Briefing note on Irish Offshore Exploration for Hydrocarbons

Prepared by the Secretariat for the Climate Change Advisory Council

19th October 2019.

This note discusses the potential impact of allowing the exploration for, and recovery of offshore reserves of oil and gas in Ireland's jurisdiction from a climate perspective. The note also considers potential impacts on national energy security.

Key messages

- Do not need new reserves of oil
    - Do not have national refining infrastructure
    - Domestic investment in oil infrastructure would lock-in and become a barrier to transition
    - Global oil reserves are sufficient and geographically diverse, and oil market sufficiently mature to ensure oil security concerns can be addressed using existing supply chains.
    - Alternative low carbon technologies exist for critical applications (terrestrial transport and heat)
- There is no clear conclusion about natural gas as its role is contingent on technology developments and policy choices
- Need rapid deployment of efficient Carbon Capture and Storage to enable continued used of natural gas (Glynn, Climate Policy, 2019[1], SEAI submission to JOC Communications, Climate Action and Environment, Jul 2018[2])
- Renewable generation coupled with energy storage is developing rapidly and is at least cost competitive with fossil fuel CCS (Nature Energy April 2019[3]).
- There are risks to achieving Ireland's emissions reductions 2030 targets and 2050 objectives if large reserves of oil and gas are brought ashore. In addition, there are risks to the economy of stranded assets and lock-in to fossil fuel based and emissions intensive energy systems.

Introduction:

The basic issue is whether the exploration and exploitation of a new gas or oil fields in Ireland is consistent with a cost-effective transition to low carbon economy by 2050, while contributing to meeting intermediate emissions reduction targets.

Explicitly, would the exploitation of new national oil and gas resources lead to higher emissions of greenhouse gases in Ireland or globally, than would otherwise be the case?

To fully address these questions there is a need for more detailed analysis than is currently available on the pathways to reach 2030 and 2050 climate objectives to establish the potential role of oil and gas in Ireland during the transition to a low carbon economy (in competition with other energy technologies and systems). However, a number of conclusions can be made based on the available evidence.

Context

Global carbon budget

The IPCC Special Report on Global Warming of 1.5^{o}C provided updated estimates of the global carbon dioxide budgets within which it would be necessary to constrain emissions in order to have a likely chance of avoiding 1.5^{o}C and 2.0^{o}C of global warming. The budget for 66% probability of not exceeding 1.5^{o}C is 420Gt CO_2 and 1170 Gt CO_2 for 2.0^{o}C. (IPCC, 2018[4]).

The Global Carbon Project, 2018 estimated the current global rate of emissions of fossil carbon dioxide is approximately 37Gt CO_2 per year,[5] driven by a global economy which remains deeply coupled to fossil fuels. At this rate, the 1.5^{o}C carbon budget will be exhausted in 12 years, and the 2^{o}C budget in 32 years.

Global fossil fuel reserves

The known global reserves of fossil fuels far exceed the 1.5^{o}C and 2^{o}C budgets for emissions of CO_2 into the atmosphere. Coal reserves exceed these limits on their own, known oil reserves are very close to the 1.5^{o}C limit. Globally, we don't need to find more coal or oil. The known reserves of natural gas do not, of themselves, exceed the carbon budget.

Exploitation of all currently known global oil and gas reserves would likely result in warming of 1.8^{o}C. These analyses did not include additional warming due to non-CO_2 GHGs and as such overestimate the available budget to some extent.

From this, it has been argued that 80% of known reserves of fossil fuels must remain in the ground (unexploited) to avoid an over reliance on unproven negative emission technologies to remove excess CO_2 from the atmosphere at some future date.

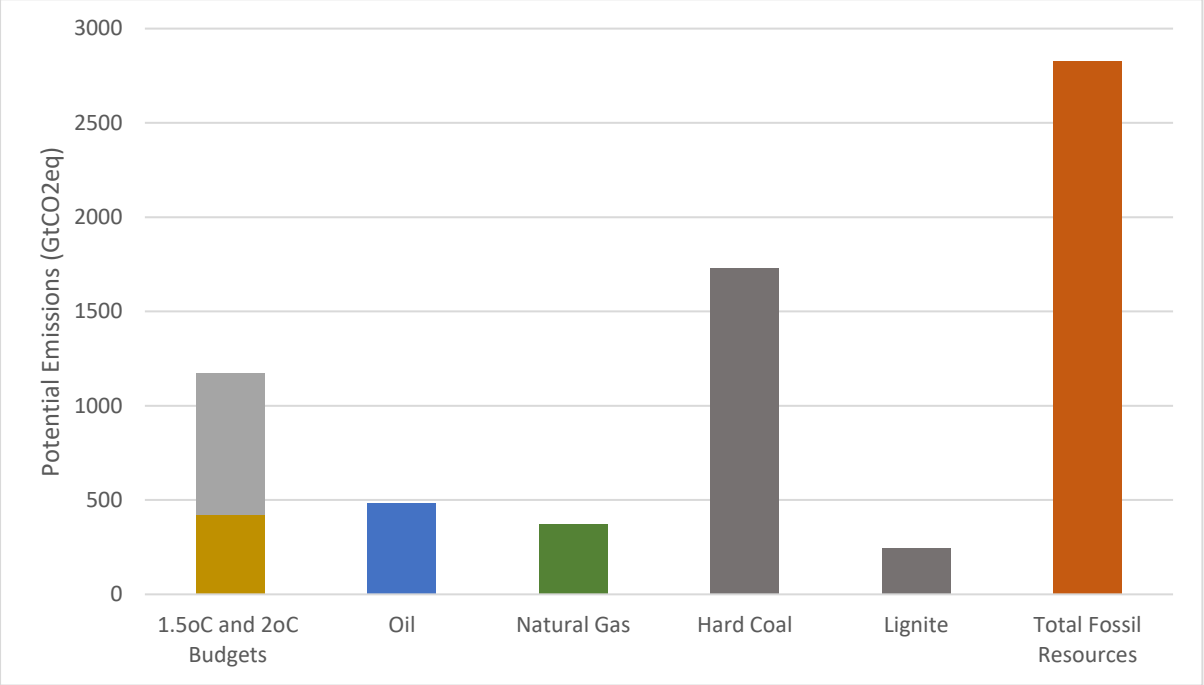

Figure 1 Known reserves of Fossil Fuels and Estimated Global Carbon Budgets for warming of 1.5^{o}c and 2.0^{o}C After IPCC Special Report on 1.5; BP Global Energy Statistics 2018.

Global committed emissions

Pfeiffer et al, 2018,[6] estimated that the global committed emissions from existing and planned power plants (2016 data) is approximately 305Gt CO_2, based on age, type and expected working lifetime of facilities. Of these 220Gt CO_2 are from coal plants and 66Gt CO_2 are from natural gas plants,11Gt CO_2 from Waste and 8Gt CO_2 from oil plants. It is worth noting that much of coal infrastructure in developed economies is relatively old, with limited remaining working life. However, much of the power generation capacity in developing economies is recent and represents a considerable lock-in to coal for the next 20-30 years. Also, in 2016, the additional capacity under construction, or in planning, amounted to additional commitment of 270Gt CO_2, which if realised would exceed the 1.5^{o}C budget by some margin.

In addition, global transport (and heat) demand remains largely reliant on fossil fuels. It is reasonable to expect bringing more oil reserves onto the market will delay deployment of sustainable alternatives for transport and heating, given the upfront costs of switching.

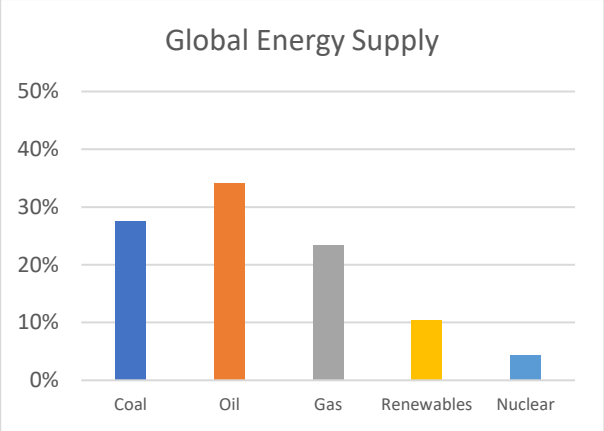

Figure 2 from BP Statistical Review of World Energy, 2019[1]

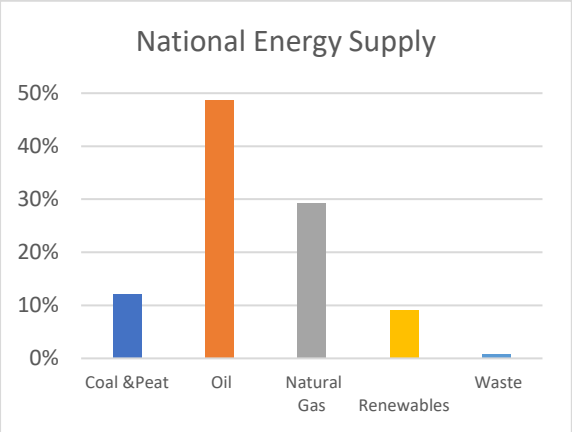

Figure 3 from SEAI Energy in Ireland report 2018

Progress on Renewables and Energy Storage

A sustained transition to renewables is required in parallel to any continued use of fossil resources. Decisions to make new investment in natural gas exploration and recovery must be viewed in this context, and the investment sunk into exploration should not influence decisions at national level in the timing of the deployment of renewables and complementary storage technologies.

The rapid fall in the cost of renewable energy and storage systems in recent years has surprised many analysts. Given the long timeline from exploration to recovery and delivery onto market of new fossil fuel reserves, renewable and storage systems are on track to undercut the price of natural gas in most power generation applications, especially where

[1] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf

CCS is also deployed. The resulting reduced demand for natural gas would extend the period over which the existing known natural gas reserves can be exploited.

Carbon Capture and Storage:

Two technical approaches exist for the deployment of CCS with natural gas: point of consumption and point of distribution.

Point of Consumption: is the more familiar model where the carbon dioxide generated in combustion is captured in the exhaust systems.

Point of Distribution: where natural gas is processed, and the carbon atom stripped from the methane molecule, and hydrogen is delivered onto the grid. This has the advantage of allowing for more diverse applications of the fuel (facilitating a transition to a hydrogen economy) and it is reported to be able to achieve very efficient capture rates (>90%).

In neither case has there been sufficient large scale deployment of technologies to determine the cost effectiveness or long term viability of either approach.

There is no literature on options for deployment of CCS with combustion of oil, except for larger stationary sources where similar post-combustion capture may be possible.

National Carbon Budget

The Climate Action Plan, 2019, commits the Government to establish as carbon budgeting approach to determining the appropriate pathway to transition to a low carbon economy by 2050. The details of this are to be teased out in the coming year. Detailed analysis of potential pathways which achieve transition within a carbon budget will inform policy regarding the medium to long term role of fossil fuels and timeline to complete decarbonisation of the energy system. Glynn *et al*, 2019, [7] provides some preliminary insight into potential carbon budgets for Ireland.

National fossil fuel reserves

Ireland has no significant reserves of coal. Reserves of peat are significant, however there is government and industry commitment to cease the extraction and use of peat in power generation by 2028.

At present, natural gas demand is met by the recovery from the Corrib and Kinsale gas fields (65%) and imports (45%). The Kinsale fields are near exhaustion, while the Corrib field is expected to be depleted in approximately 15 years.

Reportedly, there are stocks in excess of 10bn barrels of oil equivalent (boe) in Ireland's offshore basins, of which 65% are oil and 35% natural gas.[8] If fully realised Ireland's oil reserves would be equivalent to approximately 55 -60 years of current total national CO_2 emissions. However, this figure is likely an overestimate of the recoverable reserve. For example, the Barryroe oil and gas field was initially assessed to contain 1.0 to 1.6 billion boe, but revised estimates indicate the recoverable value to be closer to 346 million boe (311 oil, 35 gas).

Those advocating for continued exploration tend to assume a high probability of recoverable resources and that these would be brought to shore in Ireland. Whilst those advocating for cessation of exploration voice scepticism on both points. It is reasonable to assume recoverable natural gas would be brought ashore in Ireland. Due to the lack of significant refining infrastructure in Ireland, and ready access to existing capacity in neighbouring jurisdictions, it is reasonable to assume crude oil would be landed elsewhere.

PWC's Oil and Gas Survey 2018[9] noted that the industry considers Ireland a high risk area for exploration. The report noted the majority industry sentiment views a strong, long term price of oil (greater than €50 per barrel) is required to ensure there is sufficient potential return to exploration in Ireland, and sentiment in 2018 was that oil prices would increase. Current price volatility tends to suppress sentiment for investment in exploration in Ireland. The price of oil in 2018 was €64, while for 2019 to date the price is €57.

The industry in Ireland has expressed concern over risks associated with delays in licencing and planning processes which also temper the industry's enthusiasm to engage in exploration.

National committed emissions

There is limited analysis to determine Ireland's committed emissions based on existing energy infrastructure (age, working life, fuel type, energy policy, etc.). At present, Ireland is strongly dependent on fossil fuels (~90%).

Displacing coal (and peat) and oil with natural gas would achieve reduction in emissions in the short term but would lock-in natural gas in the medium to long term. This type of displacement has been observed in the USA, where cheaper natural gas has displaced coal in electricity generation, with the co-benefit of reducing direct emissions.

A natural gas infrastructure may be sustained for a longer period with the deployment of Carbon Capture and Storage, CCS. Glynn *et al*, 2019, [10] indicated the need for large scale deployment of efficient CCS to enable continued used of natural gas consistent with 80% emissions reduction by 2050. Earlier analysis by the MaREI research group which provided

similar insight was cited in submissions by SEAI and DCCAE to the JOC on Communications, Climate Action and Environment, Jul 2018[11]. The high technical specification of the natural gas infrastructure in Ireland means it is also capable of supporting the distribution of biomethane and hydrogen.

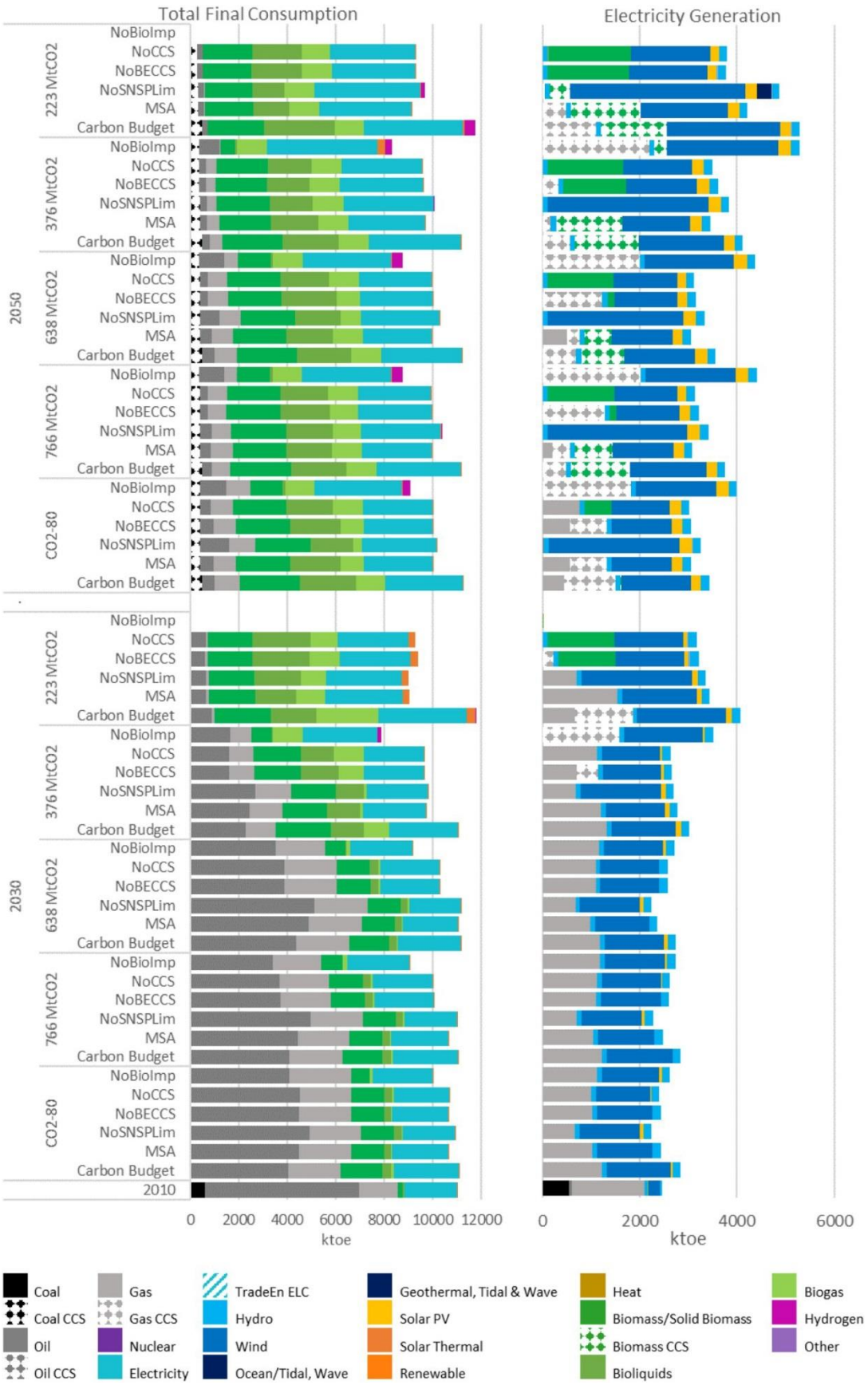

Figure 4 from Glynn et al 2019

Discussion

The reality is that removing coal and oil form the global energy systems will take time. Ireland's energy supply profile is less dependent on coal (and peat) than the global case, but we have a higher use of oil, and no nuclear power. Therefore, Ireland is better placed than many economies to remove coal (and peat) from power generation because current plants deliver a relatively low proportion of supply, and recent experience has demonstrated that power supply remains stable when coal and peat are unavailable for lengthy periods. However, this stability is only possible with the present capacity for natural gas generation, interconnection, and renewables on the system.

Exploitation of new reserves of oil will almost certainly increase global emissions of carbon dioxide.

Globally, the exploitation of identified reserves of natural gas would not result in global warning of more than the 1.5^{o}C target. However, given the scale of current global investments in coal and oil systems infrastructure, it seems necessary that existing many fossil fuel assets (especially coal and oil) will need to be retired early to achieve the necessary rapid transition to a low, or zero carbon energy system. Natural gas still has a role as a transition fuel in this transition.

The potential for natural gas to act as a transition fuel is due to its lower emissions per unit energy consumption. However, this transition period has been eroded due to inaction in the past, and the switch to from coal, peat and oil directly to renewables may be the more cost-effective option, by-passing use of natural gas as a transitional fuel. Deployment of CCS with natural gas would extend the period in which natural gas can be utilised as economies transition to complete decarbonisation.

The build specification of the current natural gas grid is high enough to support distribution of biomethane or hydrogen. Investment in the maintenance (and/or expansion) of the gas grid would provide flexibility to support deployment of these as a renewable fuel types and energy storage if production technologies emerge as cost-effective options.

The immediate challenge for the Irish economy is the move from coal, peat and oil to electricity and renewables across all sectors, but especially transport and heat. Natural gas is not a viable transition fuel for many applications. Electrification of these sectors would enable progress towards Effort Sharing Regular 2030 targets shifting the burden to the

power generation sector (under the ETS). The increased demand for electricity would ideally be met by deployment of renewables, but natural gas (with CCS) appears likely to remain on the system as back-up for some time.

Energy security and stability

Many of the submissions to the debate of the Climate Emergency Bill concentrated on the power generation from natural gas and energy security concerns given that there is a consensus industry view that natural gas will remain important for the foreseeable future. Particular emphasis is placed on the fact that natural gas can be dispatched in a timely fashion to provide stability to the grid to compensate for the intermittent nature of wind and solar. The opportunity for improved energy security and stability arising from exploration and recovery of gas reserves was highlighted.

Ireland is integrated into the existing trans-European gas network. Current natural gas supply routes might be considered vulnerable. If natural gas is to contribute to Ireland's transition to low carbon economy access to the natural gas supplies is required.

Short of major international disruption or political crisis, it is unlikely that Ireland would be disconnected from interconnection to European gas supplies. Analysts voice some concern regarding the security of the European gas supply, particularly given there is precedent for political interference in supplies as experience by Ukraine and Russian supplies.

Accidental disruption, such as infrastructure failure along the gas line, is possible. The probability of such disruption and the recovery period is difficult to assess. Discovery of accessible natural gas reserves in Irish waters may enhance security from accidental or other causes of disruption of supply, provided the gas is brought to shore/market in Ireland. But investment in improved interconnection may achieve the same goal, at arguably less cost. Gas delivery onto the grid would follow wholesale international gas prices, however, Ireland may experience higher distribution costs. There may also be revenue returns to consider. [2]

There are proposals to develop significant LNG storage capacity in Ireland. This would address some energy security concerns with regard to current reliance on a limited supply chain, without the need for new national reserves. However, issues with respect to the embedded greenhouse gas emissions associated with the production, compression, distribution and storage of natural gas sourced from a more diverse range of regions and production techniques (e.g. fracking) would need to be addressed.

[2] http://www.engineersjournal.ie/2018/05/15/irelands-future-natural-gas-supply-well-connected-island/

Although the potential stocks of oil and gas are impressive on a regional scale, Ireland's complex offshore geology, and technical challenges to recovery from relatively deep waters, make it unlikely that recovery would occur at the pace and scale that would result in significant impact on oil or gas commodity prices. Also, industry sentiment of high risk identified by PWC underlines the uncertainty than significant recoverable reserves would be realised.

A range of options exist to improve energy security:

- Additional international grid connection (gas and electricity)
- Local production of biomethane and synthetic gas (renewable)
- Additional gas local storage capacity
- Deployment diverse renewable generation capacity coupled with energy storage systems (battery, synthetic gas, compressed gas, pumped hydro etc.)
- Exploration and recovery of offshore gas reserves.

In a rapidly changing energy technologies and systems landscape, it is important that policy is flexible enough to enable for optimum and timely deployment of all options as they emerge.

Concluding comments:

The use of oil and gas cannot continue indefinitely.

Globally, there is no need to discover more oil. There are sufficient, readily accessible oil reserves identified to enable a smooth transition to low and zero carbon alternatives for the vast majority of applications.

Investment in the exploration and recovery of new natural gas reserves can only be justified in the context of early displacement and retirement of existing coal and oil systems, coupled with large scale deployment of CCS with natural gas.

Recovery of any new natural gas reserves should be contingent on global and national progress towards achievement 2030 targets, the objectives of the Paris Agreement and scientific evidence including national contribution to global carbon budget.

Renewable energy and storage systems and technologies are developing rapidly. Natural gas will likely become less competitive against alternative energy options over the coming years and decades (especially when coupled with CCS). This may be realised through improvements in the cost base of these alternative systems themselves, and the imposition of steadily higher carbon pricing. The government should avoid encouraging capital investment in fossil fuel systems (exploration, recovery, storage and distribution) beyond

what is required to maintain a stable energy system during the transition to a low or zero carbon energy system.

In a landscape of rapidly changing energy systems, it is important that policy is flexible enough to enable for optimum and timely deployment of all options as they emerge.

---

[1] Glynn, J., Gargiulo, M., Chiodi, A., Deane, P., Rogan, F. and Ó Gallachóir, B. (2018). Zero carbon energy system pathways for Ireland consistent with the Paris Agreement. Climate Policy, 19(1), pp.30-42.
[2] Sustainable Energy Authority of Ireland (2018). SEAI submission on the Petroleum and Other Minerals Development (Amendment) (Climate Emergency Measures) Bill 2018. [online], 10 July 2018, Oireachtas.ie. Available at: https://www.oireachtas.ie/en/publications/?datePeriod=all&term=%2Fie%2Foireachtas%2Fhouse%2Fdail%2F32&committee=%2Fen%2Fcommittees%2F32%2Fcommunications-climate-action-and-environment%2F&resultsPerPage=100&topic%5B0%5D=briefing-papers&topic%5B1%5D=correspondence&topic%5B2%5D=opening-statements-submissions [Accessed 27 Aug. 2019].
[3] Sgouridis, S., Carbajales-Dale, M., Csala, D., Chiesa, M. and Bardi, U. (2019). Comparative net energy analysis of renewable electricity and carbon capture and storage. Nature Energy, 4(6), pp.456-465.
[4] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.
[5] Globalcarbonproject.org. (2019). *GCP : Global Carbon Project : Homepage*. [online] Available at: https://www.globalcarbonproject.org/ [Accessed 8 Sep. 2019].
[6] Pfeiffer, A., Hepburn, C., Vogt-Schilb, A. and Caldecott, B. (2018). Committed emissions from existing and planned power plants and asset stranding required to meet the Paris Agreement. *Environmental Research Letters*, 13(5), p.054019.
[7] Glynn, J., Gargiulo, M., Chiodi, A., Deane, P., Rogan, F. and Ó Gallachóir, B. (2018). Zero carbon energy system pathways for Ireland consistent with the Paris Agreement. Climate Policy, 19(1), pp.30-42.
[8] Siptu.ie. (2011). *Report of the SIPTU Oil & Gas Review Group*. [online] Available at: https://www.siptu.ie/media/media_14689_en.pdf [Accessed 8 Sep. 2019].
[9] PWC (2019). *PWC's Oil and Gas Survey 2018*. [online] DUBLIN: PWC. Available at: https://www.pwc.ie/publications/2018/2018-oil-and-gas-survey.pdf [Accessed 8 Sep. 2019].
[10] Glynn, J., Gargiulo, M., Chiodi, A., Deane, P., Rogan, F. and Ó Gallachóir, B. (2018). Zero carbon energy system pathways for Ireland consistent with the Paris Agreement. Climate Policy, 19(1), pp.30-42.
[11] Sustainable Energy Authority of Ireland (2018). SEAI submission on the Petroleum and Other Minerals Development (Amendment) (Climate Emergency Measures) Bill 2018. [online], 10 July 2018, Oireachtas.ie. Available at: https://www.oireachtas.ie/en/publications/?datePeriod=all&term=%2Fie%2Foireachtas%2Fhouse%2Fdail%2F32&committee=%2Fen%2Fcommittees%2F32%2Fcommunications-climate-action-and-environment%2F&resultsPerPage=100&topic%5B0%5D=briefing-papers&topic%5B1%5D=correspondence&topic%5B2%5D=opening-statements-submissions [Accessed 27 Aug. 2019].