Expert testimony on the climate implications of development and operation of the Yggdrasil oil and gas fields

Michael Lazarus, Senior Scientist, SEI US

SEI Stockholm Environment Institute

September 10, 2024

Overview

My testimony addresses three sets of questions:

1. Is the Government's methodology for estimating the climate effect of a new oil and gas field appropriate? And if so, is it implemented in a robust and consistent manner?
2. Does the Government's estimate that Yggdrasil (gross 365 MtCO2e) may reduce global GHG emissions by 52 MtCO2e reflect a reasonable and robust application of net emissions analysis methodology? If not, what might be a more likely estimate?
3. What are the broader climate implications of developing the Yggdrasil oil and gas fields? Would its development be consistent on meeting global climate goals?

1. Is the Government's methodology for estimating the climate effect of a new oil and gas field appropriate? And if so, is it implemented in a robust and consistent manner?

- The Government relies on findings from a Rystad Energy report that applies an **appropriate methodology for net emissions analysis,** which seeks to a capture 3 important dynamics:
  1. **Market response**: how increased oil and gas supply translates to increased consumption
  2. **Demand substitution:** which alternative (non oil-and-gas) energy sources would be displaced and to what extent
  3. **Supply substitution:** the effects of substituting for oil and gas production in rest of world.
- I**mplementation is flawed** due to assumptions that are:
  - inconsistent with other literature
  - inappropriate for its own counterfactual scenario (Gradual Energy Transition, based on IEA "Announced Pledges Scenario")
  - not well matched with the time frame of the project
  - systematically biased towards finding of a net emissions benefit
  - not in accordance with widely-accepted GHG accounting principles
- **Other important metrics and perspectives are neglected**:
  - consistency with national and global climate targets
  - lock-in, equity, and climate leadership implications

4.6 Conservativeness

Use conservative assumptions, values, and procedures when uncertainty is high

GHG reductions should not be overestimated. Where data and assumptions are uncertain and where the cost of measures to reduce uncertainty is not worth the increase in accuracy, conservative values and assumptions should be used. Conservative values and assumptions are those that are more likely to underestimate than overestimate GHG reductions.

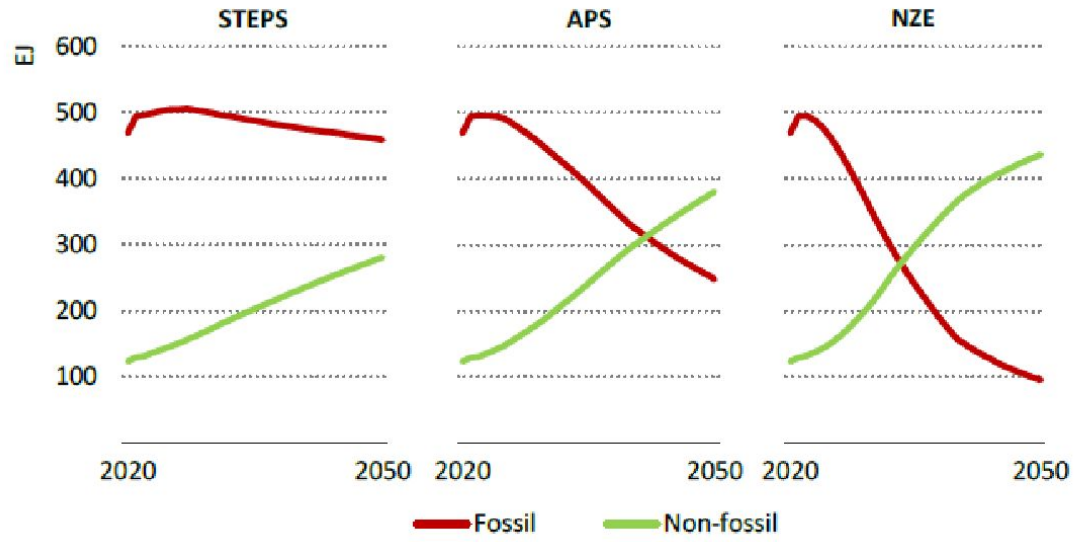
2. Does the Government's estimate that Yggdrasil (gross 365 MtCO2e) may reduce global GHG emissions by 52 MtCO2e reflect a reasonable and robust application of net emissions analysis methodology? If not, what might be a more likely estimate?

- The Government's estimate is neither reasonable nor robust.
- Application of the Government's methodology, but with assumptions more consistent with other literature and an "announced pledges" world, suggests that development of Yggdrasil would ***increase*** **global GHG emissions by roughly 80 $MtCO_2e$ over its lifetime.**

Scenario consistency

The Government uses findings from Rystad Energy's main scenario, Gradual Transition, which "is analyzed in line with the IEA's "Announced Pledges Scenario" (APS)".

Figure 1.17 ▷ Fossil and non-fossil energy supply by scenario, 2020-2050



There is an orderly process of change in the global fuel mix in all WEO scenarios, with the main differentiating feature being the rapidity of transition from fossil fuels

Five assumptions assessed and adjusted

a) Analysis timeframe

b) Oil price elasticities

c) Increase in energy demand

d) Source of displaced (substituted) energy

e) Upstream emissions of other oil and gas producers

a) Analysis timeframe

- The Rystad Energy report uses an analysis year of either 2030 or today, depending on the variable.
- Historical experience suggests the midpoint of Yggdrassil production may be closer to 2035.

The Government relies on an inappropriately early analysis year for Yggdrasil, leading to overestimation of potential emissions savings.

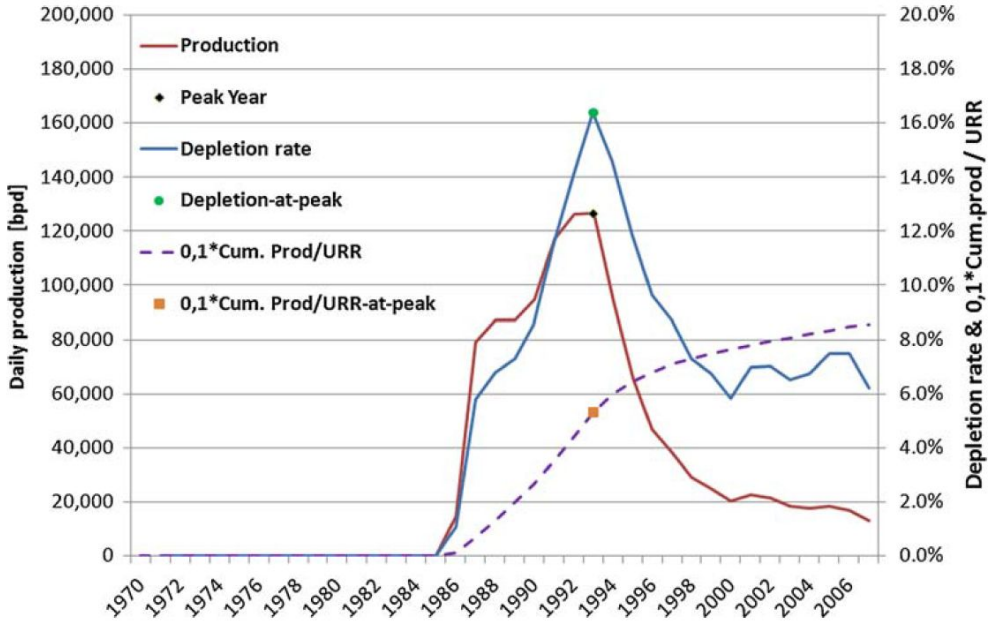


Figure 5. The actual production profile of the Norwegian giant oil field Ula. The peak occurred in 1993 at a depletion rate of 16.4% with 53% of the URR produced, which is quite representative of many offshore giant fields in the North Sea region.

Höök, M., Söderbergh, B., Jakobsson, K. & Aleklett, K. The Evolution of Giant Oil Field Production Behavior. *Nat Resour Res* **18**, 39–56 (2009)

b) Oil price elasticities

- Rystad Energy's assumptions are out of sync with widely-cited, peer-reviewed literature on market response, resulting in a very limited impact: each BOE produced increases oil consumed 0.1 BOE.
- A recent, comprehensive survey (Prest et al, 2023) of oil market elasticities suggests that, for each BOE produced, oil consumption increases 0.45 BOE.

The Rystad Energy report understates the market – and thus, emissions – impacts of increased oil production.

c) Increase in energy demand

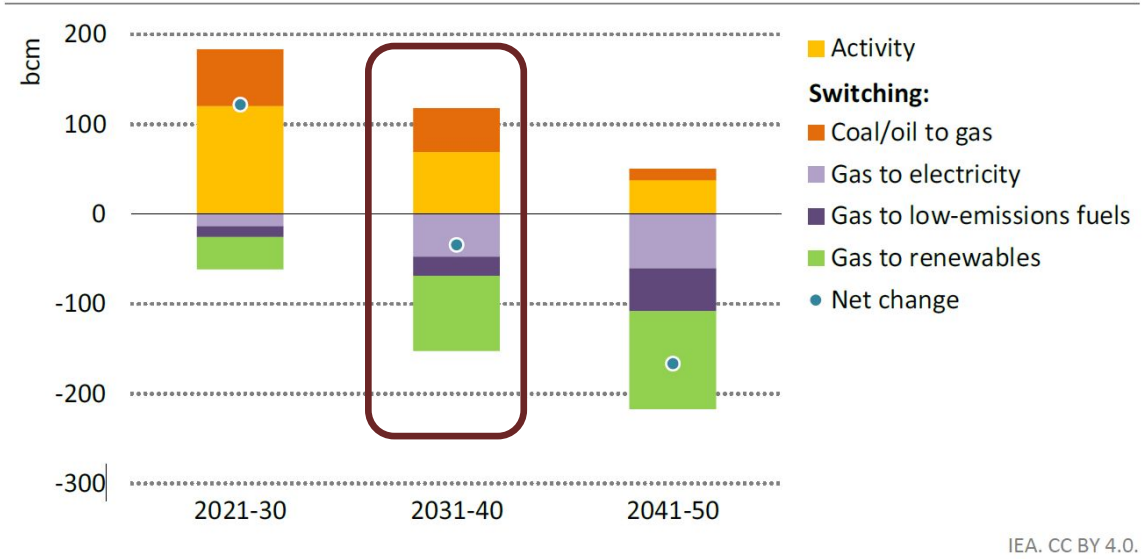
- The Rystad Energy analysis fails to account for the increase in global energy consumption that would result from increased production and lower energy prices.
- More analysis is needed to estimate energy demand effects. As a more reasonable proxy in the interim, one can assume that half of the Yggdrasil-induced increase in oil and gas consumption will result in greater energy demand (the other half in displaced use of other energy sources).

The Rystad Energy report neglects how impacts on total energy demand and thus understates the emissions impact of Yggdrassil development.

d) Displaced energy

- Overstates the extent to which increased gas production and consumption will lead to lower coal use in the power sector, largely reflecting current market conditions rather than IEA's APS in 2035.

Figure 8.24 ▷ **Drivers of change in natural gas demand in emerging market and developing economies in Asia in the APS**



Population and economic growth increase natural gas demand for a while, but renewables, low-emissions fuels and electrification diminish gas demand in the long term

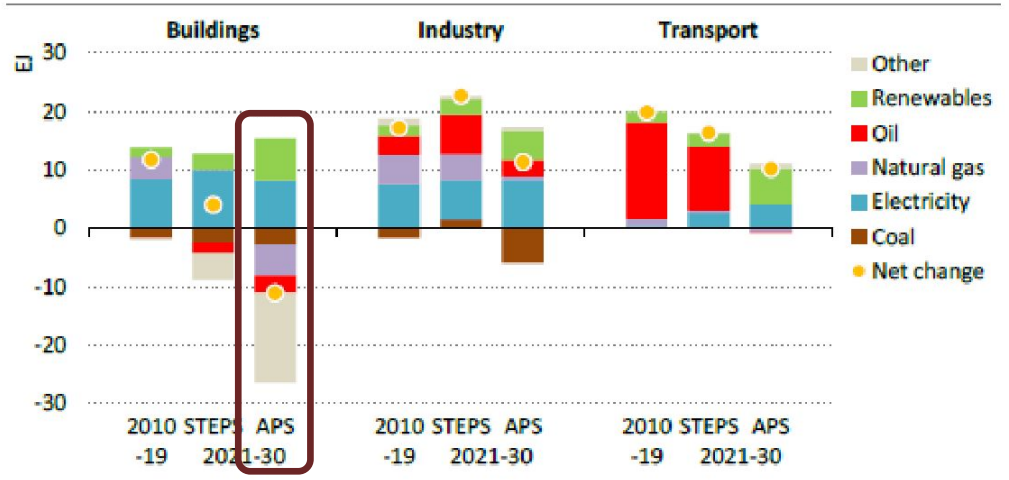
Alternative assumption: 35%/65% coal/renewables displacement in power sector;

d) Displaced energy

- Overstates the extent to which increased gas production and consumption will lead to lower coal use in the power sector, largely reflecting current market conditions rather than IEA's APS in 2035.

- Neglects displacement effects in the buildings sector.

Figure 5.6 ▷ Change in total final consumption by sector, fuel and scenario, 2010-2019 and 2021-2030



Electricity grows the most in the STEPS as buildings, industry and increasingly transport are electrified. In the APS deeper electrification and renewables uptake transforms the mix.

Note: EJ = exajoule

IEA, 2022. World Energy Outlook

Alternative assumption: 35%/65% coal/renewables displacement in power sector; 60%/40% displacement in power/buildings.

e) Upstream emissions

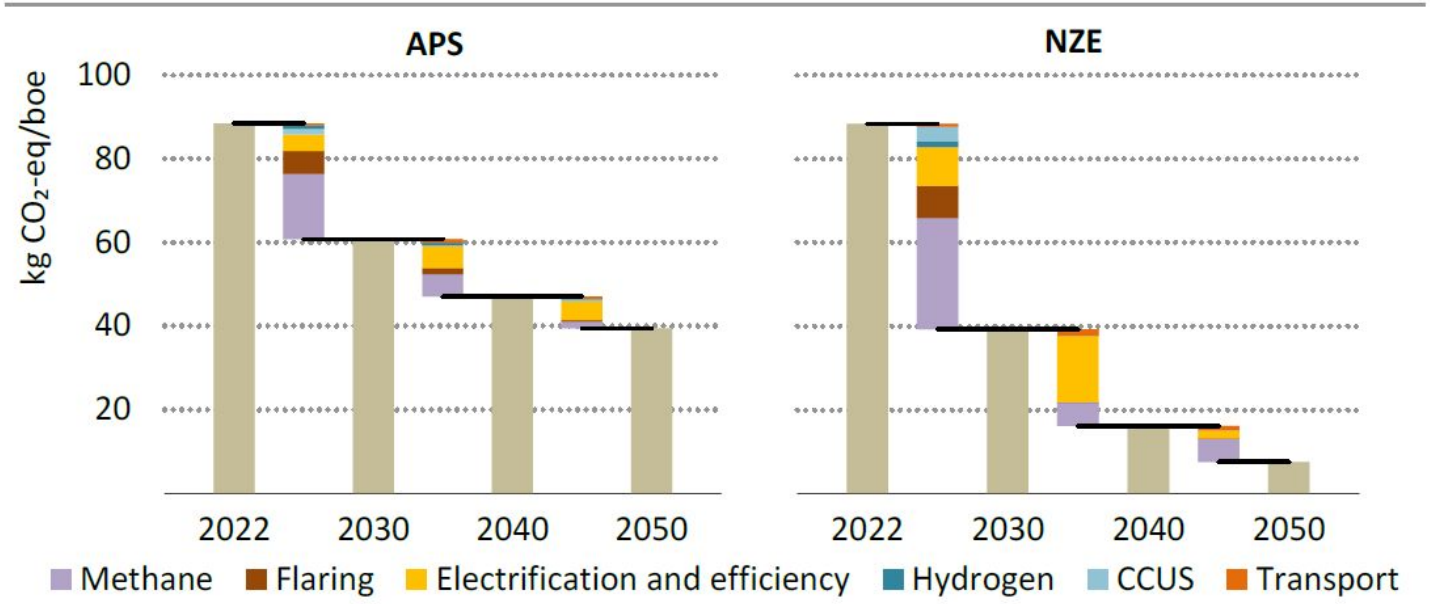
- Rystad Energy assumes O&G producers in the rest of the world take limited steps to reduce upstream methane (CH_4) and none to reduce carbon dioxide (CO_2) emissions. (Overall intensity reduction of 12%)
- Many policies and initiatives are underway to reduce emissions in major producing countries.
- IEA estimates 50% reductions in CO_2 and 55% in CH_4 emissions intensity from O&G operations by 2030 in its Net Zero Scenario.

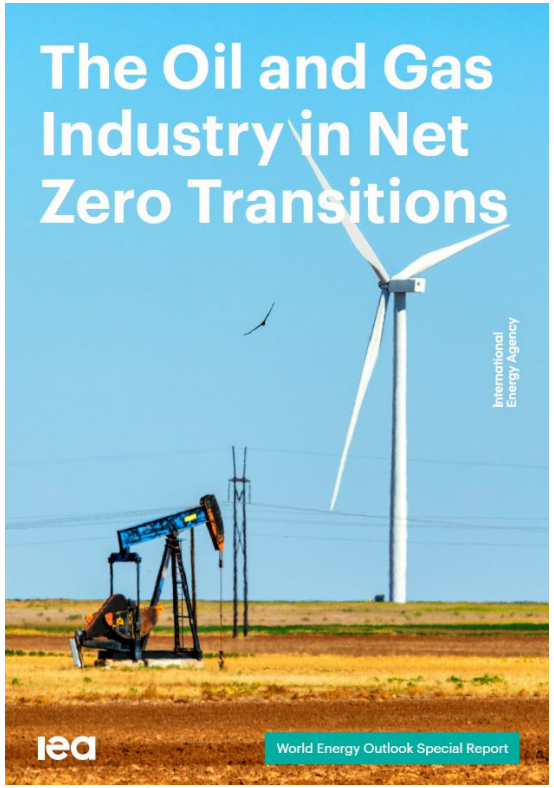
The Rystad Energy report significantly overstates emissions reductions from substituting O&G production in other countries.

IEA report released since Rystad analysis provides added insight on upstream emissions in APS

In the APS, the global average scope 1 and 2 emissions intensity of oil and gas production falls by around one-third between 2022 and 2030, and by 55% by 2050.

Figure 2.5 ▷ **Global average scope 1 and 2 emissions intensity of oil and gas production by scenario and reduction measure to 2050**





This suggests approximately 40% overall reduction in rest of world, similar to assumption used in opinion.

Five assumptions assessed and adjusted

a) Analysis timeframe
b) Oil price elasticities
c) Increase in energy demand
d) Source of displaced (substituted) energy
e) Upstream emissions of other oil and gas producers

With adjusted assumptions for these 5 items, the estimated lifetime GHG emissions impact of Yggdrasil flips from -52 MtCO2e to +80 MtCO2e.

3. What are the broader climate implications of developing the Yggdrasil oil and gas fields? Would its development be consistent on meeting global climate goals?

- Under IEA's scenario that meets global climate goals (net zero by 2050) "no new long-lead time upstream oil and gas projects are needed".
- The Government also neglects to consider "carbon lock-in", equity, and climate leadership implications. Development of Yggdrasil
  - will lead to long-lived investments in new, fossil fuel using-infrastructure that will slow the transition to clean energy
  - may be inconsistent with an equitable transition away from fossil fuels production that recognizes countries' differentiated responsibilities and capabilities
  - could undermine Norway's climate leadership

Summary

- The government's analysis of Yggdrasil's climate implications appears to be systematically biased in its net emissions analysis and seriously flawed by neglecting other important dimensions
- With assumptions more consistent with the IEA APS and other literature, the lifetime net emissions impact is closer to 80 million tCO2e, greater than Norway's current annual emissions (49 million tCO2e)
- Development of Yggdrasil would appear inconsistent with agreed climate goals and Norway's climate leadership