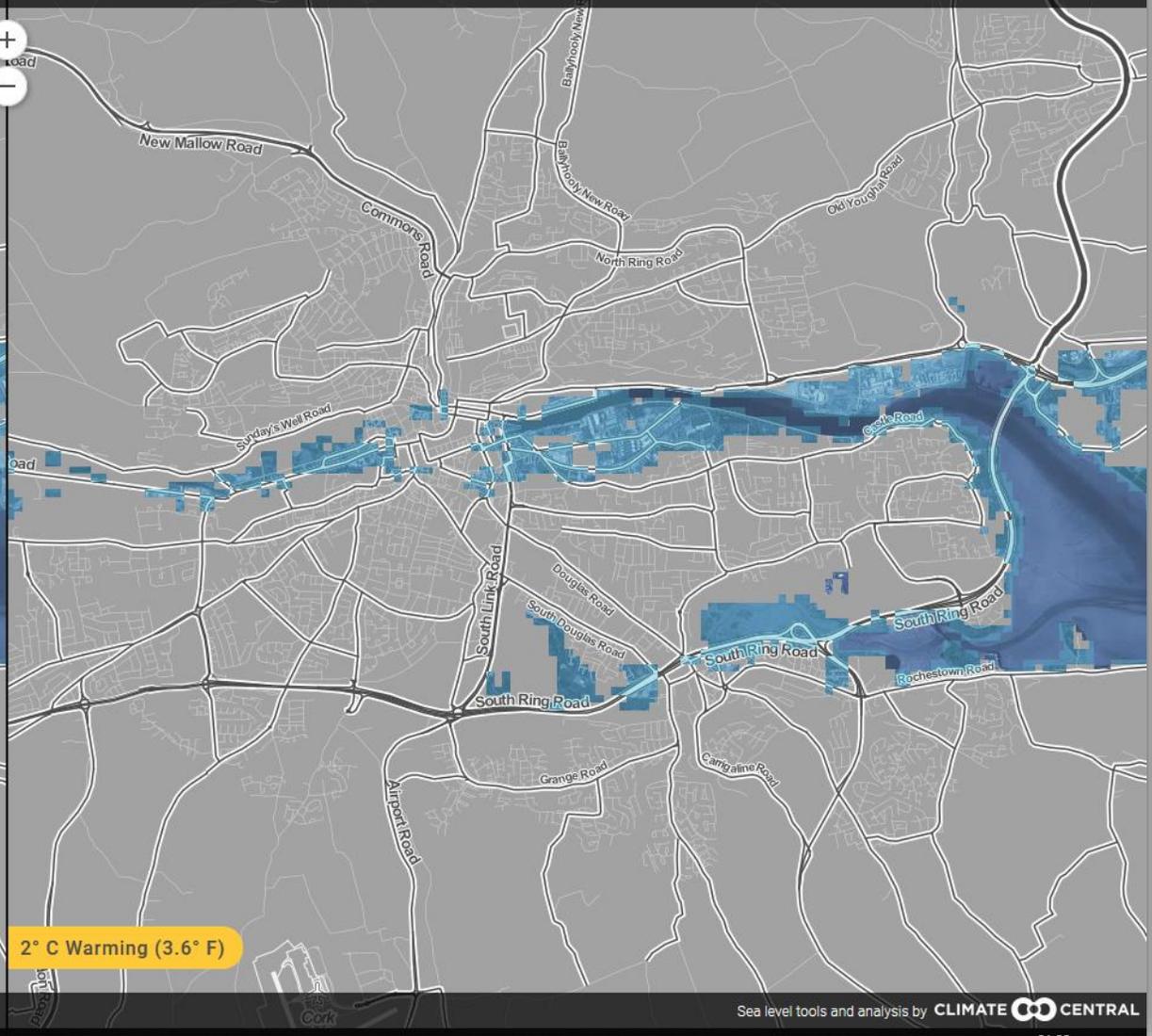
Cork, Ireland

Which sea level will we lock in?

When will this happen?



4° C Warming (7.2° F)



2° C Warming (3.6° F)

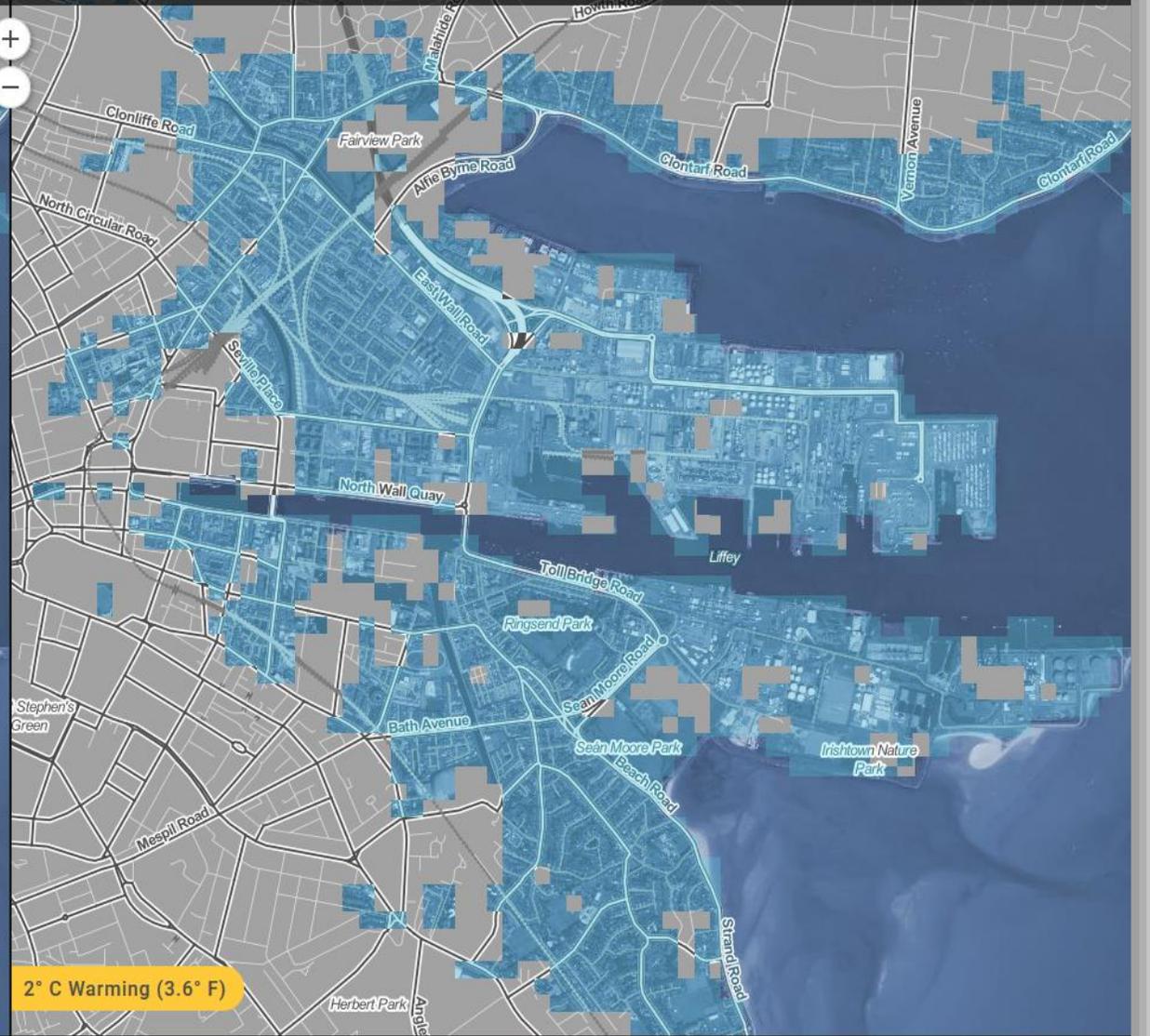
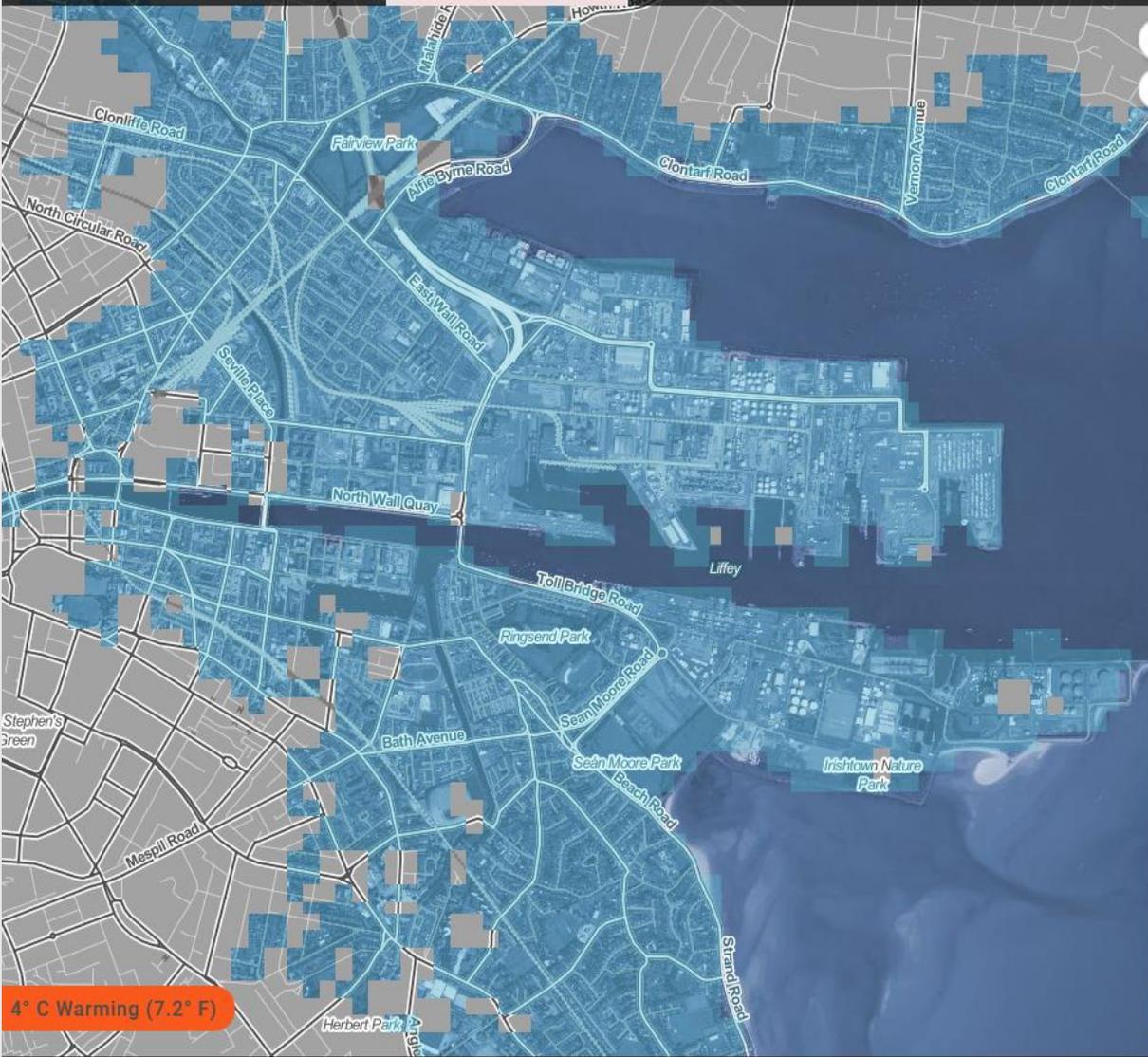
About Us | Disclaimer | Terms | Privacy | Contact

Sea level tools and analysis by CLIMATE CENTRAL

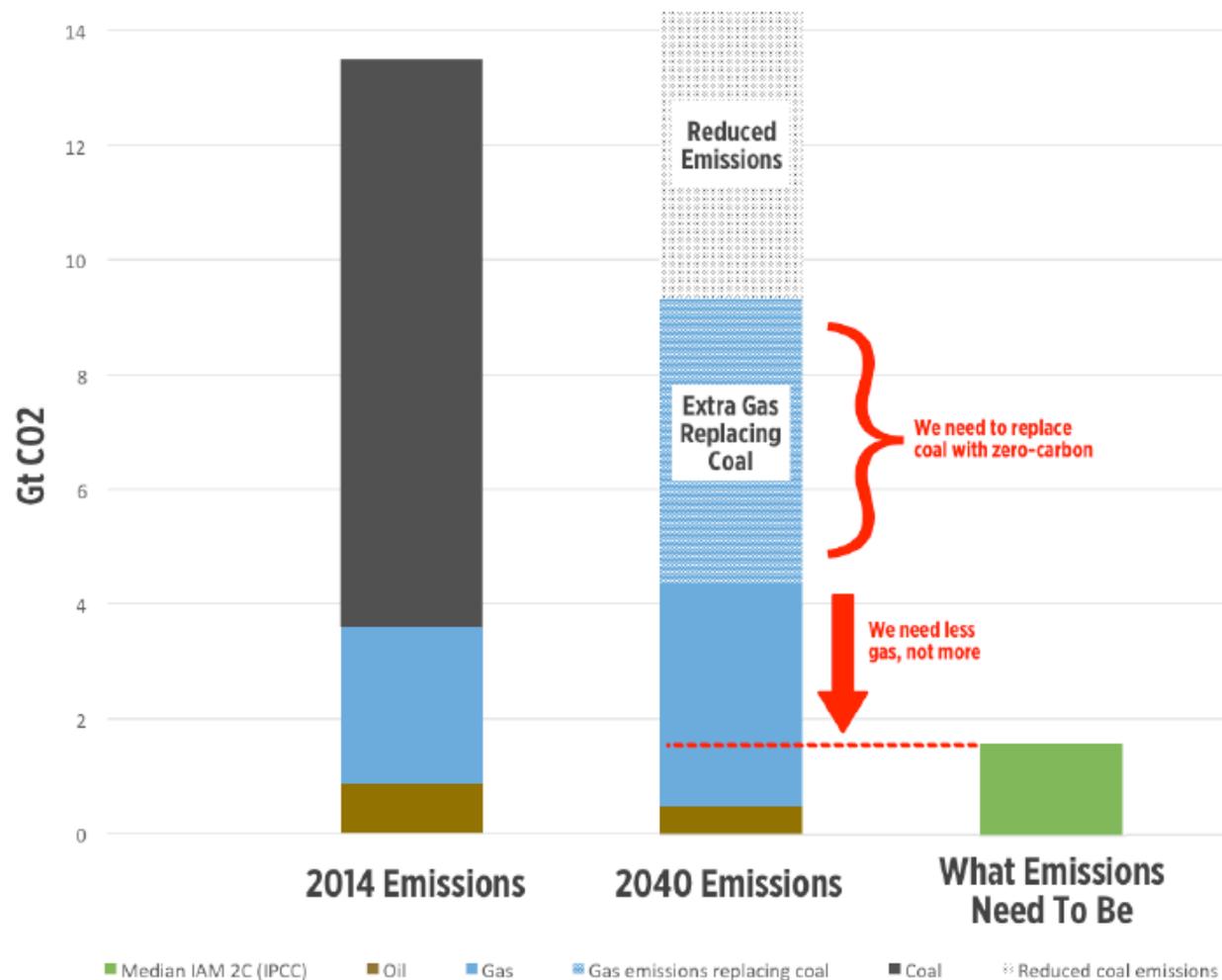
Dublin, Ireland 🔍

Which sea level will we lock in?

When will this happen?



**Figure 1: We Need Less Gas, Not More: Global Emissions from Power Generation (2014 and projected 2040 in IEA New Policies Scenario) Compared to Median IPCC 2040 Power Emissions Consistent With a Likely 2°C Scenario**



**Natural Gas and Climate Change** - Prof Kevin Anderson, University of Manchester & Uppsala University & Dr John Broderick, University of Manchester & Teesside University (17 October 2017)

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**

Source: Oil Change International analysis, using data/projections from IEA<sup>13</sup> and IPCC<sup>14</sup>

## 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 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. Sabine, LA: 0.7 Bcfd (Cheniere/Sabine Pass LNG) (CP11-72 & CP14-12)
6. Hackberry, LA: 2.1 Bcfd (Sempra–Cameron LNG) (CP13-25)
7. Freeport, TX: 2.14 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction) (CP12-509) (CP15-518)
8. Cove Point, MD: 0.82 Bcfd (Dominion–Cove Point LNG) (CP13-113)
9. Corpus Christi, TX: 2.14 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)
10. Sabine Pass, LA: 1.40 Bcfd (Sabine Pass Liquefaction) (CP13-552) ★
11. Elba Island, GA: 0.35 Bcfd (Southern LNG Company) (CP14-103)

##### APPROVED – NOT UNDER CONSTRUCTION - FERC

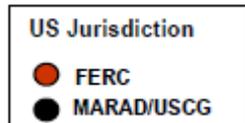
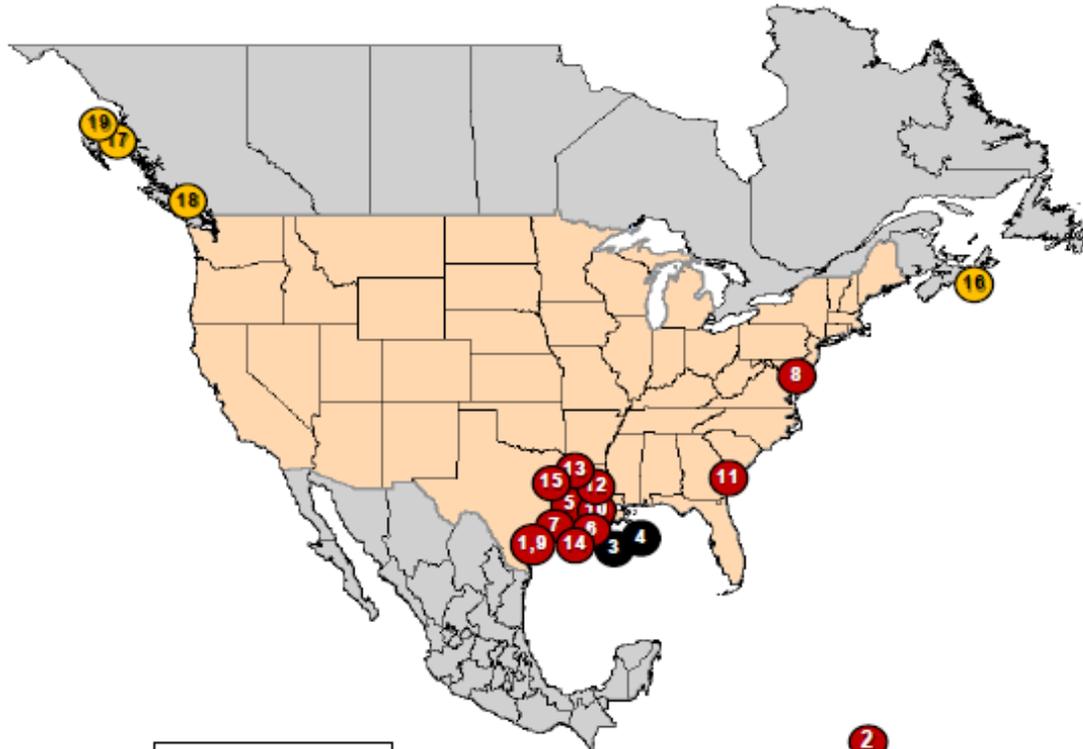
12. Lake Charles, LA: 2.2 Bcfd (Southern Union – Lake Charles LNG) (CP14-120)
13. Lake Charles, LA: 1.08 Bcfd (Magnolia LNG) (CP14-347)
14. Hackberry, LA: 1.41 Bcfd (Sempra - Cameron LNG) (CP15-560)
15. Sabine Pass, TX: 2.1 Bcfd (ExxonMobil – Golden Pass) (CP14-517)

#### Canada

##### APPROVED – NOT UNDER CONSTRUCTION

16. Port Hawkesbury, NS: 0.5 Bcfd (Bear Head LNG)
17. Kitimat, BC: 3.23 Bcfd (LNG Canada)
18. Squamish, BC: 0.29 Bcfd (Woodfibre LNG Ltd)
19. Prince Rupert Island, BC: 2.74 Bcfd (Pacific Northwest LNG)

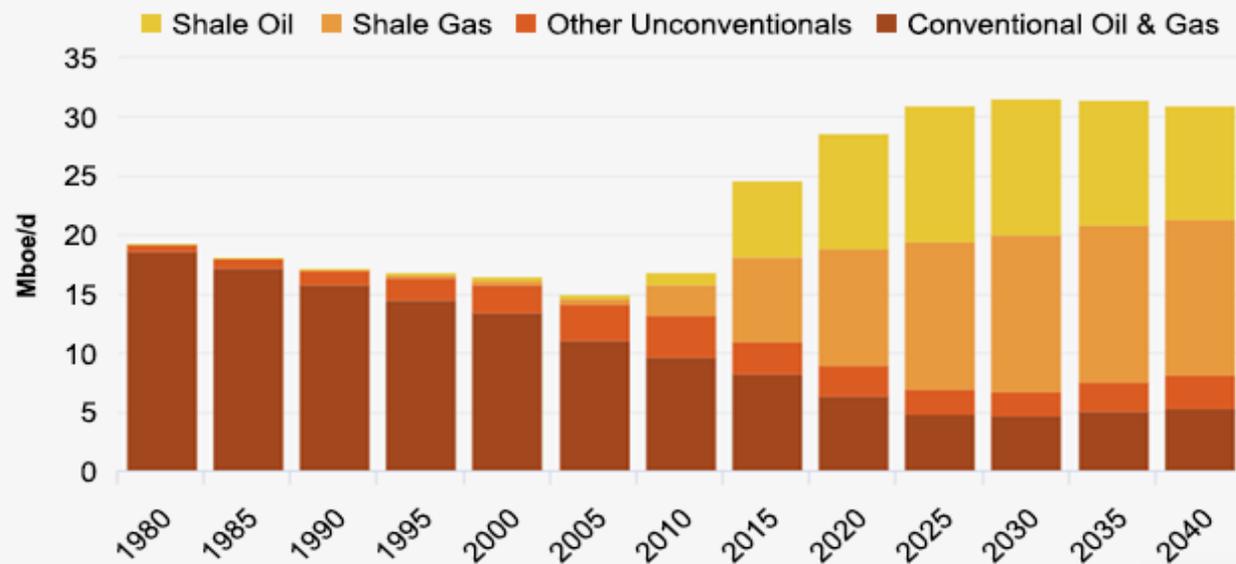
★ Trains 5 & 6 with Train 5 under construction



As of May 1, 2017

## Oil & Gas Production in the United States

### New Policies Scenario, 1980–2040



Source: International Energy Agency

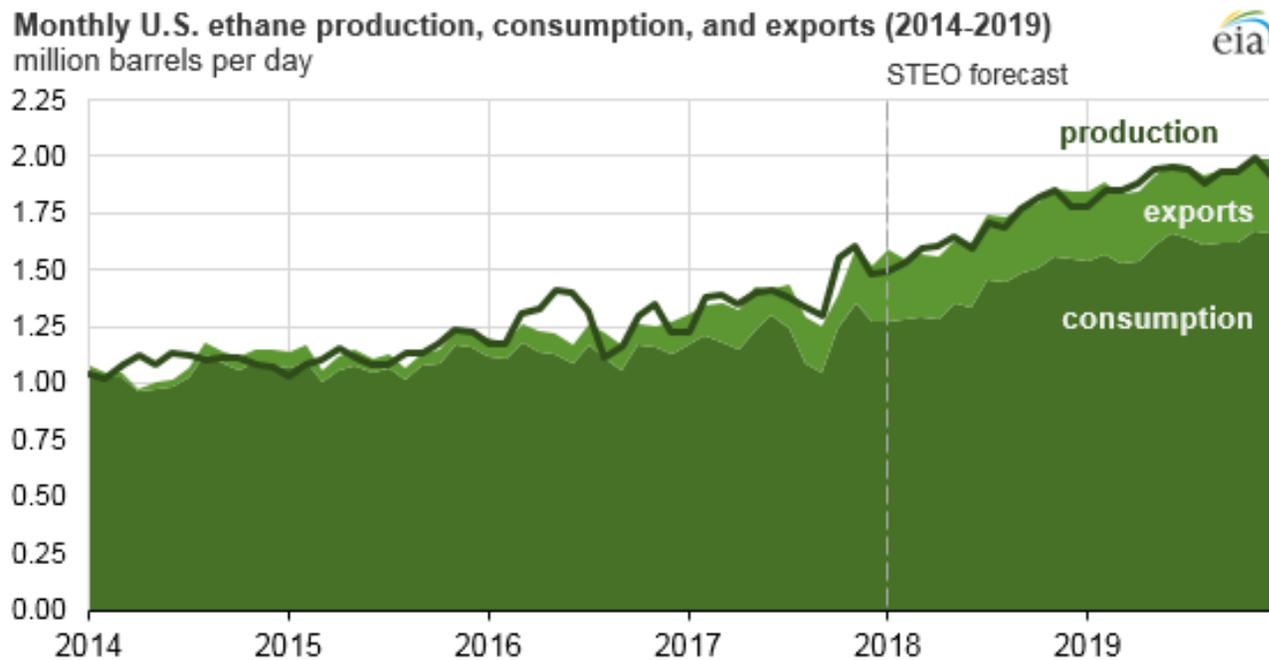
**325 new petrochemicals investment projects – about \$194 billion worth – are underway or planned (40% already completed or underway)**

**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

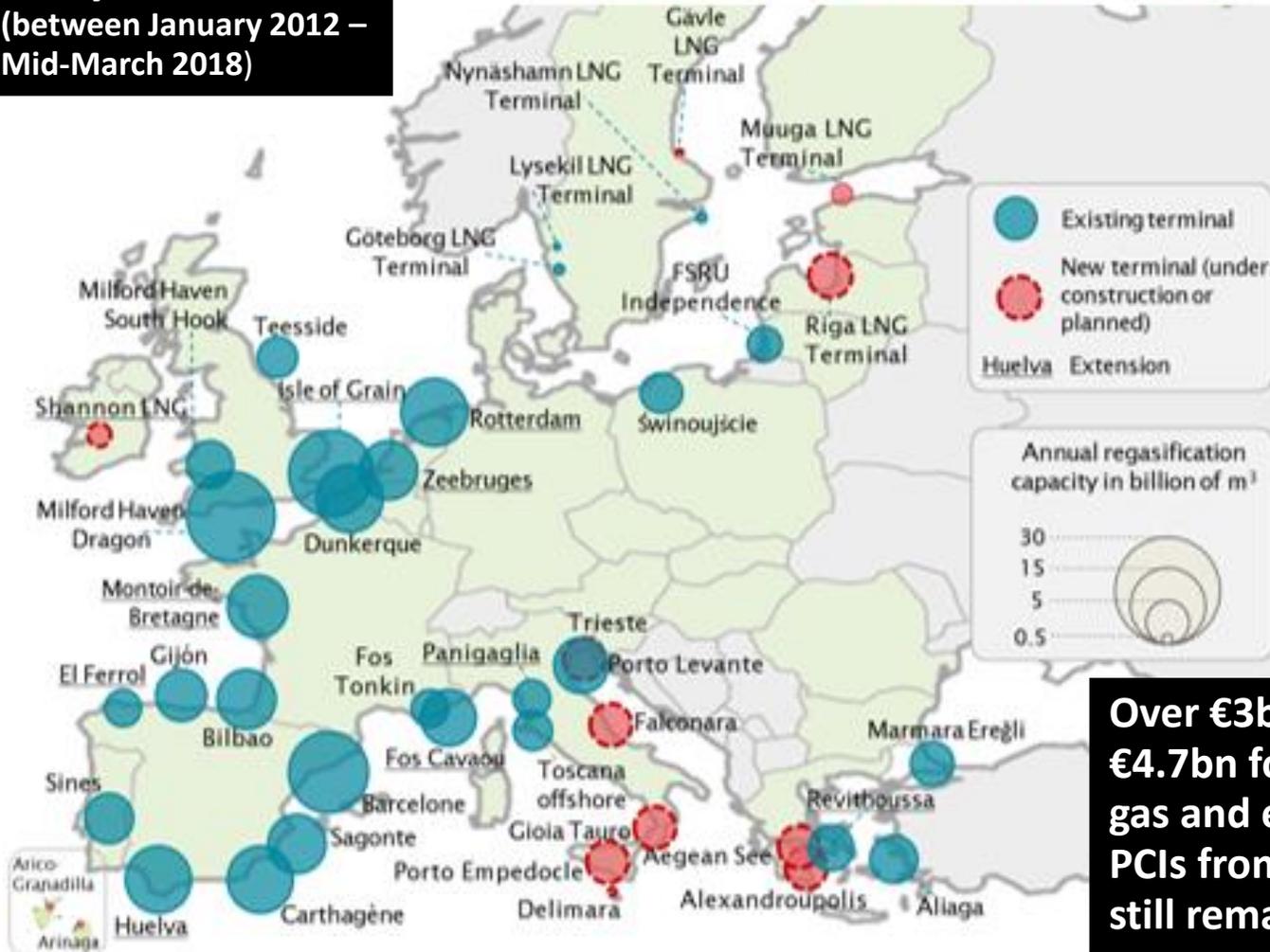
- Shell working on **US\$6 billion ethane cracker in Pennsylvania**



Source:  
[https://www.foodandwaterwatch.org/sites/default/files/ib\\_1702\\_fracking-plastic-web.pdf](https://www.foodandwaterwatch.org/sites/default/files/ib_1702_fracking-plastic-web.pdf)  
<https://peopleandnature.wordpress.com/2018/03/06/still-bigger-mountains-of-plastic-on-the-way/>  
<https://www.bloomberg.com/gadfly/articles/2018-01-15/plastic-industry-looks-indestructible-despite-attenborough>  
<https://oilprice.com/Energy/Natural-Gas/Is-This-The-Worlds-Next-Petrochemical-Hub.html>  
[https://www.americanchemistry.com/Shale\\_Gas\\_Fact\\_Sheet.aspx](https://www.americanchemistry.com/Shale_Gas_Fact_Sheet.aspx)

All EU LNG terminals:  
Utilization rate of  
lousy 22% - 23%  
(between January 2012 –  
Mid-March 2018)

## Infrastructures Existing and planned LNG terminals in Europe



Over €3bn of the  
€4.7bn foreseen for  
gas and electricity  
PCIs from 2014-2020  
still remains unspent.

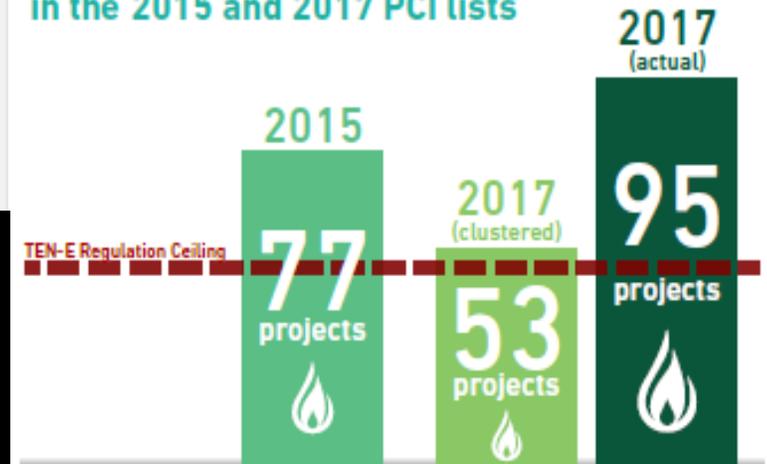
Source : GIICNL (2017), GLE (2016)

## CEF-Energy Funding per category since 2014



Source : European Commission. Investing in European Networks, The Connecting Europe Facility, Mid-term results, 2017.

## Number of Gas projects in the 2015 and 2017 PCI lists



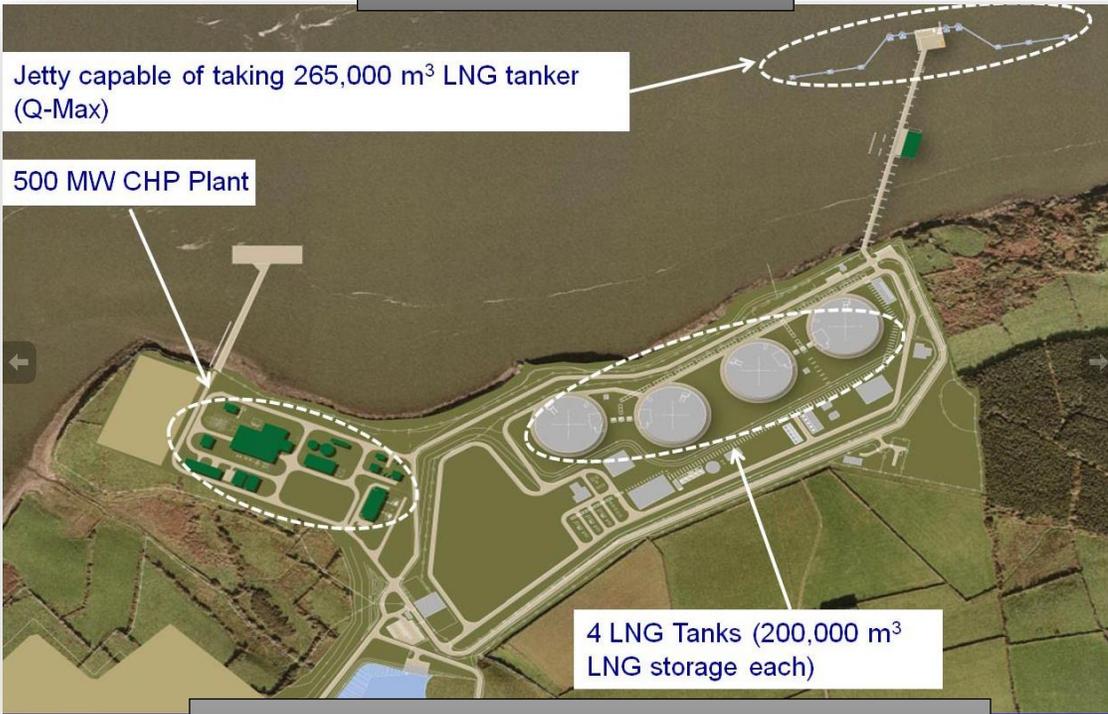
Source : European Commission, ACER



### 3. LNG terminals for Ireland?

– despite fracking ban & need to reduce emissions -

# Shannon LNG



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

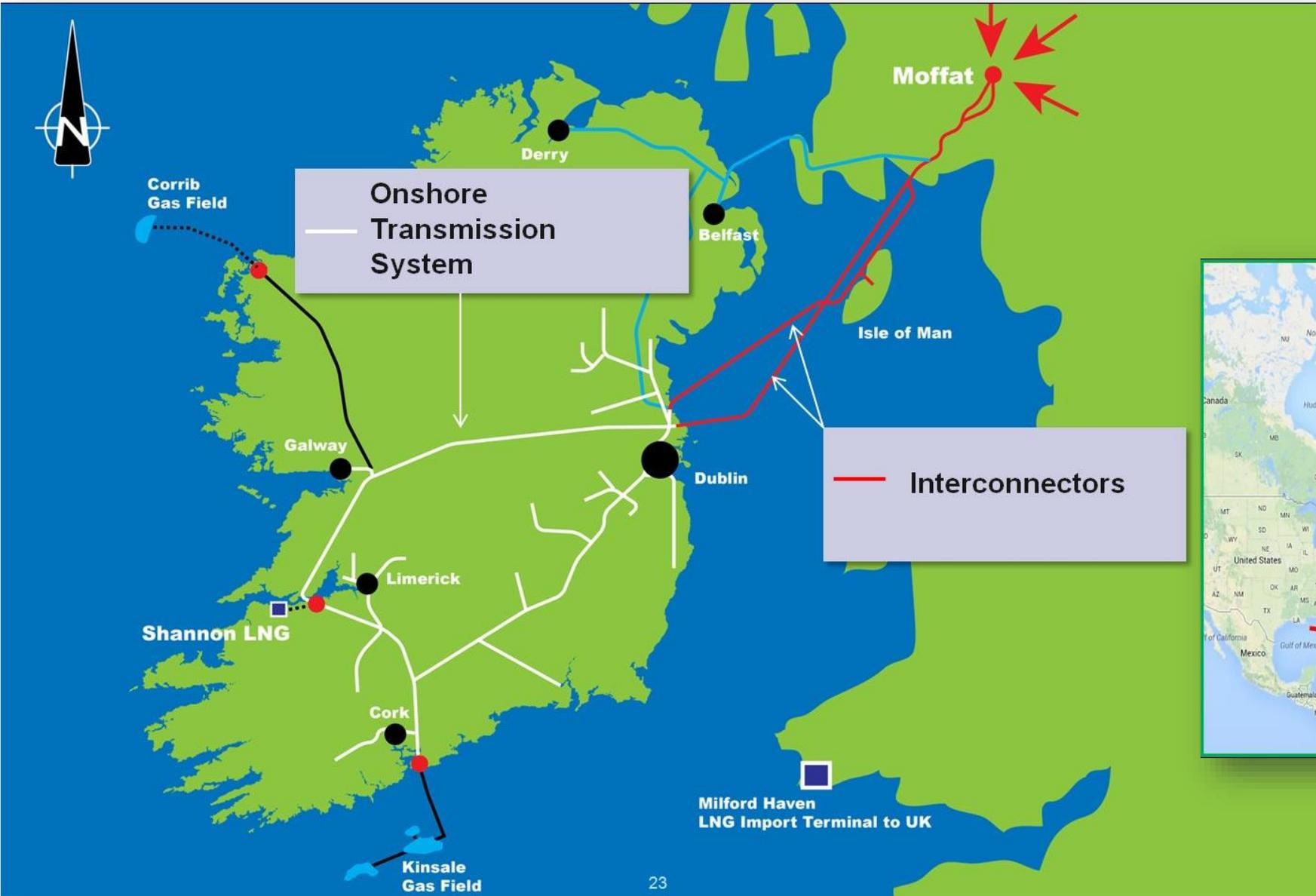


# Cork LNG



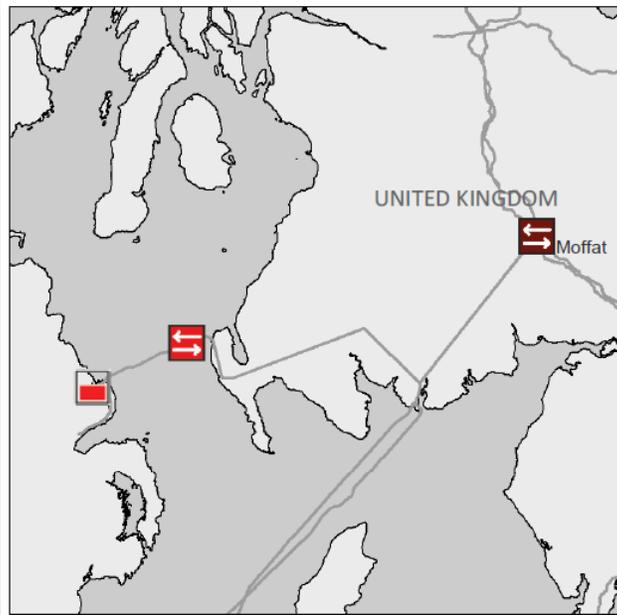
**Re-gasification (send-out) capacity:  
3.85 bcm – 4.38 bcm/a**





# Gas interconnection

## North-South gas interconnections in Western Europe



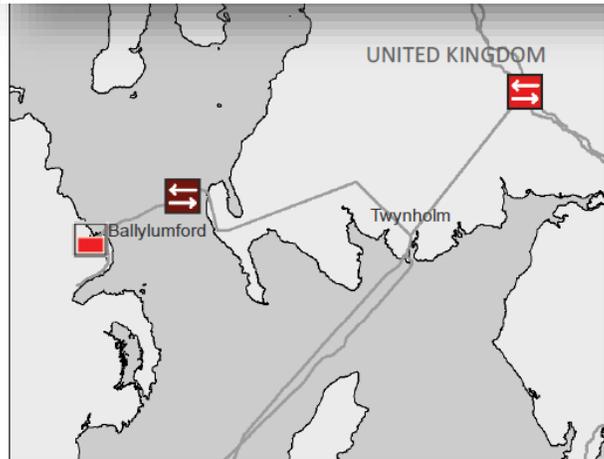
- PCI 5.1.1 - Gas reverse flow
- Existing pipeline network
- Projects belonging to cluster 5.1**
- Gas reverse flow
- Gas storage



Source: PLATTS, GISCO, European Commission

### Definition

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



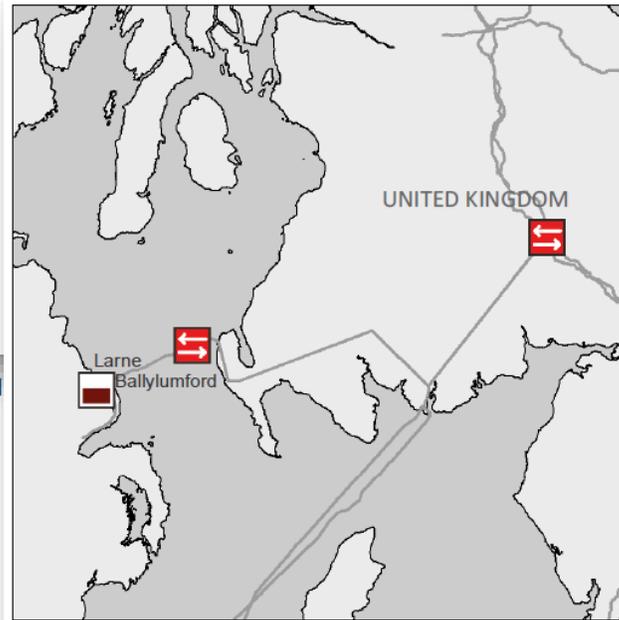
- Projects belonging to cluster 5.1**
- Gas reverse flow
- Gas storage



Source: PLATTS, GISCO, European Commission

### Definition

5.1.2 - Upgrade of the SNIP (Scotland to Northern Ireland) pipeline to accommodate physical reverse flow between Ballylumford and Twynholm



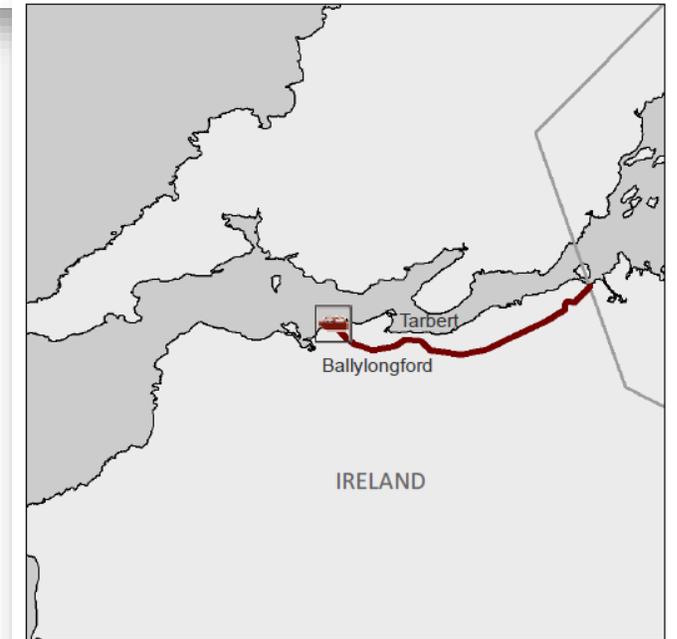
Source: PLATTS, GISCO, European Commission

### 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



Source: PLATTS, GISCO, European Commission

### Definition

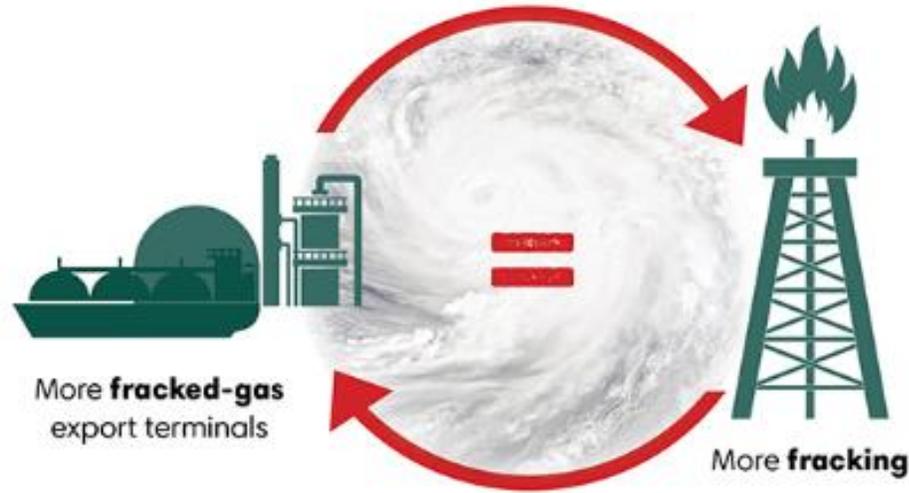
5.3 - Shannon LNG Terminal and connecting pipeline (IE)

Shannon		LNG Terminal planned	Cork	
Yes (the exact site in the Shannon Estuary is now an EU Special Protected Area)		PCI - eligible for EU funds	No	
Shannon LNG Ltd. & Hess Corporation (former owner), PWC is looking for a new owner (as advisor for current owner, Sambolo Resources)		Companies/Investors	NextDecade Global Solutions, FLEX LNG (Oslo Børs: FLNG), NextDecade, LLC, Port of Cork	
€500 million		Planned investment	€338 million?	
Re-gasification (send-out) capacity:	up to 28.3 million standard m <sup>3</sup> per day (MMscm/d) – about <b>10 bcm/a</b>	<b>Planned capacity</b> (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)	Re-gasification capacity:	3 mtpa (million ton LNG/a)vi – about <b>3.85 bcm – 4.38 bcm/a</b>
LNG storage tanks:	Up to 4 tanks of 200,000 m <sup>3</sup> capacity each		Floating Storage and Regasification Unit ("FSRU")	Associated LNG import terminal infrastructure
LNG tankers:	Up to 266,000 m <sup>3</sup> cargo capacity			
Connection pipeline:	26 km 30 inch pipeline & connection to national gas grid approved			

Shannon		LNG Terminal	Cork	
Mar 2008	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.	<b>Timeline / History</b>	Dec 2016	NextDecade Global Solutions and FLEX LNG sign agreement to develop regasification solutions for Rio Grande LNG export project in Brownsville, TX
Oct 2013	EU Project of Common Interest (1st PCI list)		July 2017	NextDecade, LLC, signs MOU with Port of Cork for a new Floating Storage and Regasification Unit and associated LNG import terminal infrastructure. NextDecade announced that the company is in discussions with EU energy companies to enter into long-term purchase contracts for delivery at the Port of Cork. Additionally, NextDecade wants to manage shipping from its proposed Rio Grande LNG export facility to Cork.
Dec 2013	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		End 2019 / early 2020	NextDecade, Flex LNG & Port of Cork hope that terminal could be operational
Nov 2015	Hess sells Shannon LNG to shelf company Sambolo Resources Ltd. – despite a €67 million investment		2022	LNG production at Rio Grande LNG Brownsville should start
Feb 2018	An Bord Pleanála, decides that extending the expiring planning permission is a "Material Change" and then, 26 days later, changes its mind			
Mar 2018	EU Parliament votes for 3 <sup>rd</sup> PCI list (Shannon LNG & connected projects “on board”)			
May 2018	Extension granted by An Bord Pleanála for the submission of comments			

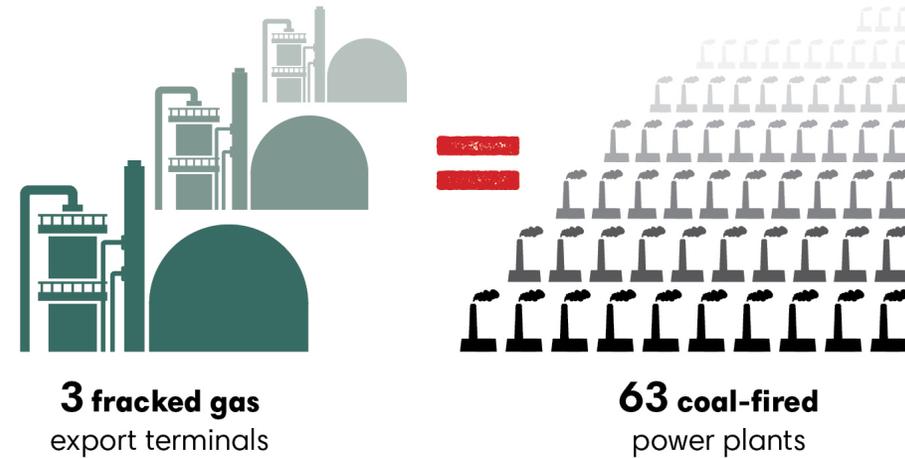
## 4. Impacts of LNG terminals and opposition

## DESTRUCTIVE LNG AND FRACKING CYCLE



Source: <https://www.ran.org/lng>

## CLIMATE IMPACTS OF FRACKED GAS TERMINALS PROPOSED IN RIO GRANDE VALLEY



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<sub>2</sub>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 CO<sub>2</sub>e)!

- 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

The MARITIME EXECUTIVE  
INTERNATIONAL CAPITAL AND EXECUTIVES

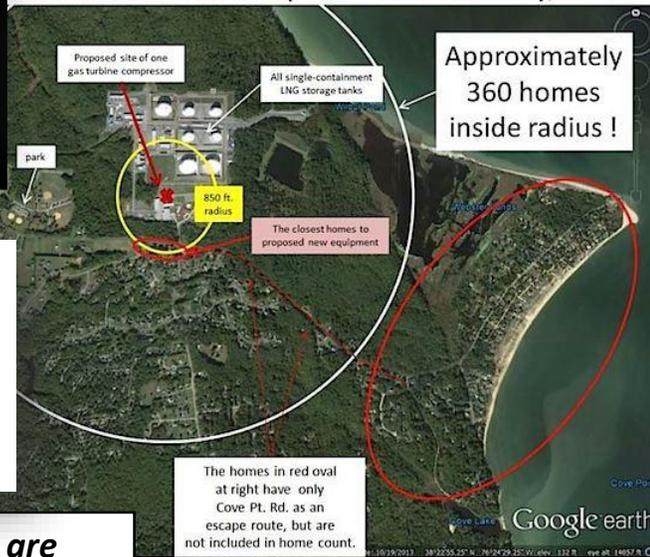
NEWS FEATURES PODCASTS MAGAZINE NEWSLETTER BLOGS DIRECT

### Leak Forces Tank Shutdown at Sabine Pass LNG



Storage tanks at Sabine Pass LNG (file image)  
BY MAREX 2018-02-12 20:39:00

### Resources Cove Point Liquefaction in Lusby, MD



Proposed site of one gas turbine compressor

All single-containment LNG storage tanks

Approximately 360 homes inside radius!

850 ft radius

The closest homes to proposed new equipment

The homes in red oval at right have only Cove Pt. Rd. as an escape route, but are not included in home count.

Google earth

Concerned Health Professionals of NY

PSR PROFESSIONAL SOCIAL RESPONSIBILITY

### Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction)

Fifth Edition  
March 2018

THE TYEE NEWS. CULTURE. SOLUTIONS.

NEWS

### How Safe Is LNG? Not as Safe as the BC Government Has Claimed

New studies and past incidents raise questions about location standards and safety.

By Andrew Nikiforuk, 28 Apr 2017 | TheTyee.ca

Andrew Nikiforuk is an award-winning journalist who has been writing about the energy industry for two decades and is a contributing editor to The Tyee. His award-winning book, Sixty Hours documents the Jessicairst case and the history of fracking. Find his previous stories [here](#).

835 shares



# E&E NEWS

<< Back to E&E News index page.

NATURAL GAS

### Explosive LNG issues grab PHMSA's attention

Jenny Mandel, E&E News reporter  
Energywire: Tuesday, June 7, 2016



Smoke pours from petroleum storage tanks following a 2009 explosion at the Caribbean Petroleum Corp. refinery in San Juan, Puerto Rico. The blast and fire damaged 17 of the 48 tanks at the site, and flames burned for nearly 60 hours. Photo courtesy of the U.S. Chemical Safety and Hazard Investigation Board.

VANCOUVER SUN

### Delta LNG plant touts public safety as paramount amid massive \$400m expansion

The risks at the FortisBC liquefied-natural gas facility at Tilbury Island in Delta are so real that visitors are ordered not to take photos or even turn on their cellphones during a tour as a way to minimize the chance of electrical sparks creating an ignition source.

LARRY PYNIN Updated: March 10, 2017

PACIFIC NORTHWEST NEWS

### 4 injured, 200 evacuated after Washington natural gas plant explosion

Updated Mar 31, 2014; Posted Mar 31, 2014

**... risks at FortisBC liquefied-natural gas facility ... are so real that visitors are ordered not to take photos or even turn on their cellphones during a tour as a way to minimize the chance of electrical sparks creating an ignition source. ...**

# Saving the RGV from LNG: The smoggy landscape

LISSETTE CASTILLO • MARCH 15, 2018



## 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“

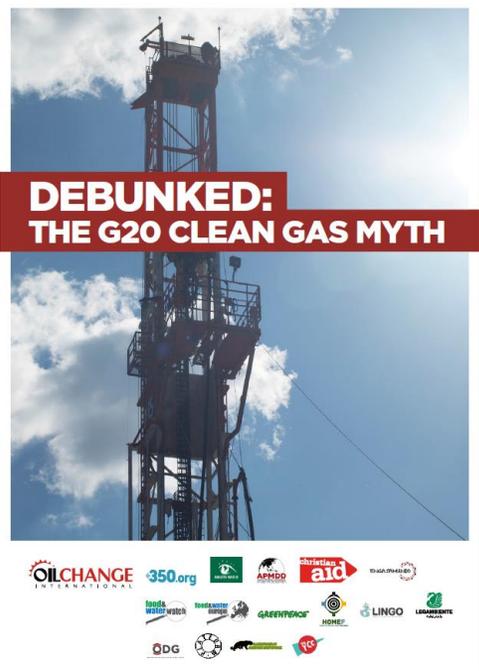
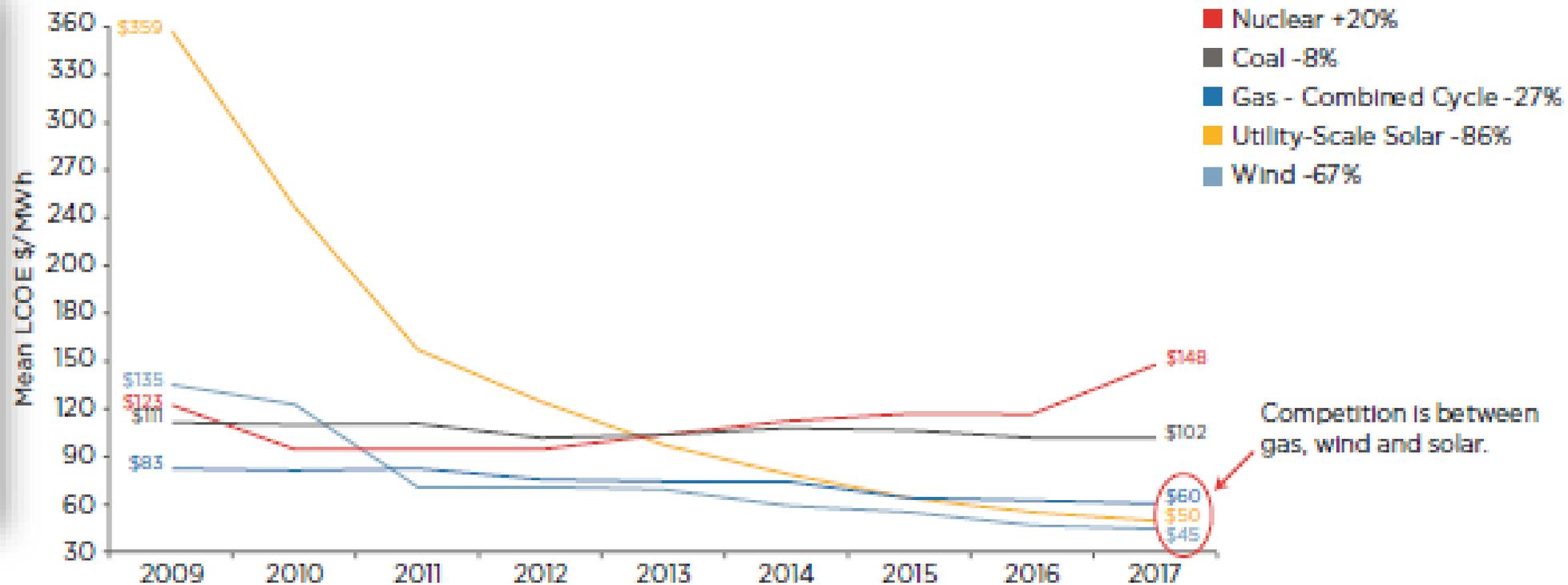


Figure 4: Gas Competes with Wind and Solar More than Coal



Source: Lazard 2017<sup>28</sup>

Source: <http://priceofoil.org/2018/06/11/debunked-g20-clean-gas-myth/>




**EUROPEAN COMMISSION**  
 DIRECTORATE-GENERAL FOR ENERGY  
 Directorate C - Renewables, Research and Innovation, Energy Efficiency  
**C.1 - Renewables and CCS policy**  
 The Head of Unit  
 Brussels, **20 NOV. 2017**  
 AMI/vk ener.c.1(2017)6347650

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.“***

Source: [https://ec.europa.eu/energy/sites/ener/files/documents/final\\_mac\\_to\\_clean\\_energy\\_islands\\_chania\\_-\\_opening\\_with\\_links.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/final_mac_to_clean_energy_islands_chania_-_opening_with_links.pdf)

The Initiative will promote the energy transition on islands by assisting in the development of concrete energy transition plans and technical assistance to develop bankable projects with funding from private sector investors and - where relevant - existing EU funding, to accelerate the clean energy transition on all EU islands and increase their energy independency.

The Initiative will explore the inclusion of main islands as well as corresponding smaller islands of the countries involved. In principle, specific projects on island groups or single islands could be eligible and promoted. Details will need to be assessed and decided on a case-by-case basis. In order to support the different steps in the energy transition of EU islands the Commission intends to also establish a General Secretariat which would be in charge of the general coordination and administration of the EU islands signing up for the initiative.

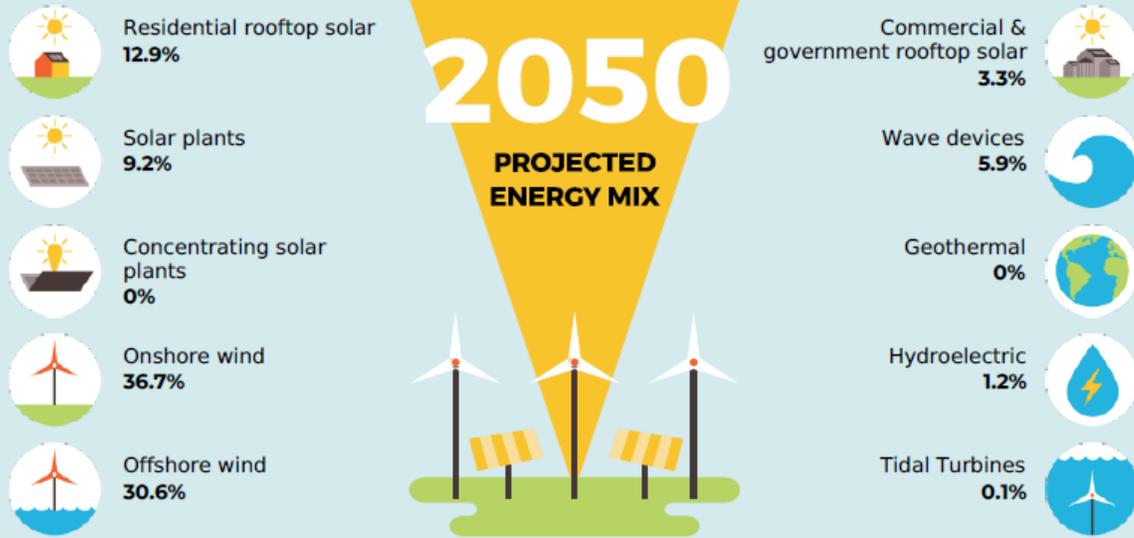
**Horizon 2020: budget of €5.68 billion for secure, clean and efficient energy (2014-2020)**

**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**

# 100% IRELAND

A vision for the transition to 100% wind, water & solar energy



**40-Year Jobs Created**  
Number of jobs where a person is employed for 40 consecutive years

 Construction jobs: **17,350**  
 Operation jobs: **18,194**

A fossil free path for the future is not only a vision to have ... it is a very feasible goal to achieve!

Source: [http://thesolutionsproject.org/wp-content/uploads/2015/11/100\\_Ireland.pdf](http://thesolutionsproject.org/wp-content/uploads/2015/11/100_Ireland.pdf)