



University
of Stavanger

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Climate change and economic risk

Better climate risk management

Climate change and the energy transition
UNEP/OFD Workshop
Geneva, 28 August 2019

Who am I?

<http://www.uis.no/Mohn>

Education



Economics (PhD)

- University of Bergen (cand mag, 1988)
- Universität Mannheim (økonometri, 1989)
- NHH (cand oecon, 1991)
- University of Oslo (PhD courses, 1993)
- University of Stavanger (PhD, 2008)
- University of Stavanger (professor, 2011)

Experience



Macroeconomics, finance, and energy

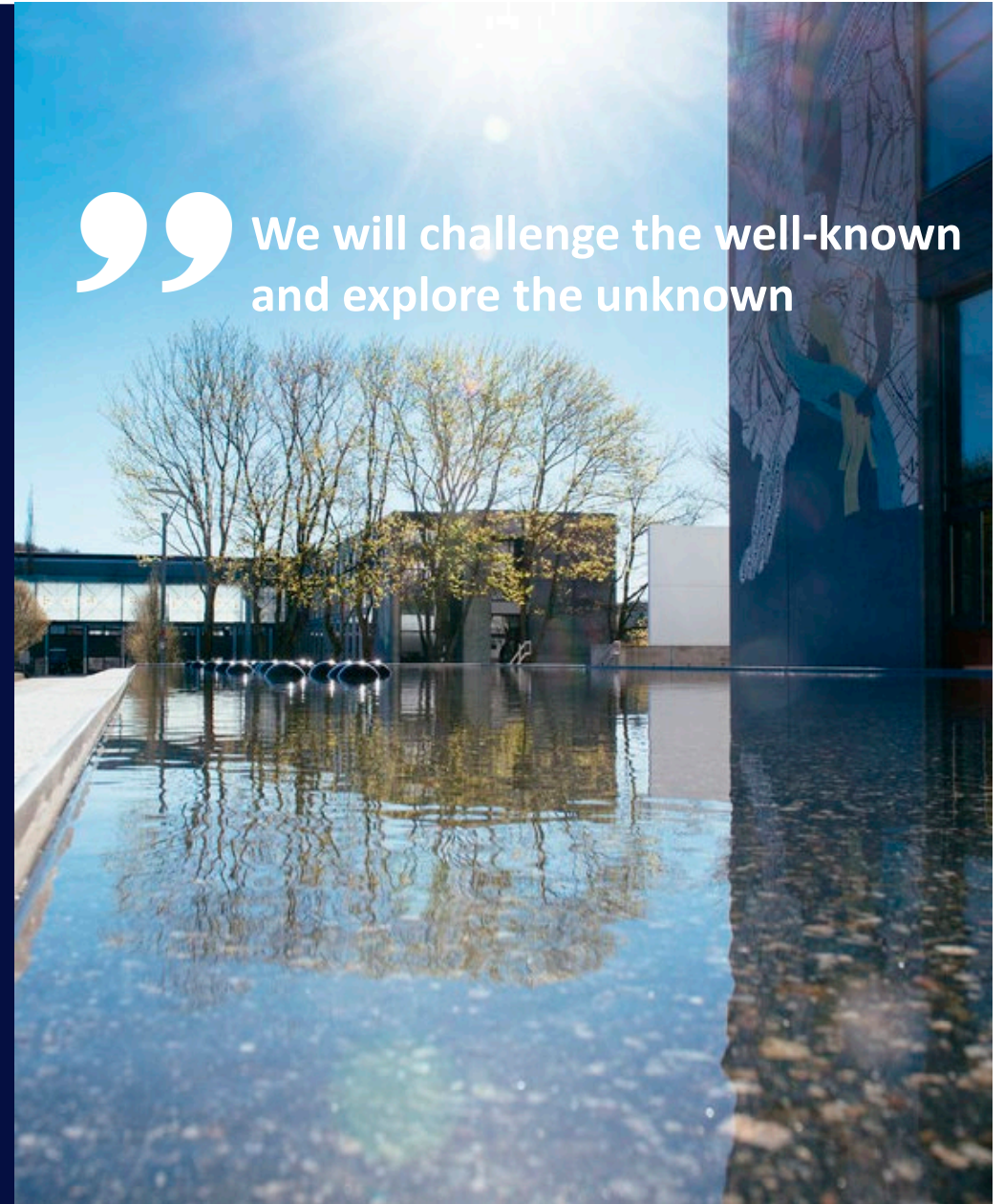
- SSB (research department, 1992-1994)
- DnB Markets (macro economist, 1994-1996)
- Statoil/Equinor (1996-2013; Macro economist, finance, investor relations, CEO's office, strategy, chief economist)
- University of Stavanger (professor, 2013-2019)
- NHH (professor II, 2013-2019)
- University of Stavanger (rector, 2019 -)

University of Stavanger

- 1,800 employees and 12,000 students across seven faculties
- Proud member of European Consortium of Innovative Universities (ECIU)
- Joint ECIU University project (2019-)
- 12 % foreign students
- 300 international cooperation agreements



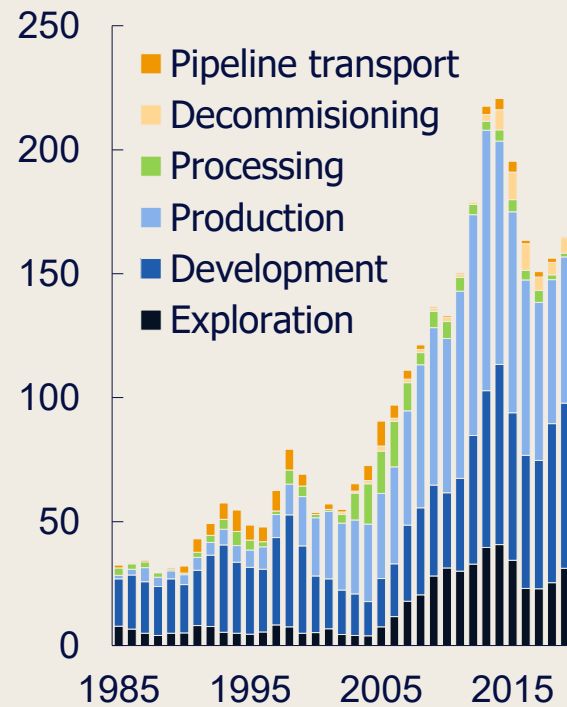
We will challenge the well-known
and explore the unknown



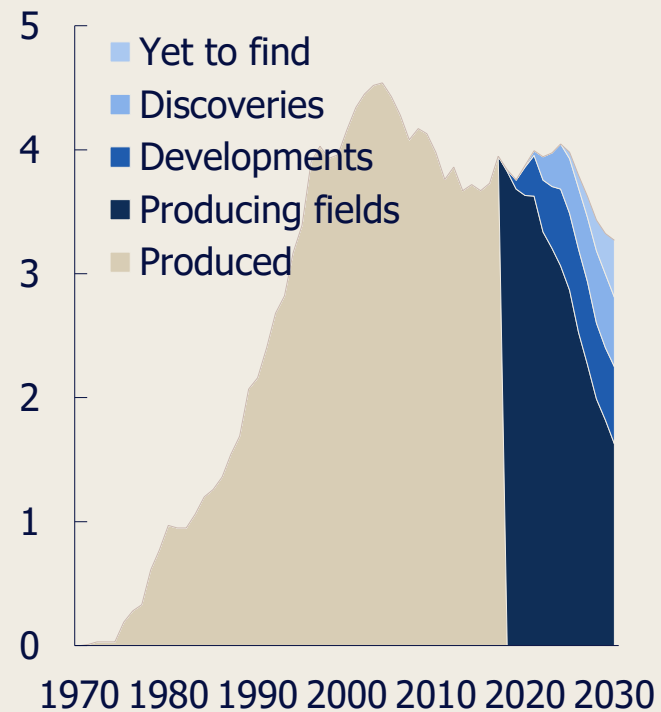
Conversion of natural capital

From below-ground resources to financial resources

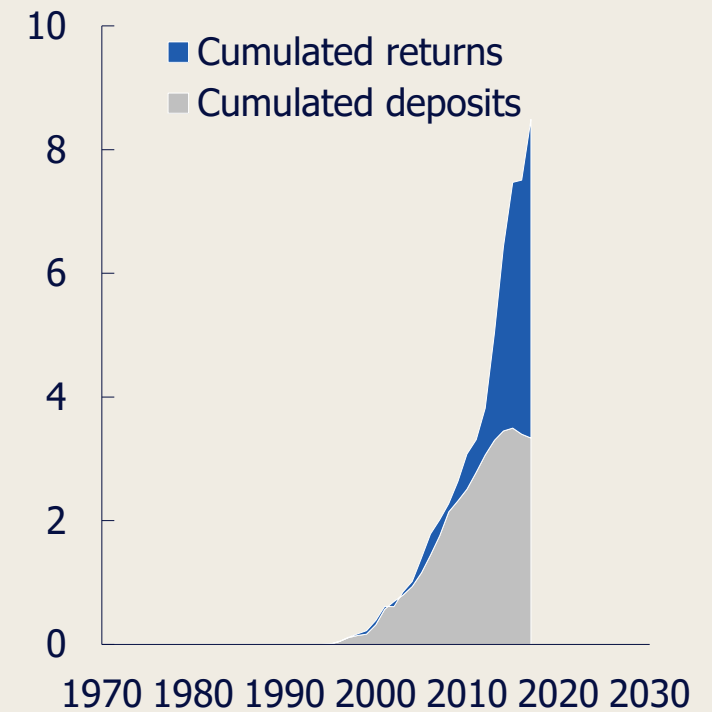
Investment
NOK bn (nominal)



Extraction
mmboepd



Revenue management
Oil fund, NOK trn



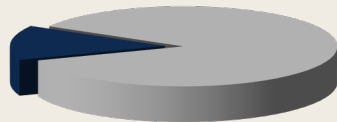
An industry that makes a difference

A significant role in the Norwegian economy

Oil price review

Brent blend 1970-2019 (USD/bbl at 2018 prices)

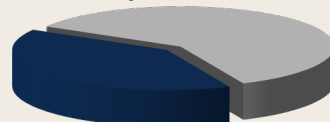
GDP
14 per cent



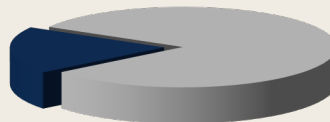
Government revenue
17 per cent



Total export
40 per cent



Total fixed capex
19 per cent



Investments: 2x Russia Football World Cup
Every year



Framework and organisations

Triad of fiscal instruments and institutions

Petroleum taxation



MINISTRY OF FINANCE

The State's Direct Financial Interest



Government Pension Fund - Global

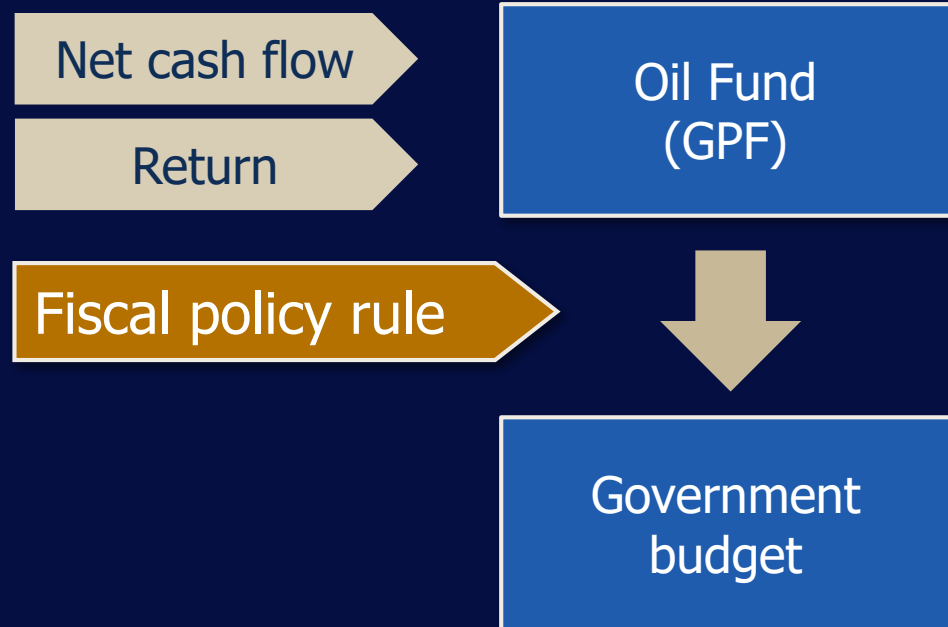
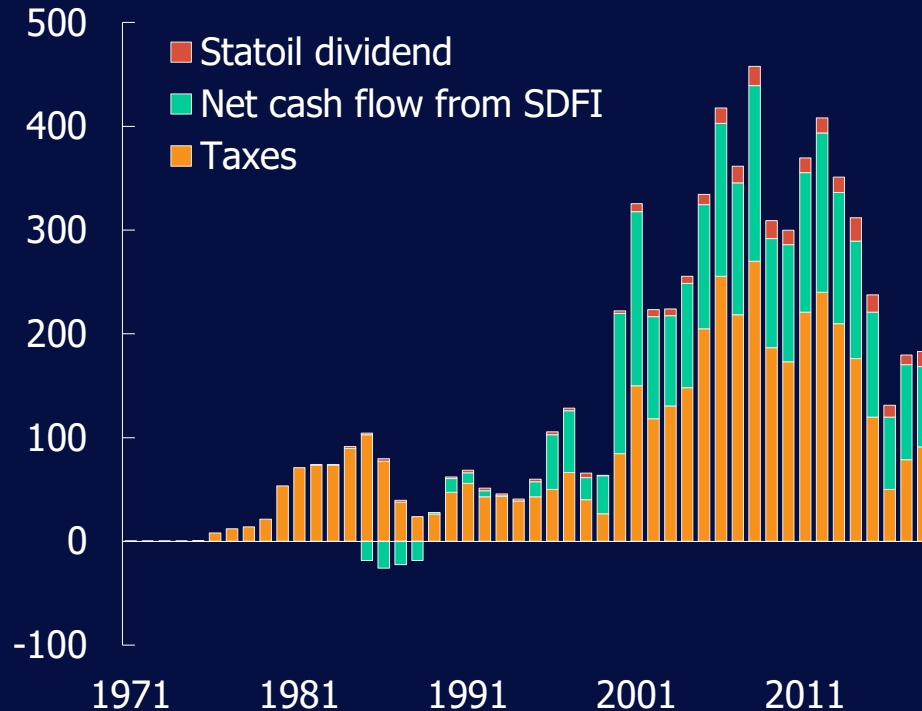


NORGES BANK
INVESTMENT MANAGEMENT

Oil fund mechanism and fiscal policy rule

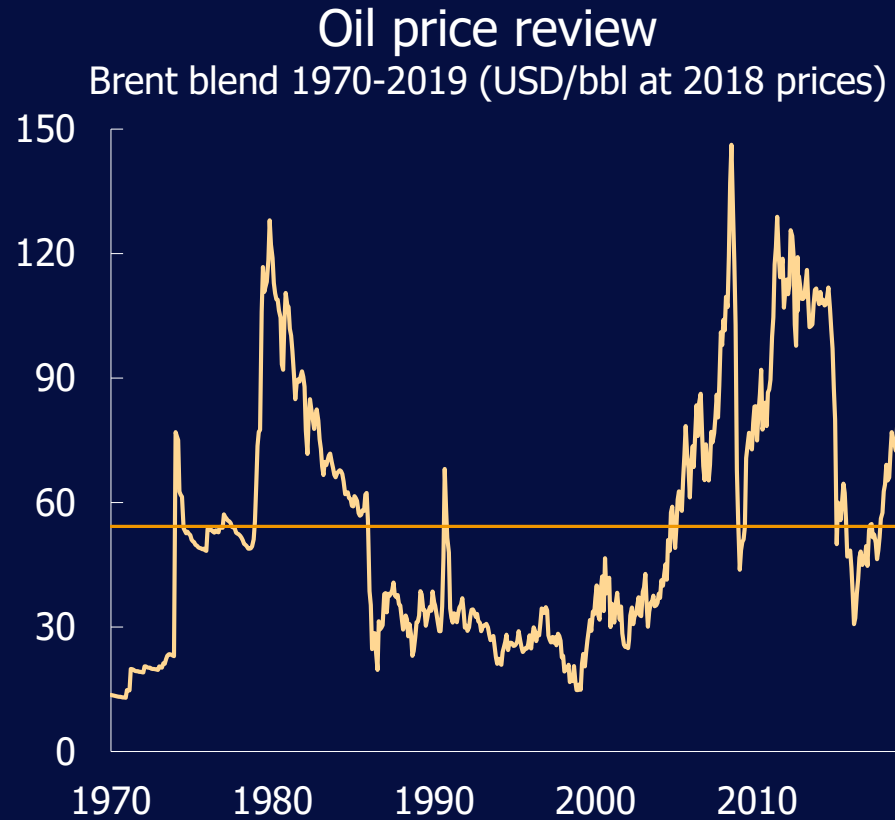
Separation of accrual and spending of oil and gas revenues

Government net cash-flow...
...from petroleum activities (NOK bn)



Modest recovery offers relief

Cost improvement is now paying off



Substantial reduction in average well cost

Development plans approved in 2018
– further development of the Shelf

Development plans submitted in 2018 – significant investments yield substantial values

Johan C
Ærfugl
Fenja
Nova
Troll (T
Snorre
Skogul
Yme (n
Valhall

■ New, stand-alone facilities
■ Further development and use of existing infrastructure

Illustration: Equinor

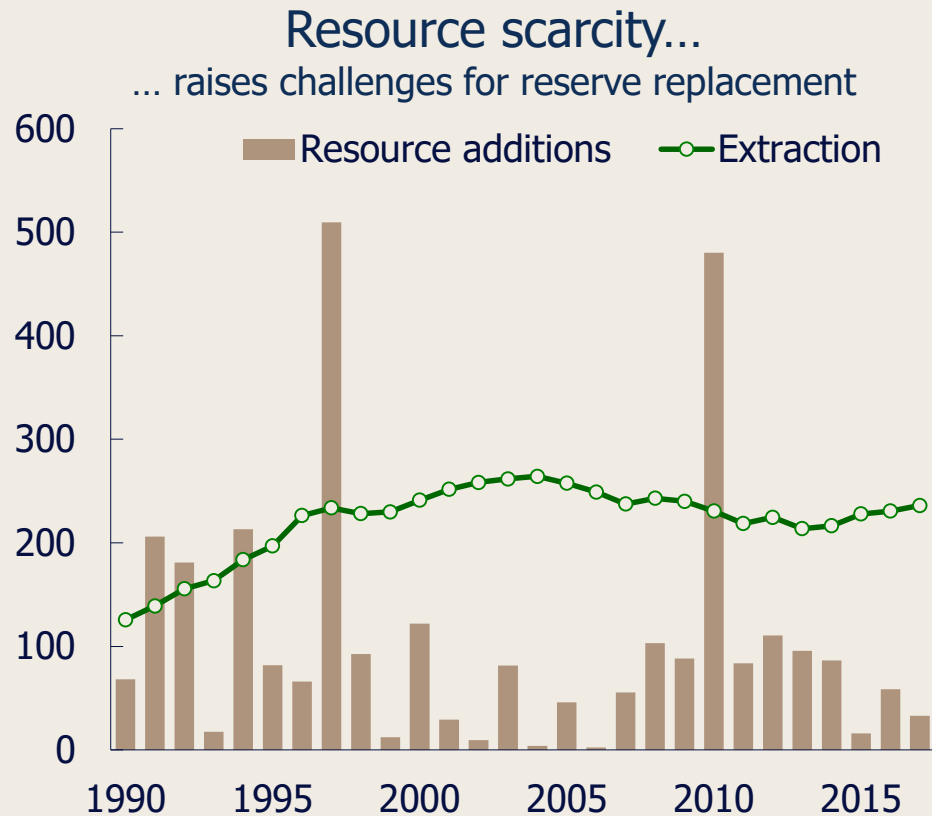
Illustration: Wintershall

Illustration: Equinor

■ New, stand-alone facilities
■ Further development and use of existing infrastructure

Clouds on the horizon

Constraints resource mobilisation and demand



Climate policy uncertainty...
... raises raises risk around demand and prices

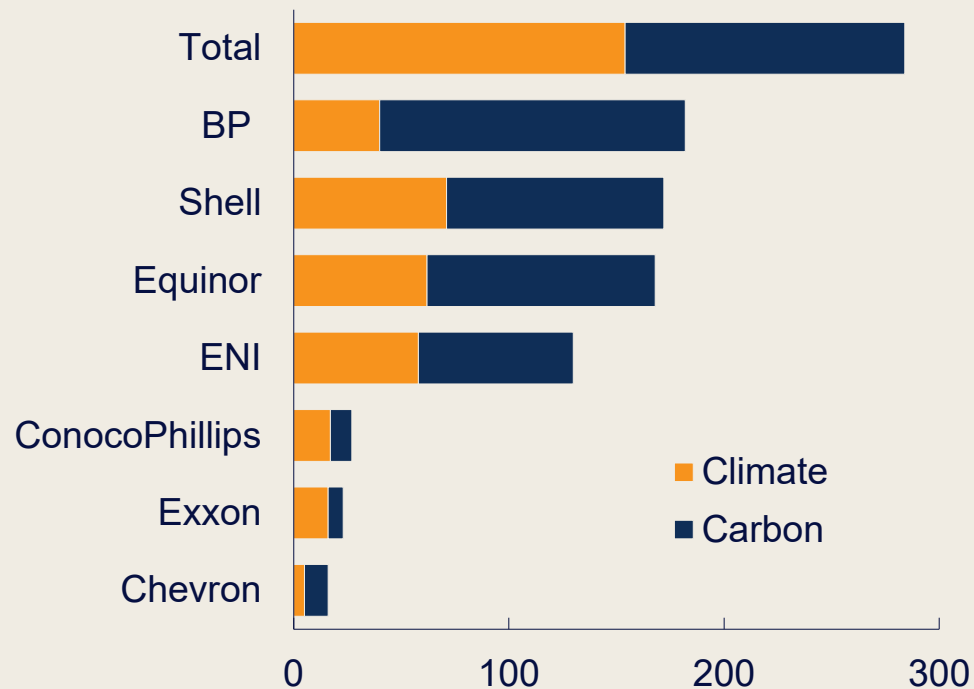


COP21-CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

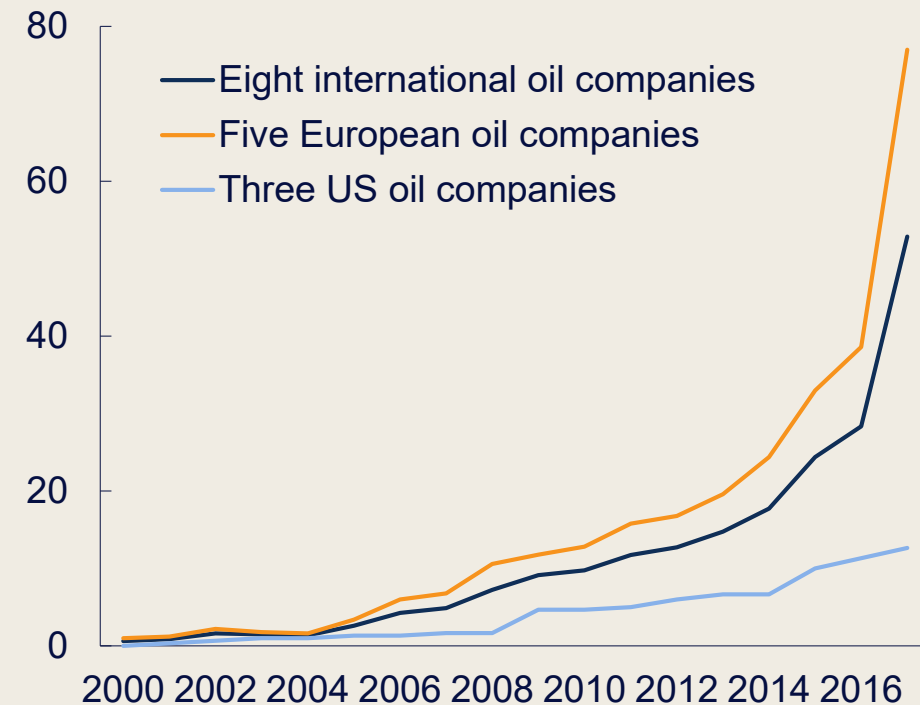
More words about climate and CO₂

Indicators of climate risk: Word counts from annual reports

Word counts from annual reports 2017



Average frequency for 'climate'



Norway's Climate Risk Commission

Better climate risk management

Official Norwegian Reports NOU 2018: 17 Summary

Climate risk and the Norwegian economy



Vedlegg 6

Klimarisiko: Respons og

Klaus Mohn, professor Hans

1 Innleiing

Den norske olje- og gassverksmda fører med i omfattende ringverksmdar for fastlandsøkonomi og store kontrastressumar til statskassa. Utviklar for olje- og gassnæringa spelar dermed ei viktig rolle for norsk økonomi og offentlege finans. Etter meirvold og store hauss gjennom fleire år i olje- og gassnæringa no overfor utfordringar, bl interasjonalt og i Noreg (Mitchell og Marx 2012; Mitchell mfl, 2015).

Dei siste åra har ny teknologi utleyst store leggesreservar verda over (Mohn, 2010), som i tur har lagt grunnlag for eit strukturelt sjøkk tilbudsida av olje- og gassmarknaden (Baffes i 2015). Aukende produksjon av olje frå tette bergarter i USA førte til at eit overkotsutlød v demna opp i oljemarknaden frå 2010 og uton som blei utleyst då Opec gav opp kontrollen av oljeutlød og overlevert til marknaden å bestem oljeprisen frå november 2014. Resultatet var oljeprisen fllt, frå eit årsgegnomsnitt på 99 US dollar i 2014 til 50 USD/dol i 2015. Rett nok har o prisen stige vesentleg frå dei lågaste nivå i 20 men mykje tydar likevel på at dei langsaltege i vestingane til oljeprisen kan ha fått eit perit over segnet skick.¹

I tillegg kjem at oljeselskapa i den vesti verda er i beitt for olje- og gassreservar til frar dige ferskbyggingar. Reservar i høinslæge f vunar er i ferd med å tømast, leireselskapa svake og kostnadane per eining ved leiting utvinning blir pressa opp av mogning og restu kappelid. Dei lågaste fruktene er plukka, og o selskapa må no akseptere meir risiko – teknisk og politisk – om aktiviteten skal haldst v

¹ I ei brleg spørundersøking blant oljeselskapa frå i Equity Research (2017) av dei gassrike olje- og gassreservar for langtidsplassering oppgitt til 92 USD i 2013, og 25 USD fra 2011 (avgitt av undersøkinga). F reidom blei i oljemarknaden representerer meir direkte endringar i spotprisen, og muligheter i skruvande ut (15.11.2018) som oppgitt i desember 2012 rundt 67, 52 dol.

Official Norwegian Reports Climate risk and the Norwegian economy

Summary of a report from 6 October 2017 to assess for the Norwegian economy

The original report is in Norwegian and available in Finance on 12 December

Translation from Norwegian



January 2019

Energy Transition, Uncertainty, and the Implications of Change in the Risk Preferences of Fossil Fuels Investors

Abstract

Energy transition risk is often viewed as a long-term risk, the impacts of which will not be felt for decades to come. However, this view is an imprecise presentation of reality. This is because although completion of transition might take decades, the increased uncertainty around the transition impacts the energy markets on a much shorter time scale than the transition itself. This article presents the results of a survey of institutional investors on hurdle rates for new energy projects and compares it with information available in the public domain about discount rates on completed projects. The survey shows that uncertainties associated with energy transition have already started to alter the risk preferences of investors in fossil fuel projects. Investors are demanding a much higher hurdle rate in order to invest in long cycle oil and coal projects. We contend that such changes in risk preferences will have several key implications for fossil fuel markets. First, the payback period of discounted investment costs is extended dis-incentivising long cycle projects, therefore concentrating upstream investment around short-term projects with shorter payback periods. Second, it impacts asset valuation of fossil fuel companies with consequences for firms' cash flows and asset payoffs. Third, it encourages the oil and gas companies to adopt a low risk operation model, focus on the harvesting phase of their oil assets, and move away from exploration, appraisal and development. Fourth, it could affect the volume of available supplies if there is not enough investment into the sector with potential consequences on prices depending on demand projections. Fifth, it could affect the long-term price of oil when energy markets start to price in transition related risks. Sixth, the energy transition process could be accelerated as higher long-term oil prices improve the economics of alternative resources.

1. Introduction

Energy transition is inherently a risky process. Generally market participants will be exposed to four types of risk during the transition (i) demand and technology risks (ii) market price risks (iii) policy risks and (iv) other risks. Demand and technology risks are related to the entire set of parameters that affect the volume of the goods and services that are traded annually (e.g. electric vehicles vs. internal combustion engine (ICE) vehicles) and the technology or the fuel that is associated with them (e.g. renewable kWh versus Coal kWh). Market price risk pertains to factors that impact the ways in which non-policy related prices of goods and services evolve. This includes commodities themselves (for example oil and gas prices or the price of carbon emissions) and technology inputs into the production process (for instance the price of batteries). Policy risk is related to all types of policy related incentives (e.g., subsidies), costs (e.g., tax), performance standards (e.g. fuel efficiency standards), production

Oxford Energy Insight: 45

Bassam Fattouh, Director, OIES,
Rahmatullah Poudineh, Lead Senior Research Fellow, OIES &
Rob West, Head, Global Energy Research, Redburn & Research Associates, OIES

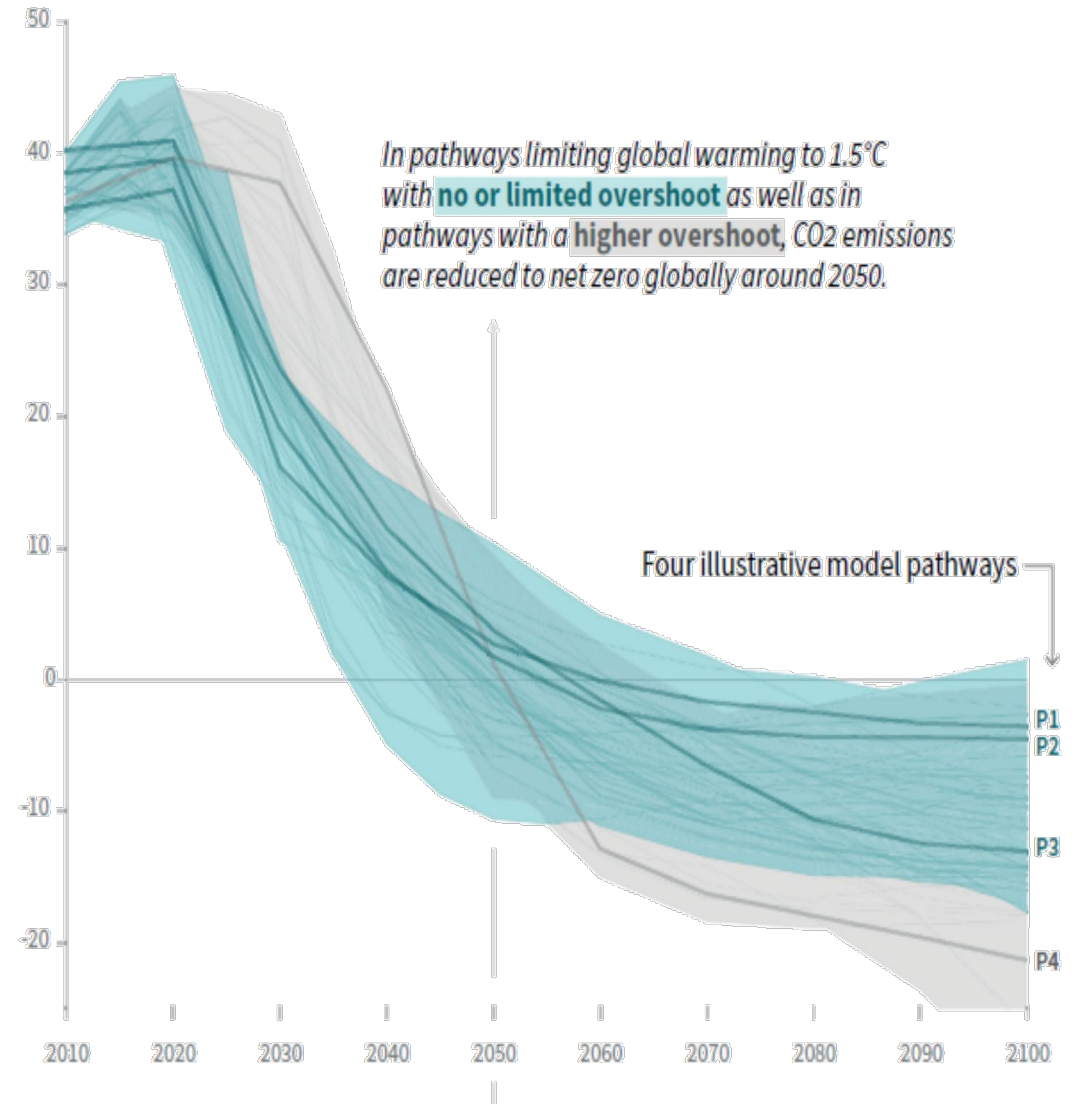
The climate challenge is massive

Paris was just a teaser, the work starts now

- Success requires continuous scaling of policies and effort
- Global net emissions shall have to be zero by 2050
- Demand and extraction of fossil fuels needs to be cut
- Any delay will add complications - and cost

Source: IPCC.

Global CO₂ emissions
Gigatonnes per year



The world is not on the right track

Energy demand and CO₂ emissions keep increasing

Global Energy & CO₂ Status Report

The latest trends in energy and emissions in 2018



“

Despite major growth in renewables, global emissions are still rising, demonstrating once again that more urgent action is needed on all fronts — developing all clean energy solutions, curbing emissions, improving efficiency, and spurring investments and innovation, including in carbon capture, utilization and storage.

FATIH BIROL
EXECUTIVE DIRECTOR, IEA



Government Commission on Climate Risk

Members, mandate, and priorities



Martin Skancke



Terje Aven



Trude Myklebust



Nalan Koç



Linda Nøstbakken



Klaus Mohn



Ragnar Torvik

The commission was asked to describe climate risk

- Climate-related risk-factors and their significance for the Norwegian economy
- How climate risk can be analysed and described most appropriately
- How private and public sector entities can be provided with an analytical framework for analysing and managing climate risk in the best possible way

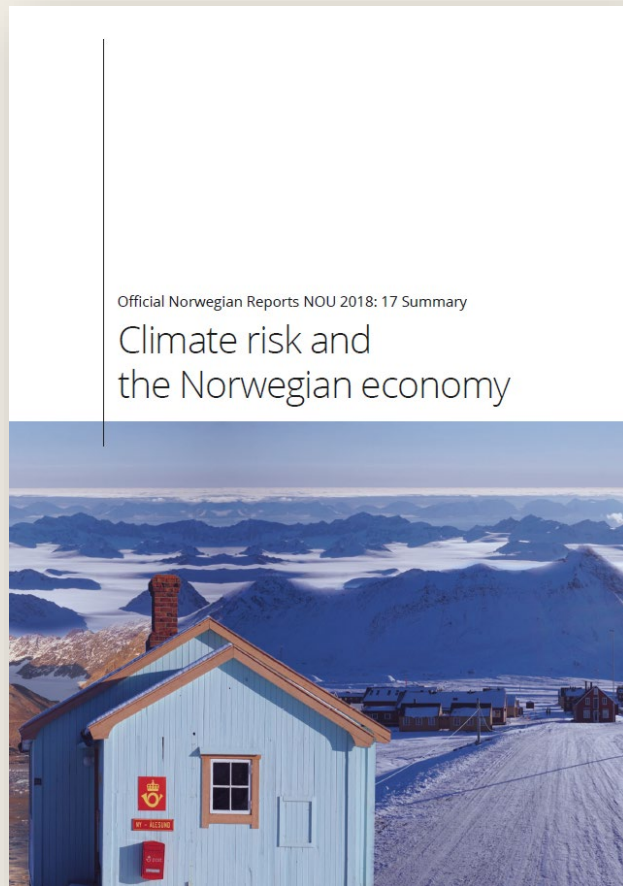
Too many questions, too little time

- Twelve months, nine meetings
- Wide range of stakeholder input
- Univocal report and proposals
 - Call for more systematic approach to climate risk
 - A broad and aggregate perspective
 - Sound principles and processes
 - Information, reporting, knowledge



Main themes of the commission's work

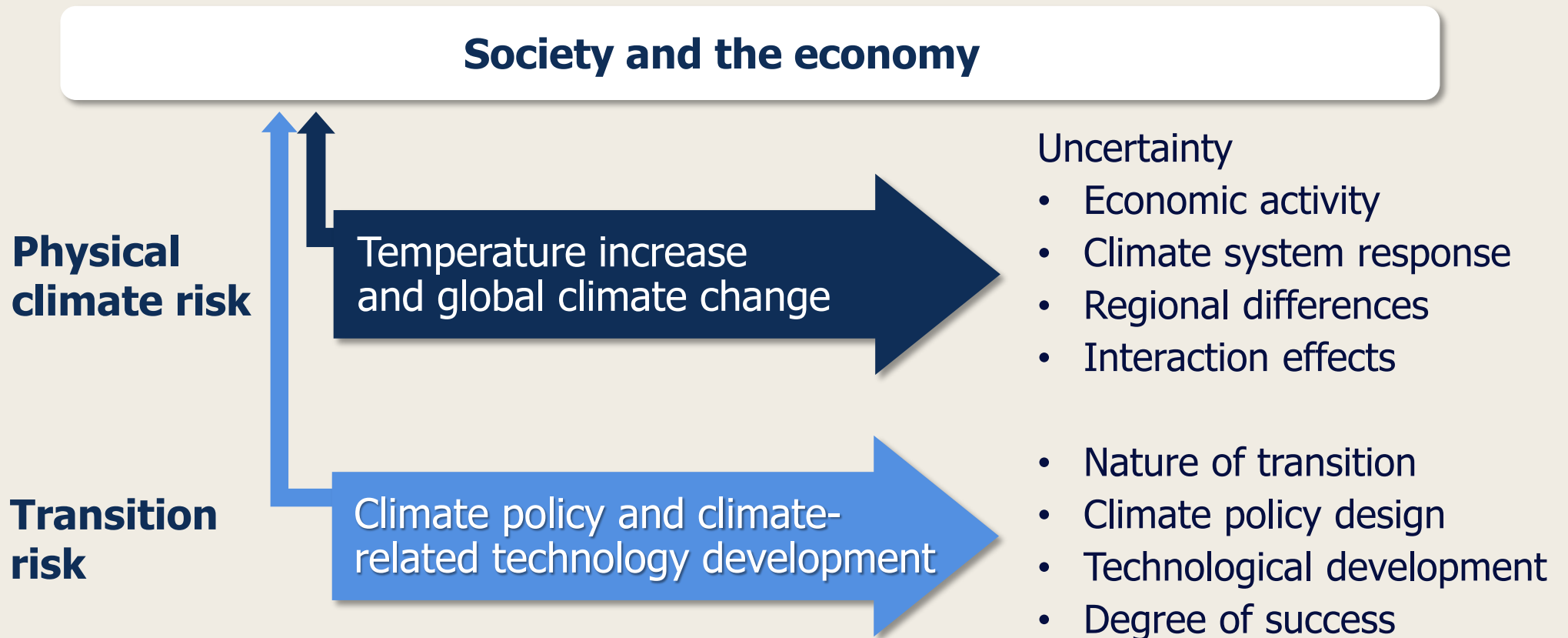
Climate-related risk factors and their significance for the Norwegian economy



- Assessment of climate risk
- Framework for ongoing monitoring of climate risk
- Climate risk management principles
- Sound decision-making processes that integrate climate risk
- Appropriate incentives

Climate risk – key relationships

Climate change, climate policy, technology, economy, and society



Government commission on climate risk

Climate-related risk factors and their significance for the Norwegian economy

- The climate system is changing
- Global appreciation of climate risk
- Economics and risk theory
- A broad and general perspective
- Sound climate risk management may support climate policy

Climate policy and climate risk management

Reduce likelihood of catastrophic climate change
Reduce uncertainty around energy transition



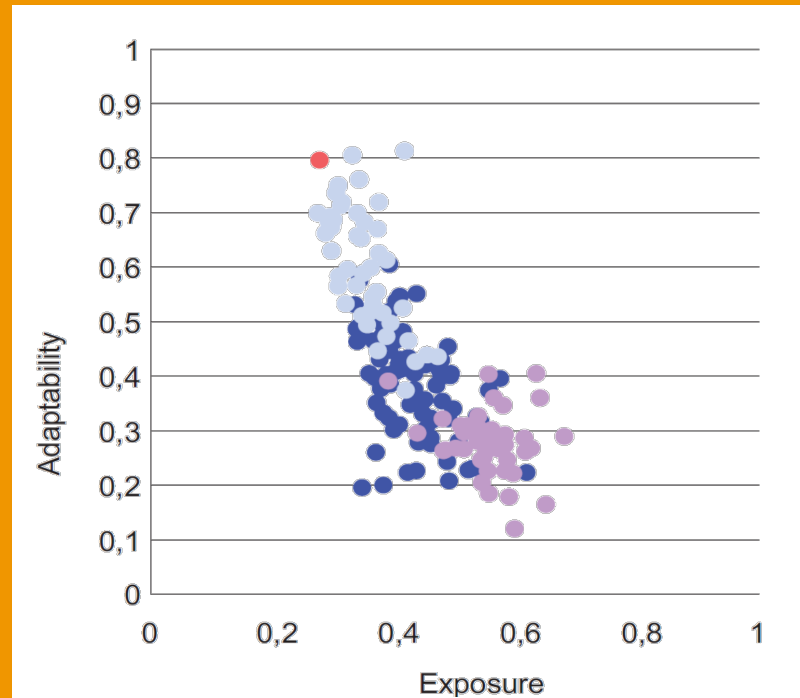
Better-informed investment decisions
Smooth transition to low-emission society

Climate risk to the Norwegian economy

Well developed, well adjusted, well managed

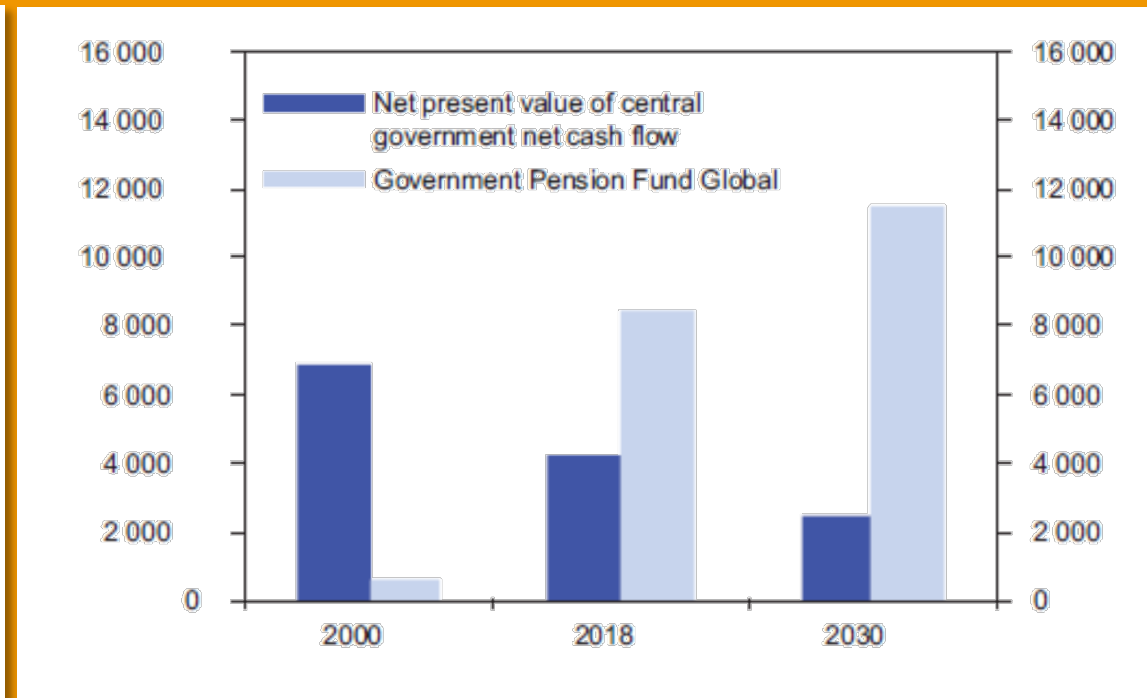
Climate risk exposure

University of Notre Dame Global Adaptation Index



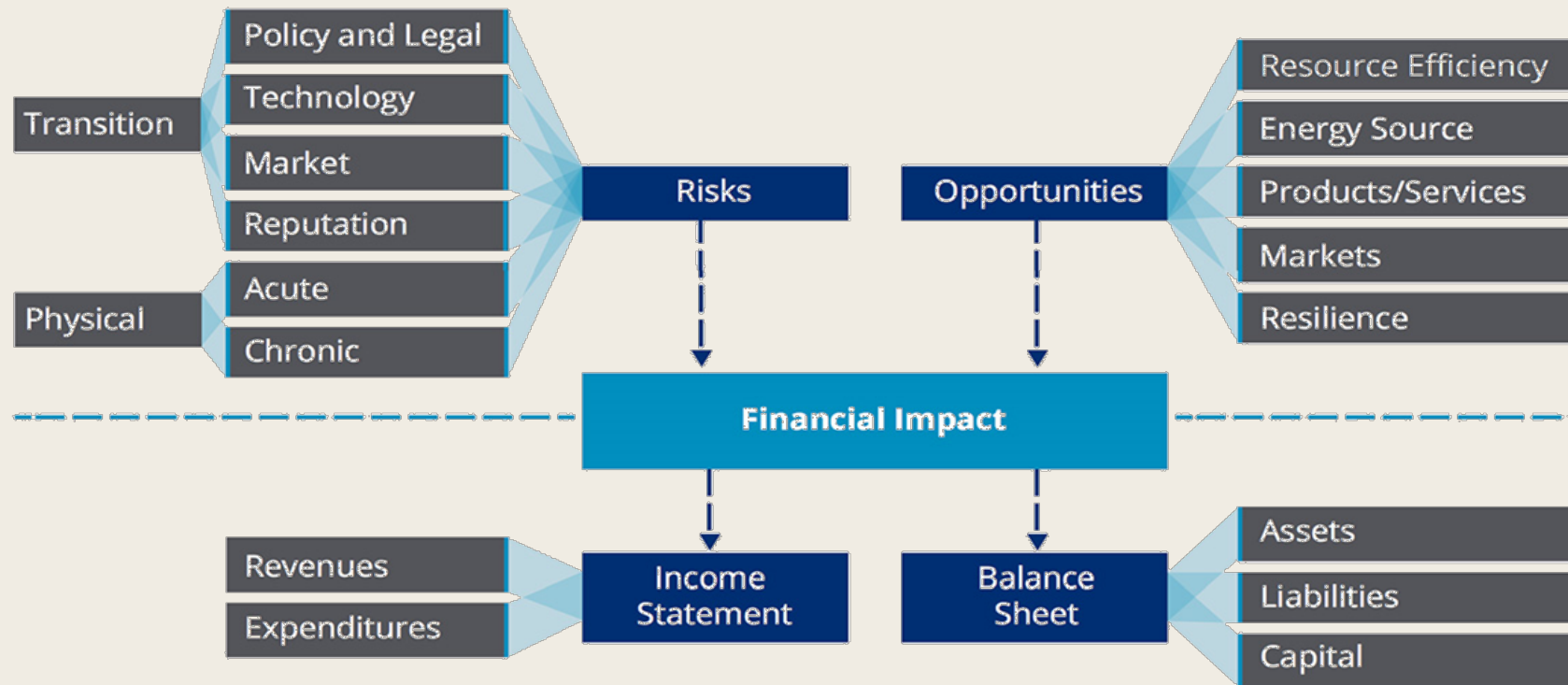
Resource revenue management

Gradual reduction in climate risk exposure



Climate risk for business and industry

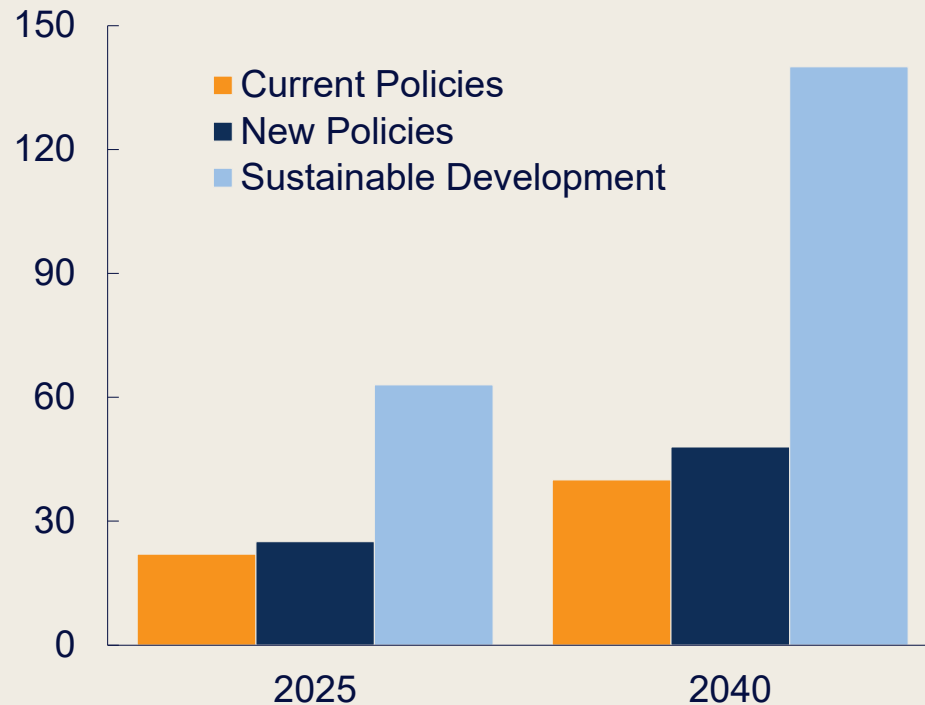
TCFD approach to climate-related risks, opportunities, and financial impact



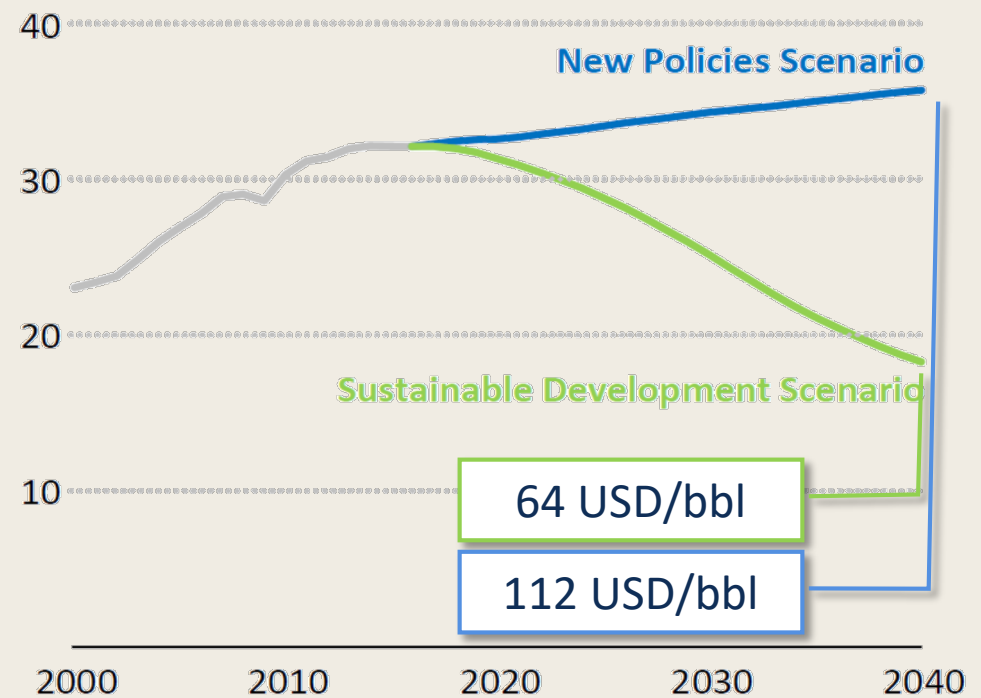
Climate risk for the oil and gas industry

All about prices and valuations

CO₂ prices in EU in IEA's scenarios USD/tonne



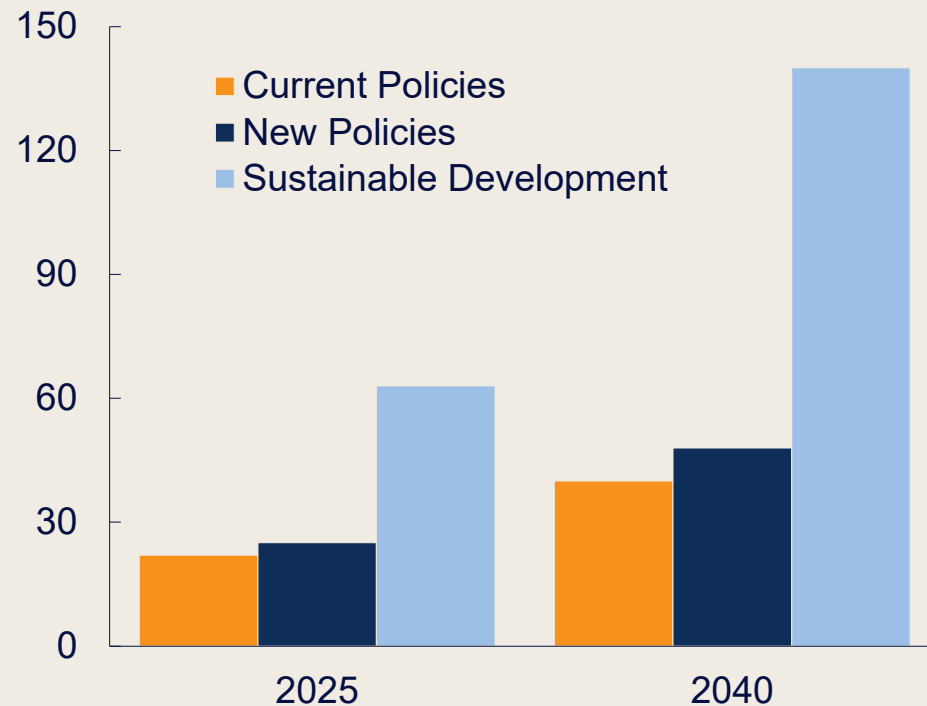
Global CO₂ emissions towards 2040... ... and oil price impact



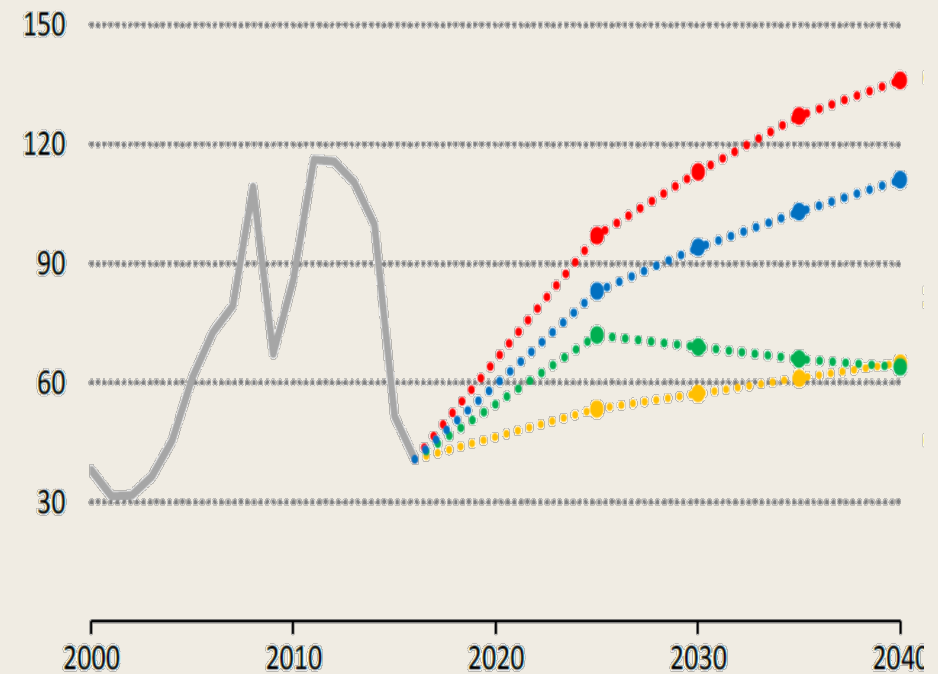
Climate risk for the oil and gas industry

All about prices and valuations

CO₂ prices in EU in IEA's scenarios USD/tonne



Scenarios for the oil price Brent blend, USD per bbl



Adjustment of operations

Short-term response



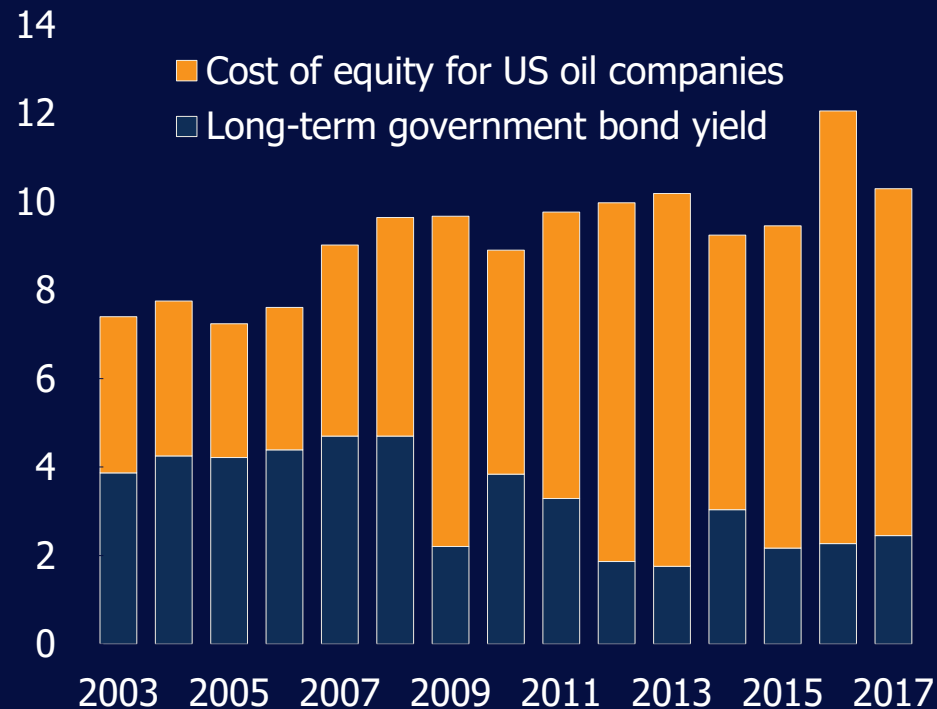
- Climate risk is long-term
- The response is immediate
- Push for lower CO₂ intensities
 - Energy efficiency
 - Electrification
- Push for lower costs

Adjustment of investment

Higher uncertainty, lower project values, more caution

Equity cost for oil companies

Market data from USA 2003-2017 (per cent)



- Lower capital expenditure
- Myopic investment behaviour
- Appreciation of flexibility
- Cross-fire on gas projects
 - Attractive CO₂ intensity
 - Capital intensity and project horizon

Adjustment of strategy and governance

Impact on strategy and business development

- Public outreach
- Diversification
 - Horizontal integration
 - Vertical integration
- Acquisition and development of new business activities
- Governance and shareholder activism

Companies with energy scenarios
Increasing engagement in energy dialogue



Government commission on climate risk

General climate risk management principles

- **Comprehensiveness:** Use an integrated process in analyses of threats, opportunities, and risk factors
- **Framework:** Address climate risk in the context of other risks and risk frameworks
- **Appetite:** Desired level of risk must be based on a broad assessment of benefits, costs, and robustness
- **Resilience:** Attach weight to resilience in line with the precautionary principle
- **Incentives:** Clear links should be established between decisions and implications
- **Standardisation:** Risk assessments should be performed as similarly as possible across various fields
- **Communication:** Risk management should be based on cooperation, information sharing, and transparency

Norway's climate risk commission

Better climate risk management

- Climate change means climate risk
- The only answer is climate policy
- Norway's economy is highly exposed, but also resilient
- Climate risk should be understood and managed
- TCFD principles should be adopted



” Thank you for listening!

