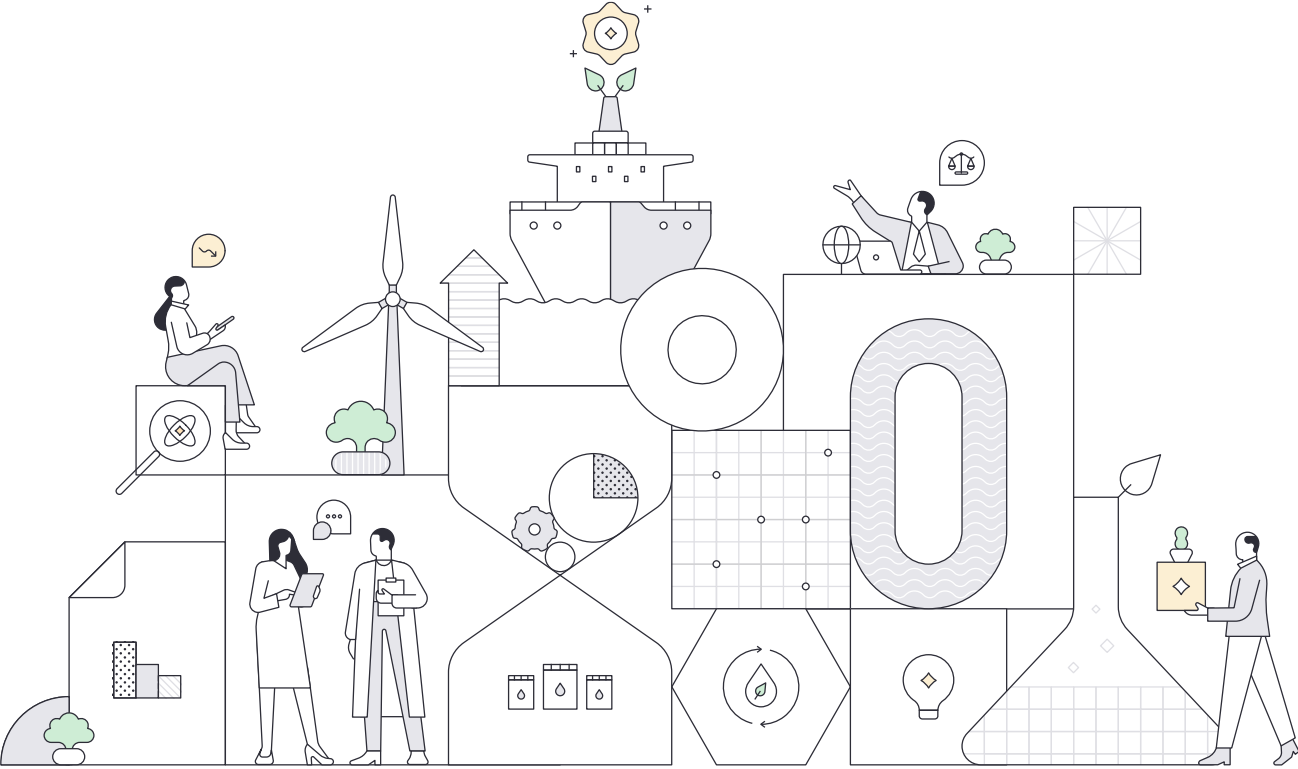# We show the world it is possible

Bo Cerup-Simonsen
ATV annual meeting 10 May 2022

Net-Nul skibsfart i 2050:
En historisk mulighed for de
tekniske videnskaber – hvad er
potentialet og hvad kræves?

ATV Årsmøde 2022

Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping

The Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping - we show the world it is possible

Our vision

Decarbonization of the global maritime industry by 2050.
Robust initiation of the decarbonization transition by 2030.

Our mission

To be an independent and significant driver of a sustainable maritime decarbonization.

Not-for-profit

Any donation or earned profit is used to pursue our objective

Independent

We collaborate with key players across the value chain but are independent and technology agnostic
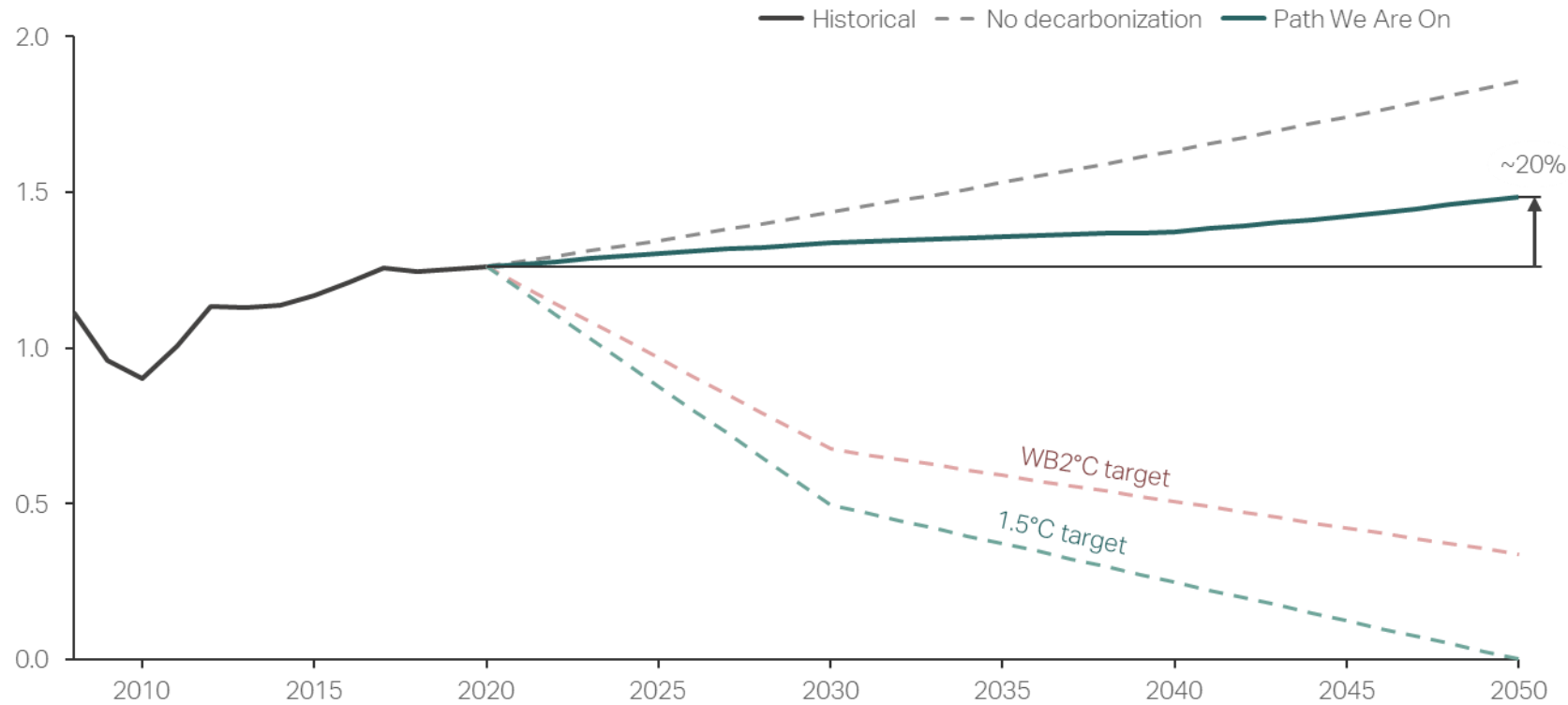
Science-based

We explore viable decarbonization pathways and base our positions on data and scientific methods

The great reduction potential and market is outside of Denmark
Scale: Fuel: 300mtons/year fossil, equivalent of 2000GW installed renewable energy

WTW Maritime emission pathways[1]
$GtCO_2$-eq/year

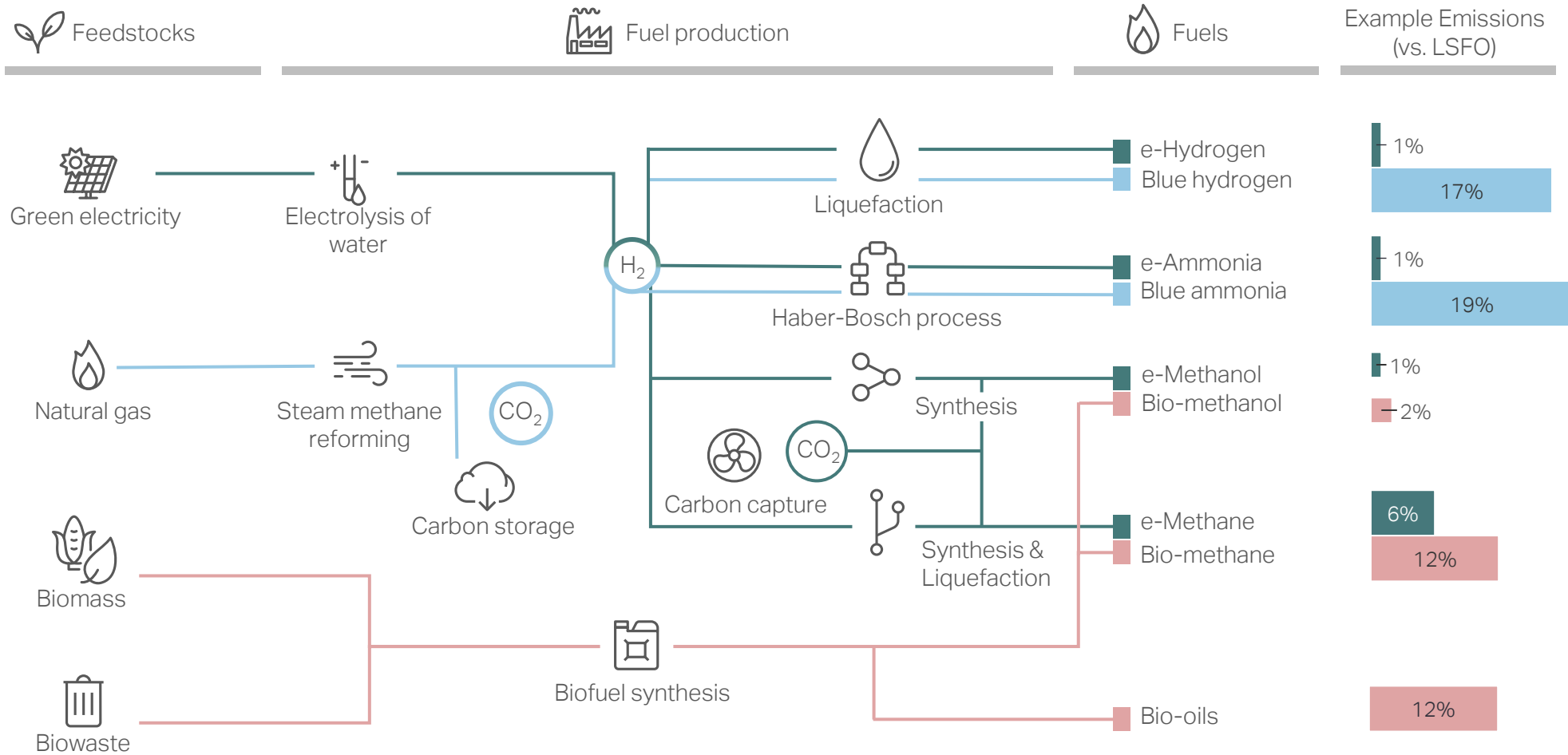—— Historical - - - No decarbonization —— Path We Are On

2.0

1.5

~20%

1.0

WB2°C target

0.5

1.5°C target

0.0

2010 2015 2020 2025 2030 2035 2040 2045 2050

Energy efficiency industry-wide

First Movers show it is possible, and how

Establish scalable energy pathways

Global Regulation and standards

Sources: IMO, IEA, Clarksons and Techno-economic model MMM Center for Zero Carbon Shipping
1 WTW = well to wake.

Scalable energy pathways are within reach this <u>decade</u>
Enormous bottom-up innovation potential this <u>century</u>

Feedstocks

Fuel production

Fuels

Example Emissions (vs. LSFO)

Green electricity → Electrolysis of water → H_2

Natural gas → Steam methane reforming → Carbon storage / CO_2

Biomass

Biowaste → Biofuel synthesis

Liquefaction → e-Hydrogen (1%) / Blue hydrogen (17%)

Haber-Bosch process → e-Ammonia (1%) / Blue ammonia (19%)

Carbon capture / CO_2 → Synthesis → e-Methanol (1%) / Bio-methanol (2%)

Synthesis & Liquefaction → e-Methane (6%) / Bio-methane (12%)

Bio-oils (12%)

Need: Scale – cost reduction – technology maturity – standards – holistic assessment for systemic benefit

Alternative fuels for decarbonization

Energy Carrier	Feedstock availability	Fuel production	Fuel storage, logistics, bunkering	Onboard fuel conversion[1]	Onboard safety and fuel management[2]	Regulation[3]
Fossil fuels	Mature and proven	Mature and proven	Mature and proven	Mature and proven	Mature and proven	Mature and proven
e-hydrogen	Mature and proven	Solutions identified	Major challenges remain	Major challenges remain	Major challenges remain	Major challenges remain
Blue hydrogen	Mature and proven	Mature and proven	Major challenges remain	Major challenges remain	Major challenges remain	Major challenges remain
e-ammonia	Mature and proven	Solutions identified	Major challenges remain	Major challenges remain	Major challenges remain	Major challenges remain
Blue ammonia	Mature and proven	Mature and proven	Major challenges remain	Major challenges remain	Major challenges remain	Major challenges remain
e-methanol	Solutions identified	Solutions identified	Mature and proven	Mature and proven	Solutions identified	Solutions identified
Bio-methanol	Solutions identified	Solutions identified	Mature and proven	Mature and proven	Solutions identified	Solutions identified
e-methane	Solutions identified	Solutions identified	Mature and proven	Mature and proven	Solutions identified	Major challenges remain
Bio-methane	Solutions identified	Mature and proven	Mature and proven	Mature and proven	Solutions identified	Major challenges remain
Bio-oils	Solutions identified	Major challenges remain	Mature and proven	Solutions identified	Mature and proven	Solutions identified

Legend:
- Mature and proven (green)
- Solutions identified (yellow)
- Major challenges remain (red)

This decade will be critically important to get started – and the need for continuous improvement will remain
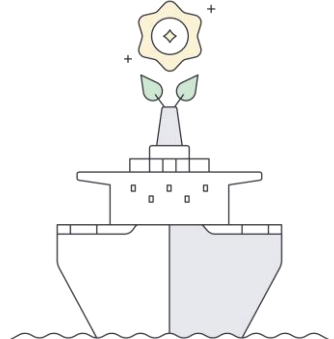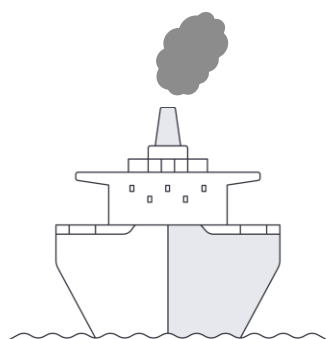
3% of global emissions
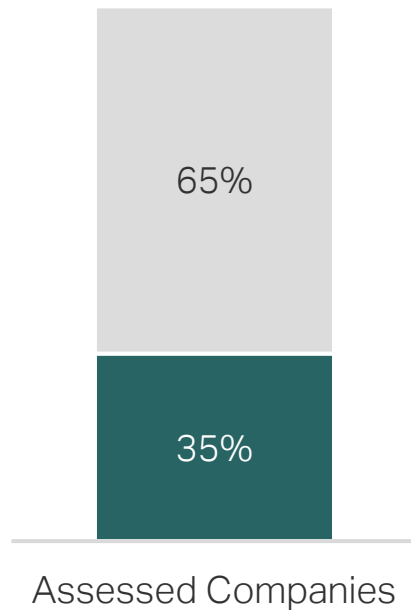
Shipping Sector	2022 Commitment By industry and countries	2026 Demonstrate and initiate Green corridors, demos	2030 Adopt and Scale Global regulation	2050 Continuous Improvement
Academia	Research Education Innovation	Research Education Innovation	Research Education Innovation	Research Education Innovation

Only about 10% of shipping emissions are covered by net-zero targets. First movers are catalyzing the transition – and there is a long way to go

Of the 94 largest shipowners assessed, 35% have announced decarbonization pledges

Split across categories Containers have the most pledges but Bulk is similar in terms of addressing net zero ambitions

◻ No Pledge ■ Decarbonization Pledges

◻ No IMO or net zero pledge ◻ IMO pledge ■ Net zero 2050 pledge
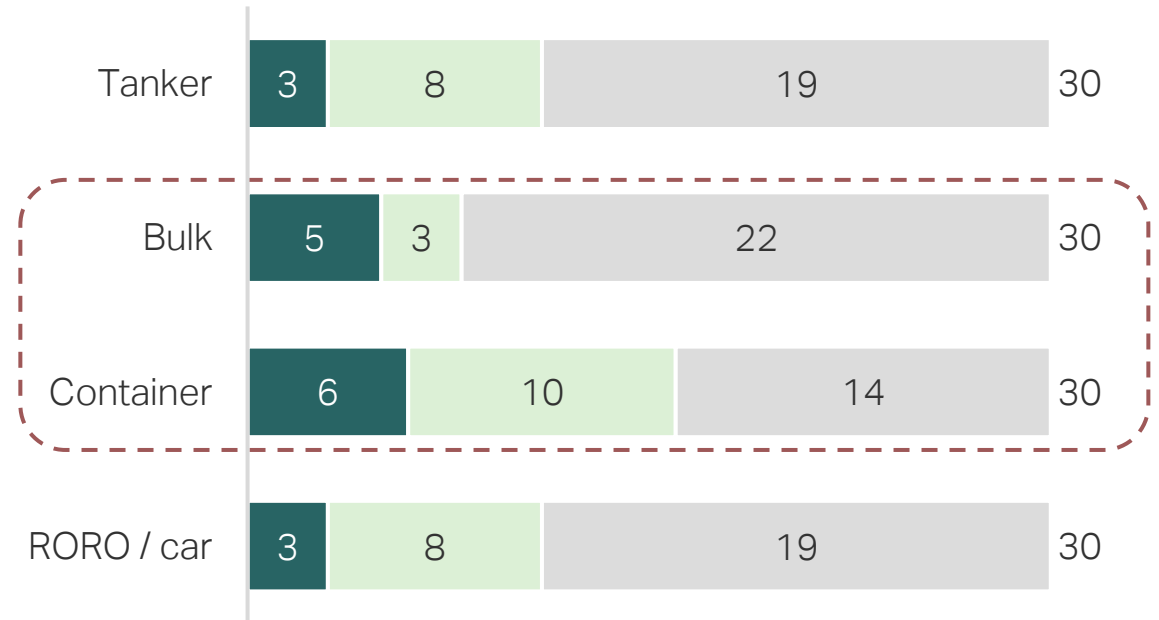
	Net zero 2050 pledge	IMO pledge	No IMO or net zero pledge	Total
Tanker	3	8	19	30
Bulk	5	3	22	30
Container	6	10	14	30
RORO / car	3	8	19	30

65%

35%

Assessed Companies

How to stay competitive beyond 2030? Great impact potential outside of Denmark – Great value potential inside Denmark.

Fuel costs (USD/GJ)

eFuels

Blue

Bio

Oil & LNG
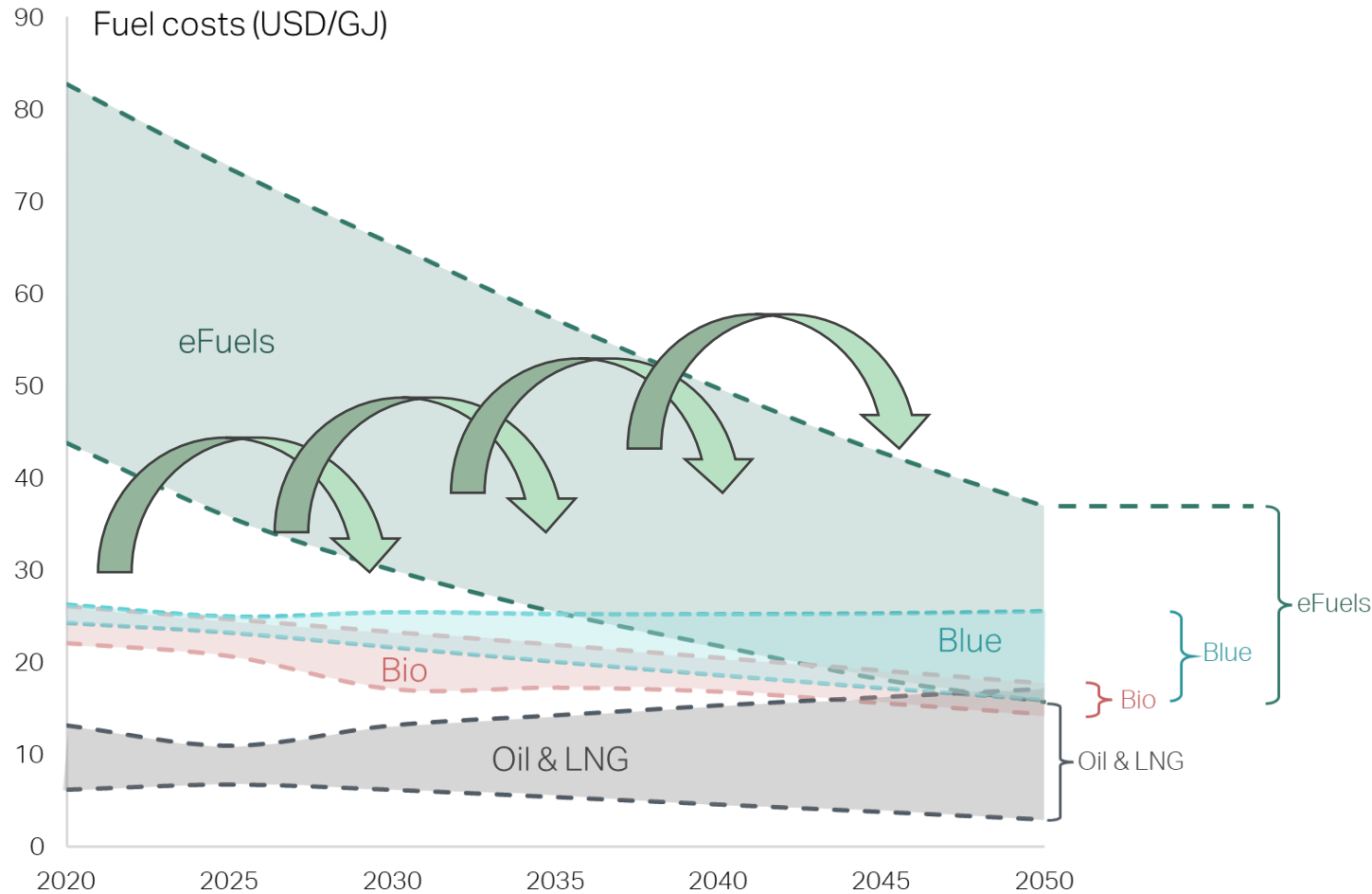
**Think BIG and LONG TERM
Transition could come in waves**

Thus, need to focus on several time horizon in parallel!

First wave

Will rely on existing technology and the focus it to get the first experiences at industry scale

Second wave

Industry wide deployment of robust technologies supported by a policy framework making investments in scale robust

Xth wave

Next generation technologies, showing breakthrough in relation to efficiencies and cost reduction
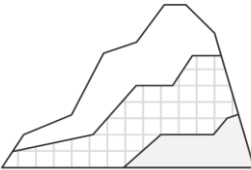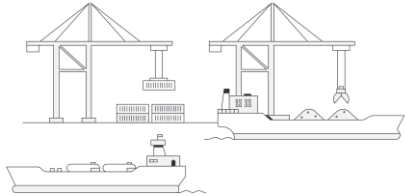
Denmark has a unique opportunity. The potential climate impact and value creation goes far beyond '70% GHG Reduction in Denmark in 2030'
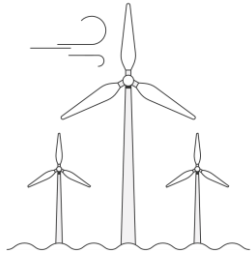
Renewable energy,
Energy and solutions
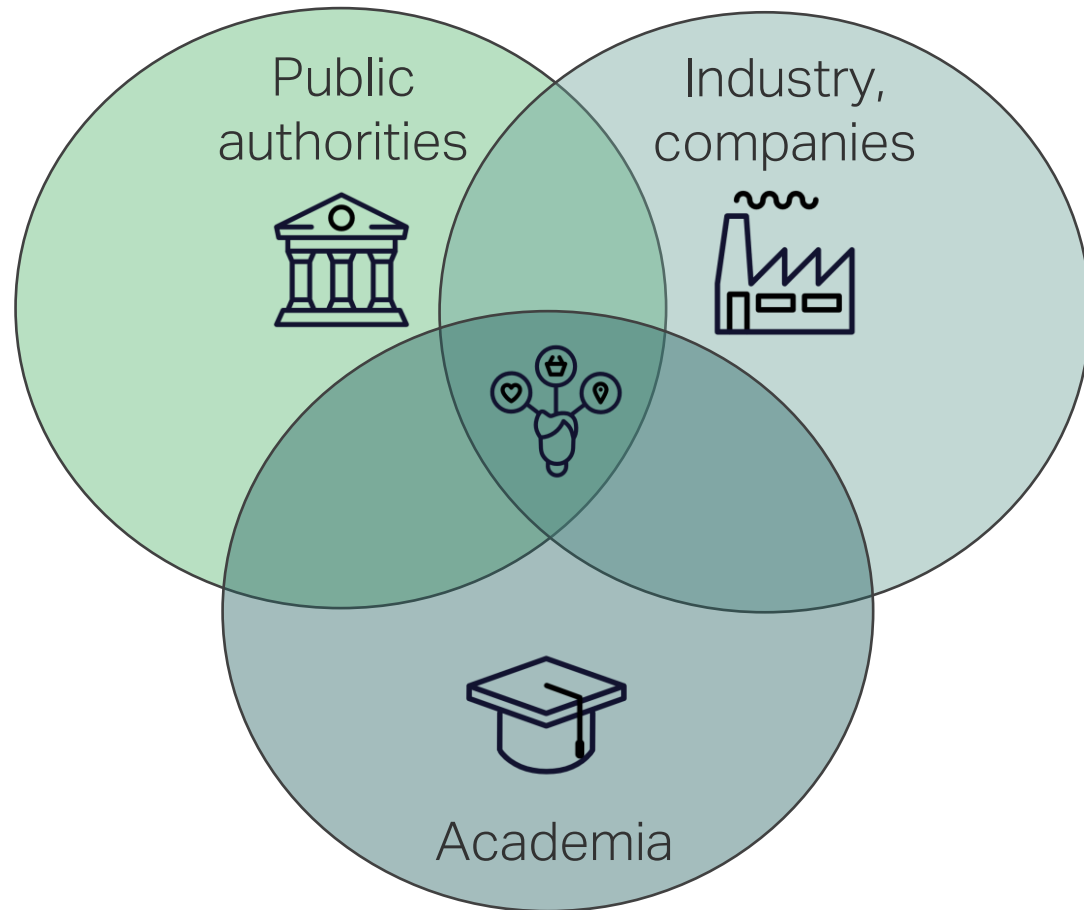
Shipping nation
First Movers

Bio, Blue, Power to X,
Fuels and solutions

Political buy-in
Universities

We have an opportunity to strengthen value creation and climate impact through collaboration and co-creation in certain areas.

**Public authorities**

Industry, companies

Academia

Collaboration in the non-competitive zones:

- The overall narrative for the transition; basis for strategies of various parts of the eco-system

- National policies across business, energy, climate, research and education

- Show why, what, how: Demonstration and Blueprints

- Transparency on industry targets and progress

- International standards and regulation

Thank you!
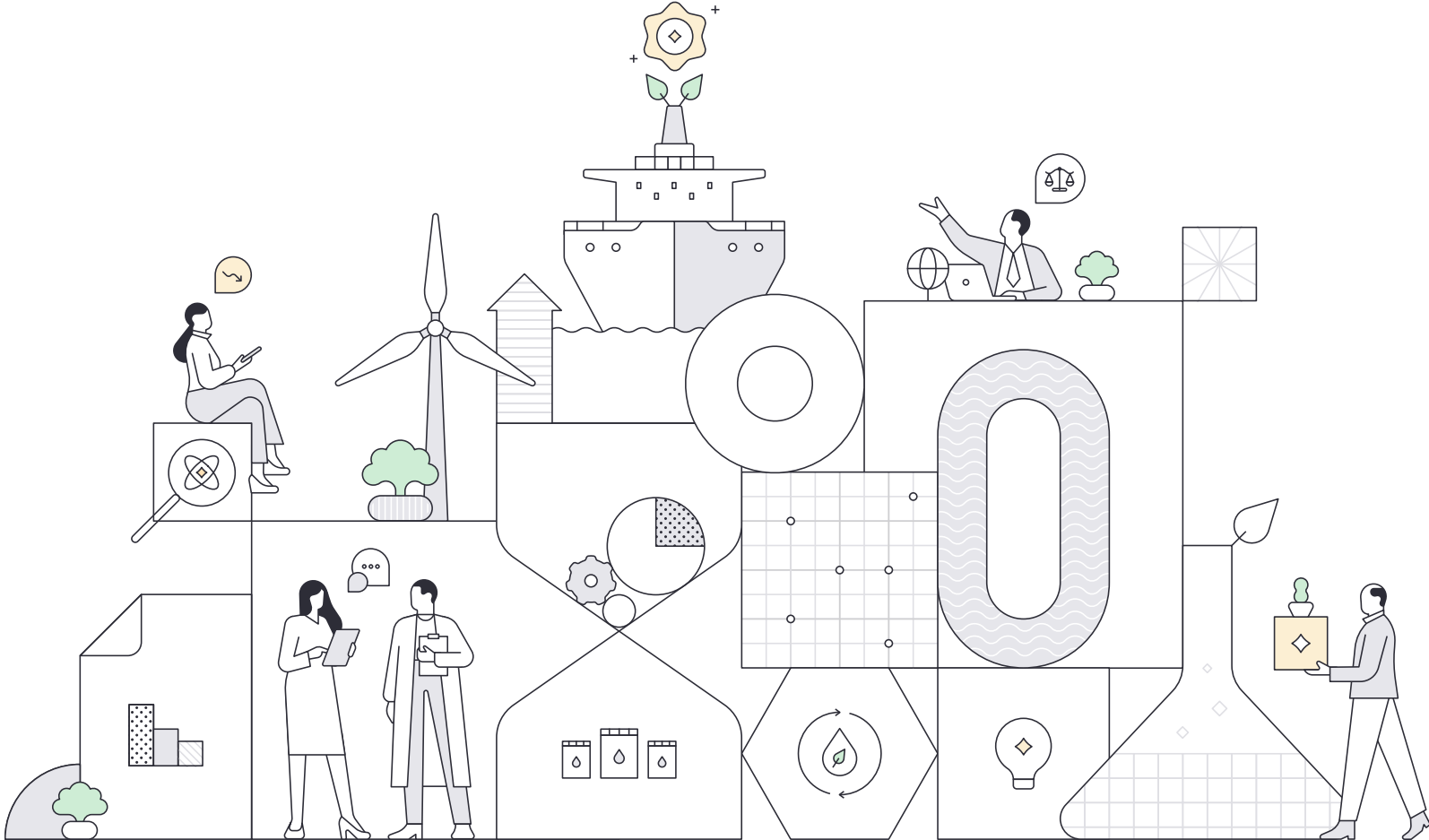
For more information go to
www.zerocarbonshipping.com