Imperial College London

Pipeline to Paris: Exploring pathways of the global oil industry in the energy transition

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Natural Environment Research Council

Oil industry is increasingly feeling the heat from climate change

The Guardian

Court orders Royal Dutch Shell to cut carbon emissions by 45% by 2030

Oil giant told plans should be brought into line with Paris climate agreement

Image source: Piroschka van de Wouw/Reuters

FT

ExxonMobil shareholders hand board seats to activist nominees

Historic vote reflecting climate concerns comes on bruising day for international oil companies

Image source: Reuters

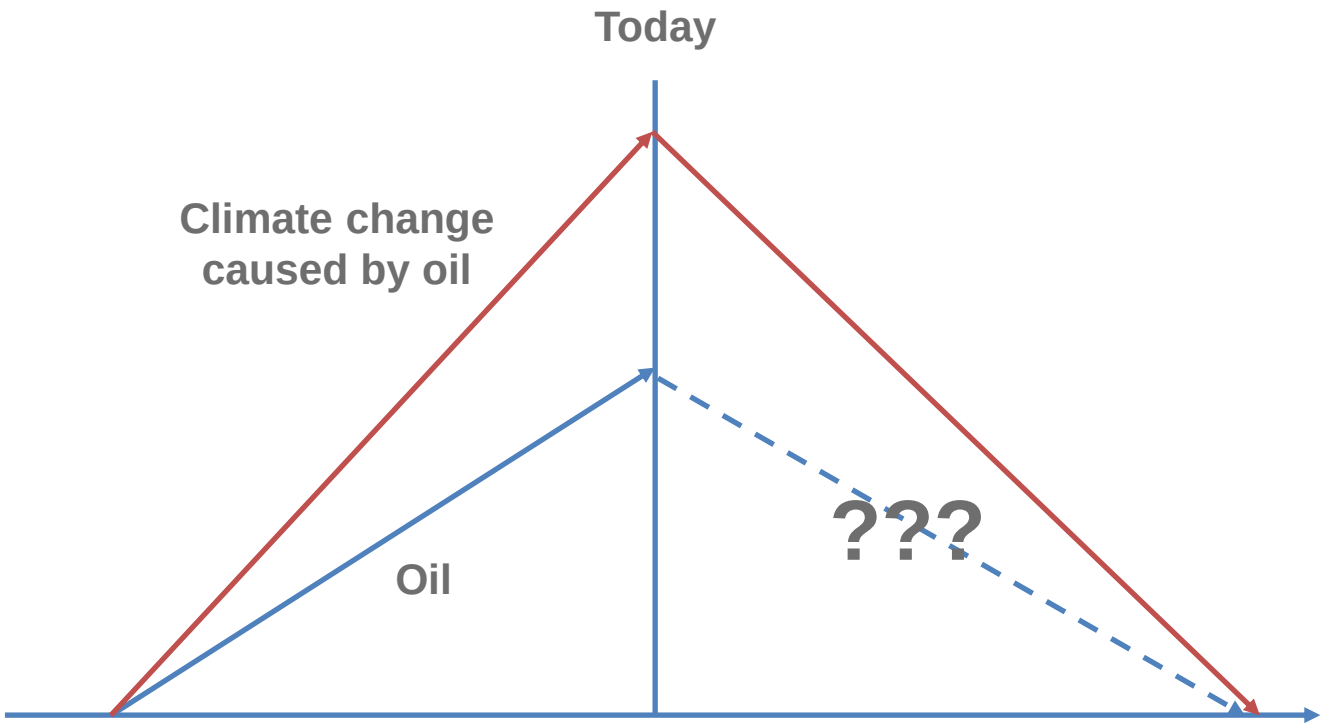
References: Boffey (2021), Brower (2021)

Agenda

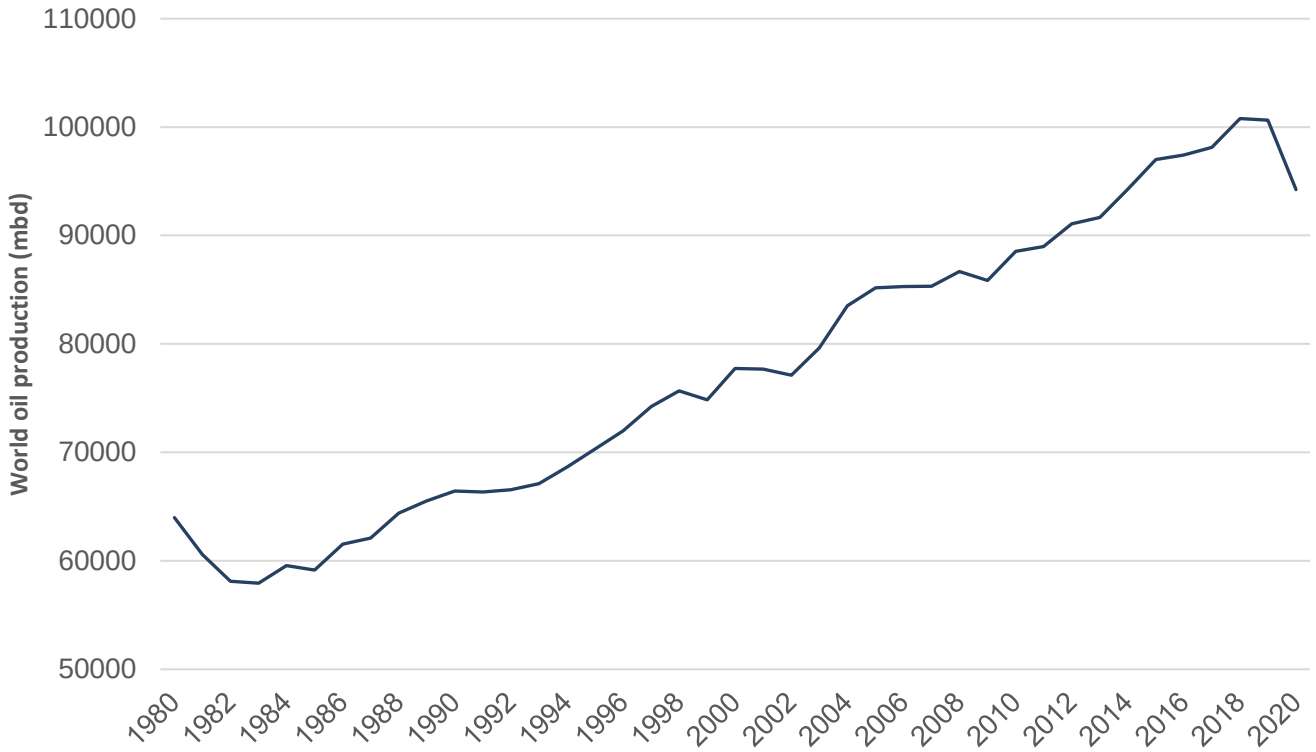
1. Introduction: The changing world of oil
2. Background: Are mainstream oil models fit for today's world?
3. Methods: New modelling to explore the future of the upstream oil market
4. Results: International oil companies can lose a lot from climate mitigation
5. Conclusion: Uncertain future presents real risks to industry and investors

1. Introduction: The changing world of oil

My PhD project: if we manage to mitigate climate change, what happens to the oil industry?



The importance of oil in modern society has led to continued growth in the long run



Data source: U.S. Energy Information Administration

Today, the outlook for oil looks less certain

INDEPENDENT

Could the coronavirus crisis be the beginning of the end for the oil industry?

FT

BP warns of oil demand peak by early 2020s

Opinion **The FT View** + Add to myFT

Big Oil faces up to a future beyond petroleum

The pandemic is set to accelerate the shift away from fossil fuels

THE EDITORIAL BOARD + Add to myFT

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The editorial board JUNE 15 2020 73

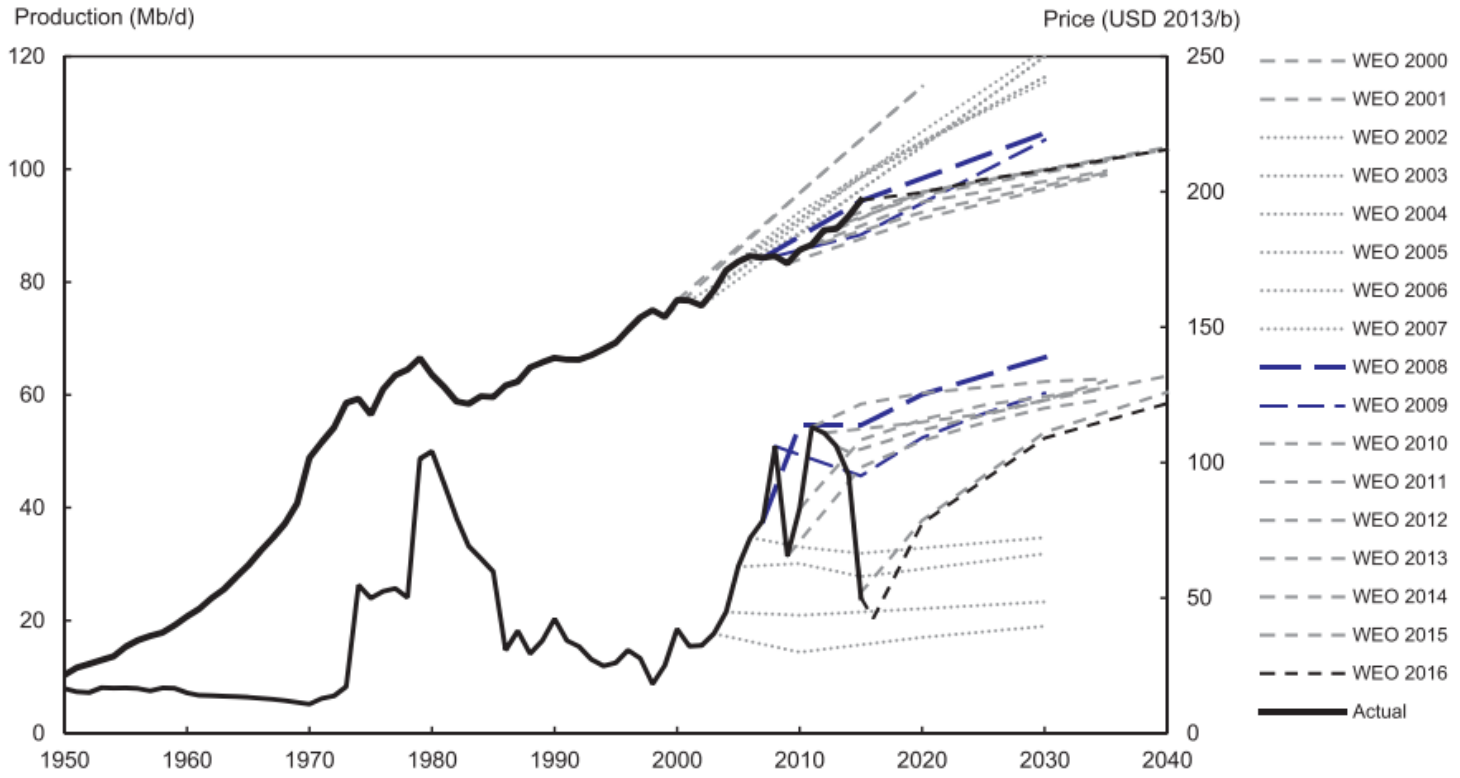
iea

Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our pathway

References: Bradshaw et al. (2019), Chapman (2020), Financial Times Editorial Board (2020), IEA (2021), Raval et al. (2020)

2. Background: Are mainstream oil models fit for today's world?

Widely used approaches to modelling the future of the oil market are not always reliable



Source: Wachtmeister, Henke & Höök (2018)

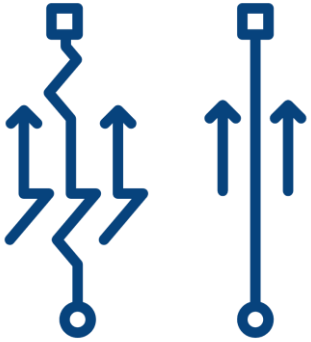
Limited data availability can be a barrier to open research of the oil industry

3. Methods: New modelling to explore the future of the upstream oil market

The aim of my modelling is to fill gaps in the oil market literature

Explore company pathways that are possible under different oil demand scenarios

Understand potential effects of decision-making under uncertainty



Model the upstream oil market in a way that is both relatively simple and informative

Agent-based modelling can complement more established modelling methods

Agent-based modelling means

- Agents making decisions
- Interactions in complex systems
- Emergence of macro-scale patterns from micro-scale actions

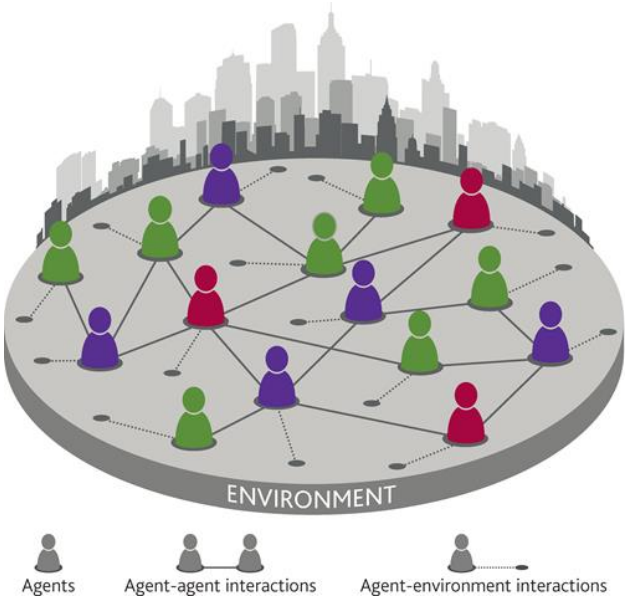


Image source: SIMTWIST Project

References: Ballantine & AlMehdar (2021), Radovic et al. (2020), van Dam et al. (2013)

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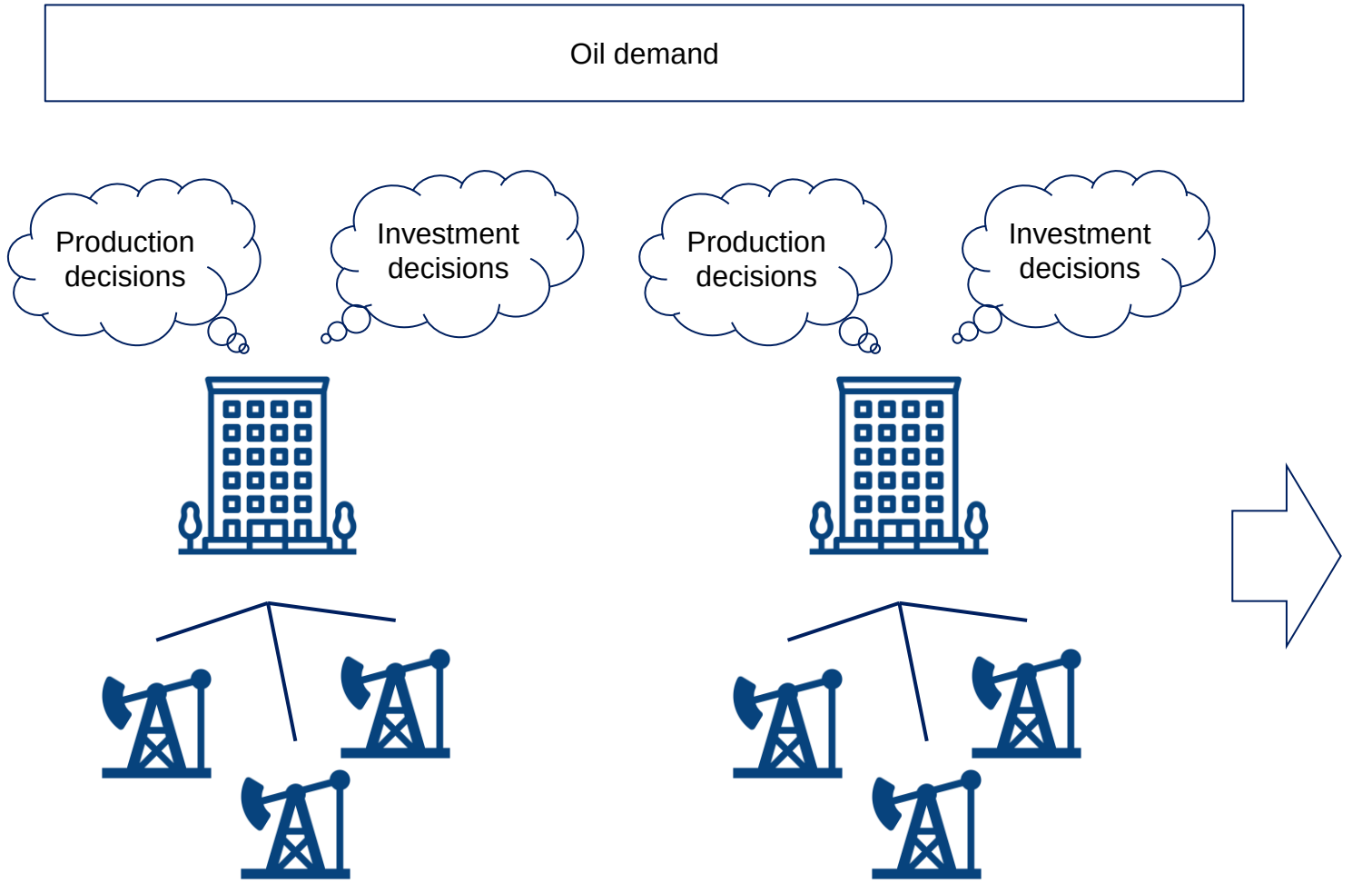
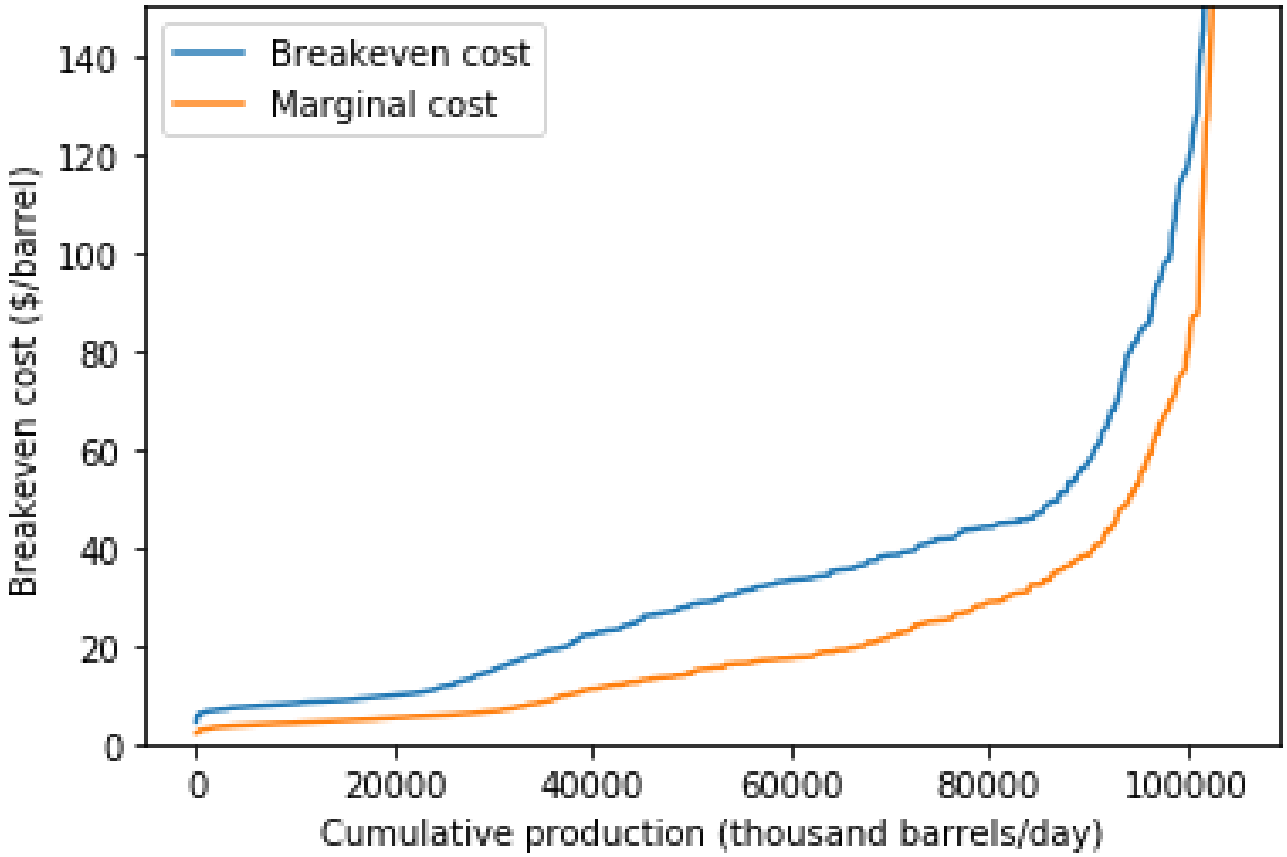
My model of the oil market outputs oil price and supply based on demand and decisions made by companies



Data set on oil supply is collated bottom-up from publicly available sources



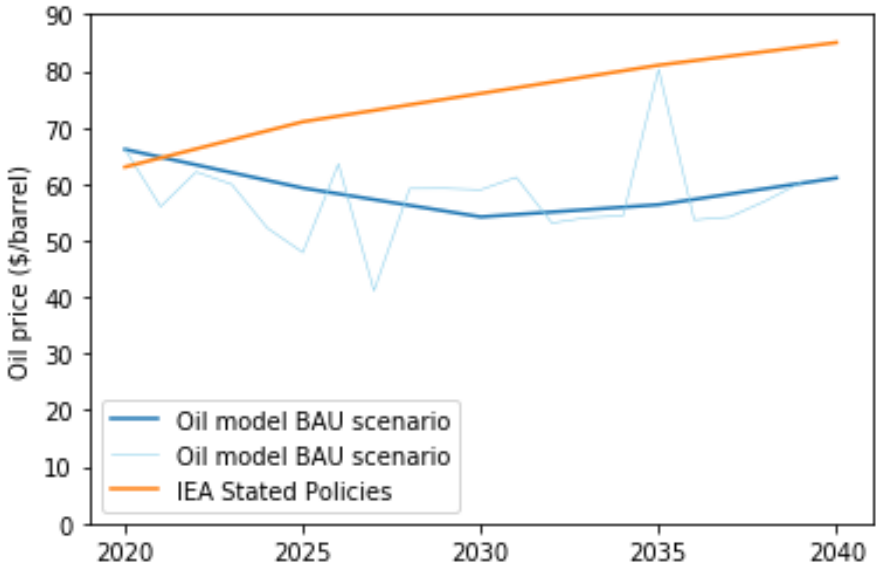
References: Halttunen, Slade & Staffell (2021)

4. Results: International oil companies can lose a lot from climate mitigation

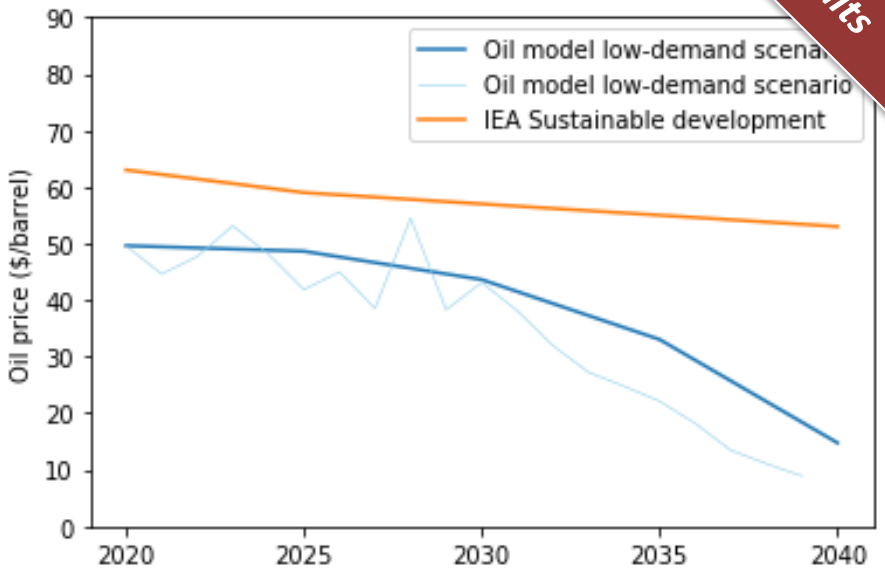
Model price output is comparable to IEA predictions, although clear differences remain

Preliminary results

Business-as-usual scenarios



Low oil demand scen

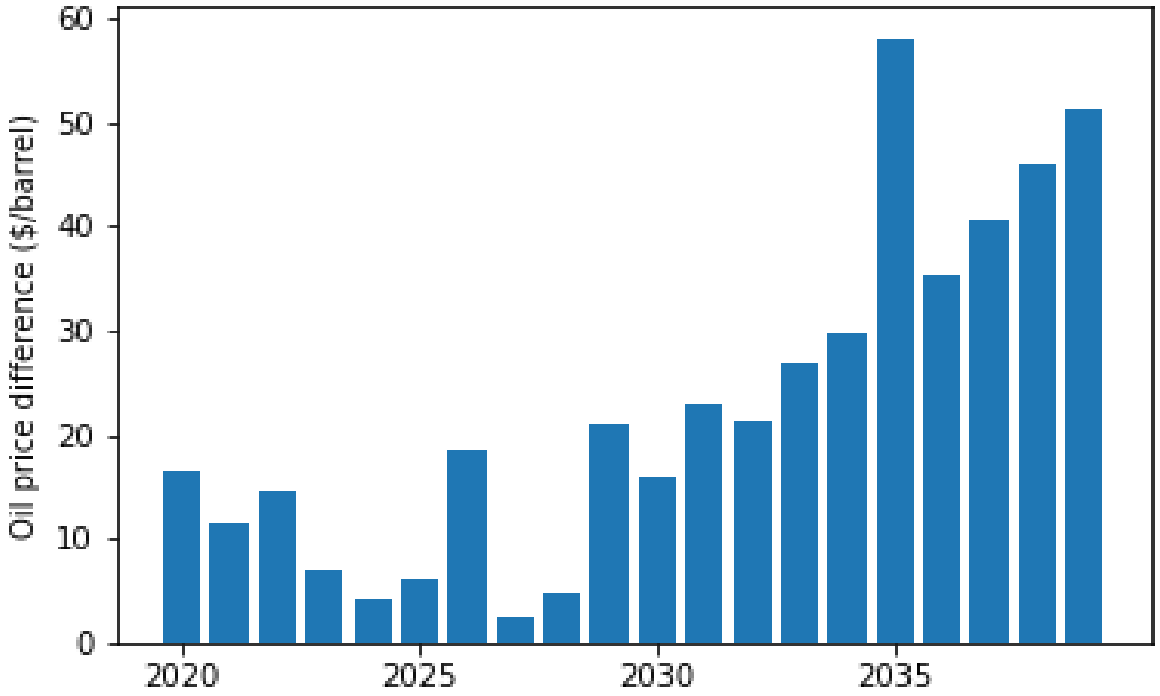


Data source: IEA (2020)

Low-demand scenario leads to lower oil prices than business as usual; difference grows over time

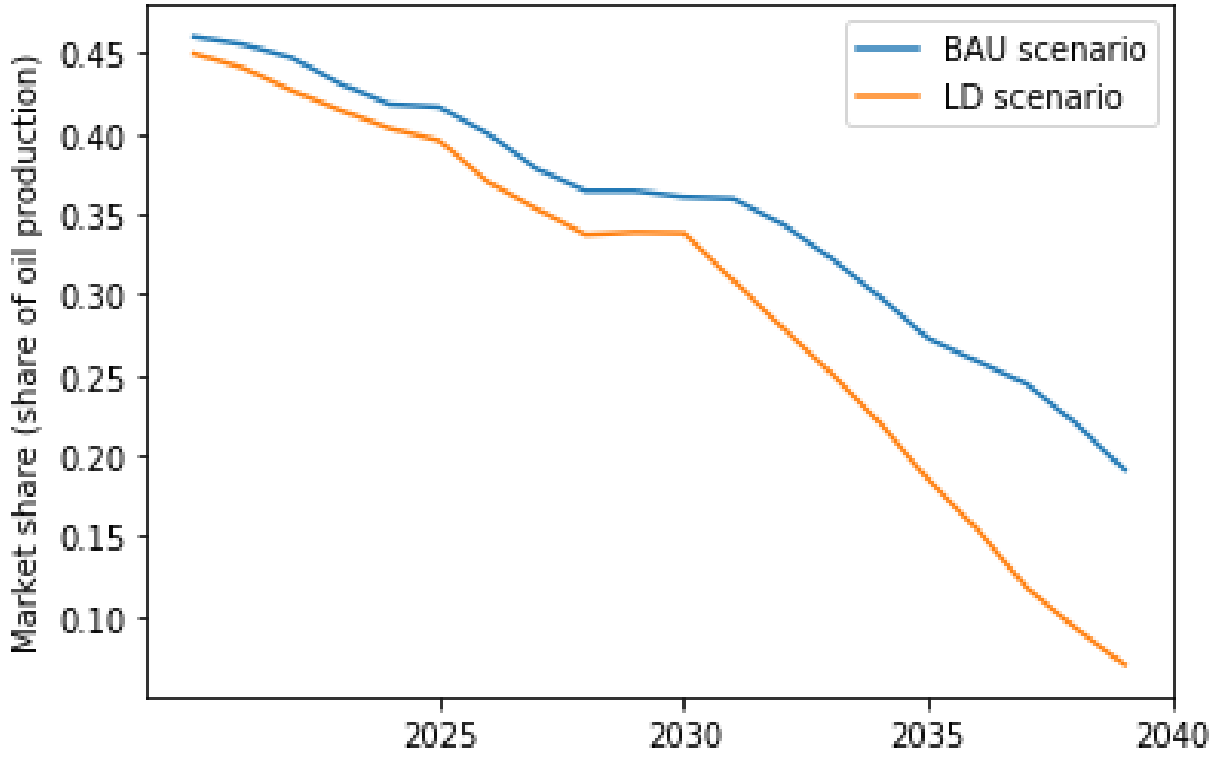
Preliminary results

Absolute annual difference in oil price between BAU and LD scenarios



Market share of international oil co's is halved in low-demand scenario compared to business-as-usual

Preliminary results



References: Halttunen, Slade & Staffell (2021)

Implication: although the future is uncertain, investors in the oil industry face real risks

Image source: William Potter/shutterstock.com

5. Conclusion: Uncertain future presents real risks to industry and investors

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New approaches and perspectives to oil industry research have a lot to offer in the changing world

1. **The future of oil is crucial to the future of climate – and increasingly uncertain.**

2. **New, exploratory modelling approaches can offer new insights into the possible future pathways of the upstream oil industry.**

3. **International oil companies and their investors face a lot of risk from the energy transition, and might want to prepare sooner rather than later.**

Thank you!

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