

# *Flytte investeringer fra olje til havvind?*

## Konsekvenser for inntjening, jobber og utslipp

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BI Center for Sustainability & Energy,  
SSB –Prosjektet SmartPaths - Forskningsavdelingen  
Ved Per Espen Stoknes 2. Sep 2021

### Plausible futures for the Norwegian Offshore Energy Sector: Business as Usual, Harvest or Rebuild?

TALL

SOM FORTELLER

DISCUSSION PAPERS

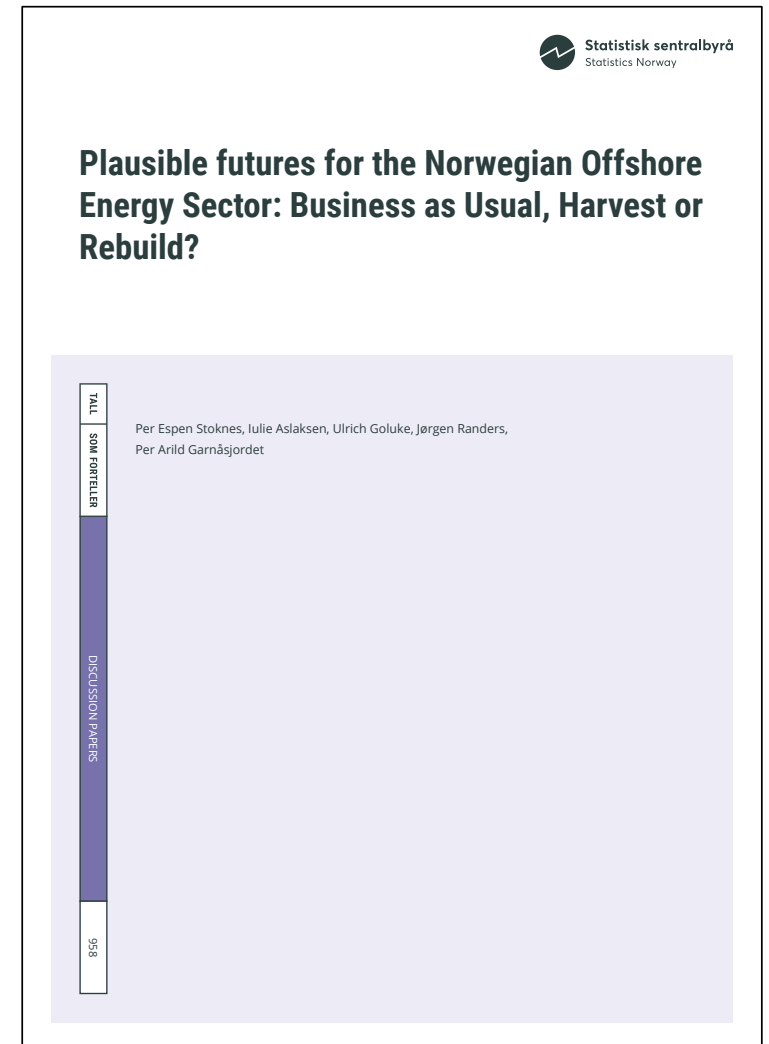
958

Per Espen Stoknes, Iulie Aslaksen, Ulrich Goluke, Jørgen Randers,  
Per Arild Garnåsjordet

# Vårt forskningsspørsmål

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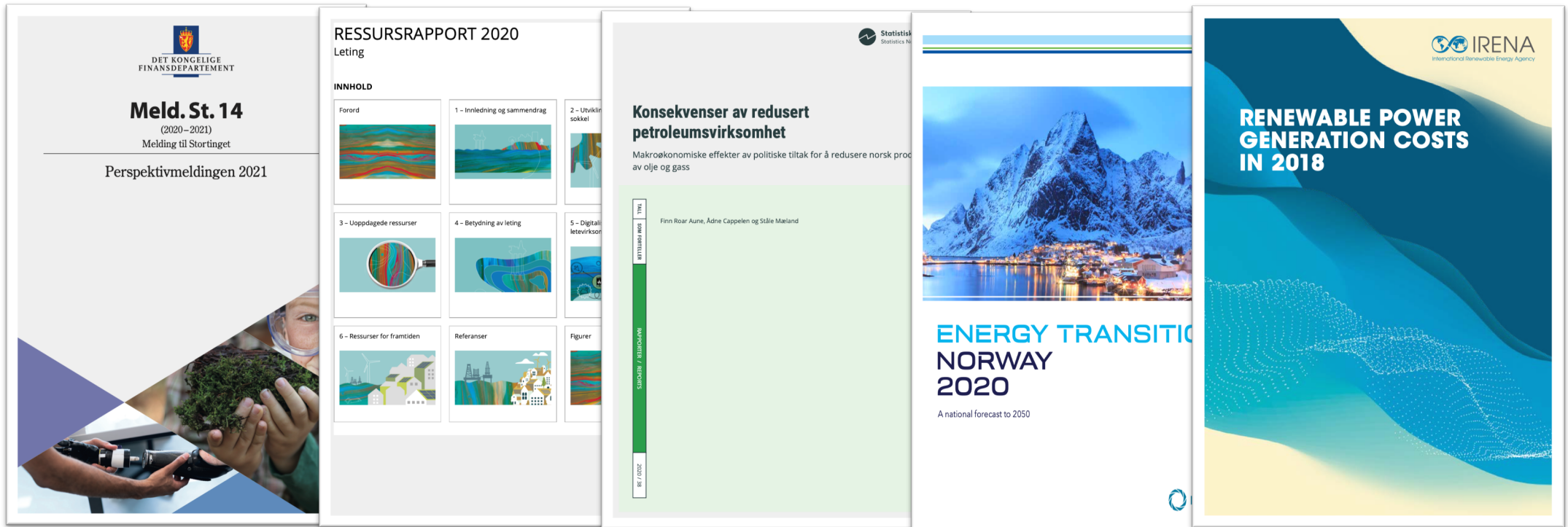
In a long-term perspective,  
what are the smart pathways that Norwegian  
policymakers can choose in the 2020s,  
to ensure and monitor investments in the  
successful transition of the country's offshore  
energy sector  
to a low-carbon economy before 2050?

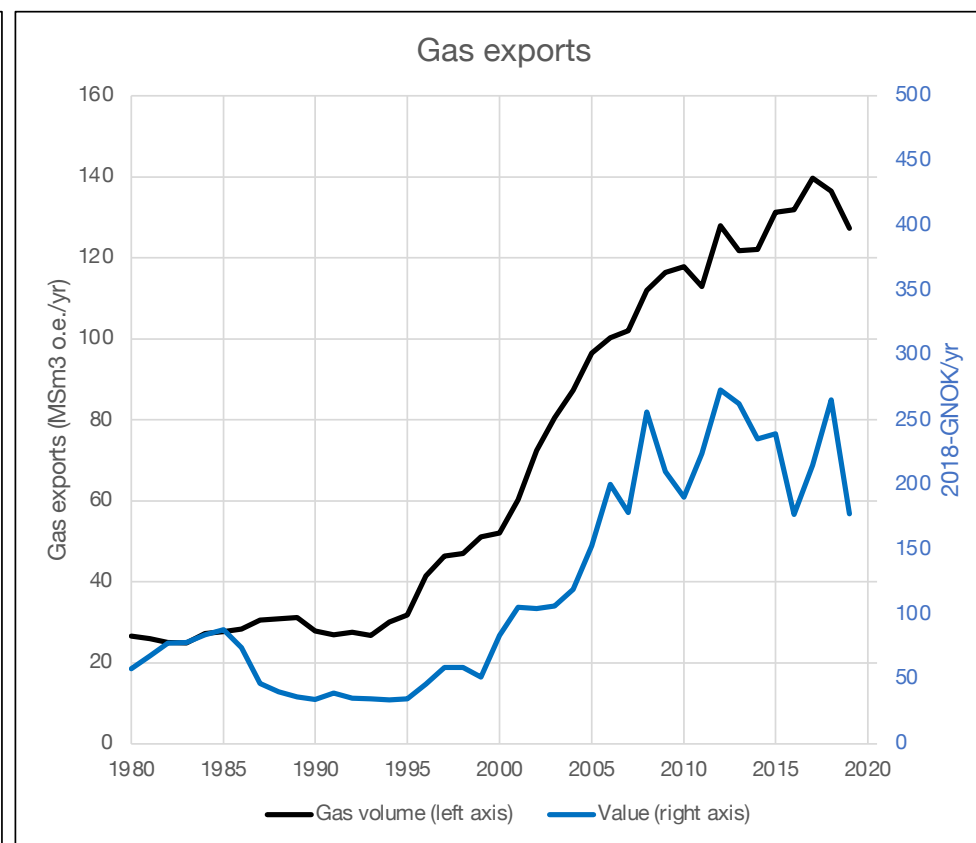
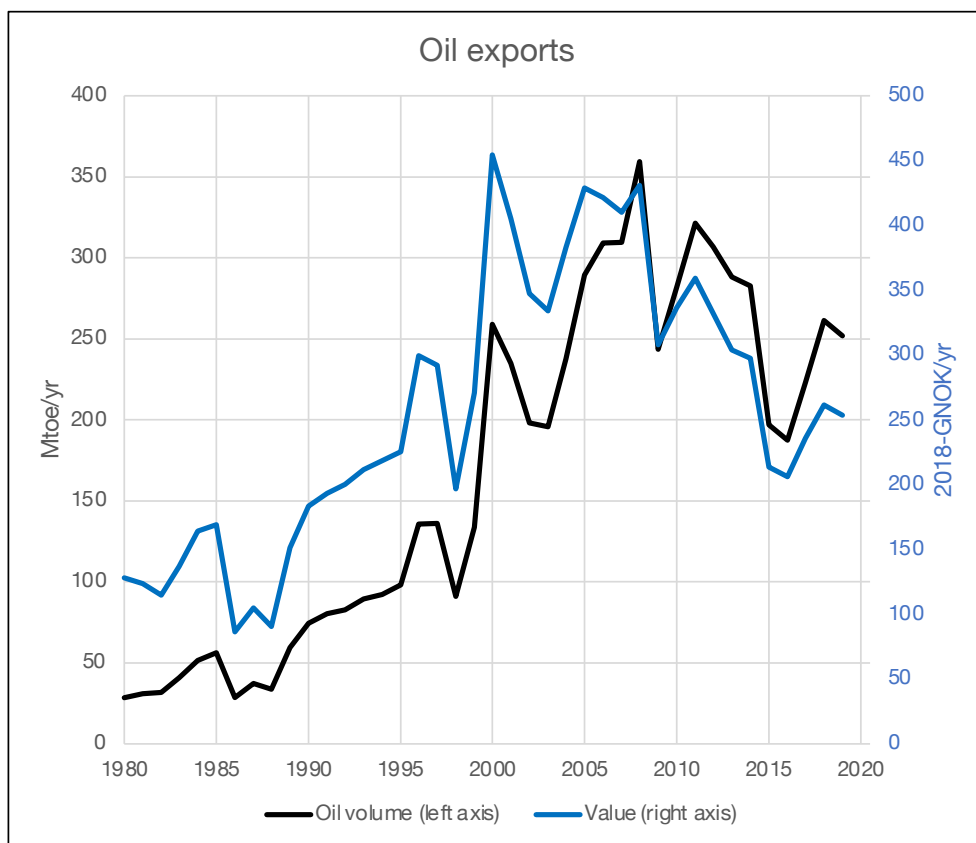


# Datakilder og prognoser

Historiske datakilder: SSB Statistikkbanken, BP Statistical Review, Oljedirektoratet, Norsk Petroleum, IRENA etc

Prognose-kilder:

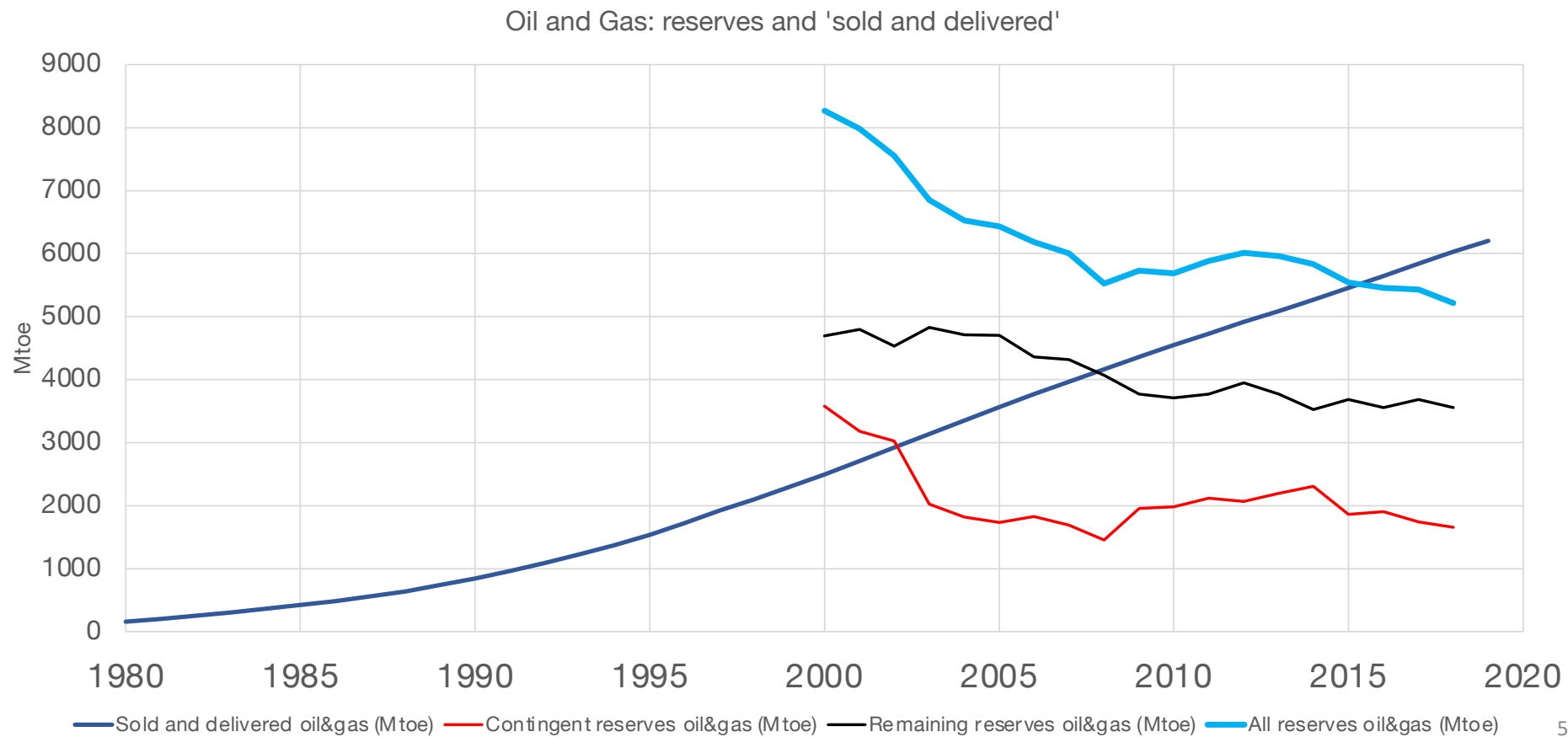




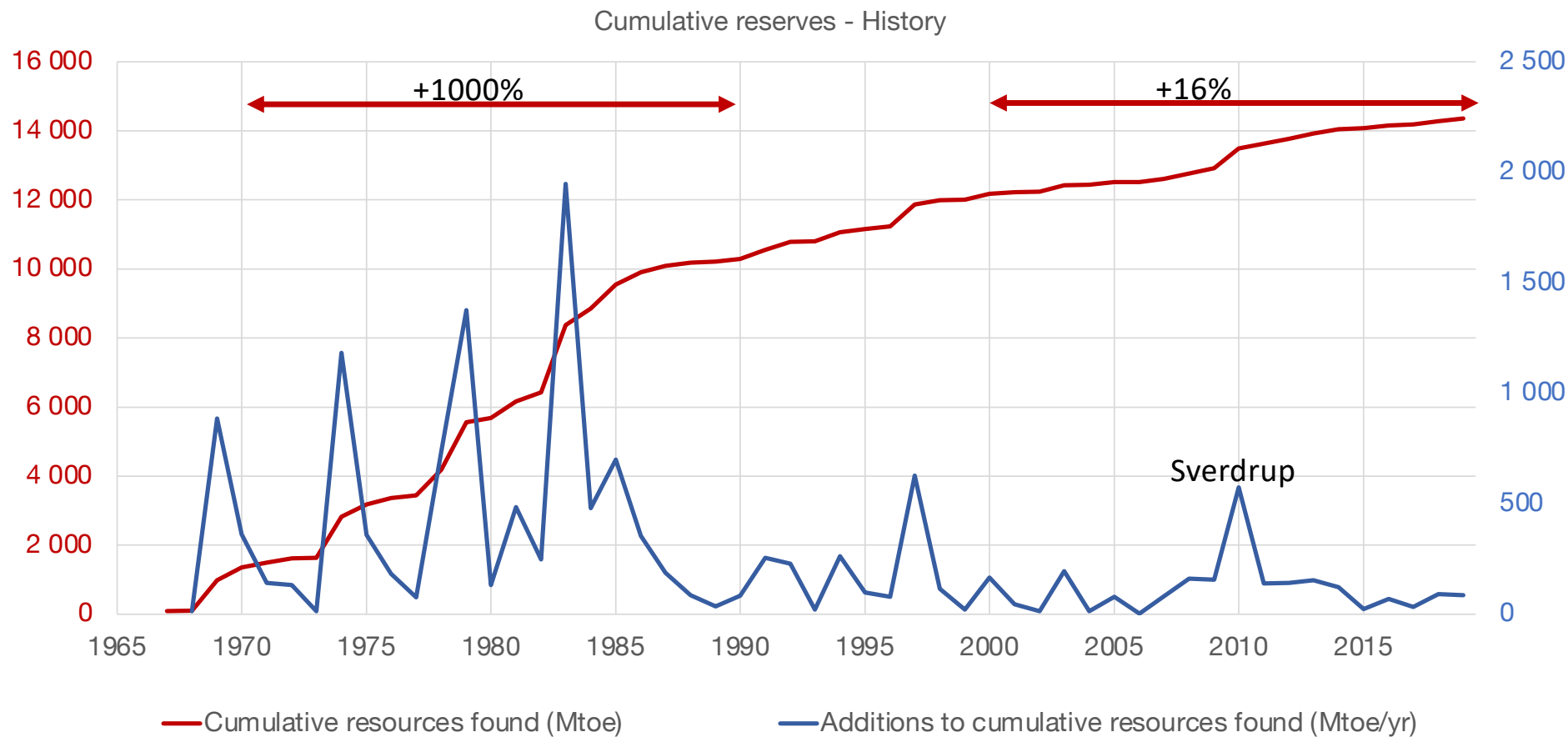
# Historikk 1980-2020 – fra Olje til Gass

\* 2018-GNOK = milliarder norske kroner i faste 2018-priser

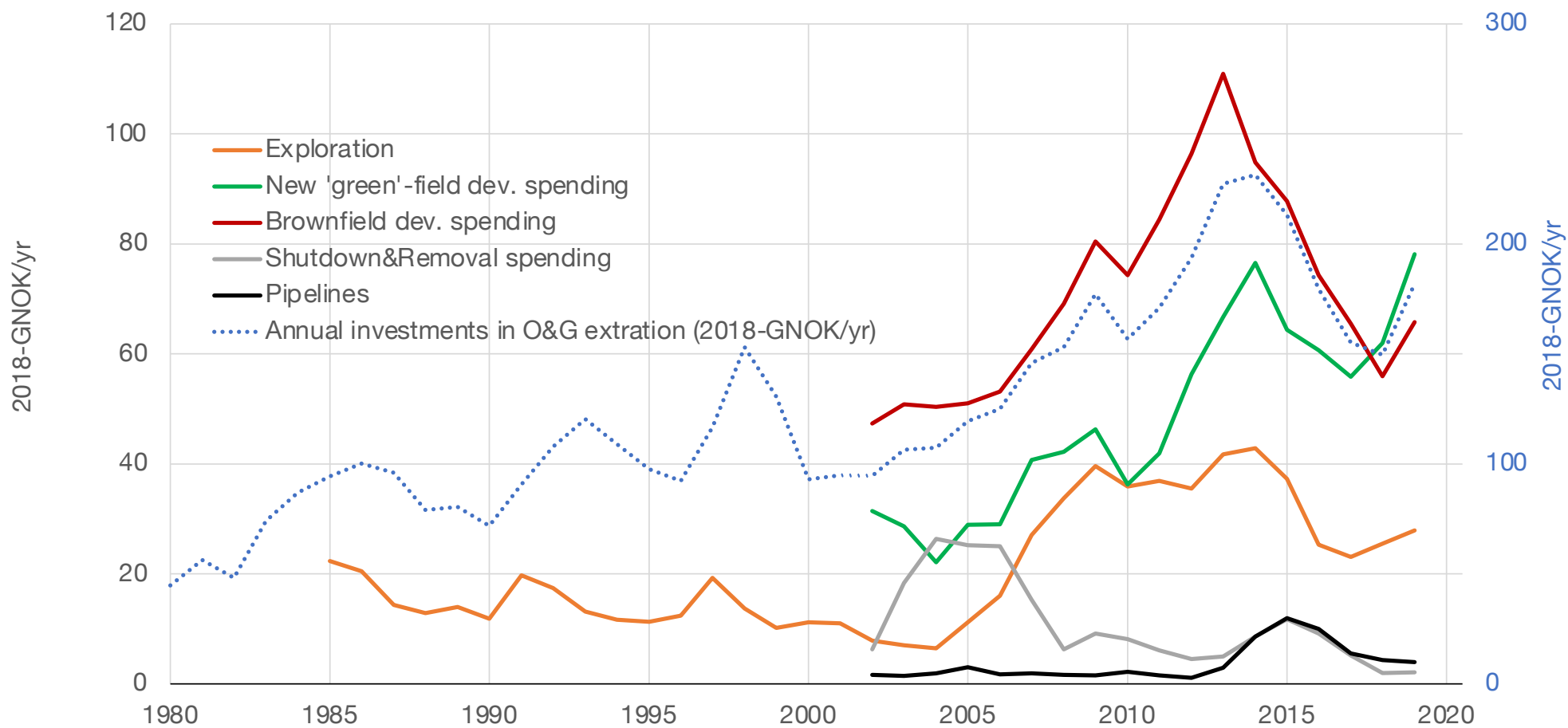
# Siden 2000 synkende reserver over tid: "moden sokkel"



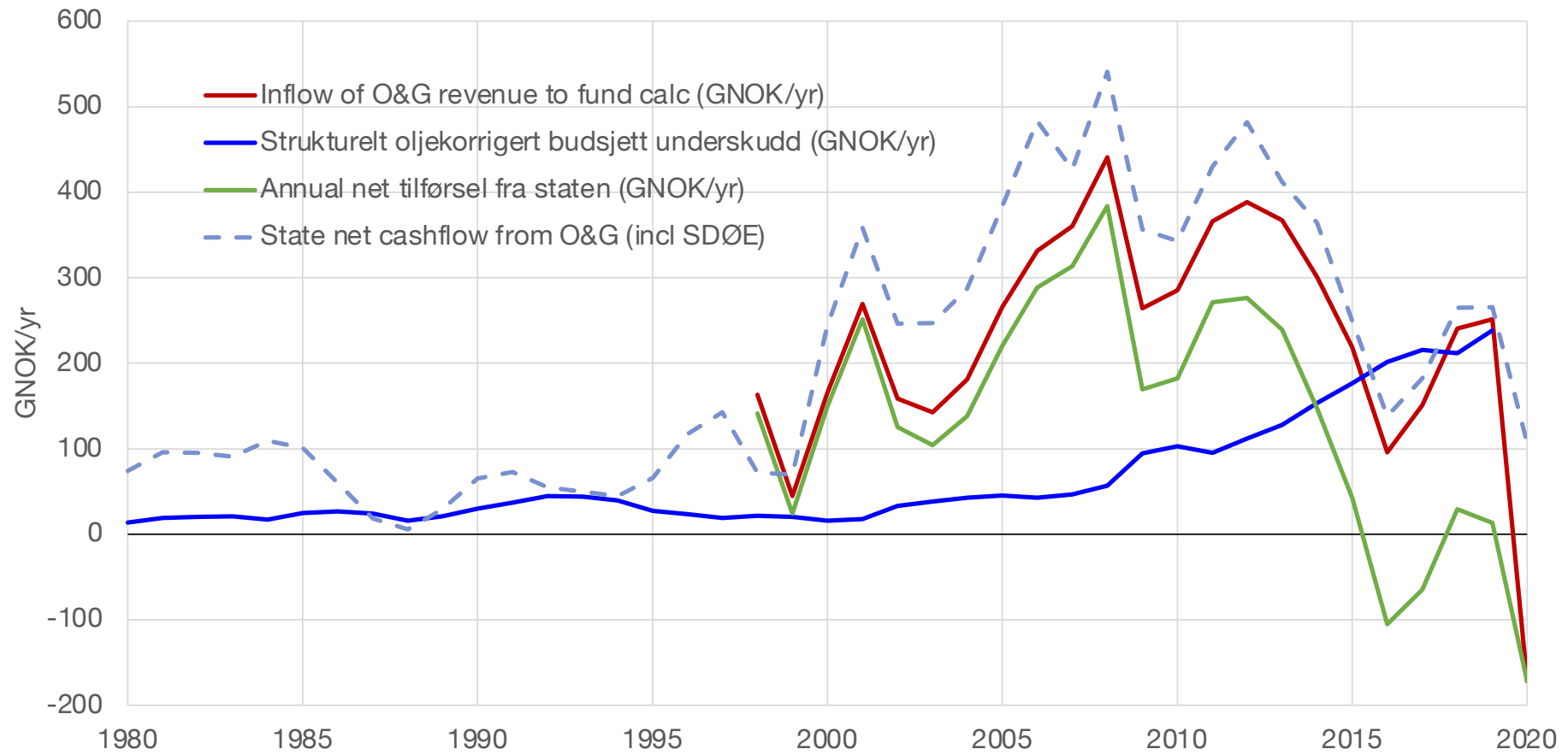
# Siden 2000 færre funn: "moden sokkel"



# Typer av Olje&gass investeringer

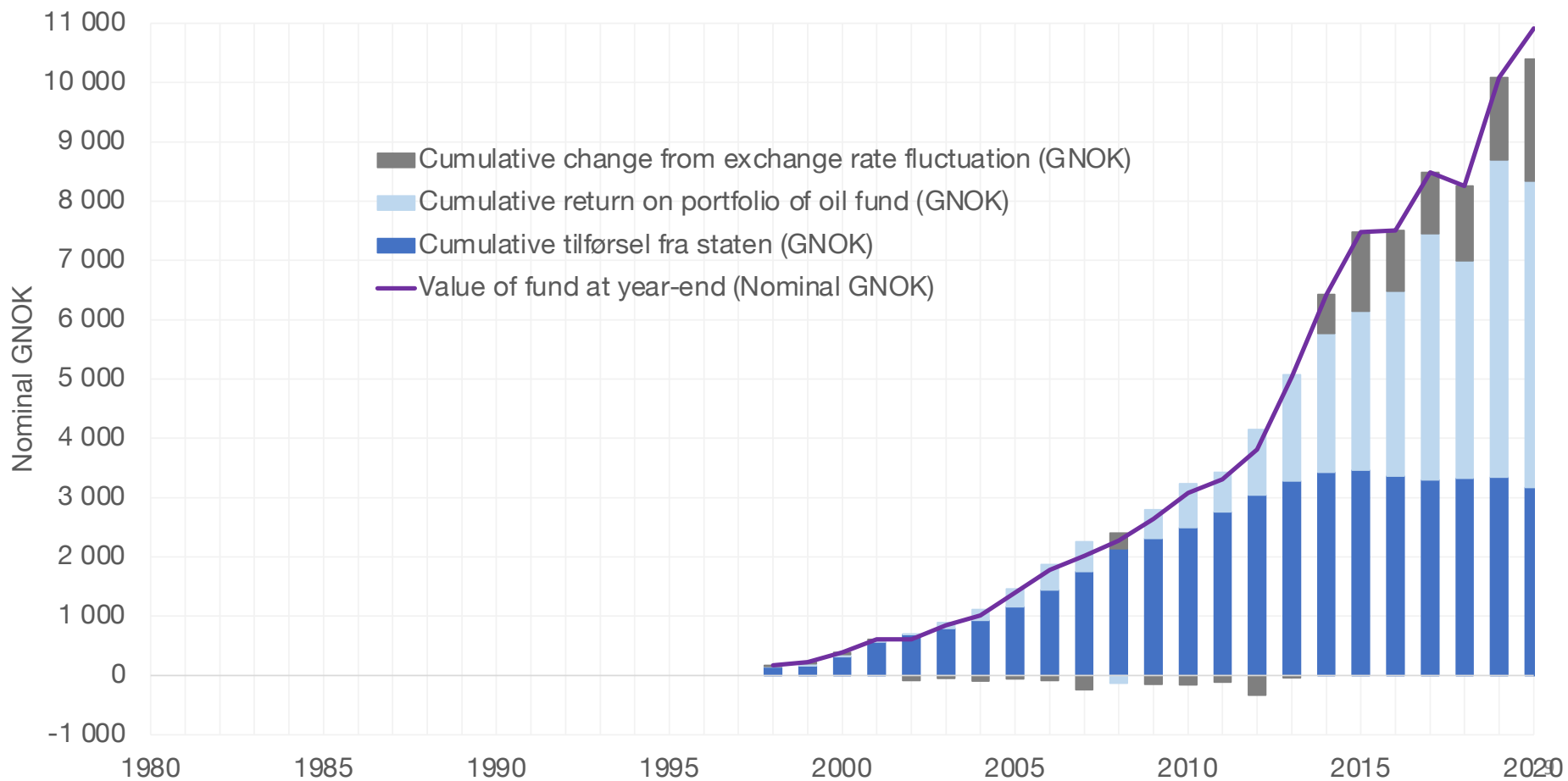


# Statens netto kontantstrøm og Oljefondet





# Oljefondets fenomenale vekst... skyldes *ikke* O&G siden 2014

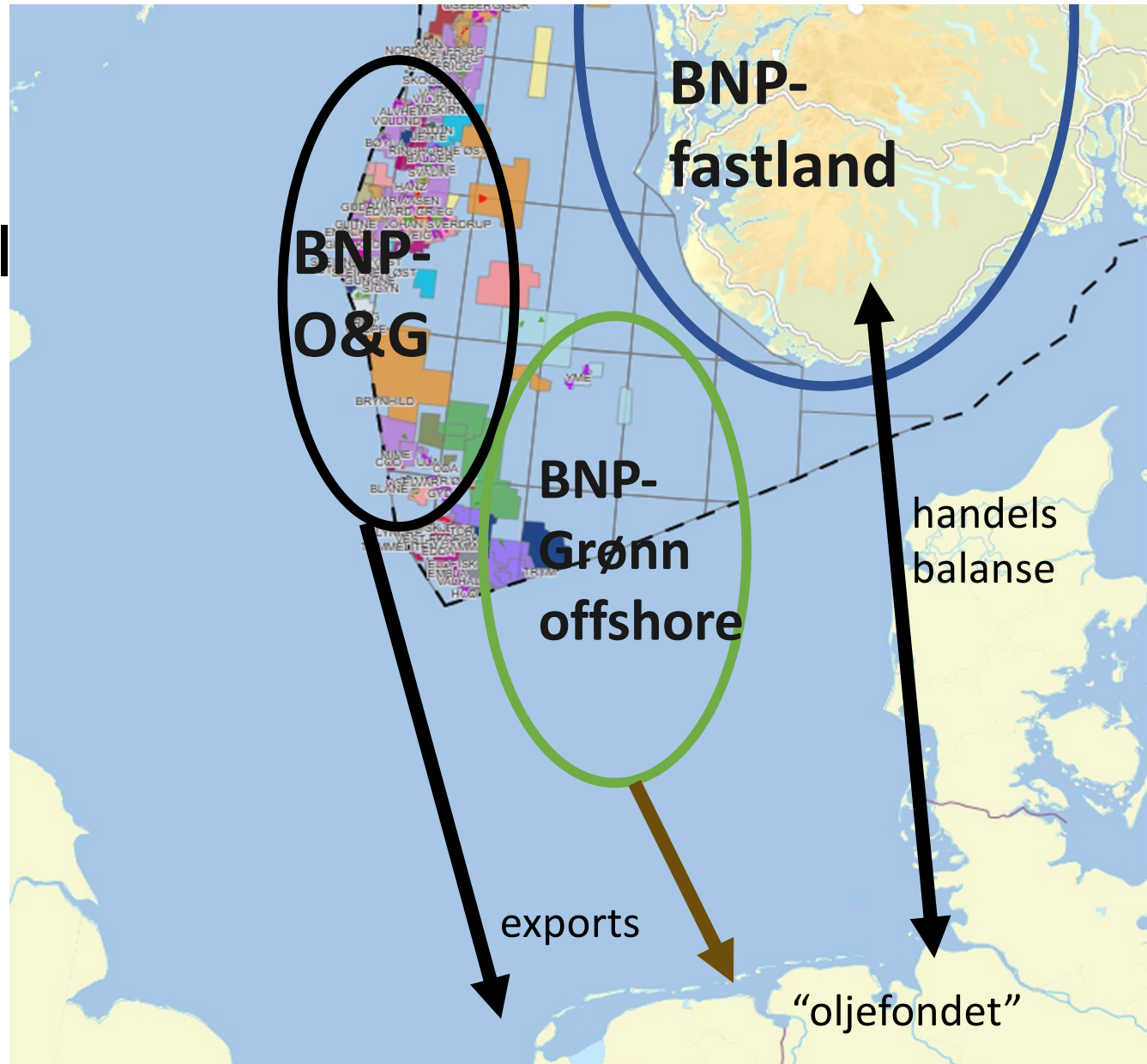


Hva nå?

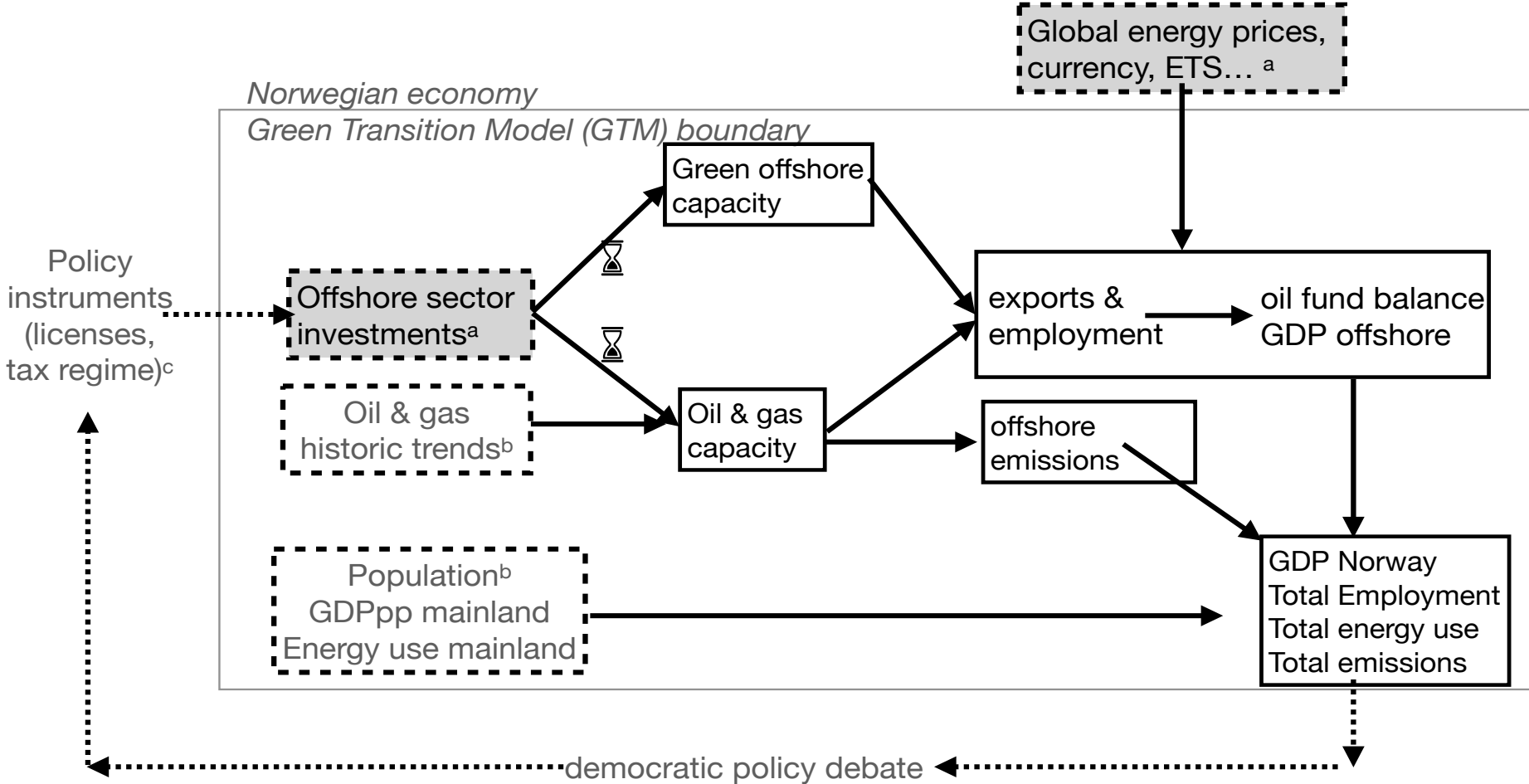
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# Green Transition Model «GTM»

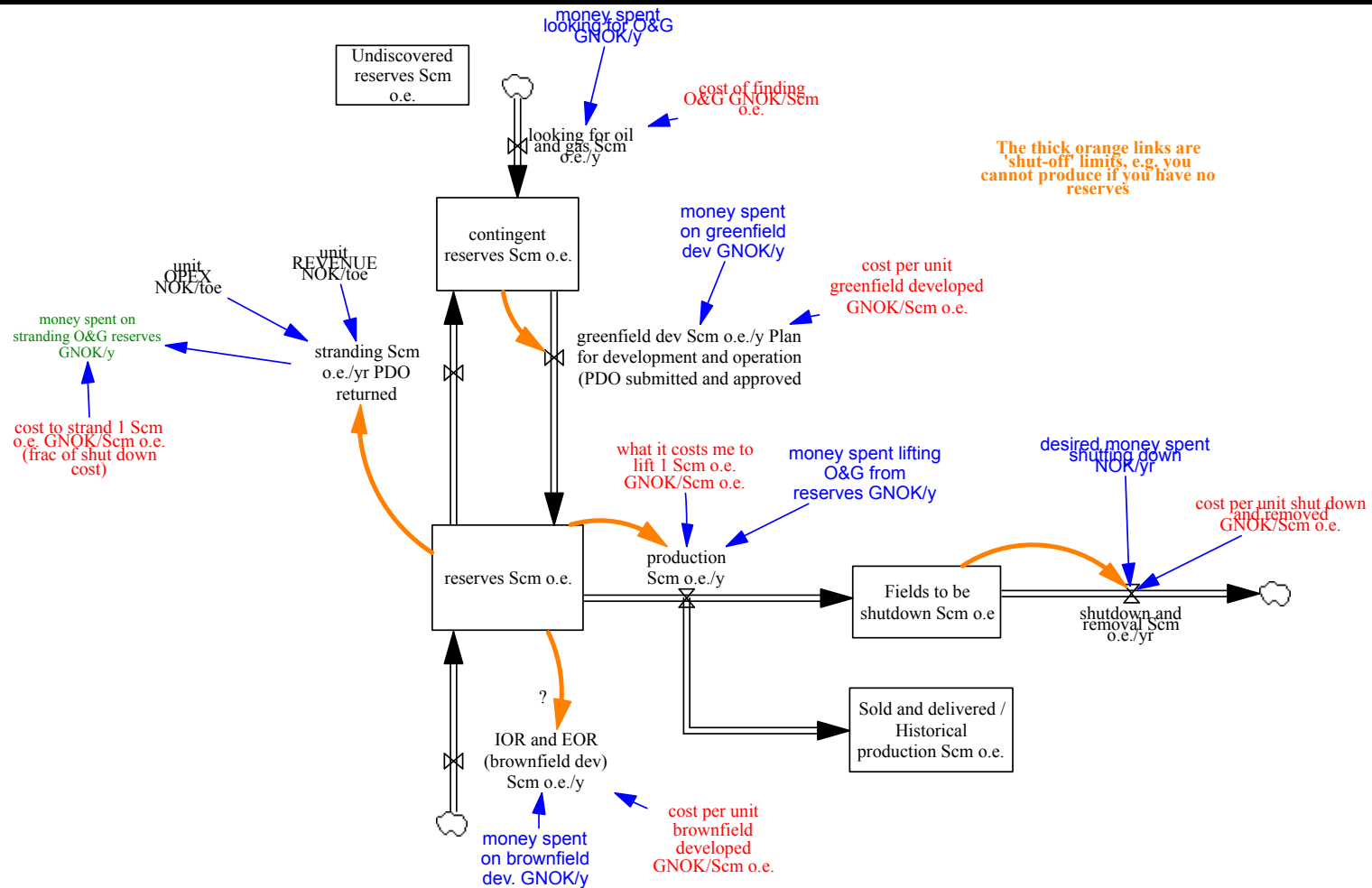
Vi har laget en ny modell med 3 sektorer, i forskingsprosjektet “SmartPaths” med BI og SSB 2020-2021



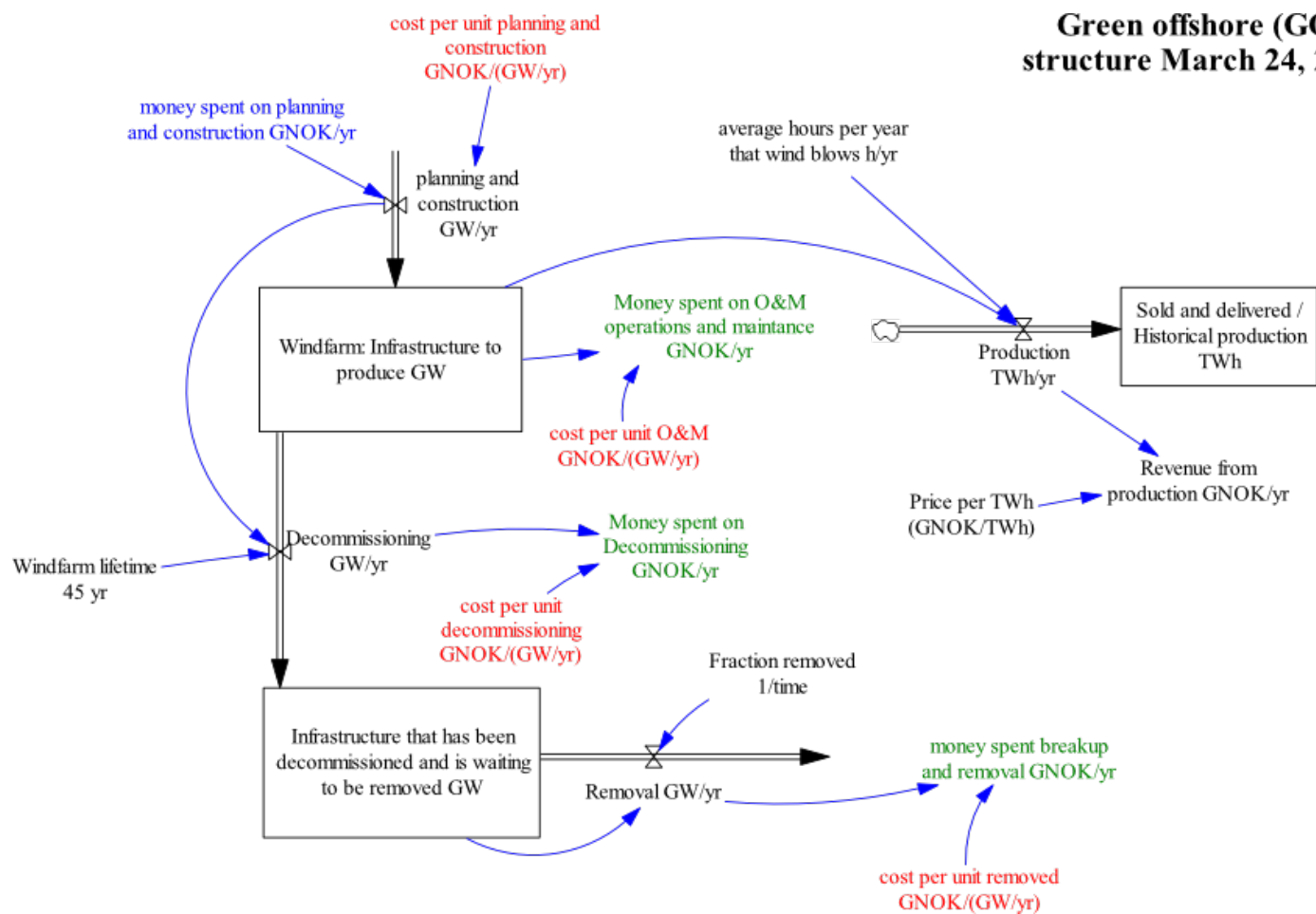
# BI / SSB's nye modell: GTM



# GTM-struktur for olje & gass-sektor (stock&flow model)



# GTM-struktur for grønn offshore sektor (stock&flow model)



# 3 scenarier til 2050 (og 2070)



*Business As Usual (BAU)*=  
den offisielle fremtiden

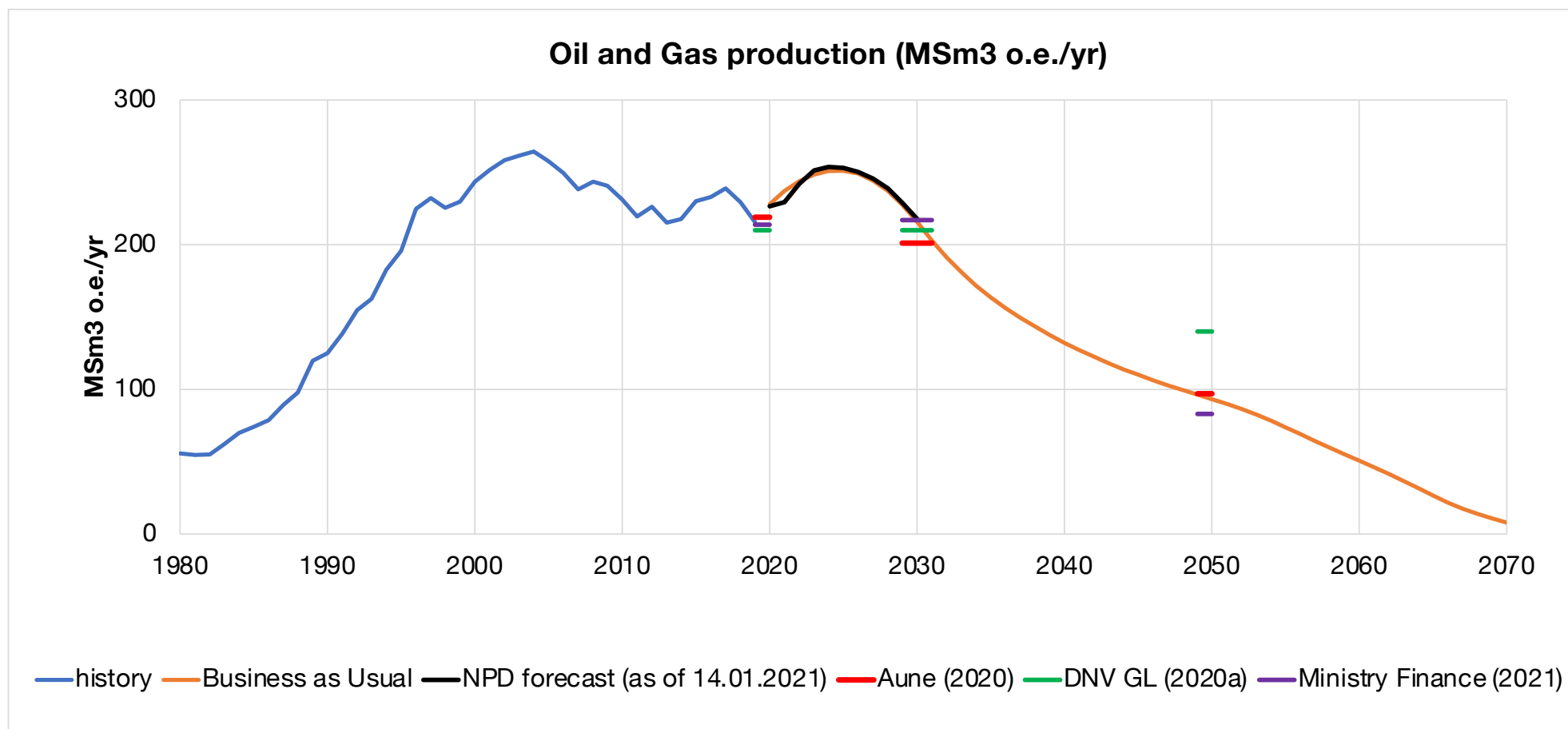


*Harvest & Exit* = Vi høster fra  
eksisterende felt (lite nytt)



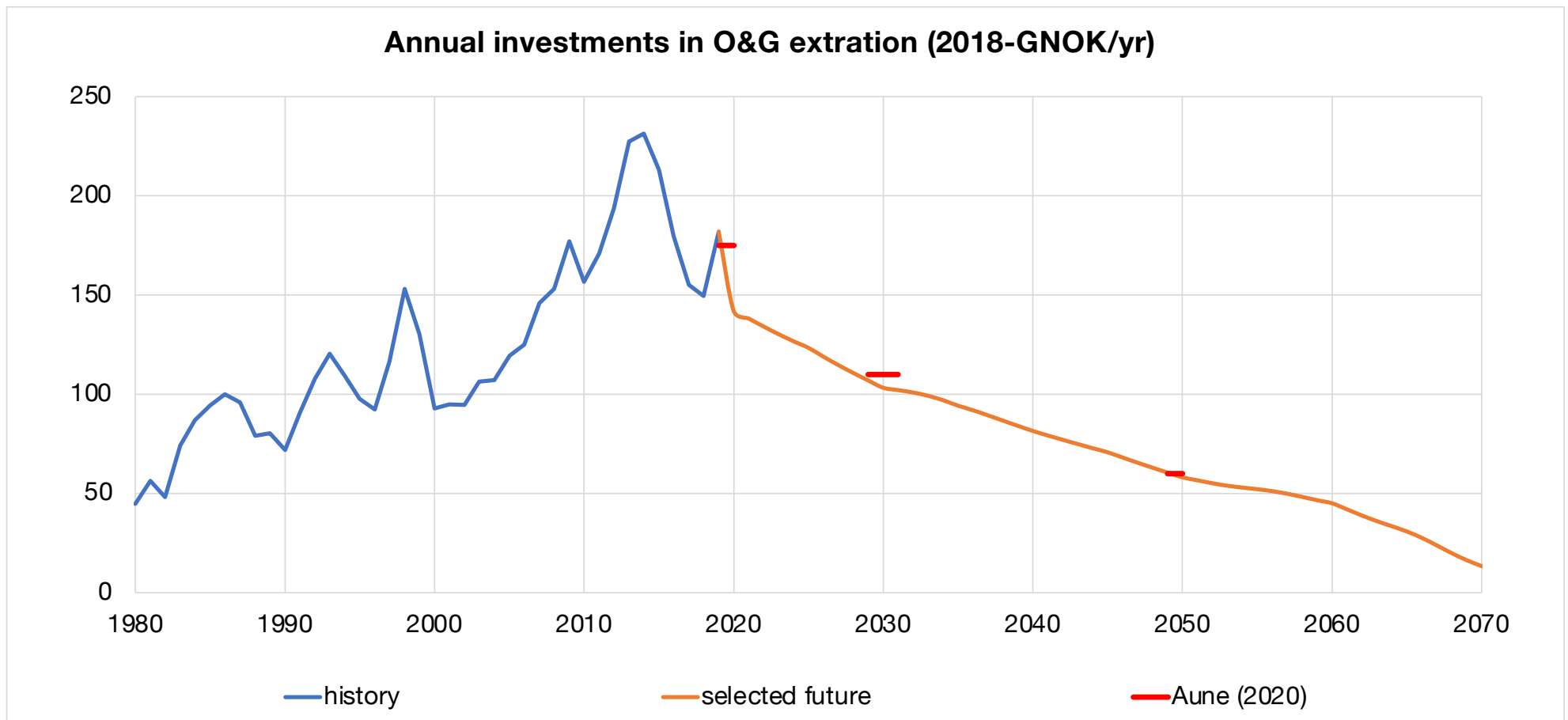
*Rebuilding* = Vi både høster og  
bygger gradvis ny  
grønn offshore sektor (fornybar  
havvind, hydrogen)

# Business-as-usual - produksjon

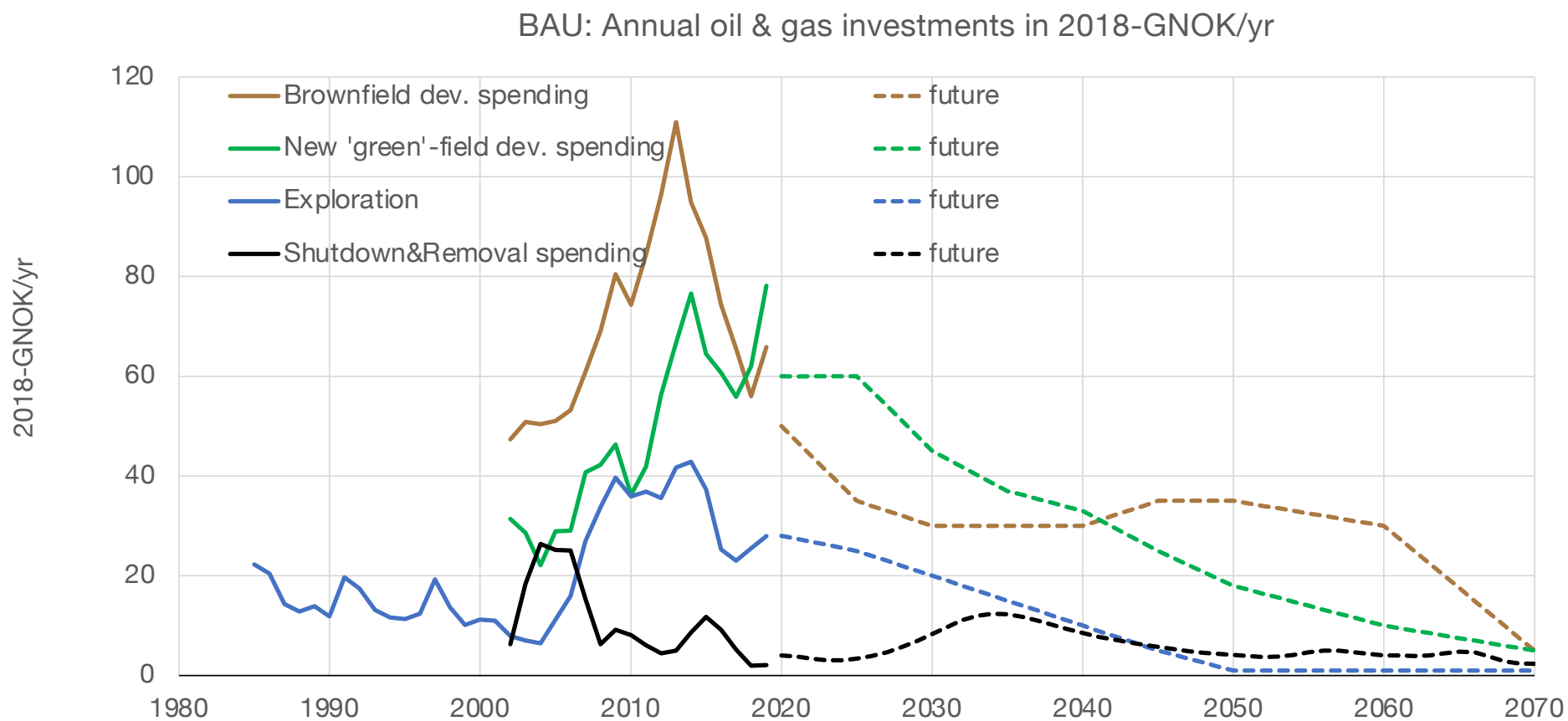




# Business-as-usual: O&G investeringer

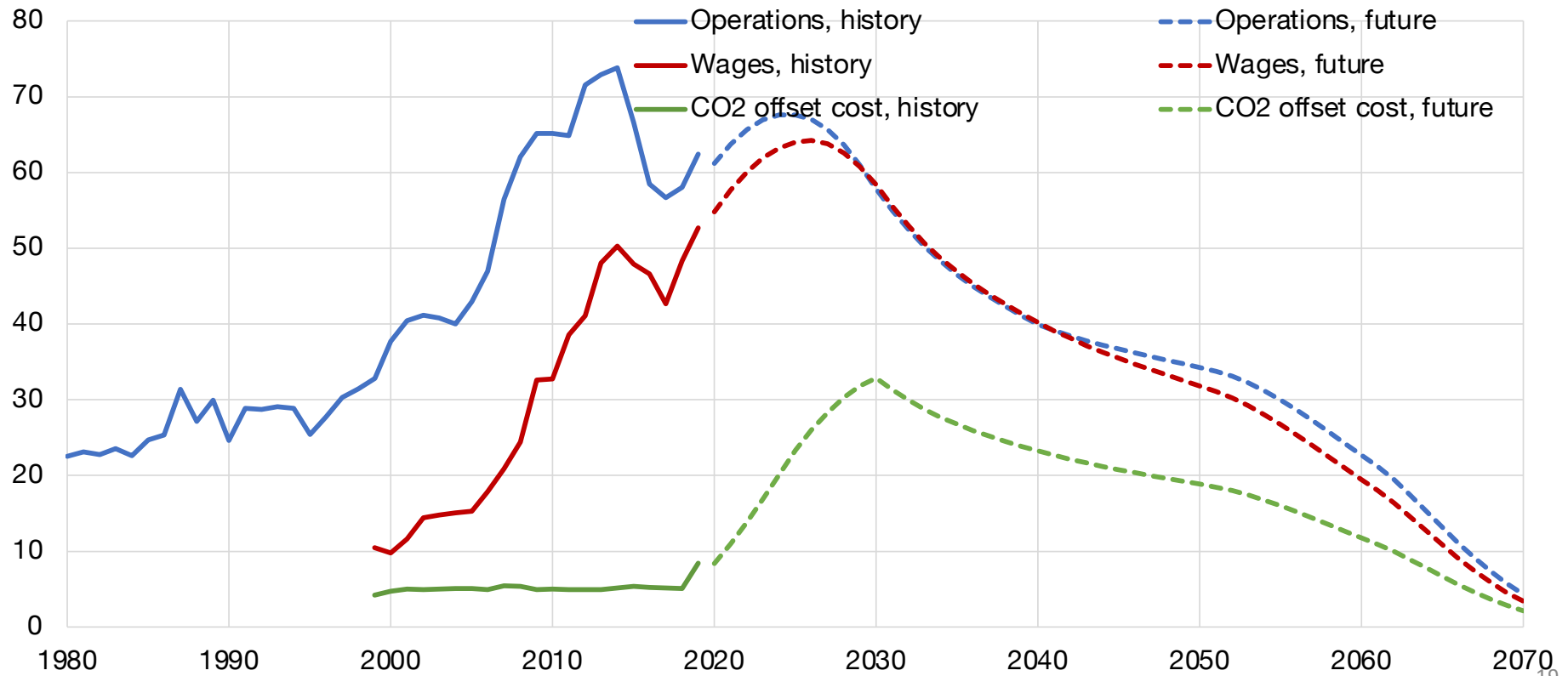


# Business-as-usual: O&G detaljerte investeringer



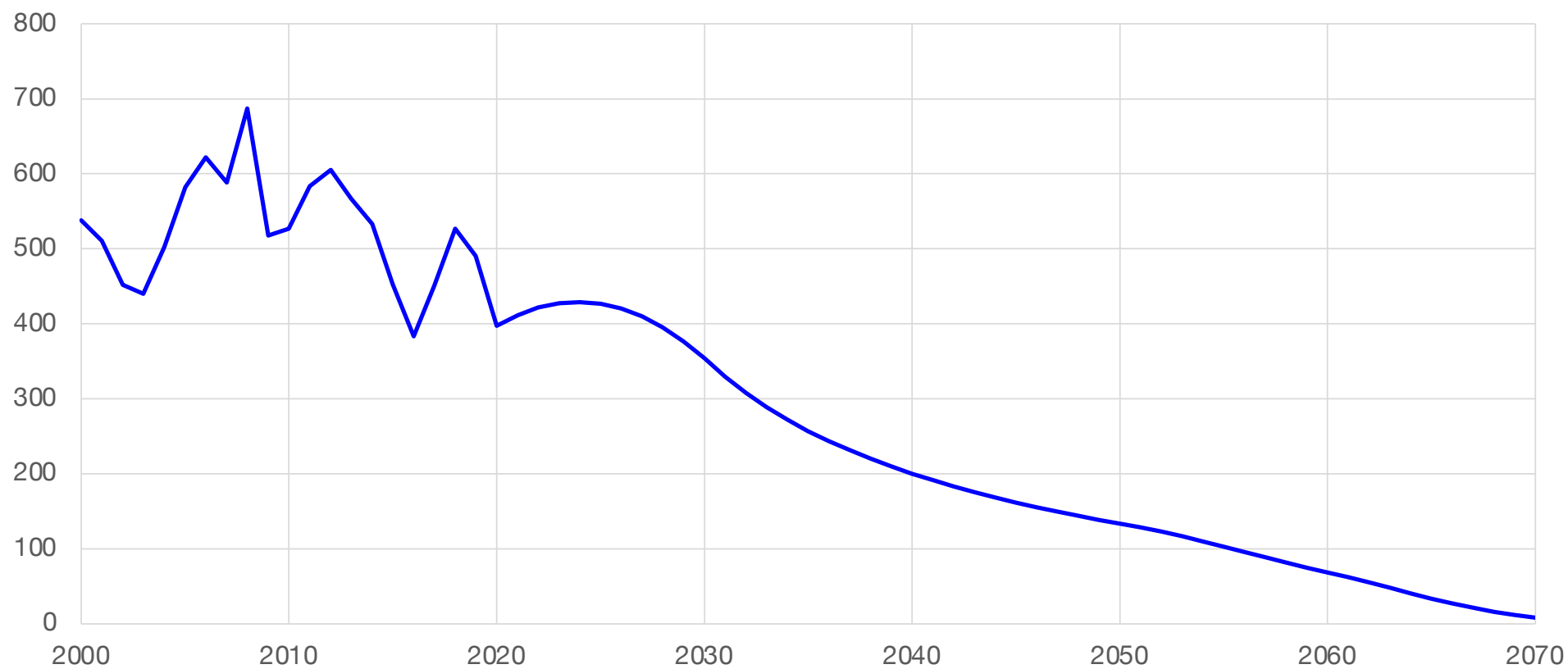
# OPEX breakdown Nominal - BAU

OPEX - Nominal GNOK/yr



# Business-as-usual: Eksport i mrd kroner faste 2018-priser

Offshore energy exports (2018-GNOK/yr)



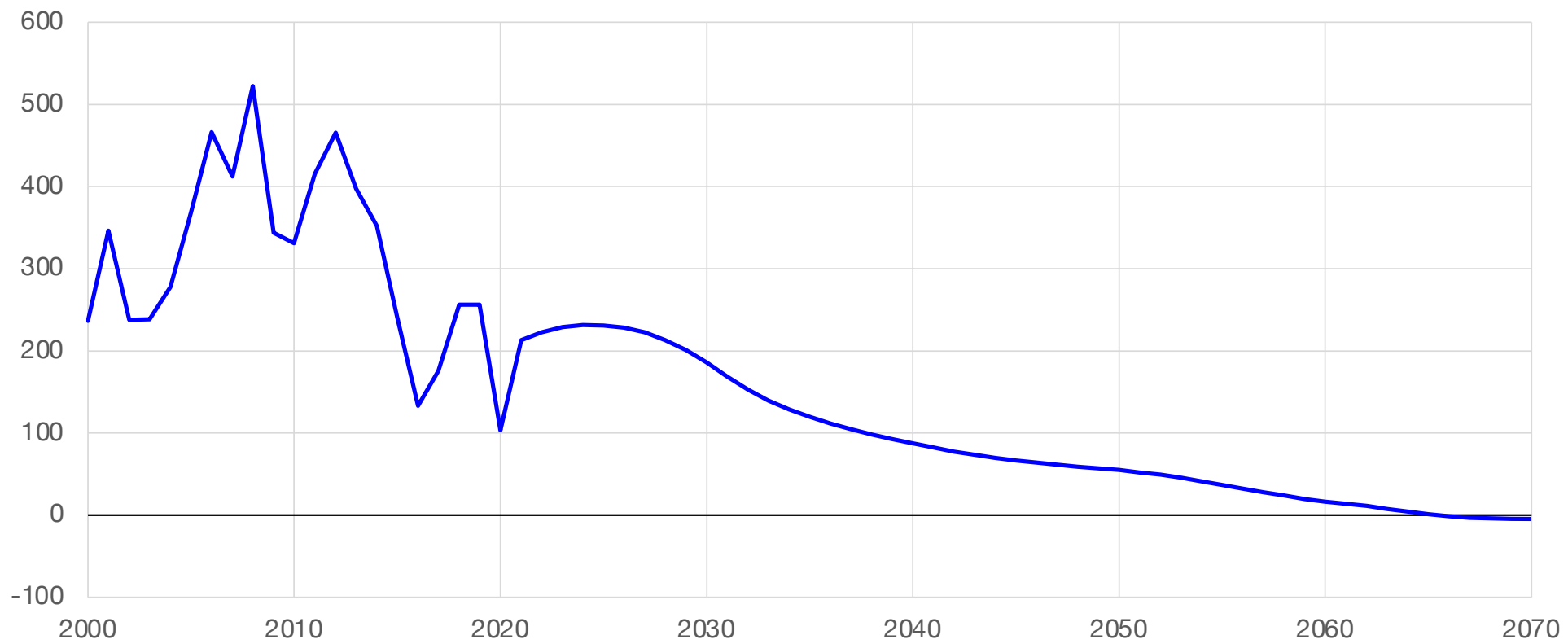
# Forutsetninger

...

		Scenarios 2020 – 2070		
	Descr/ unit	1) BAU	2) Harvest	3)Rebuilding
<b>Mainland GDPpp growth rate</b>	percent per yr	1.3%		
<b>Petroleum investments</b>	GNOK in 2030	103		
(150 2018-GNOK in 2019)	GNOK in 2040	81		
	GNOK in 2050	58		
<b>Green energy investments</b>	GNOK in 2030	-		
(0 in 2019)	GNOK in 2040	-		
	GNOK in 2050	-		
<i>Common for all scenarios:</i>				
<b>Population alternative</b>	hi / main / low	main		
<b>Oil price</b>	<b>USD/brl</b>	<b>50</b>		
<b>Gas price</b>	<b>NOK/Sm3</b>	<b>1.75</b>		
<b>Export power price (PPA)</b>	average NOK/kWh			
<b>EU ETS Carbon allowances</b>	EUR/tCO <sub>2</sub> , growing +2%/yr	50		
<b>Norwegian CO<sub>2</sub> tax</b>	NOK/tCO <sub>2</sub> from 2030	2000		
<b>Oil fund return on assets</b>	average annual real return	3%		

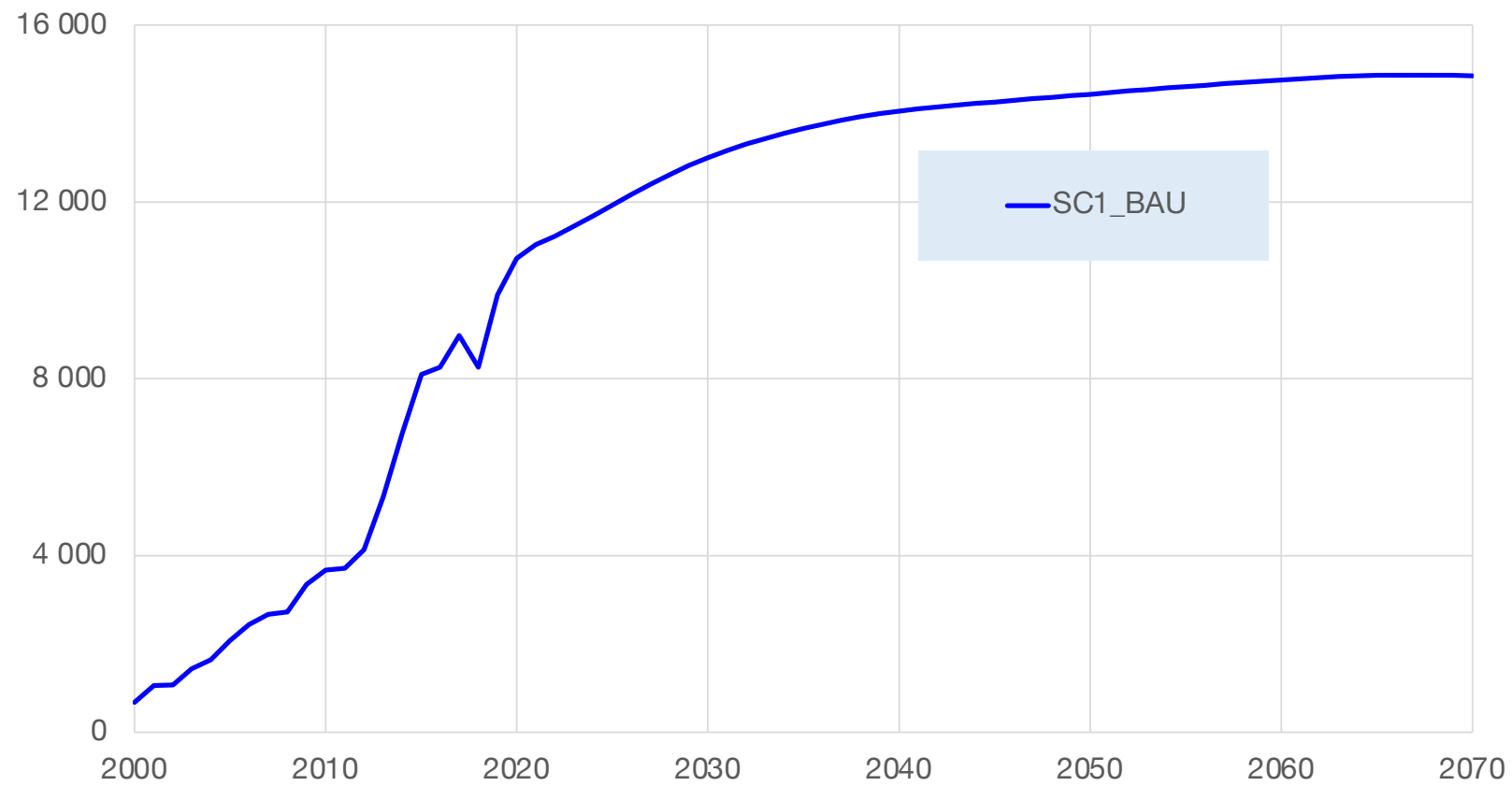
# Business-as-usual: Statens netto kontantstrøm fra offshore

(2018-GNOK/yr)

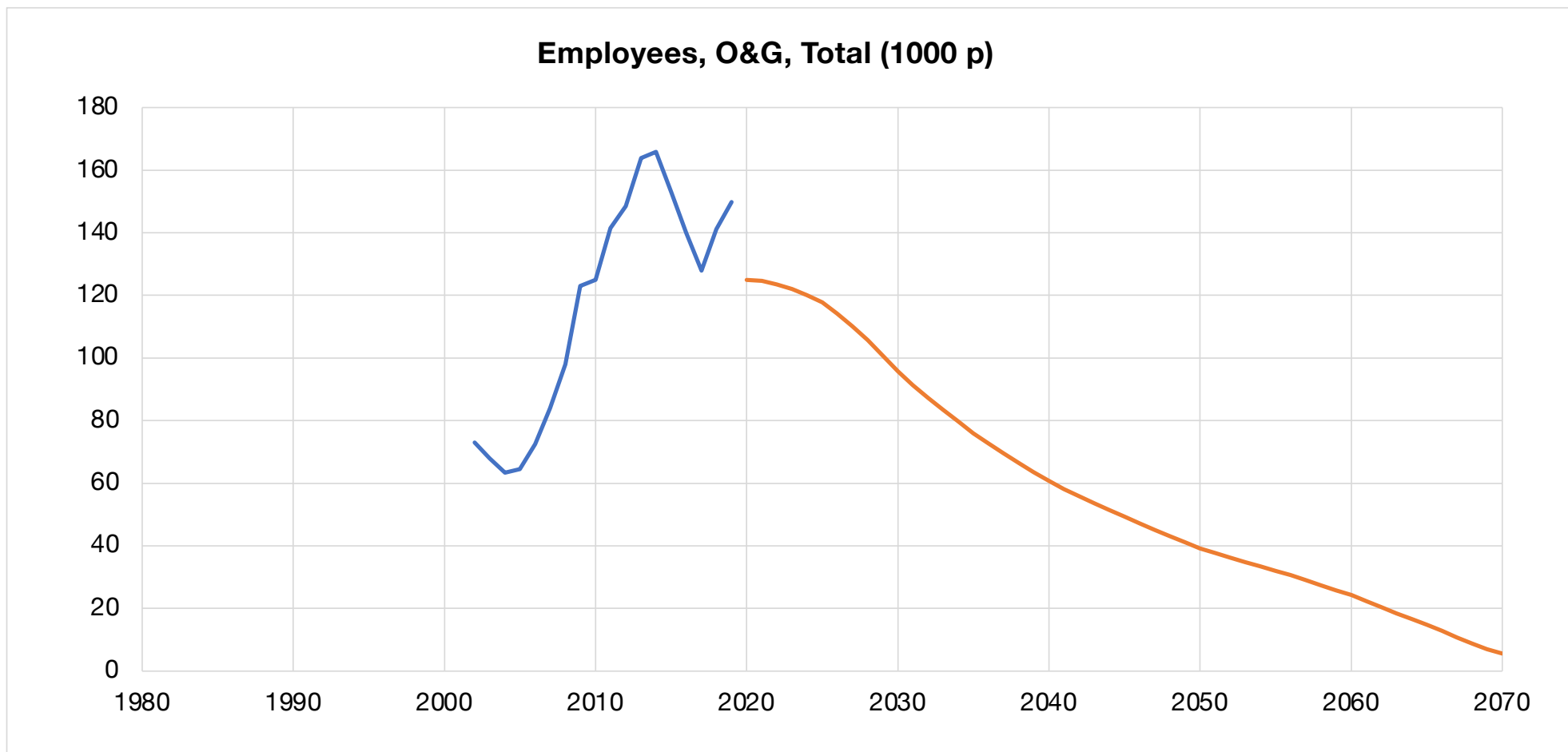


# Oljefondet i BAU

2018-GNOK



# Business-as-usual: sysselsetting (direkte + indirekte)





# 3 scenarier til 2050 (og 2070)



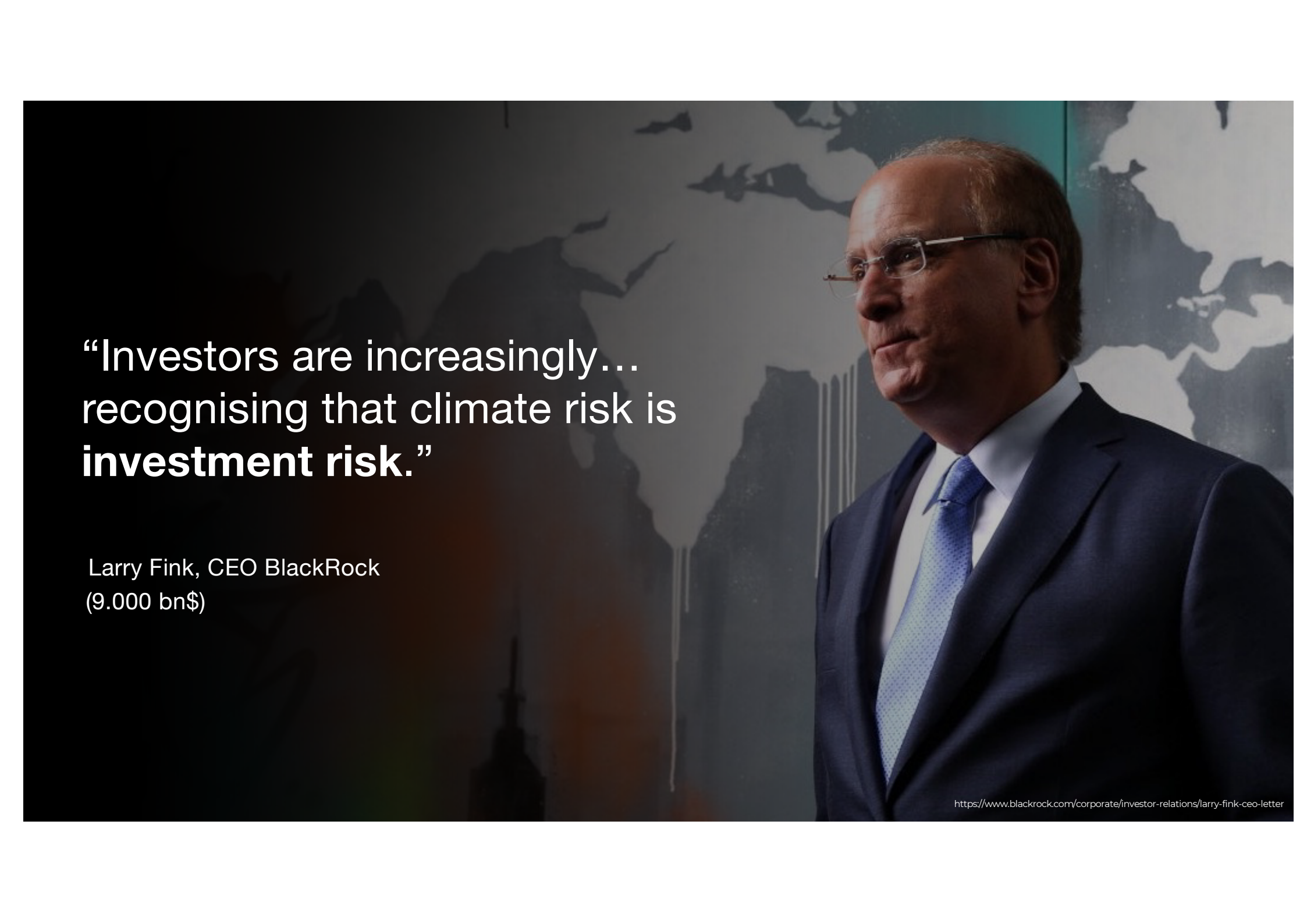
*Business As Usual* = den offisielle fremtiden



*Harvest & Exit* = Vi høster fra eksisterende felt (lite nytt)



*Rebuilding* = Vi både høster og bygger gradvis ny grønn offshore sektor (fornybar havvind, hydrogen)

A professional photograph of Larry Fink, CEO of BlackRock. He is shown from the chest up, wearing a dark blue suit, a light blue shirt, and a blue patterned tie. He has short, thinning hair and is wearing glasses. He is looking slightly to his left with a neutral expression. The background is a dark, stylized world map with a teal accent on the right side.

“Investors are increasingly...  
recognising that climate risk is  
**investment risk.**”

Larry Fink, CEO BlackRock  
(9.000 bn\$)

“Harvest”:  
reduserer  
O&G  
investeringer,  
høster max  
kortsiktig  
kontant-strøm

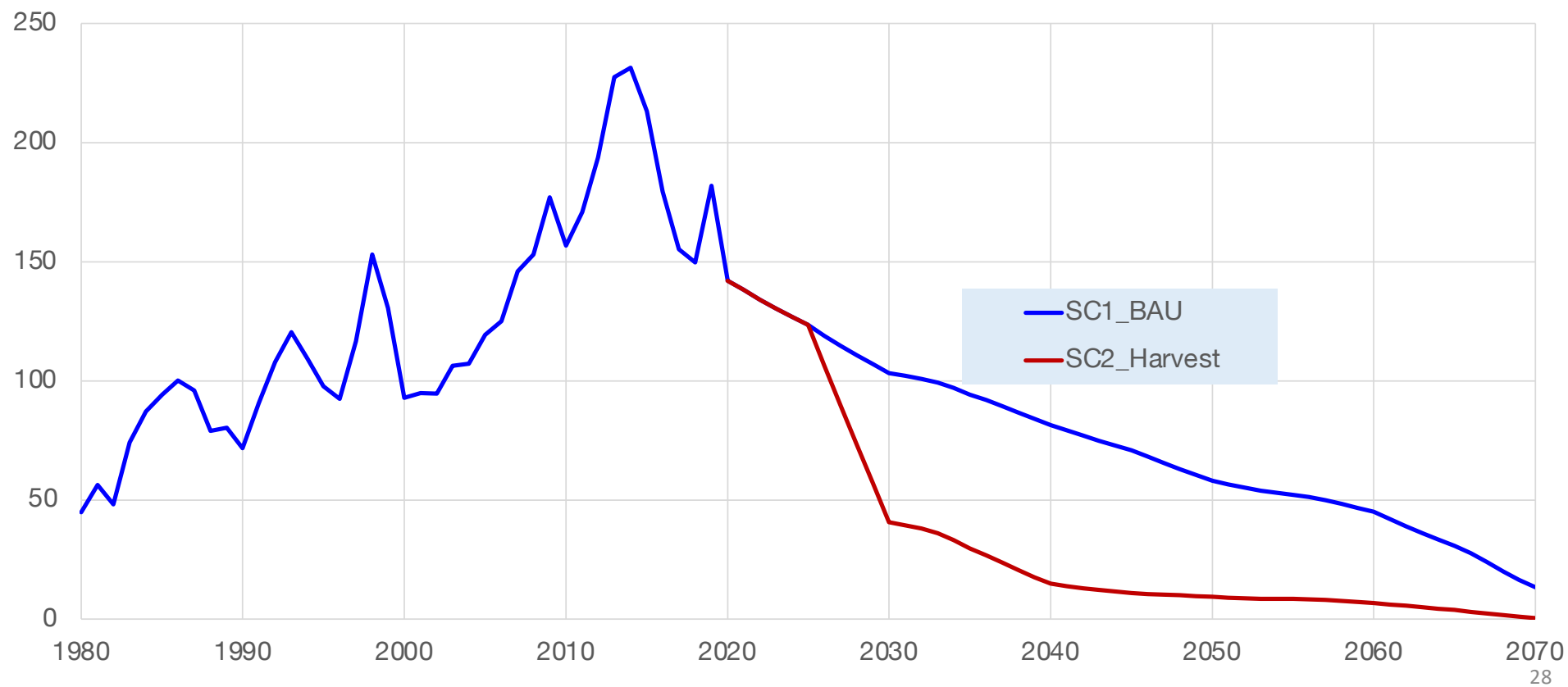
- Slutter med utdeling av nye letelisenser fra ca 2025
- Fjerner leterefusjons-ordningen, friinntekten og dagens særavskrivningsordning over 6 år.

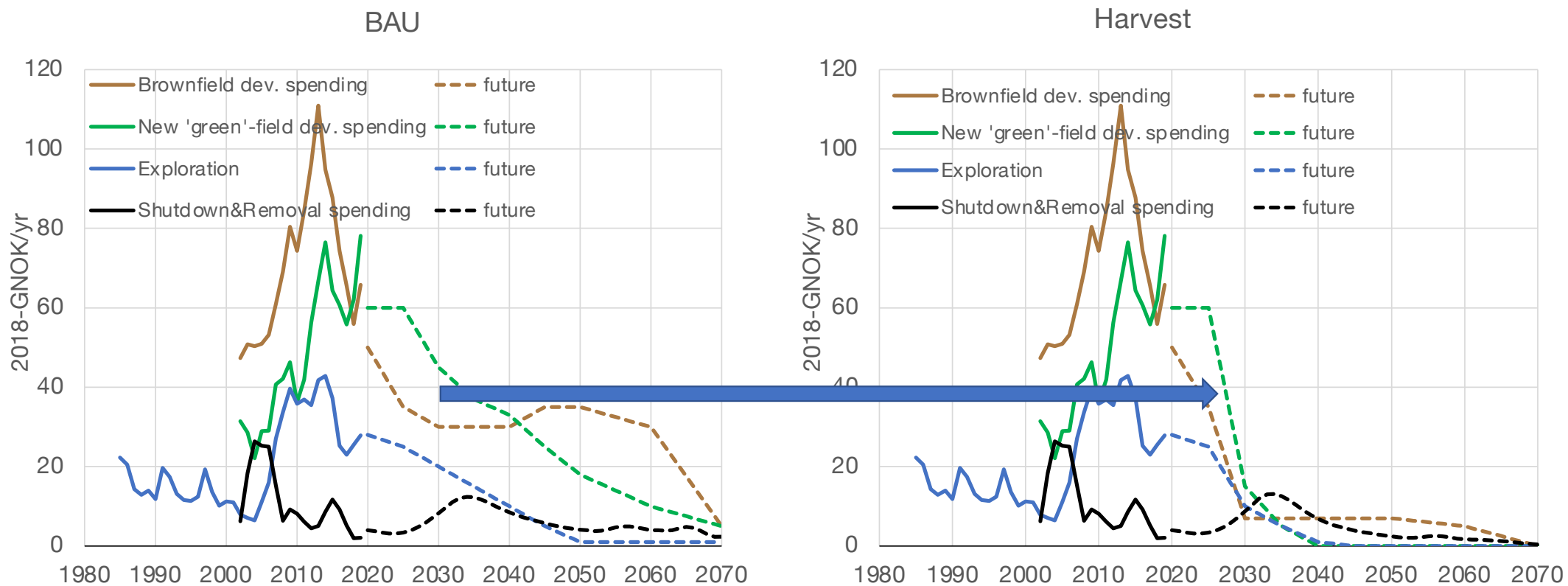


- O&G-investeringer faller da med *ca 14%* per år fra 2025
- Lønnsomheten til eksisterende operatører *øker* på kort sikt

# Samlede investeringer per år i BAU vs Høsting

Annual oil and gas and green offshore investments 1980-2070 (2018-GNOK)





# Detaljerte investeringer: BAU vs Høsting

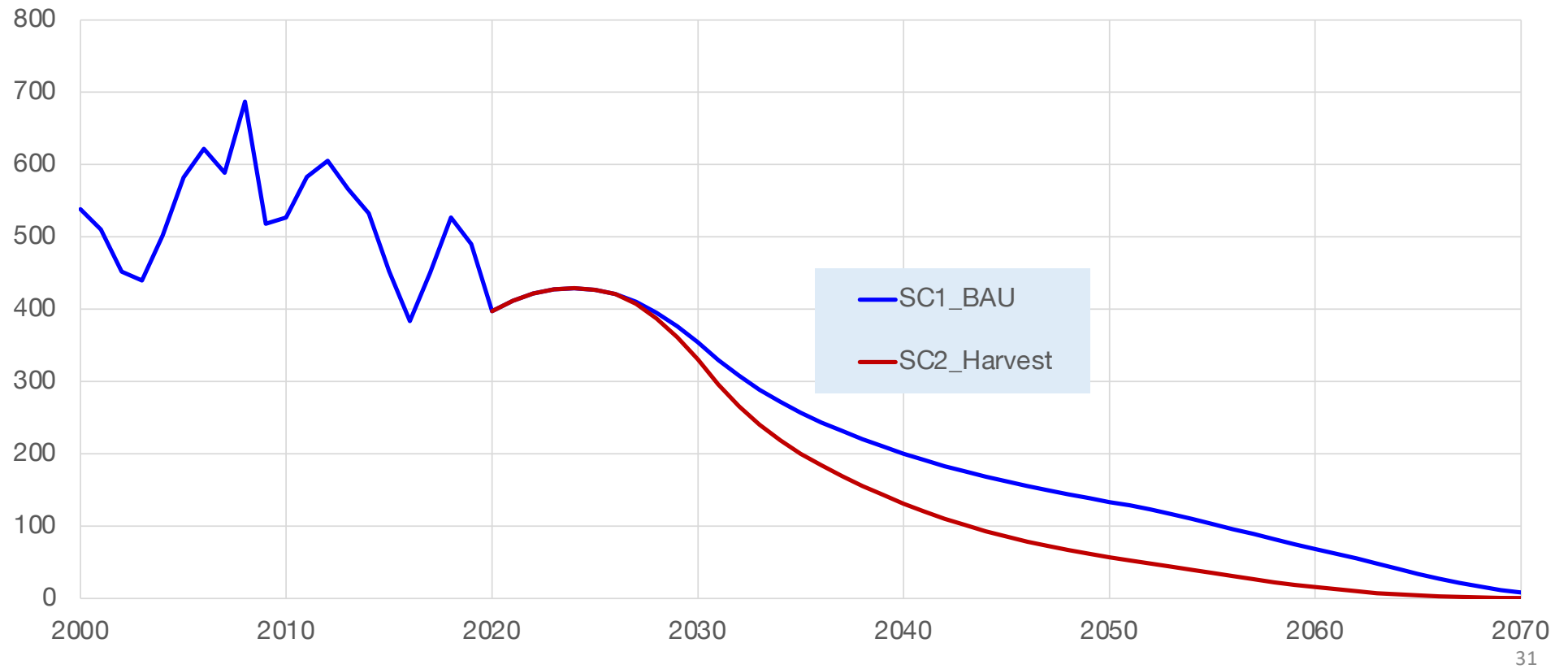
# Forutsetninger

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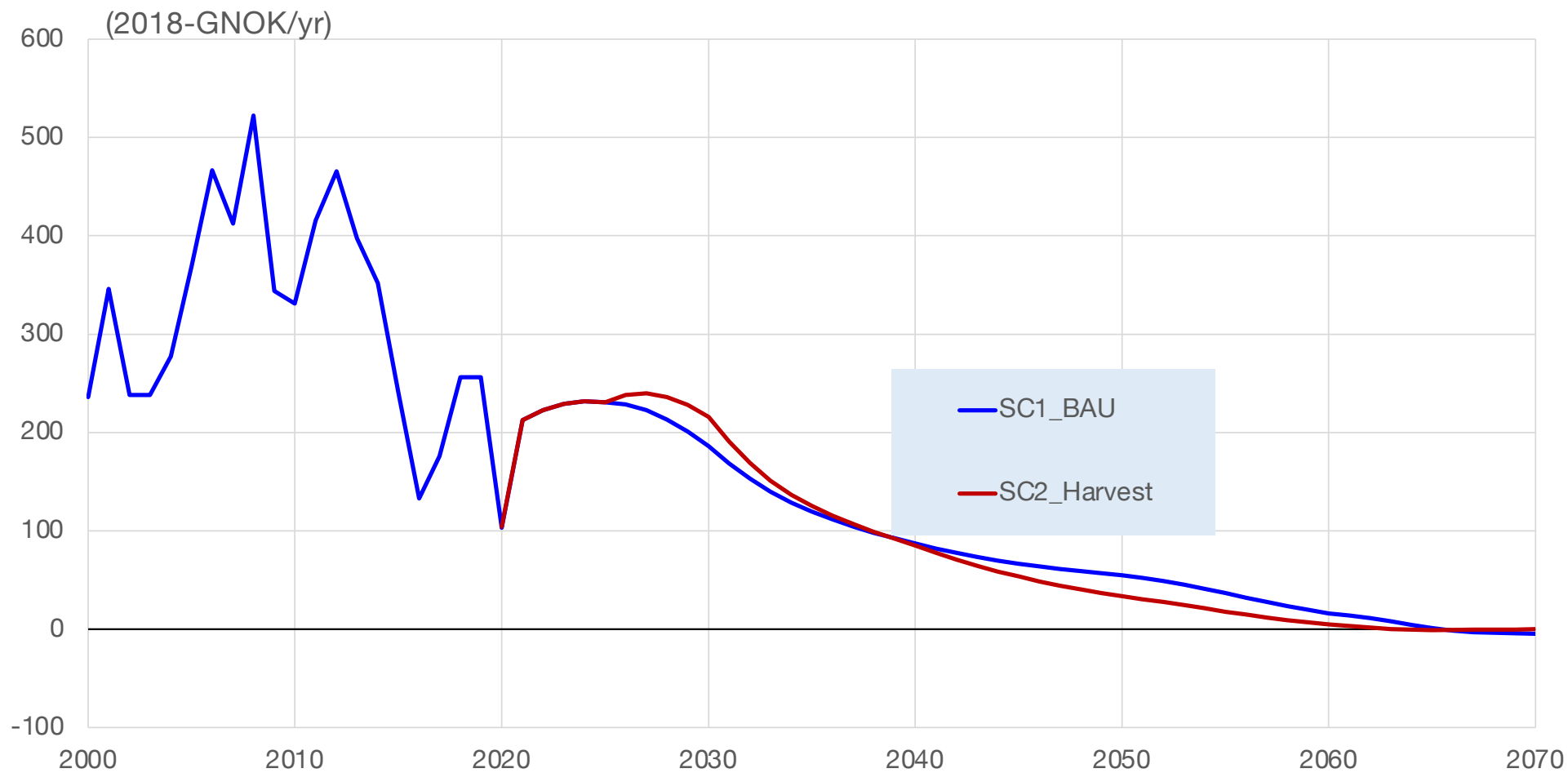
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<b>Mainland GDPpp growth rate</b>	percent per yr	1.3%	1.2%	1.3%
<b>Petroleum investments</b>	GNOK in 2030	103	41	41
<b>(150 2018-GNOK in 2019)</b>	GNOK in 2040	81	15	15
	GNOK in 2050	58	9	9
<b>Green energy investments</b>	GNOK in 2030	-	-	31
<b>(0 in 2019)</b>	GNOK in 2040	-	-	35
	GNOK in 2050	-	-	38
<i>Common for all scenarios:</i>				
<b>Population alternative</b>	hi / main / low	main	main	main
<b>Oil price</b>	USD/brl	50	50	50
<b>Gas price</b>	NOK/Sm <sup>3</sup>	1.75	1.75	1.75
<b>Export power price (PPA)</b>	average NOK/kWh		0.5	0.5
<b>EU ETS Carbon allowances</b>	EUR/tCO <sub>2</sub> , growing +2%/yr	50	50	50
<b>Norwegian CO<sub>2</sub> tax</b>	NOK/tCO <sub>2</sub> from 2030	2000	2000	2000
<b>Oil fund return on assets</b>	average annual real return	3%	3%	3%
<b>Strukturelt olje-underskudd</b>		3%	3%	3%

# Eksport i BAU vs Høsting

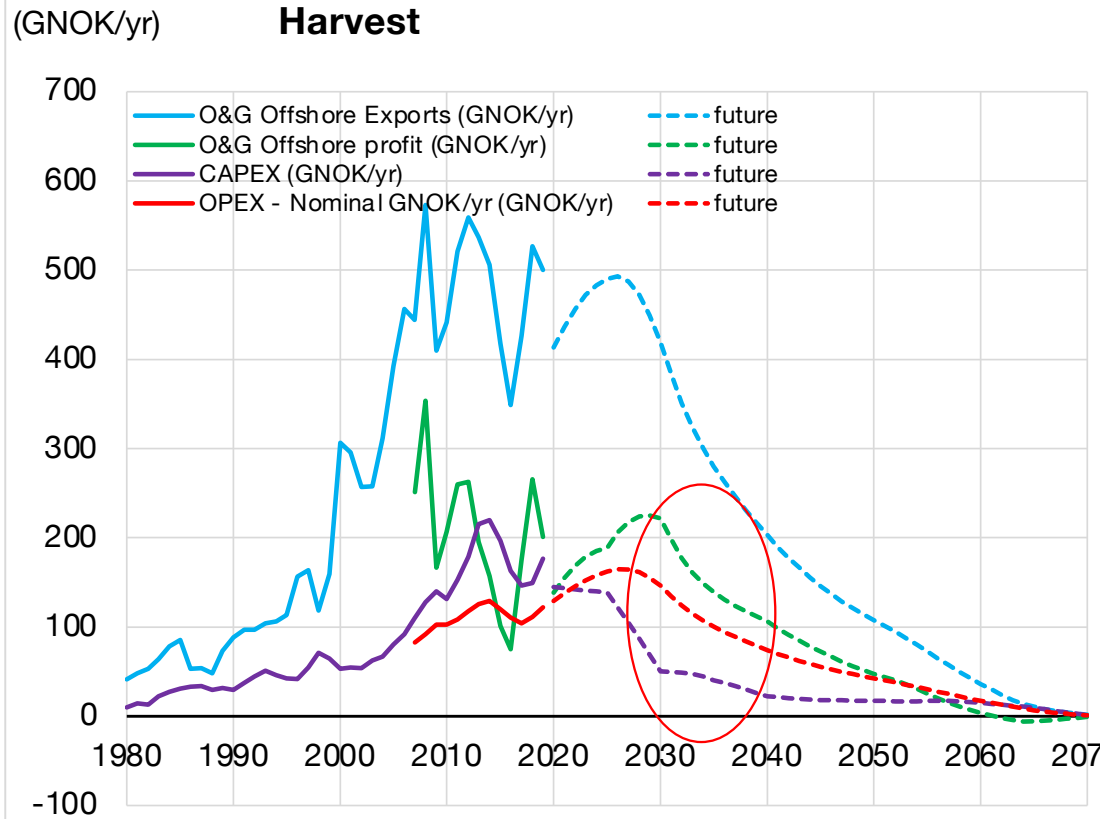
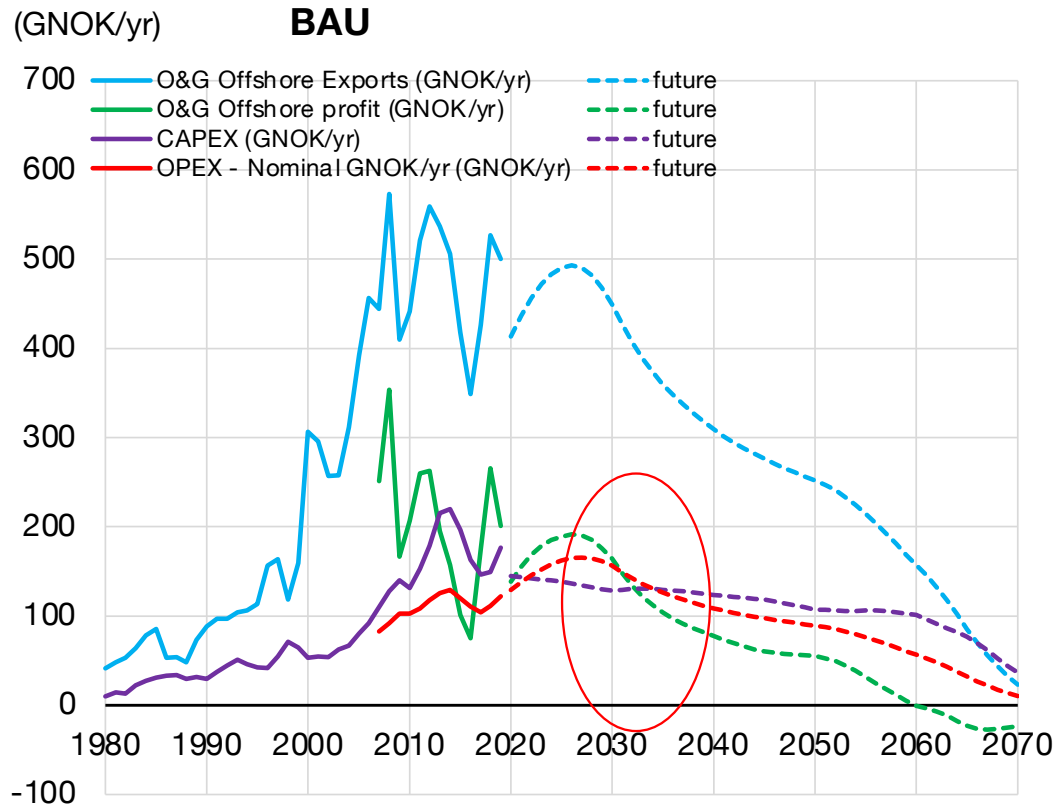
Offshore energy exports (2018-GNOK/yr)



# BAU vs Høsting: Statens netto kontantstrøm fra offshore



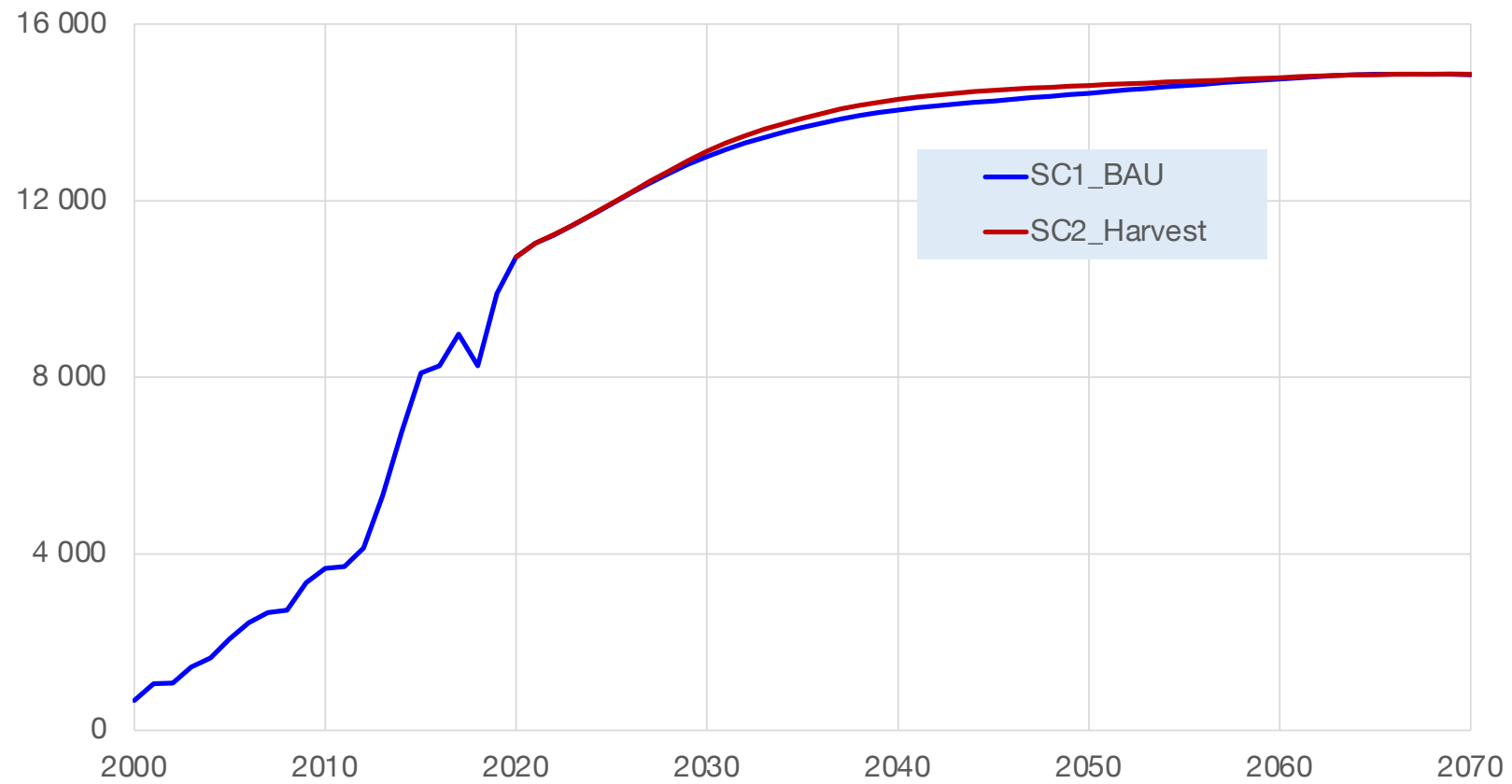




BAU vs Harvest: Hvorfor forskjell i statens netto  
kontantstrøm fra offshore??

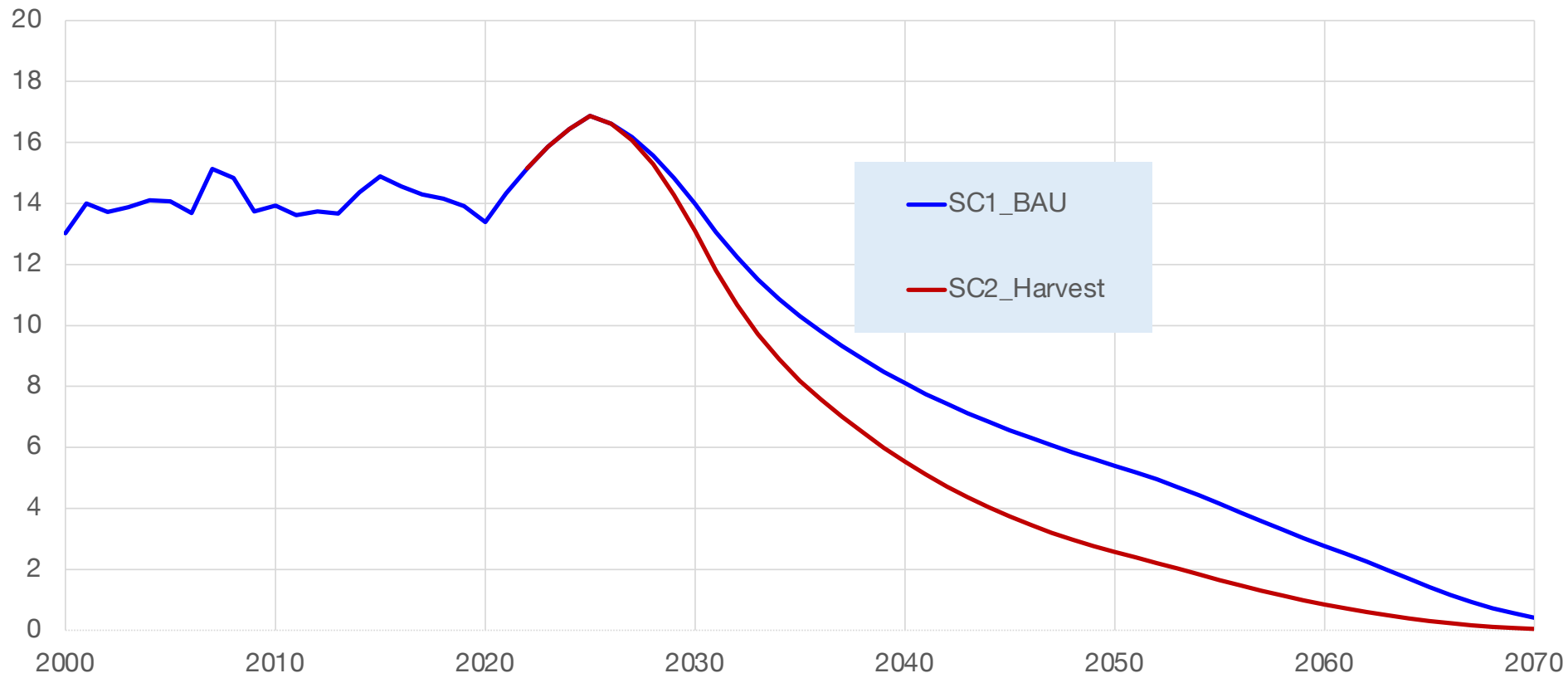
# Oljefondet 😄 😄

2018-GNOK



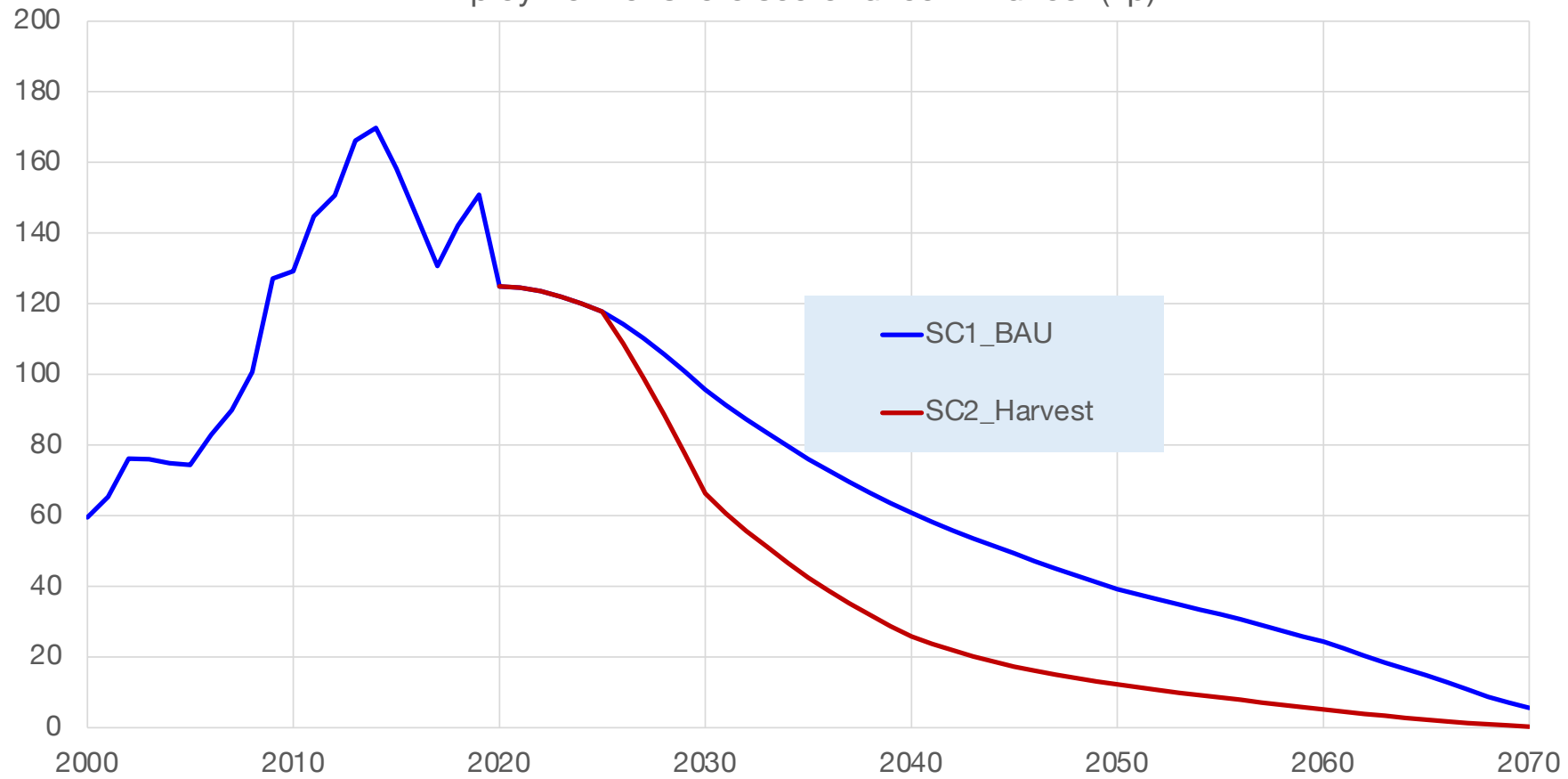
# Utslipp 🤨

MtCO<sub>2</sub>e/yr



# Men sysselsetting ... 🙄 😡 😠

Employment offshore sector direct+ indirect (kp)



# 3 scenarier til 2050 (og 2070)



*Business As Usual* = den offisielle fremtiden



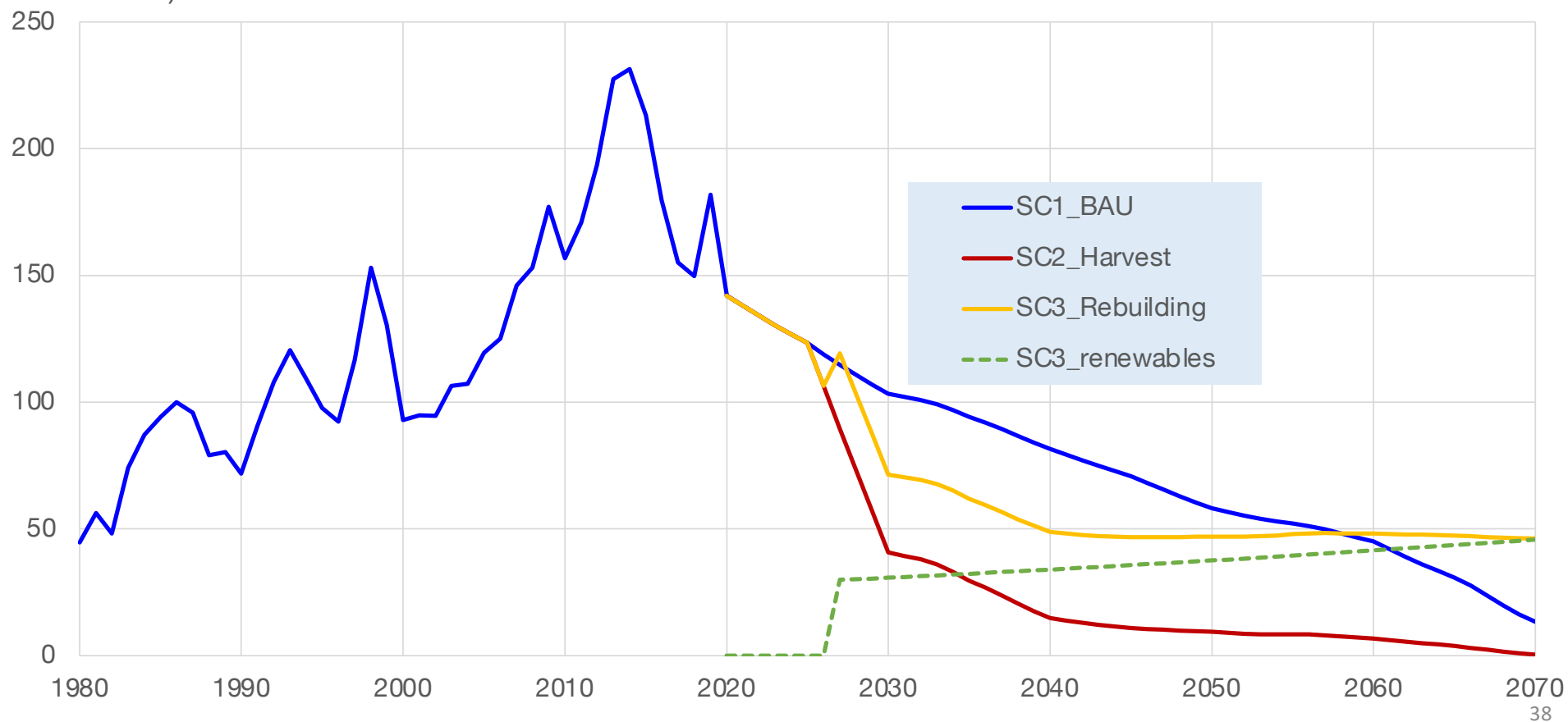
*Harvest & Exit* = Vi høster fra eksisterende felt (lite nytt)



*Rebuilding* = Vi både høster og bygger gradvis ny grønn offshore sektor (fornybar havvind, hydrogen)

# 3 ulike investerings-profiler: 1) BAU, 2) Høsting, 3) Gjenoppbygging

(2018-GNOK)



# Kostnader? Læringskurver?

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- Mange vindparker i Nordsjø-området, feks danske “Thor” på 1 GW til omlag 20 mrd NOK (2018-kroner)
- **30 mrd NOK/år gir ca 1.5 GW/år**
- Hvis vi bruker 15 MW vindmøller blir det 100 vindmøller per år, først bunnfaste – så flytende fra 2030+
- IRENA gir en god nedbryting av arbeidsplasser per GW installert og i drift
- Investeringer øker med 1% mer per år, men får også 3% mer GW per år



# Skatteregime?

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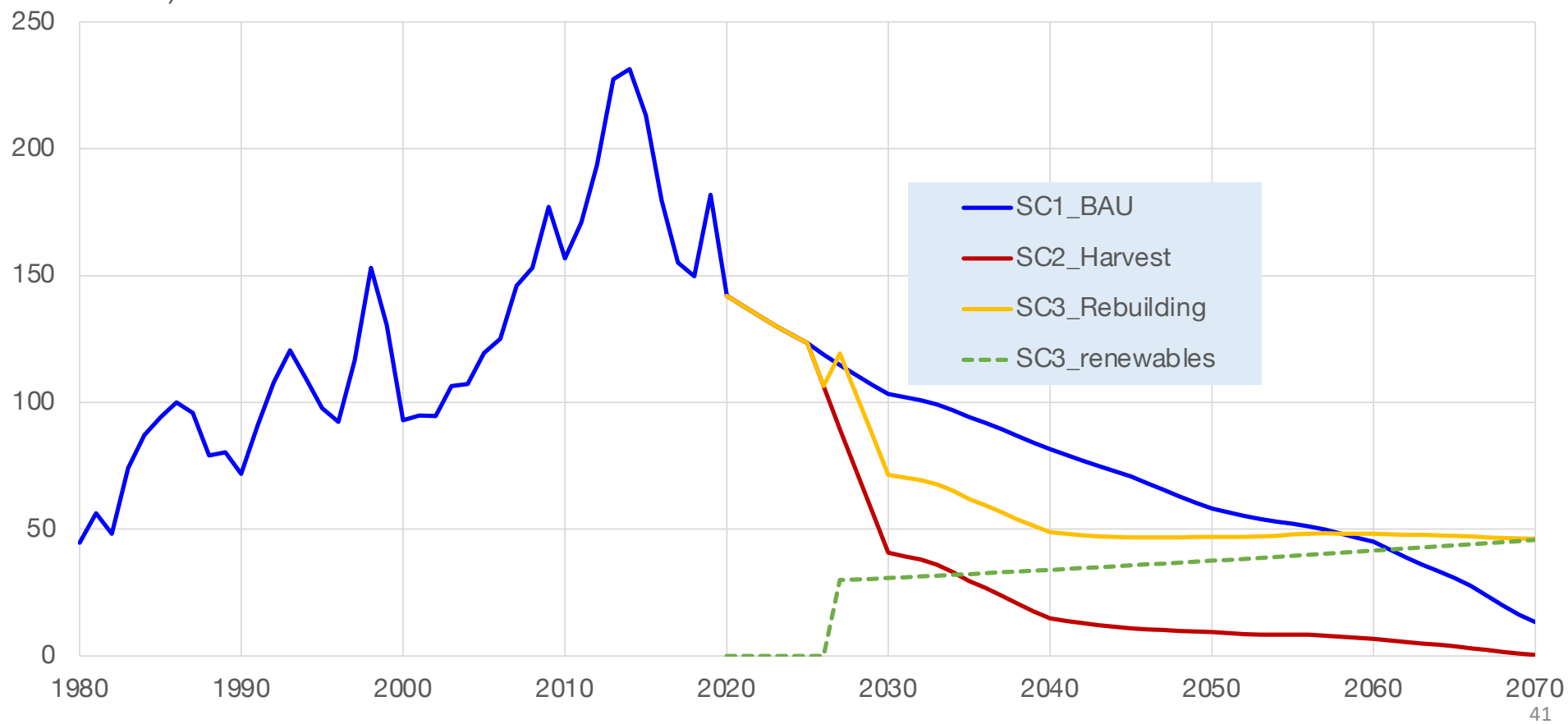
- Vi antok at «oljeskatte-modellen» utvides til å bli «offshore-skattemodellen»
- Vi antar at auksjonene bruker differansekontrakter for pris (garanti-priser)
- Vi antar at strømmen i all hovedsak eksporteres ev. omformes til grønn hydrogen, for en gjennomsnittspris på **0,50 øre/kWh** (faste priser) hele veien til 2070





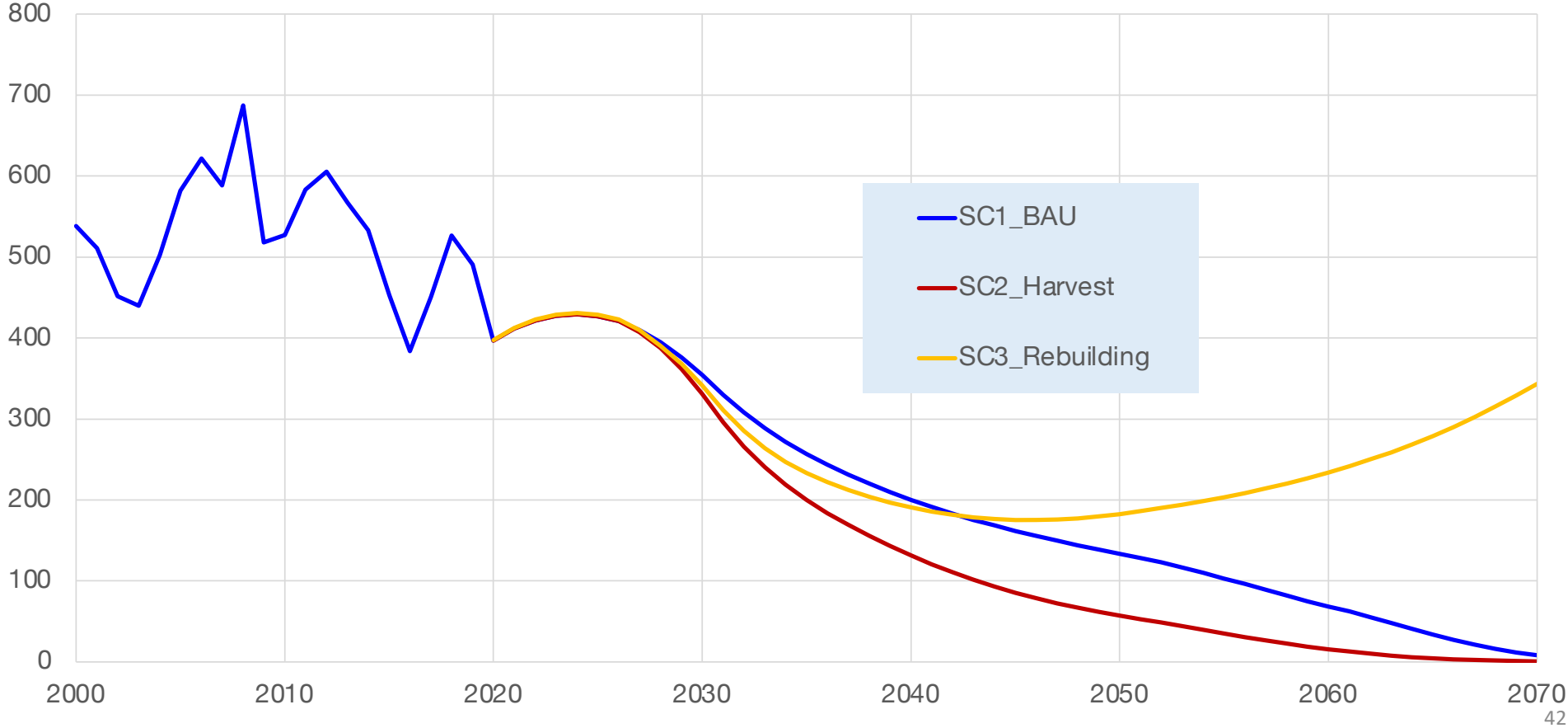
# 3 ulike investerings-profiler: 1) BAU, 2) Høsting, 3) Gjenoppbygging

(2018-GNOK)



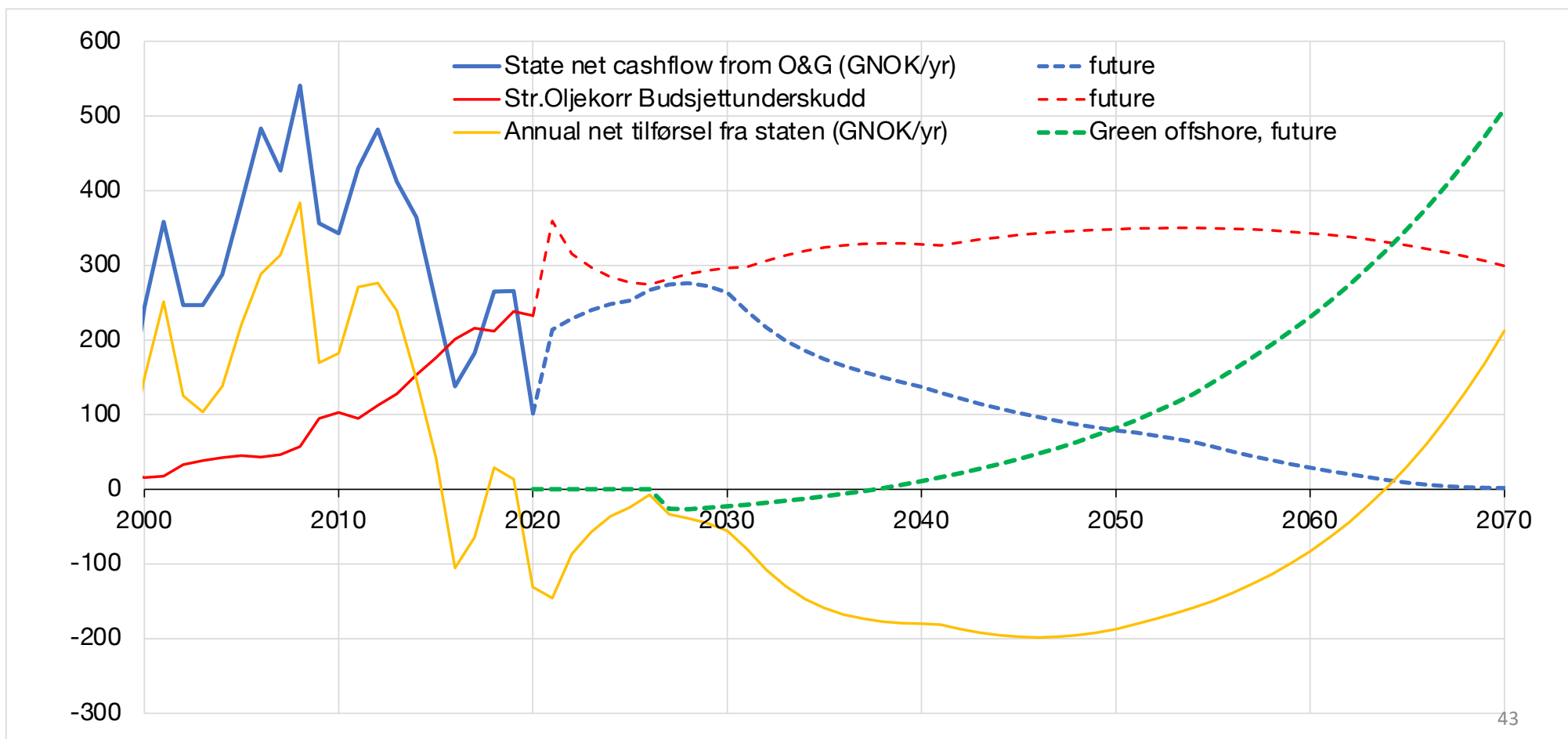
# Offshore energi-eksport (mrd kroner faste priser)

(2018-GNOK/yr)



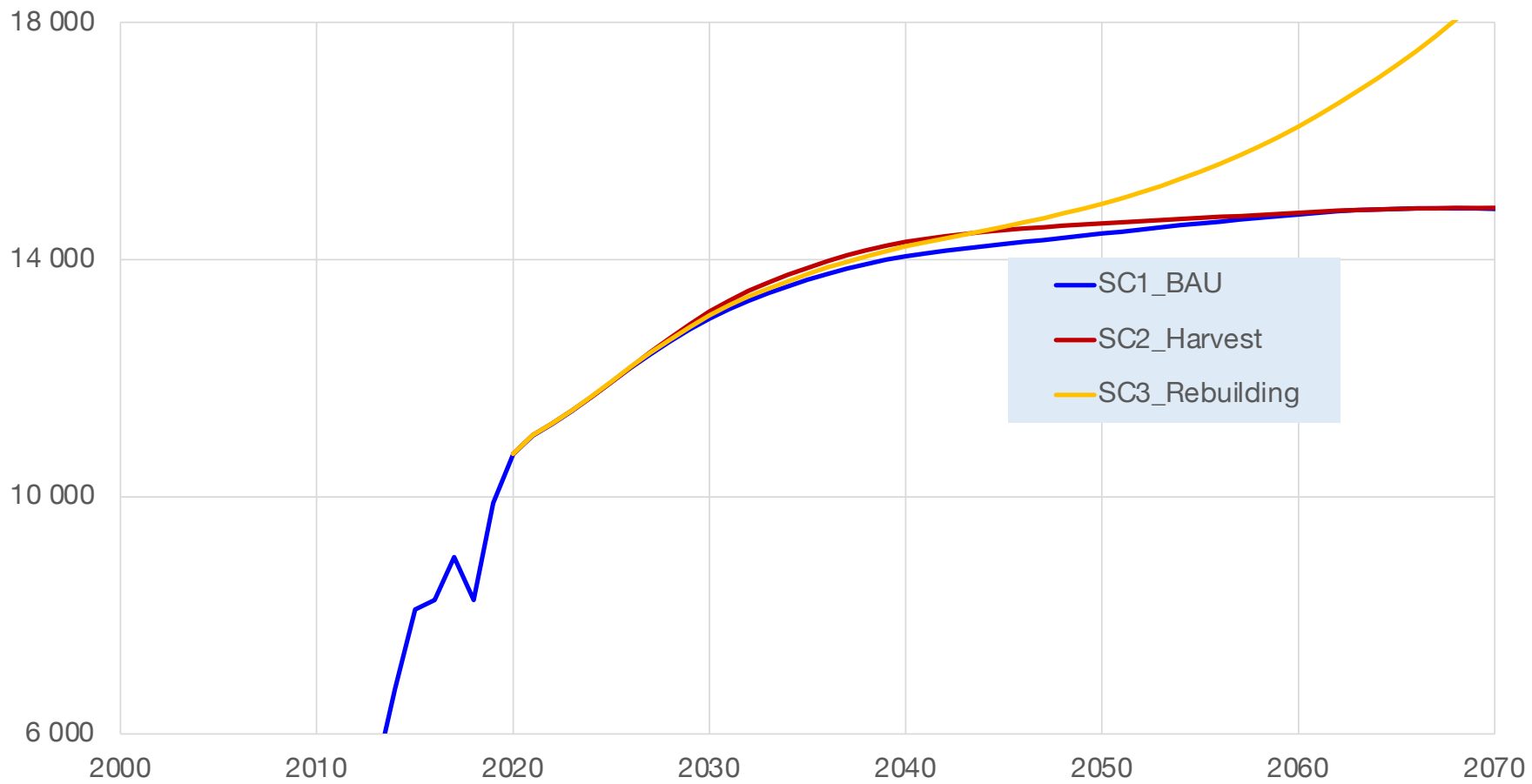


# Statens netto kontantstrøm fra O&G vs grønn sektor, budsjett-underskudd og netto fra staten til oljefondet (GNOK/yr)



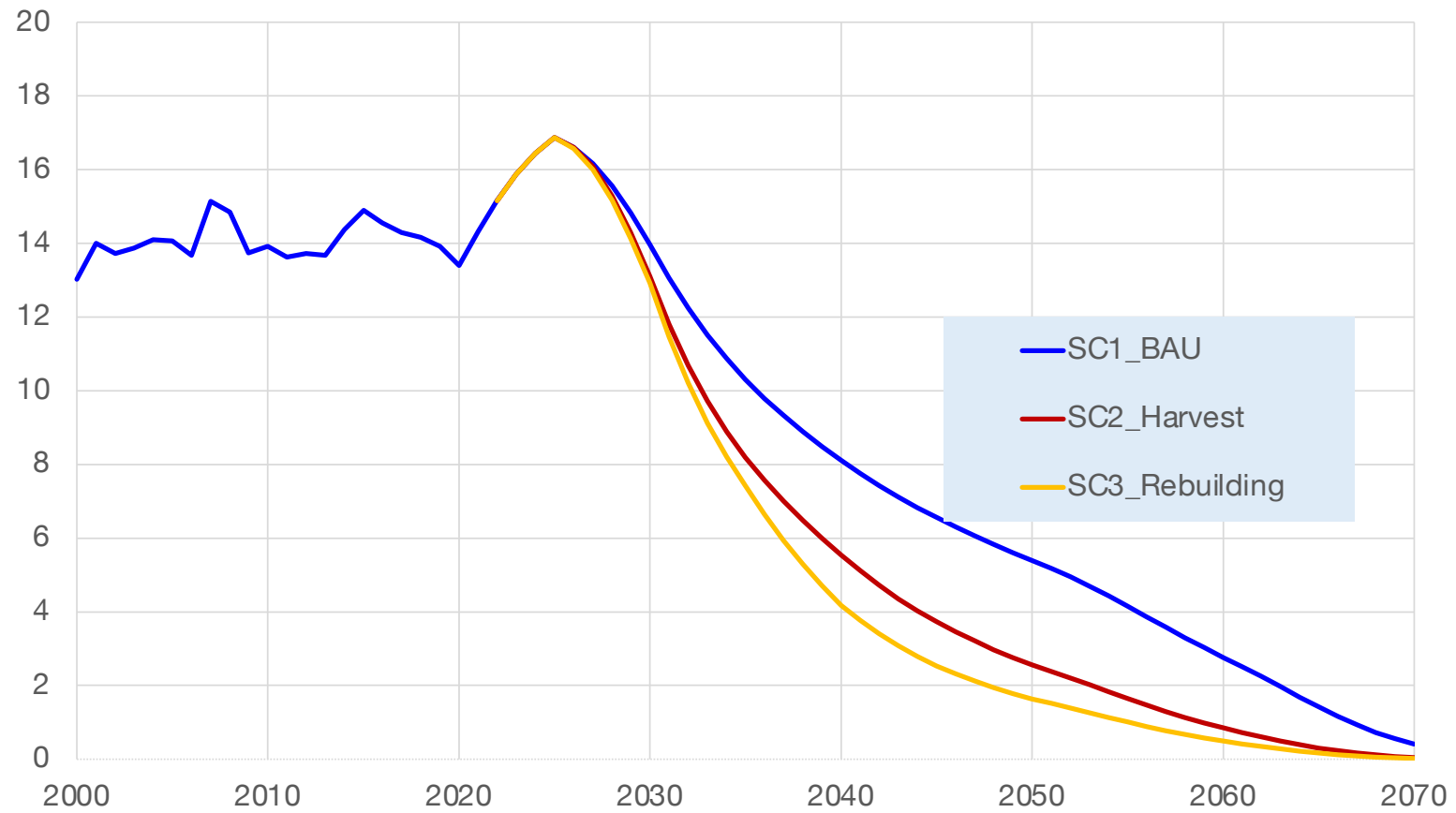
# Oljefondet 😄😄😄

2018-GNOK



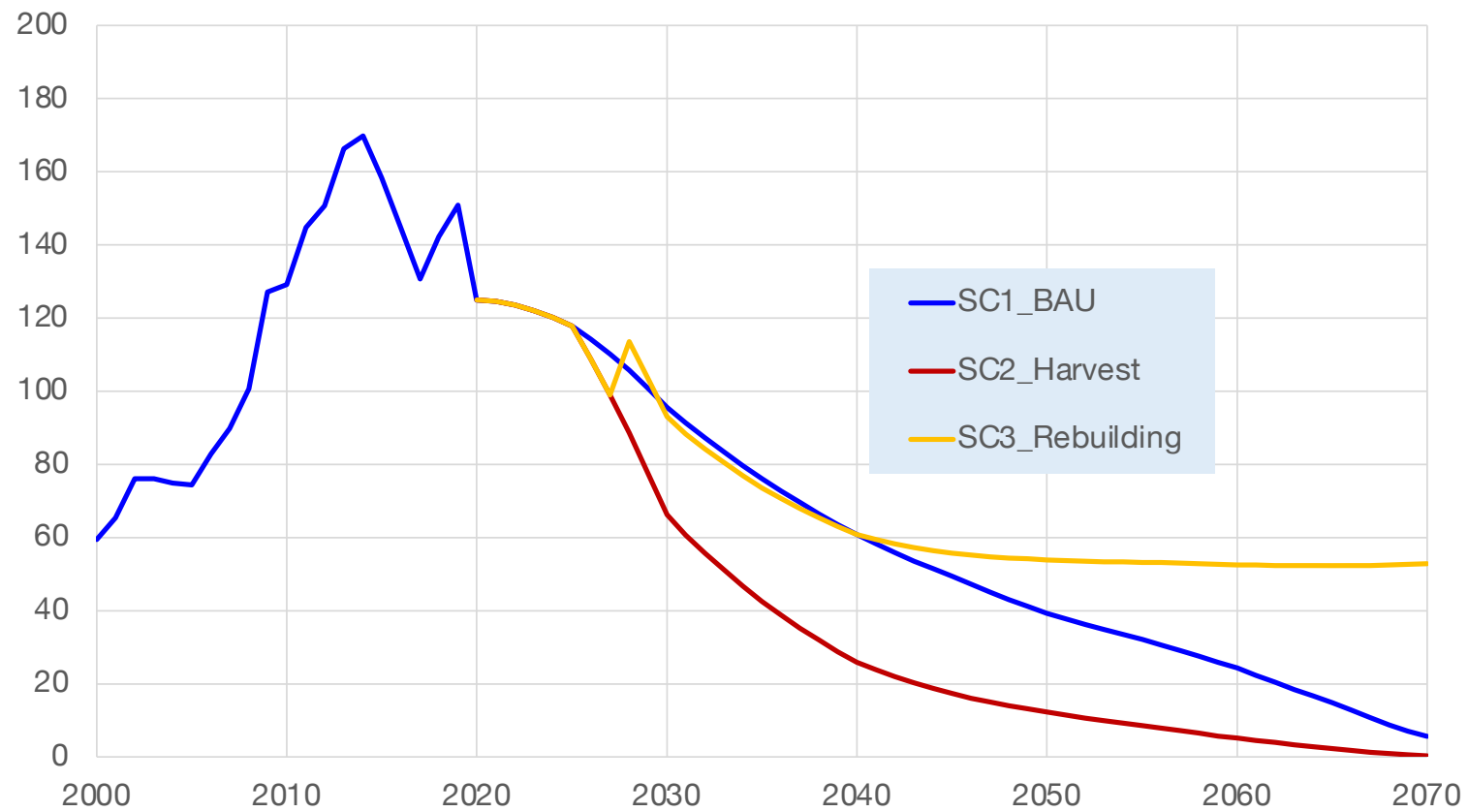
# Offshore Utslipp 😊

MtCO<sub>2</sub>e/yr

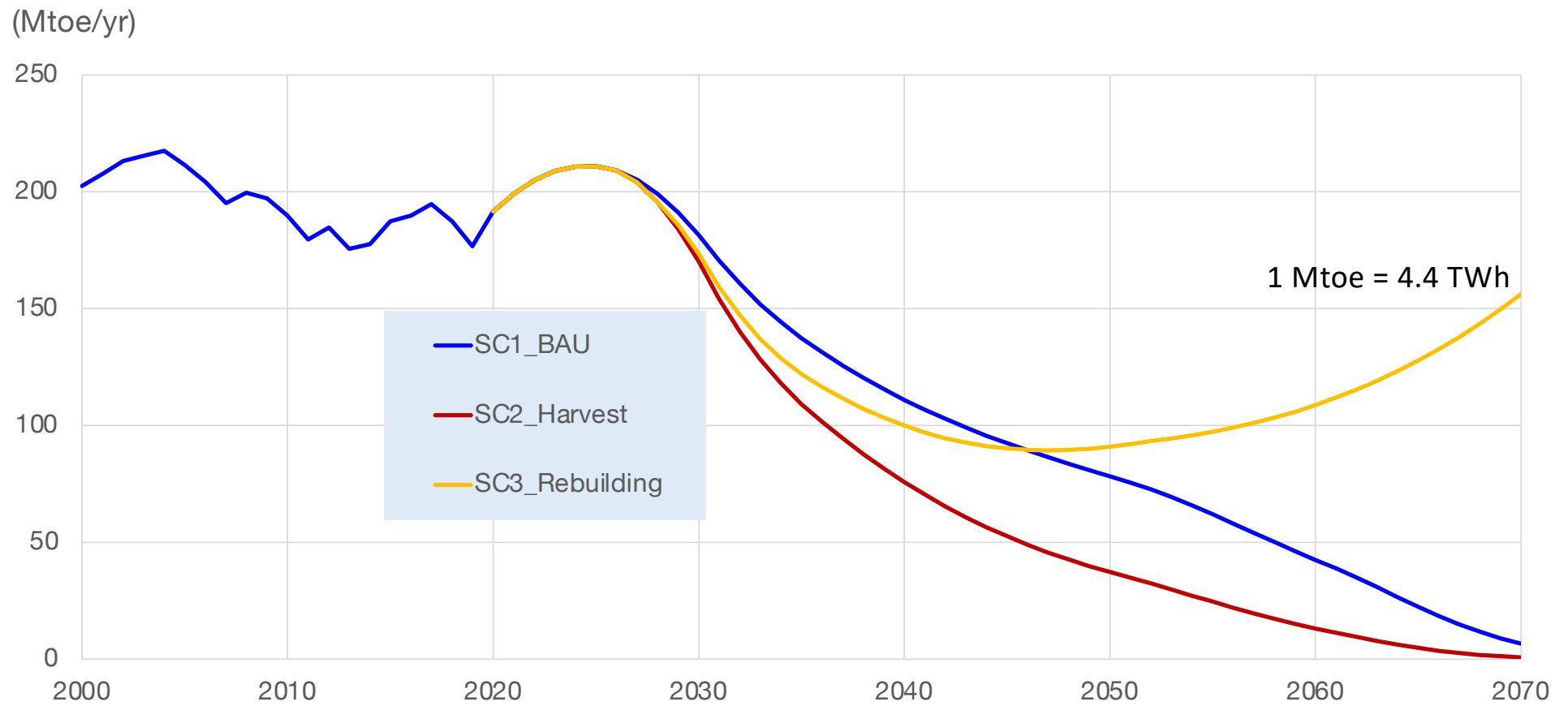


# Og sysselsetting ... 😊

Employment offshore sector direct+ indirect (kp)



# Offshore Energi-produksjon



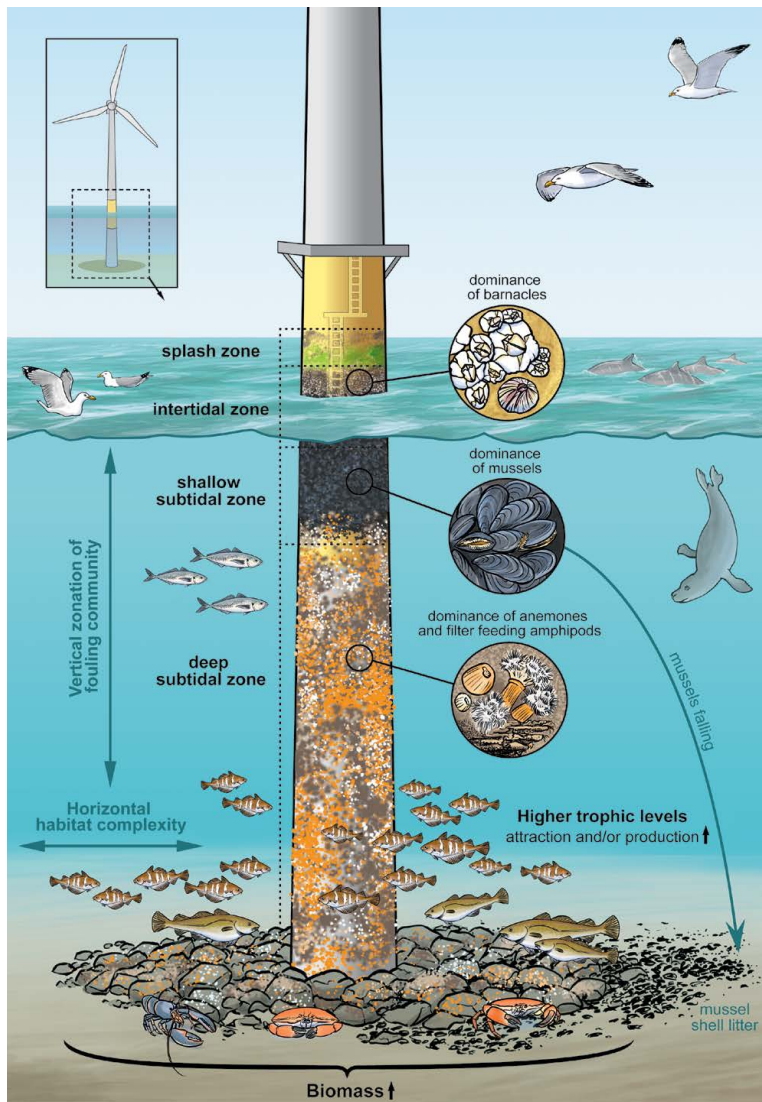


Illustration by Hendrik Gheerardyn

## Øko-system effekter?

**“Offshore wind farm structures provide habitat for invertebrate organisms that foul the foundation along the depth gradient and attract predator fish, seabirds, and marine mammals.”**

Degraer, Steven, Drew A Carey, Joop WP Coolen, Zoë L Hutchison, Francis Kerckhof, Bob Rumes, and Jan Vanaverbeke. “Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure and Functioning.” *Oceanography* 33, no. 4 (2020): 48–57.

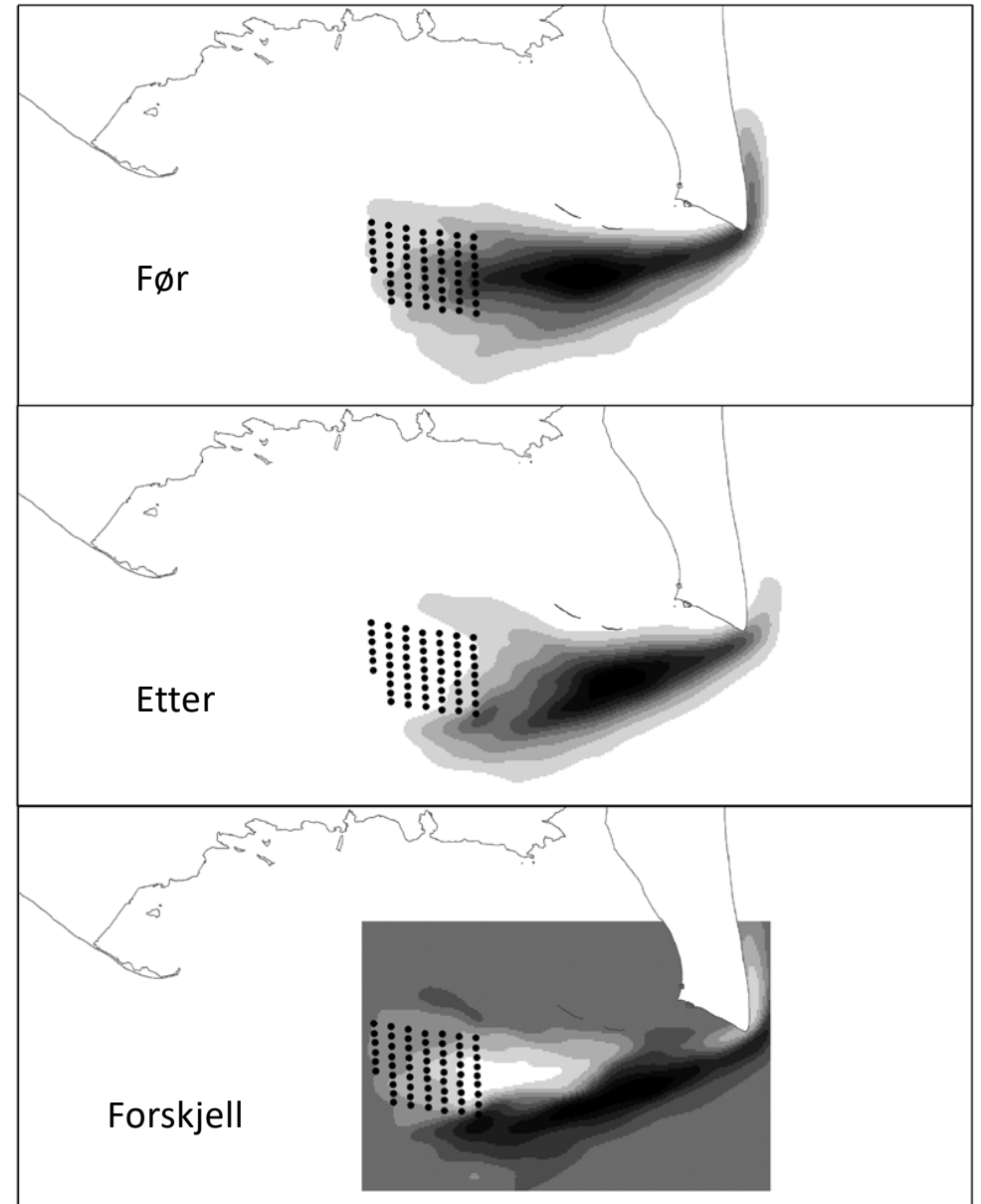


# Konflikt med fugletrekk offshore?

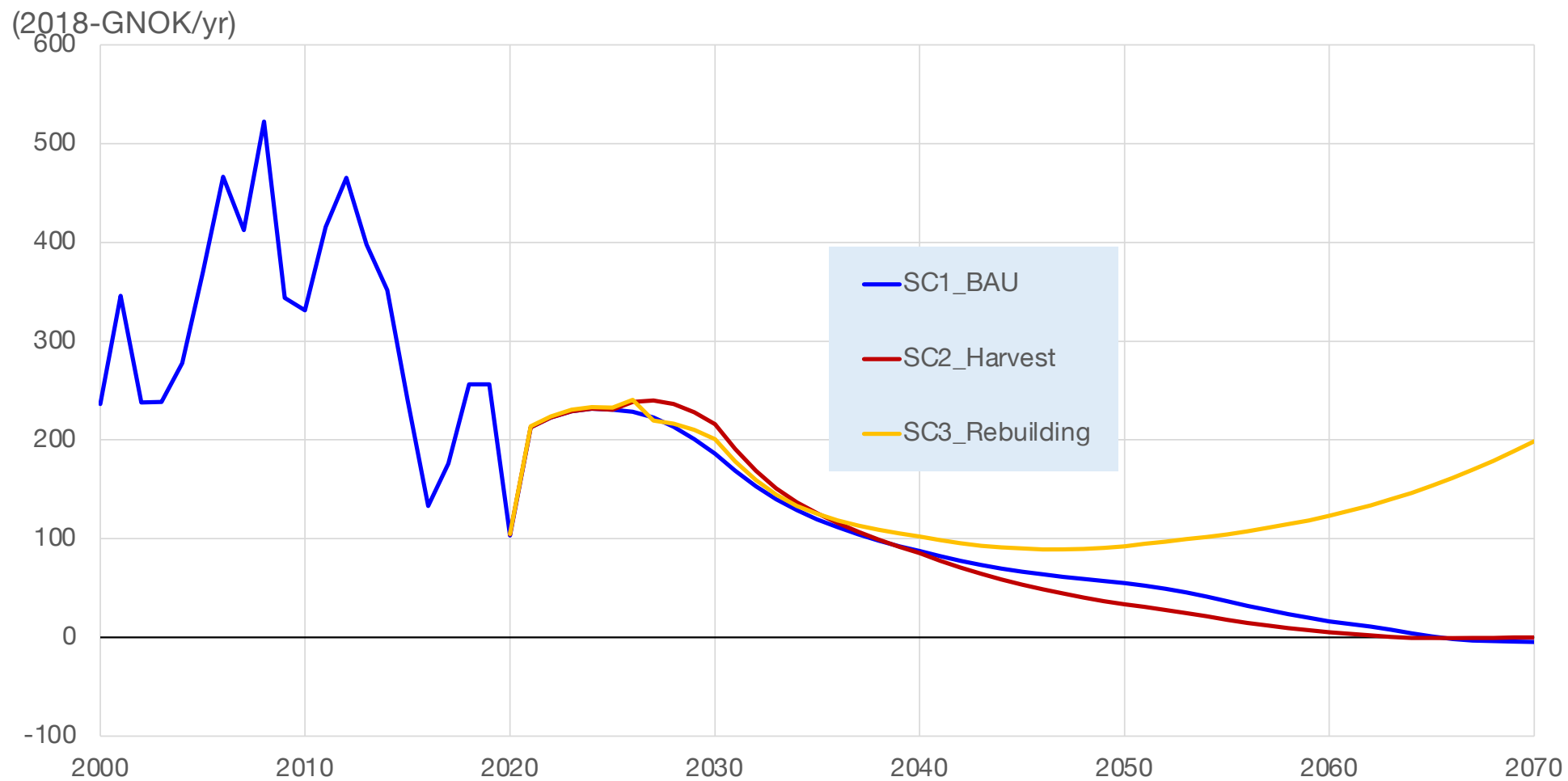


“There is growing evidence for widespread avoidance of offshore turbines by large-bodied birds, while our knowledge for smaller bird species is less adequate.

Source: Fox, A. & Petersen. “Offshore Wind Farms and Their Effects on Birds.” *Dansk Ornitologisk Forenings Tidsskrift* 113 (2019): 86–101.

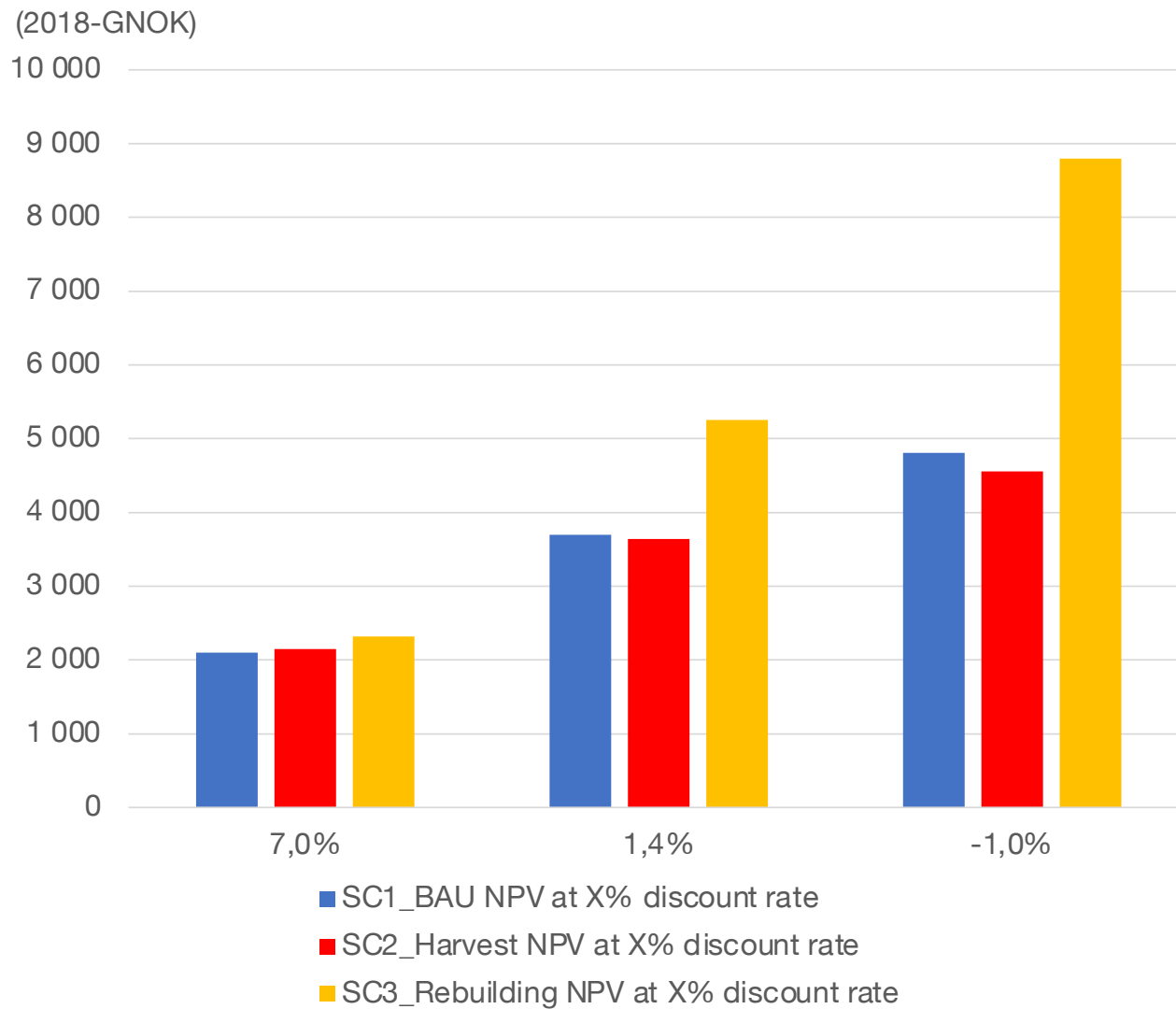


# Statens netto kontantstrøm fra offshore energi



# NPV av statens netto kontantstrøm fra offshore energi?

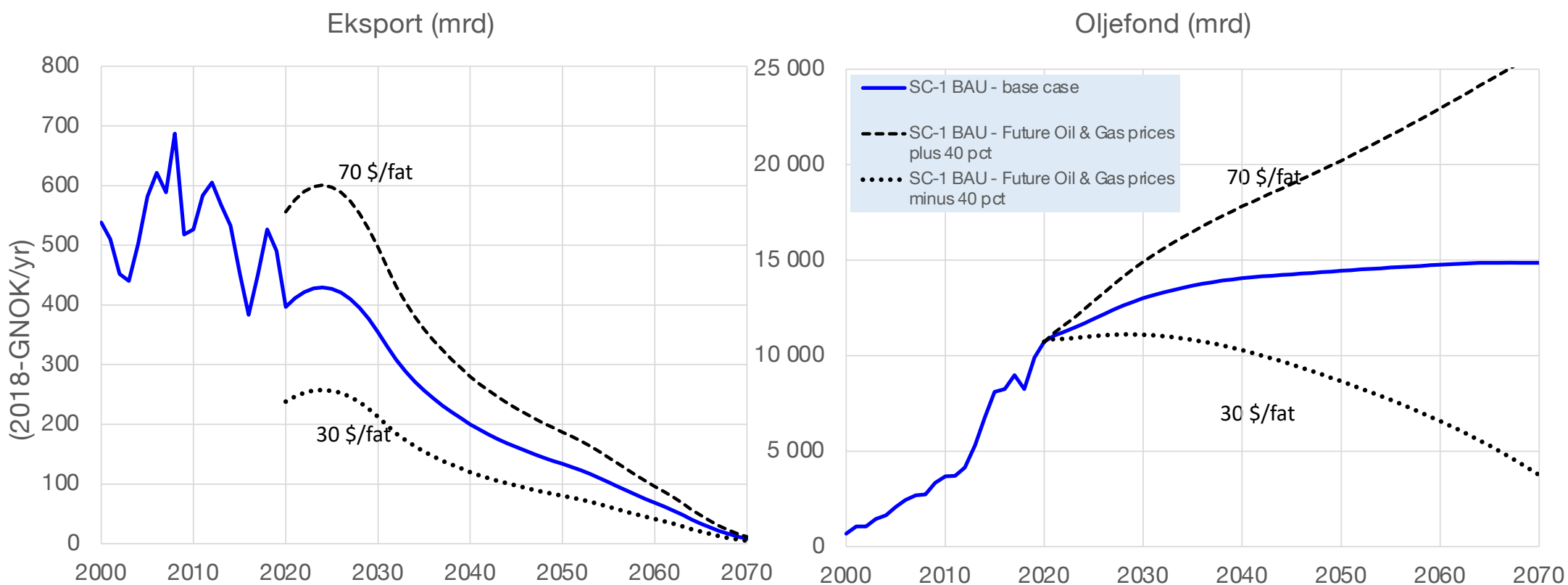
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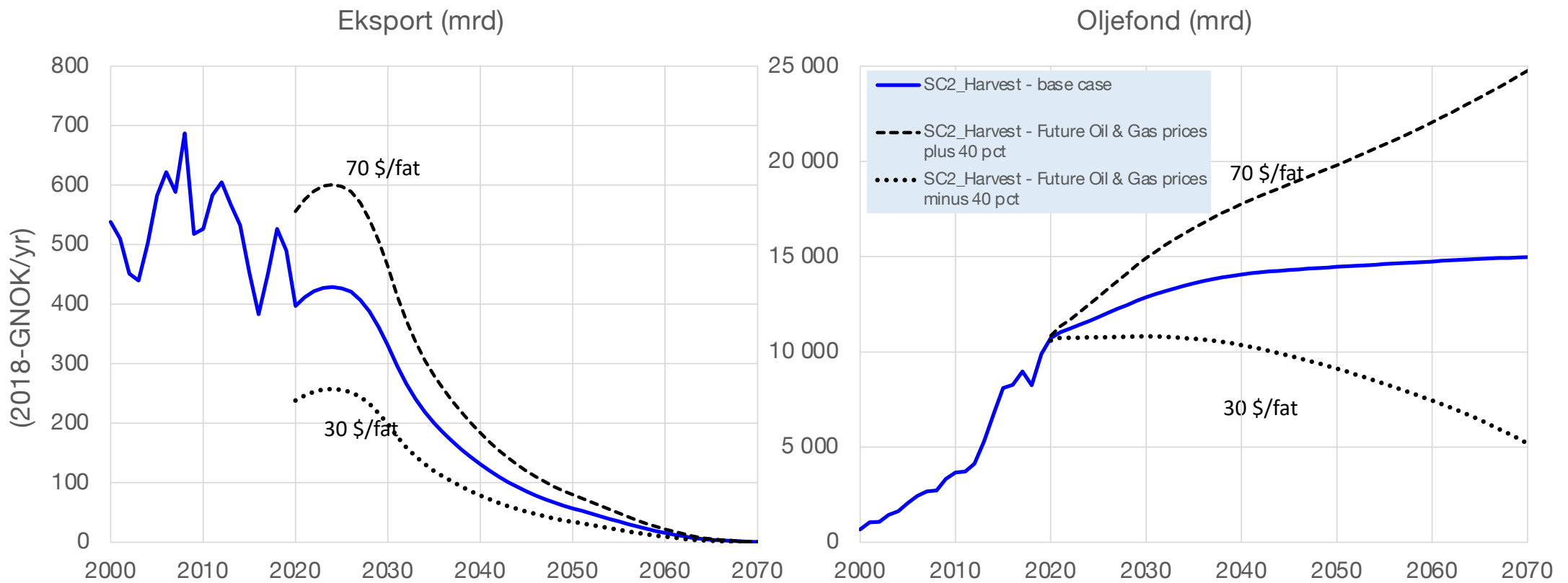
# Noen konklusjoner fra SmartPaths- arbeidet

- Netto-effekten av en Høste-strategi på oljefondet er positiv hele veien til 2050
- Olje-jobber synker allerede, men tap utover BAU kan motvirkes av grønne insentiver (havvind-auksjoner).
- Bruk av ekstra-inntektene fra Høsting kan finansiere Gjenoppbygging av en grønn offshore sektor uten vesentlig tap av sysselsetting, oljefond, velferd (BNPpp) for Norge
- TTT – ting tar tid: Med 30 mrd/år investeringer i havvind, kan det ta minst ti år før statens netto kontantstrøm fra grønn offshore blir positiv

# Hva hvis +/- 40% oljepriser (30-70\$/fat) i BAU?

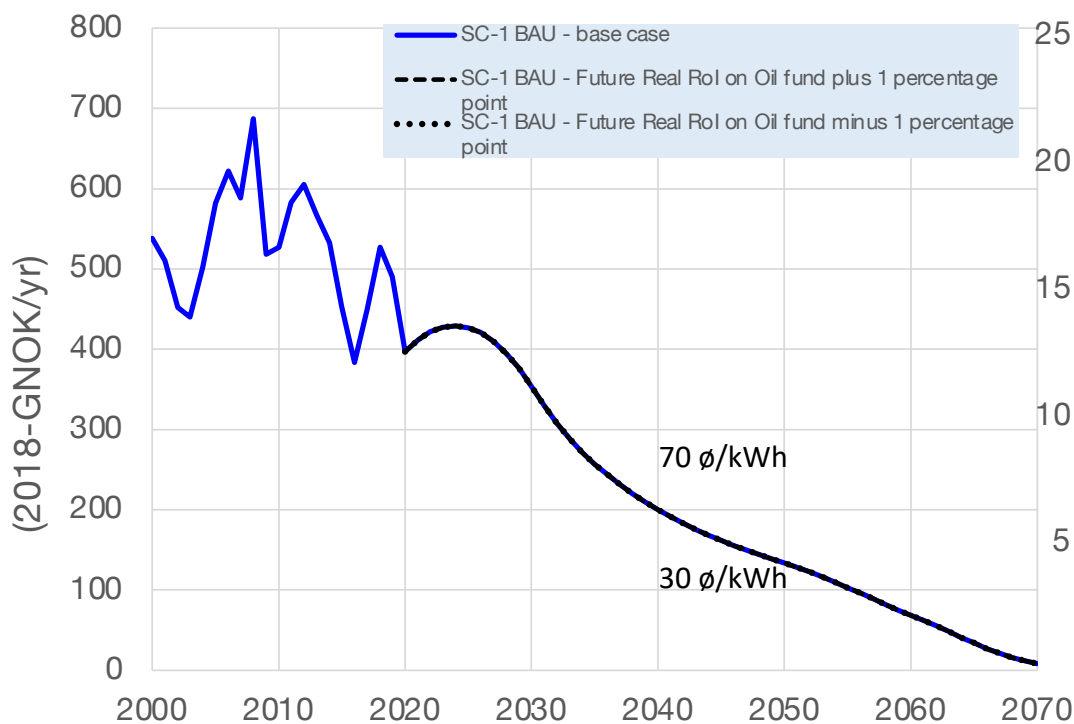


# Hva hvis +/- 40% oljepriser (30-70\$/fat) i *Høsting*?

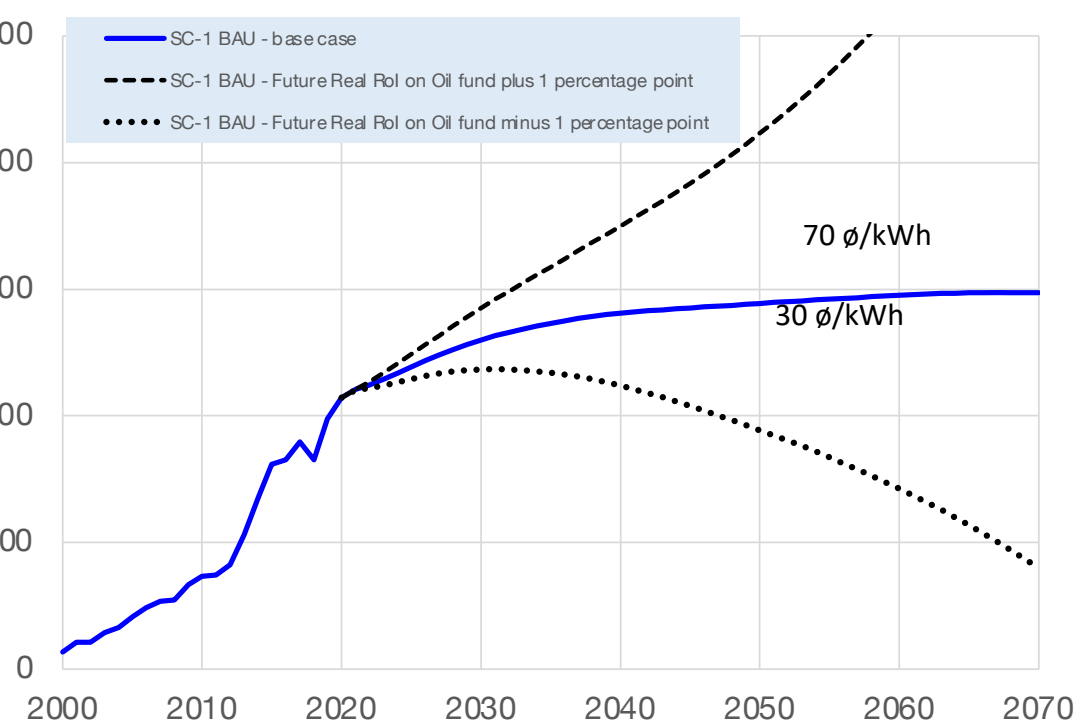


# Hva hvis +/- 40% el-priser (30-70 ø/kWh) i Gjenoppbygging?

Eksport av olje + el, (mrd)



Oljefond (mrd)



# Hva hvis vi får +4%/år i realavkastning på oljefondet? (eller 2%)

Mrd 2018-kr

