

# Environmental impact of products containing recycled materials

## Case of the end-of-life of offshore oil platforms

Steel recycling and the Reefing effect

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SCORELCA

# Oil & Gas offshore activities and reefing effect



Offshore platform



Reefing



Offshore jacket



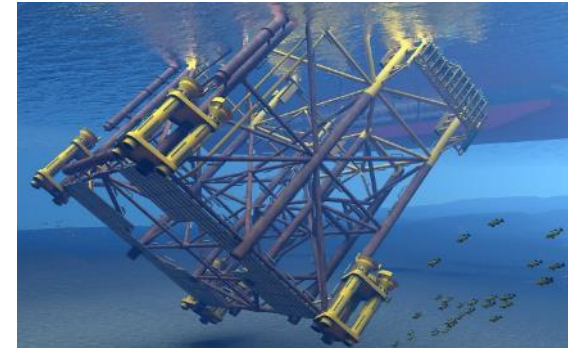
Enhancement of fish population

# Decommissioning options

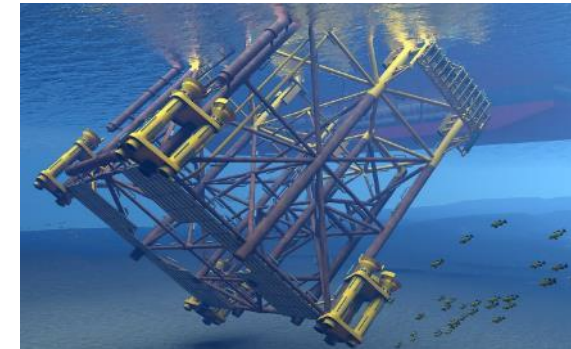
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Complete removal

1958 United Nations Convention  
of the Law on Sea  
1992 OSPAR Convention



# Decommissioning options



- What is the best option for the future of decommissioned offshore jackets?

Complete removal

Partial removal

Leave in Place

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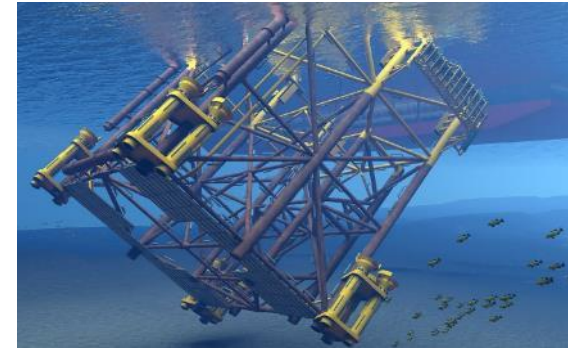
Some regulations leave options open ... but decisions need to be supported  
Safety, Environment, Feasibility, Other Users of the Sea, Costs...

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these structures.

Act like **hard bottom reef structures**

Enhance habitat for marine species but also **ecosystem services**

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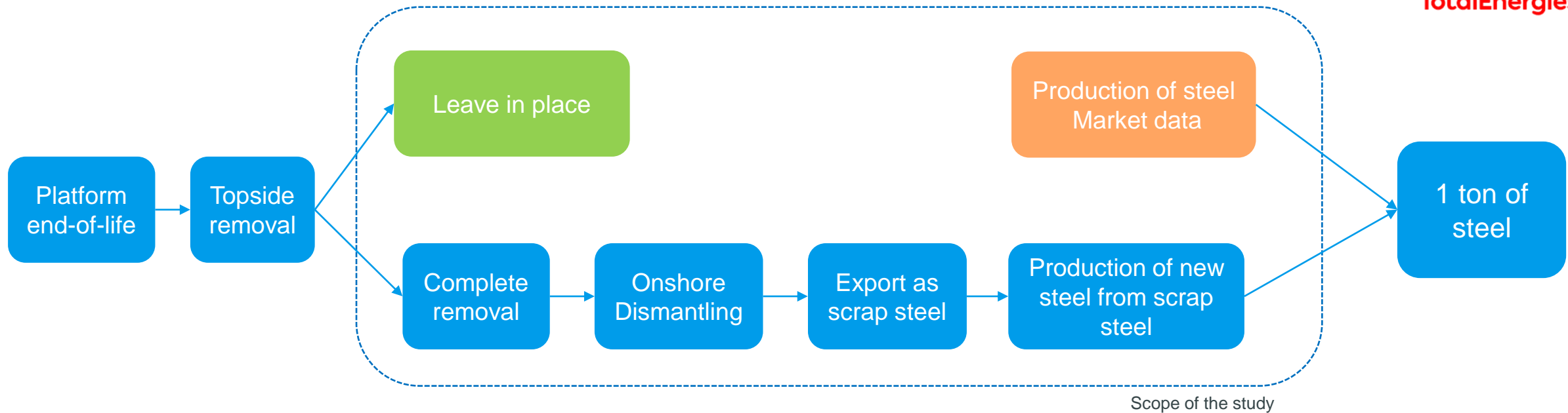
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What about steel circularity?  
Any environmental advantage in recycling steel from offshore jackets?

# Leave in place vs complete removal value chains



- Leave in place
  - Need to produce new steel to replace the one left in place
- Complete removal
  - Use of scrap steel to produce new steel



# Steel production carbon footprints



		Blast Furnace (BF) Basic Oxygen Furnace (BOF)	Electric Arc Furnace (EAF)
Worldwide share (Worldsteel)		70%	30%
European share (Eurofer)		46%	54%
Energy		Coal	Electricity
Iron Inputs		Iron ore Scrap steel (<20%)	Iron ore Scrap steel (up to 100%)
Ecolinvent 3.10, Cut-off	<b>Carbon Footprint INDIA</b>	1,9 kgCO <sub>2</sub> e/kg steel	3,1 kgCO <sub>2</sub> e/kg steel
	<b>Carbon Footprint EUROPE</b>	2,2 kgCO <sub>2</sub> e/kg steel	0,5 kgCO <sub>2</sub> e/kg steel
	<b>Carbon Footprint RoW</b>	2,4 kgCO <sub>2</sub> e/kg steel	1,5 kgCO <sub>2</sub> e/kg steel
	<b>Carbon Footprint GLO Market</b>	2,2 kgCO <sub>2</sub> e/kg steel	
GaBi	<b>Carbon Footprint Asia</b>	1,8 kgCO <sub>2</sub> e/kg steel	
	<b>Carbon Footprint Europe</b>	x	1,0 kgCO <sub>2</sub> e/kg steel

Based on <10% scrap steel

Based on 100% scrap steel

- Steelmaking carbon footprint depends on
  - Technology
  - Scrap steel content
  - Electricity mix of country
  - Database

# Complete removal value chain with steel recycling



**1** Decommissioning of jackets. Include transport to dismantling yard





# Complete removal value chain with steel recycling



**1** Decommissioning of jackets. Include transport to dismantling yard

**2** Dismantling yard in Qatar





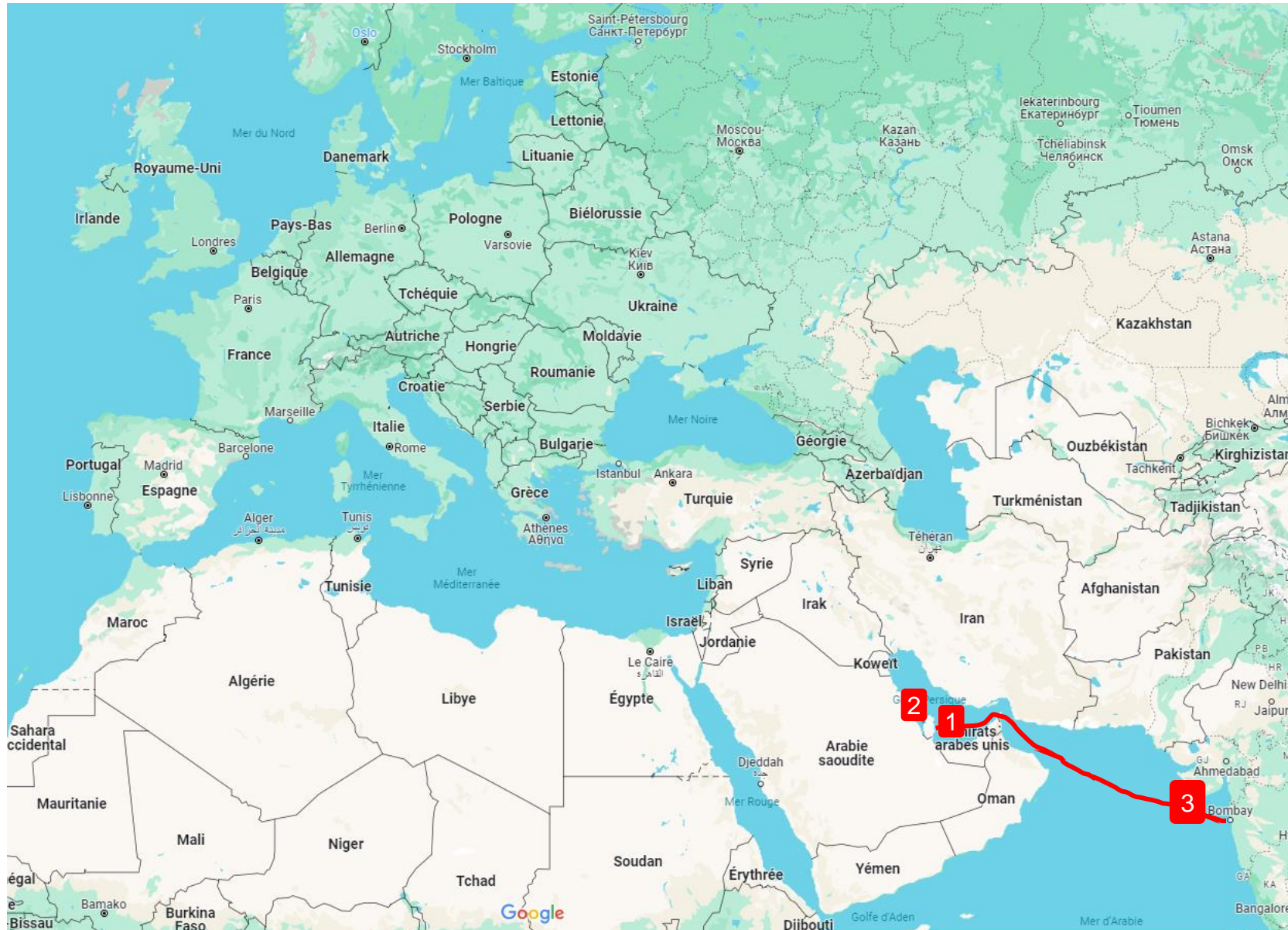
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1 Decommissioning of jackets. Include transport to dismantling yard

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# Complete removal value chain with steel recycling

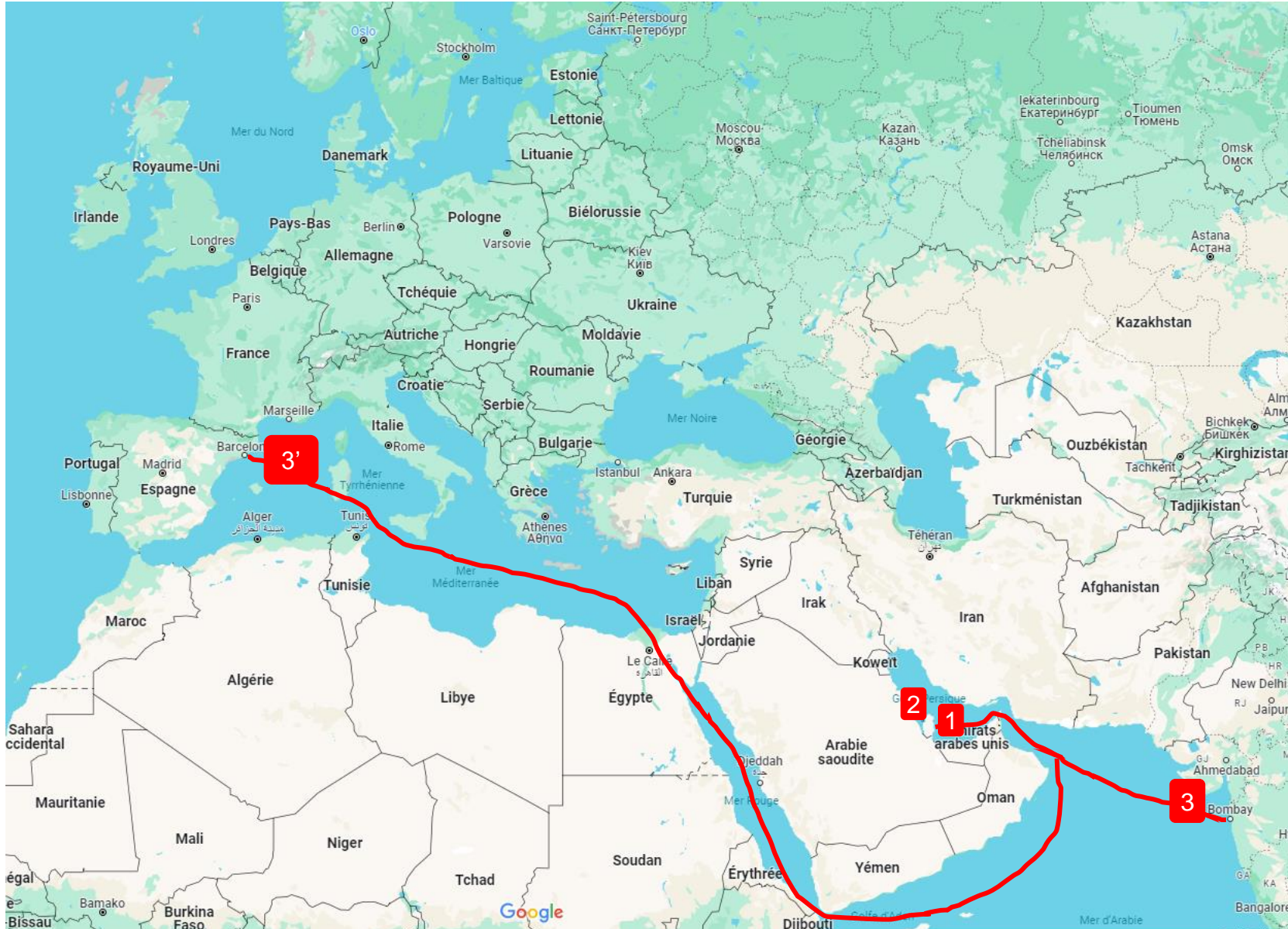


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**3** Transport by sea to India

**3'** Transport by sea to Spain





# Complete removal value chain with steel recycling



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**3'** Transport by sea to Spain

**3''** Transport by sea to Norway





# Complete removal value chain with steel recycling



1 Decommissioning of jackets. Include transport to dismantling yard

2 Dismantling yard in Qatar

3 Transport by sea to India

3' Transport by sea to Spain

3'' Transport by sea to Norway

4 Use of scrap steel to produce new steel in India  
*Elec: 900 gCO<sub>2</sub>e/kWh*



# Complete removal value chain with steel recycling



TotalEnergies



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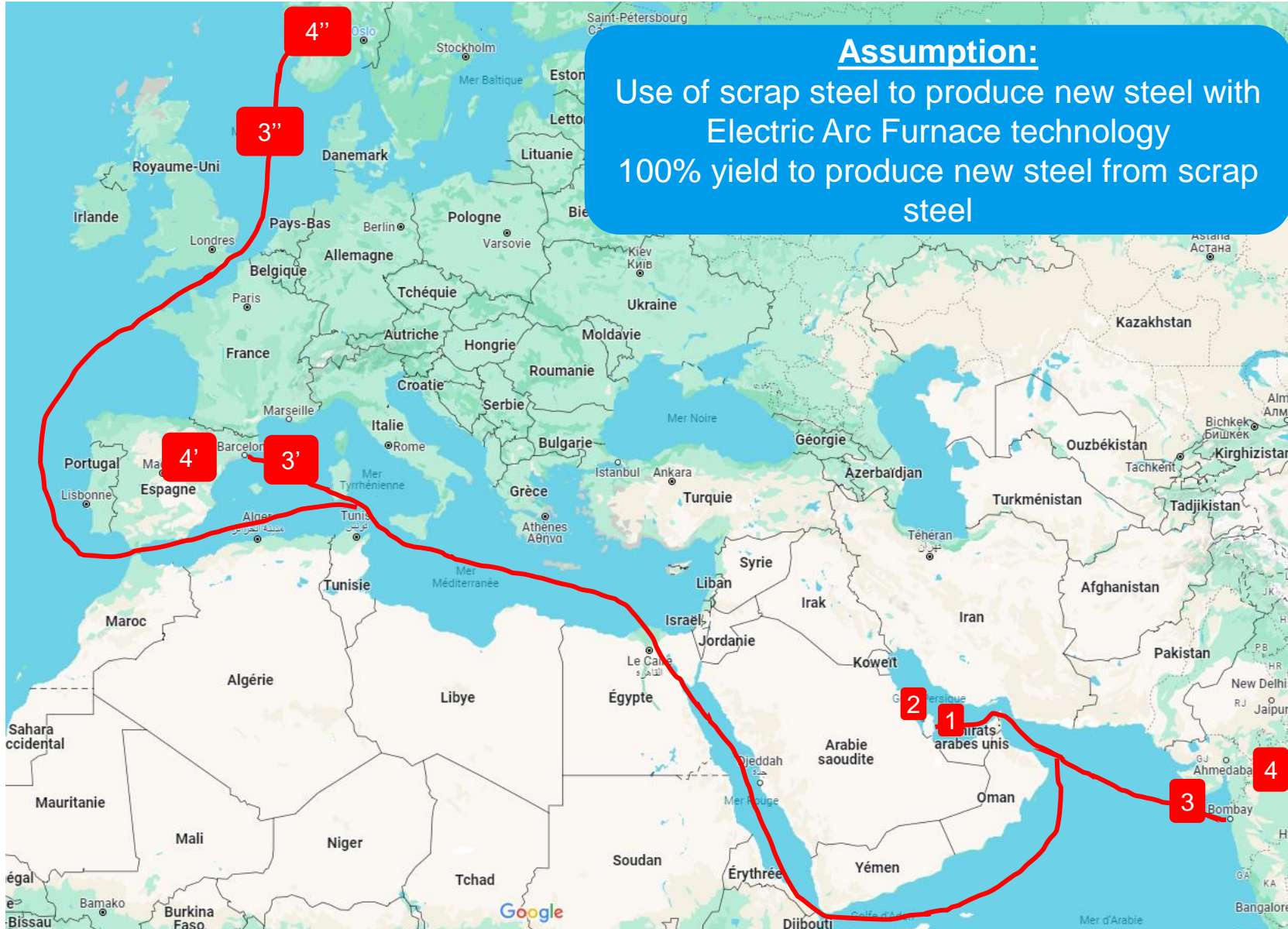
**3''** Transport by sea to Norway

**4** Use of scrap steel to produce new steel in India  
*Elec: 900 gCO<sub>2</sub>e/kWh*

**4'** Use of scrap steel to produce new steel in Spain  
*Elec: 314 gCO<sub>2</sub>e/kWh*



# Complete removal value chain with steel recycling



**Assumption:**  
Use of scrap steel to produce new steel with Electric Arc Furnace technology  
100% yield to produce new steel from scrap steel

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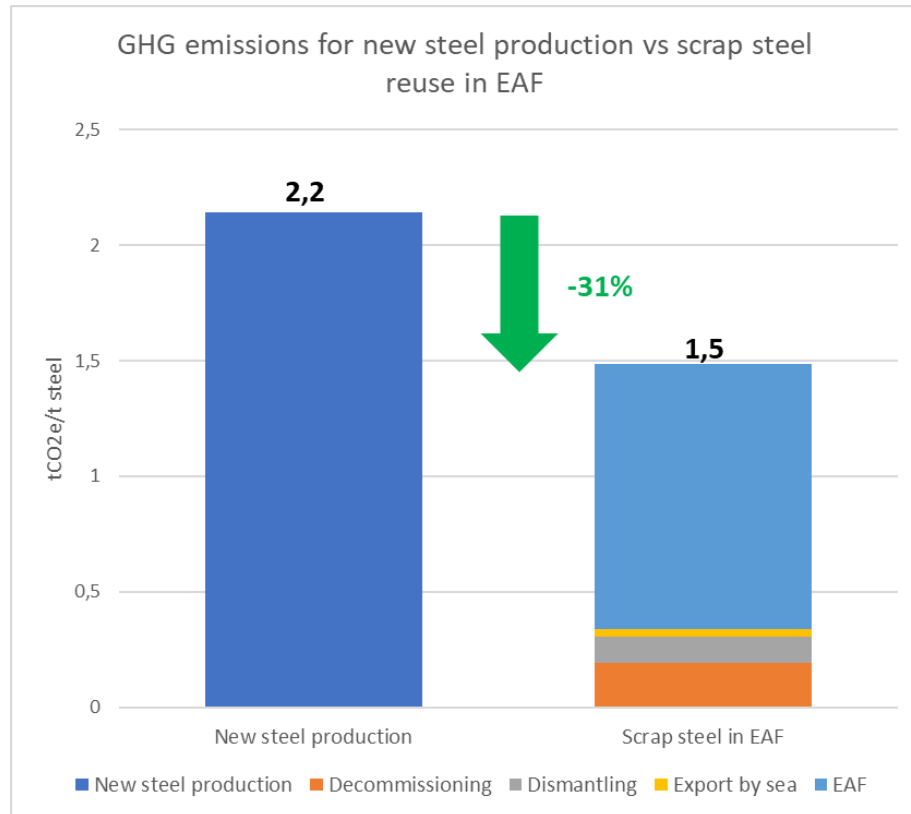
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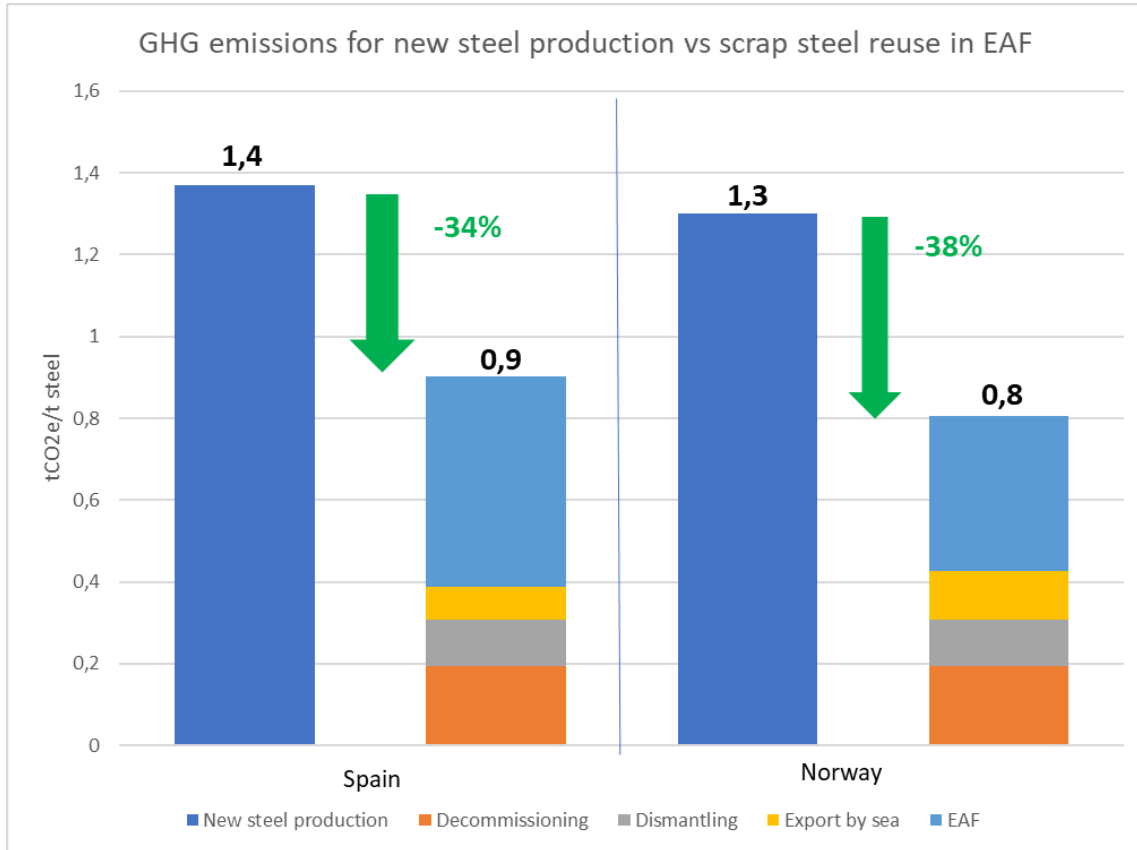
**4''** Use of scrap steel to produce new steel in Norway  
*Elec: 19 gCO<sub>2</sub>e/kWh*

# Results for India



- New steel production in India made of 70% BF-BOF and 30% EAF
  - 2,2 tCO<sub>2</sub>e/t steel
- Leave in place scenario with scrap steel recycling only in EAF technology based on India electricity mix (100% scrap steel)
  - 1,5 tCO<sub>2</sub>e/t steel
  - EAF step is the main contributor (1,1 tCO<sub>2</sub>e/t steel)
- Reduction of GHG emissions by 30% with complete removal of jackets compared to leave in place scenario
  - 0,7 tCO<sub>2</sub>e avoided/t steel

# Results for Europe



- New steel production in Europe based on 46% EAF and 54% BF-BOF
  - 1,4 tCO<sub>2</sub>e/t steel
- Leave in place scenario with scrap steel recycling only in EAF technology based on country electricity mix (100% scrap steel)
  - 1,9 tCO<sub>2</sub>e/t steel
- Reduction of GHG emissions by 35% with complete removal of jackets compared to leave in place scenario
  - 0,5 tCO<sub>2</sub>e avoided/t steel

# Conclusions and Perspectives



## Comparison between

- Leave in place scenario → no steel valorisation through circularity
- Complete removal of offshore jackets and steel valorisation in EAF technology

Under study's assumptions, complete removal scenario allows to decrease GHG emissions by 30-35% compared to leave in place option

- 0,5 to 0,7 tCO<sub>2</sub>e avoided / t steel



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## Indicative LCA results based on various assumptions

Need more info on steel market, country steel production, scrap steel use...

Validity of LCI from databases

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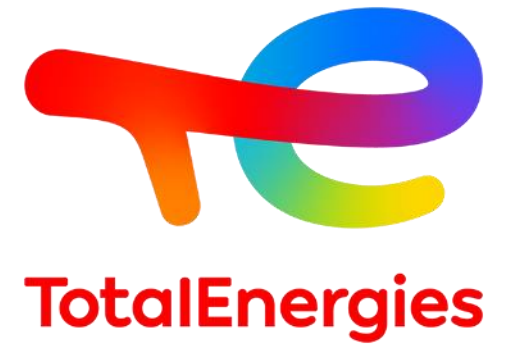
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## What about the ecosystems value?

Marine biodiversity  
Ecosystem services  
Fisheries for local people

Save biodiversity or reduce GHG emissions?



Thank you