



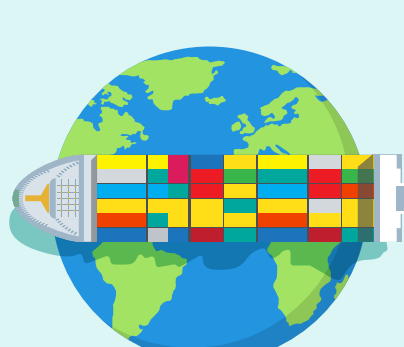
SUSTAINABLE SHIPPING

A BRIEF OVERVIEW

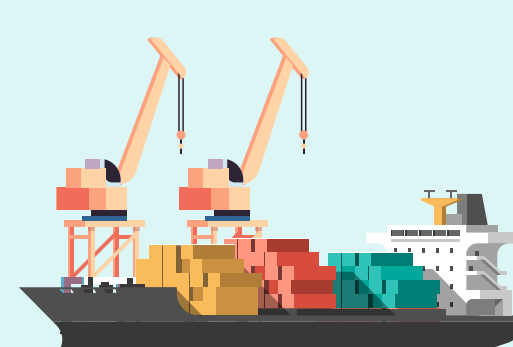
FACTS ABOUT SHIPPING



The world's
most efficient
mode of transport¹



Carries over
80%
of world trade



Ships are the world's
largest machines,
with diesel engines up
to four-storeys tall²

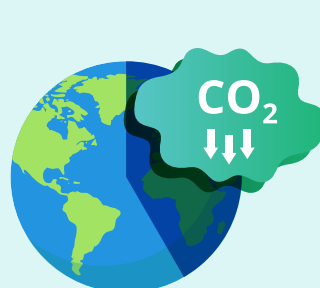
PATHWAY TO GREENER SHIPPING



2020

IMO 2020 Global Sulphur Cap¹ –
Reduction in sulphur limit for fuels
from **3.5% to 0.5%**

- Improved Health
- Cleaner Air
- Healthier Earth



2030

At least **40%**
reduction in CO2
emissions per
transport work
(compared to
2008 levels)³



2050

At least **50%**
reduction in total
annual greenhouse
gas emissions
(compared to
2008 levels)³

HOW TO FUEL SUSTAINABLE SHIPPING?

Did You Know?

Singapore is the world's largest
bunkering hub.⁴

Today, fossil fuels power virtually all-commercial
shipping activities. However, they are not
sustainable or clean energy sources.

82%

Heavy Fuel



18%

Marine Gas
and Diesel Oil⁵

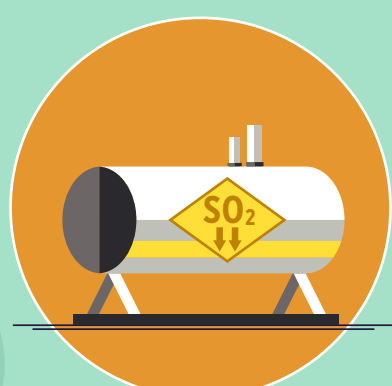


What Alternatives Are There?

Short-Term

Benefits: More environmentally friendly, able to meet current IMO sulphur cap

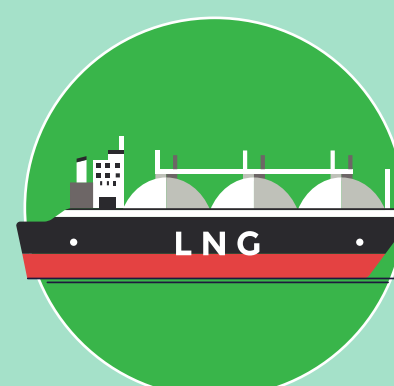
Limitation: Still emit pollutants



1. Low-Sulphur Fuels

From evaporating crude oil using
fractional distillation and condensing
it into liquid fractions⁶

Limitations: Potential stability and
compatibility complications⁷



2. Liquid Natural Gas

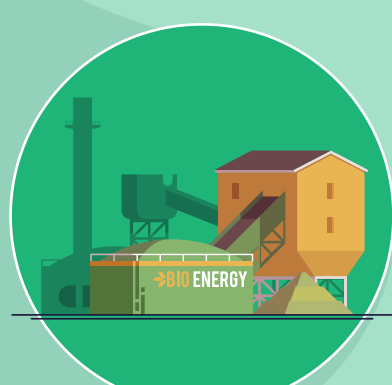
From gas within Earth's crust

Limitations: Challenging to transport⁸,
Causes methane pollution⁹

Long-Term

Benefits: Clean and sustainable

Limitation: Not ready for deployment on a massive scale



1. Bio-Fuels

From biological materials e.g. plants

Benefit: Renewable¹⁰

Limitation: May have resource
competition¹⁰

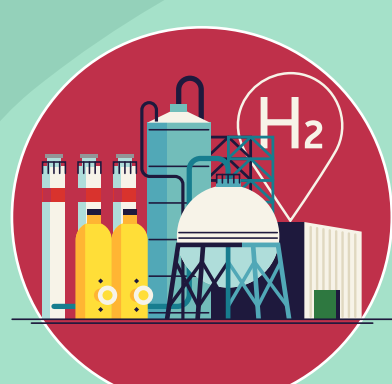


2. Synthetic Fuels e.g. bio-methanol

From renewable energy using electricity
as the primary energy source

Benefit: Can be conveniently stored¹¹

Limitation: Large amount of
renewable energy required¹²



3. Fuel Cells

Produce electricity from an external
fuel source e.g. ammonia, hydrogen

Benefits: Low maintenance and
produce less noise¹³

Limitation: Costly technology¹⁴



4. Batteries

Store and discharge electricity

Benefits: Reduce fuel consumption and
maintenance costs¹⁵

Limitation: High infrastructure costs¹⁵

WHAT NON-FUEL SOLUTIONS ARE THERE?



1. Building energy-efficient vessels



**2. Investing in Research and
Development (R&D),
innovation and collaboration**



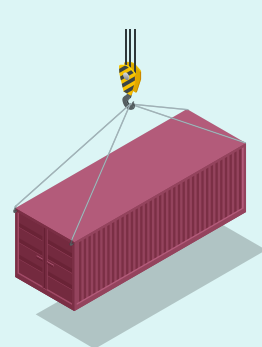
**3. Developing new regulations
and policies**

ACHIEVING SUSTAINABLE SHIPPING

The Best Solution?

There is no one-size-fits-all solution. Decarbonisation is a multifaceted issue that requires innovation, close
collaboration amongst stakeholders, proper infrastructure and supportive regulatory frameworks.

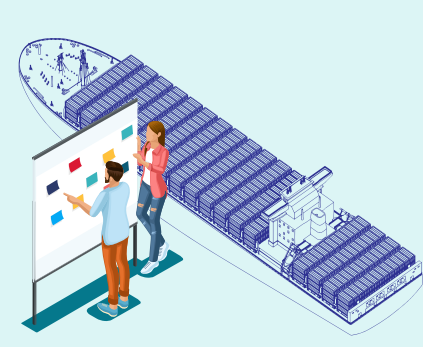
Stakeholders



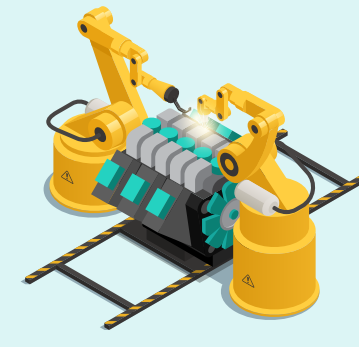
Ship and Cargo Owners



Charterers



Ship Builders and Designers



Engine Manufacturers



Fuel Suppliers and Financiers



Policy Makers



Research Institutions



NGOs

Sources:

¹ Sustainable shipping is making waves, The Guardian 2014

² Sulphur 2020 – Cutting sulphur oxide emissions, International Maritime Organisation 2020

³ Reducing greenhouse gas emissions from ships, International Maritime Organisation 2020

⁴ Singapore grants two new bunker supplier licenses, Seatrade Maritime News 2020

⁵ Shaping shipping's sustainable future: A quest beyond green fuels, Eco-Business 2020

⁶ Marine Fuel Oil Advisory December 2019, ABS 2019

⁷ 2020 Vision: Preparing for the Big Switch – Option 2: Compliant VLSCO Products, The North of England P&I Association Limited 2019

⁸ Different Types and Dangers Involved, Marine Insight 2019

⁹ Alternative Marine Fuels, Maritime Industry Decarbonisation Council

¹⁰ An Overview on Biofuels and Their Advantages and Disadvantages, Asian Journal of Chemistry 2019

¹¹ The Potential Role of Electrofuels as Marine Fuels: A Cost-Effective Option for The Future Shipping Sector?, Shipping in Changing Climates 2016

¹² An end to emissions? Why hydrogen fuel-cells will revolutionise maritime, Riviera

¹³ Better together: batteries and fuel cells, Riviera

¹⁴ 2020: LNG, biofuel and batteries, Riviera 2019

¹⁵ Batteries gain momentum in the maritime sector, DNV GL 2019