# *THE FUTURE OF OIL EXPLORATION IN A CARBON-NEUTRAL WORLD*

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## Overview

Oil exploration continues to play a significant role in the global energy landscape, even as ambitious targets to achieve carbon neutrality by 2050 under the Net Zero Emissions (NZE) framework are pursued. Despite proven reserves exceeding the carbon budgets compatible with net-zero goals, substantial investments in new exploration persist, amounting to tens of billions of dollars annually. Proponents argue that these efforts are necessary to address production decline rates and that newly discovered fields may reduce lifecycle environmental costs. This analysis critically examines these claims, assessing whether continued exploration aligns with welfare and environmental imperatives in a decarbonizing world. Through detailed modelling of exploration and production, we produce a cost benefit analysis of allowing exploration from a social planner perspective.

The discussion contextualizes global exploration bans, such as France's 2017 law prohibiting new fossil fuel exploration and similar policies in Denmark, Spain, Greenland, Ireland, and New Zealand, exploring their relevance as a pathway to align energy policy with climate goals.

## Methods

Global oil supply dynamics from 2022 to 2100 are modelled using extraction data from the Rystad Energy database and carbon intensity metrics derived from OPGEE (Oil Production Greenhouse Gas Emissions Estimator), PRELIM (Petroleum Refining Life Cycle Inventory Model) and OPEM (Oil Products Emissions Model). The dataset captures the heterogeneity of private costs and carbon intensities across approximately 12,000 observed oil assets and characteristics of yet-to-find resources are modelled based on observed basin-level trends. An optimization framework integrates exploration dynamics, carbon tax scenarios, and environmental cost-private cost trade-offs to evaluate the implications of continued exploration. To account for OPEC's market power and its influence on global demand through pricing, the analysis includes a cartel-fringe treatment of OPEC countries.

Scenarios with and without new exploration are analysed, assessing both private and environmental costs while considering the potential for demand increases driven by additional resource availability.

## Results

A preliminary analysis, agnostic with respect to the characteristics of undiscovered resources, indicates that cheap and low-emission assets are already abundant among discovered resources. This suggests it is highly unlikely that newly discovered resources would provide significant advantages, whether in terms of lower private extraction costs or reduced carbon intensity. We also find that at demand levels near NZE, capacity constraints are not binding, as current reserves are sufficient to meet demand.

Using our field-level optimization model, the findings reveal a misalignment between private incentives for exploration and global decarbonization objectives. Under a globally optimal carbon tax, the welfare and environmental benefits of allowing exploration are positive by design but remain modest. In contrast, allowing exploration in a competitive world without a carbon tax leads to a striking decline in global social welfare, driven by a significant increase in demand due to the expanded pool of available resources.

These results are robust across various assumptions, including different carbon intensity calculations, modelling of yet-to-find assets and their characteristics, and demand function specifications. Notably, a global exploration ban in the absence of an appropriate carbon tax brings outcomes closer to the first-best scenario—a world with exploration but under an optimal carbon tax. The ban achieves a reduction of 88 GTCO2, representing a 15% decrease in

emissions compared to the unregulated scenario. This reduction corresponds to about one-quarter to one-third of the emissions savings that would be achieved through optimal taxation.

## Conclusions

Our research underscores the significant risks posed by continued oil exploration in a world lacking a global carbon tax or operating under suboptimal carbon pricing. Without proper regulation, exploration exacerbates demand growth, leading to excessive emissions and undermining global decarbonization efforts.

A key finding of this study is the abundance of high-quality, low-cost, and low-emission assets within existing reserves. When combined with a carbon tax, further exploration yields minimal welfare gains, highlighting the limited welfare and environmental justification for expanding resource pools.

In the absence of an optimal global carbon tax, however, banning exploration emerges as an effective second-best mitigation strategy. By limiting the availability of new resources, an exploration ban curbs demand growth, reduces global emissions, and moves outcomes closer to the first-best scenario of a regulated market with a globally optimal carbon tax.

In conclusion, this paper emphasizes the importance of aligning energy policies with climate goals. A global exploration ban, while not a perfect substitute for optimal taxation, represents a pragmatic and impactful policy to mitigate the risks of unregulated resource expansion and its associated environmental consequences.