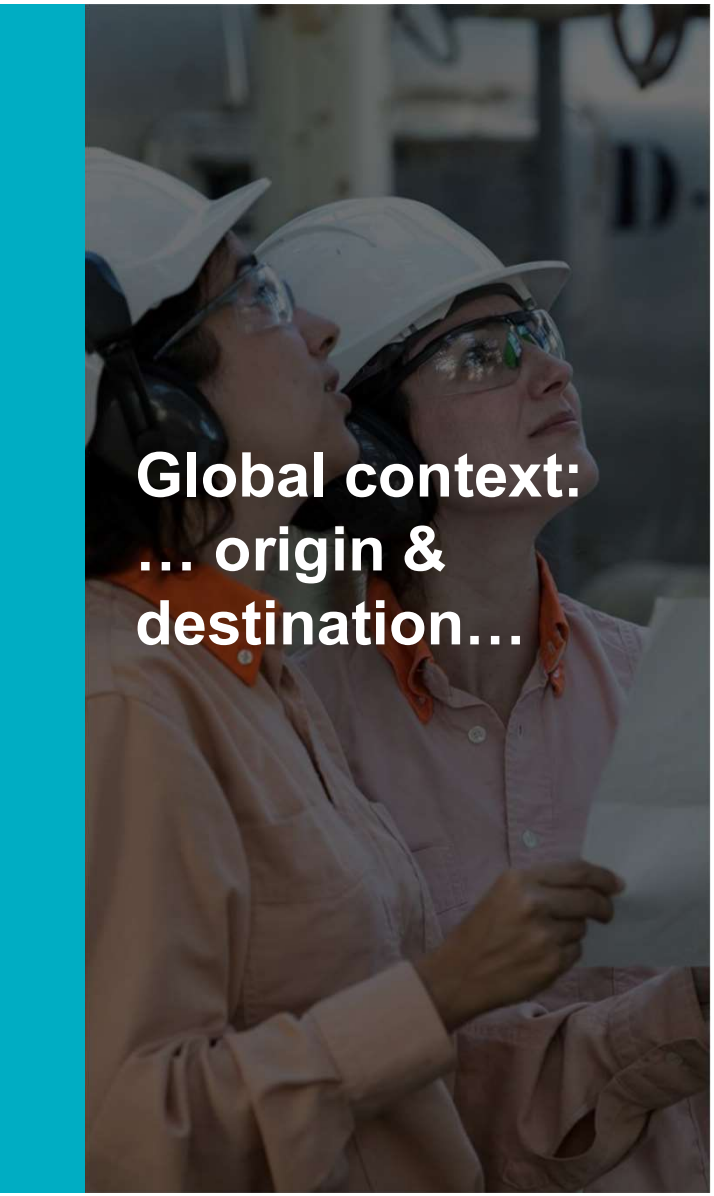
Low Carbon Fuels

Raúl García Redondo
Marine Sales

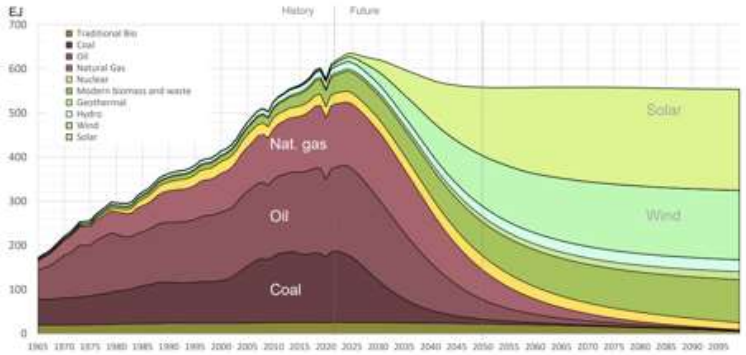
The Repsol Commitment
Net Zero Emissions
by 2050



Global context: … origin & destination…

Repsol Low Carbon Fuels

Current sitation… Where do we go?

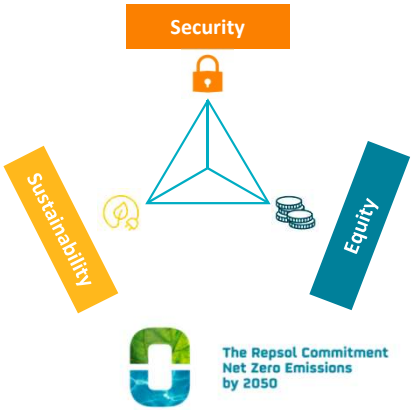


Primary energy demand estimation	
Year	EJ
2023	615
2025	630
2030	650
2035	680
2050	575

Actual De la actual refinería y procesos petroquímicos...

...hacia la refinería y planta petroquímica de cero emisiones netas **2050**

Energy Trilemma



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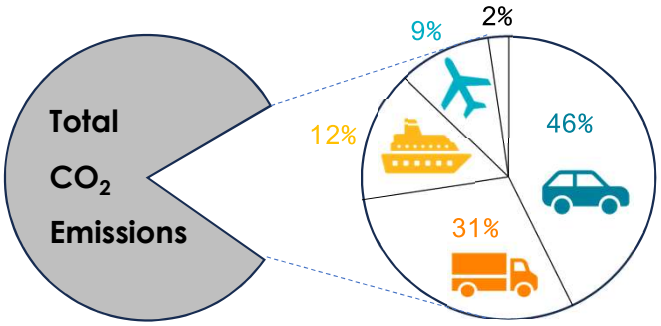
Maritime context in the emissions global arena

Shipping around 3% of global emissions (*hard to abate*)



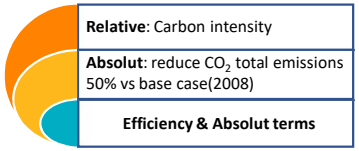
Year	Aplicable regulation
2011	Compulsory adoption of efficiency regulation: EEDI (*) & SEEMP (**)
2013	EEDI & SEEMP come into force
2015	Phase 1 EEDI into force – 10% reduction in carbon intensity in new buildings
2016	IMO *data collection system* (DCS) and obligation to report consumed fuel
2018	IMO initial strategy to reduce GHG emissions
2019	First year of compulsory report of fuel consumption to IMO DCS
2020	Phase 2 EEDI into force – 20% reduction in carbon intensity in new buildings
2021	Actions for reducing carbon intensity 40% (@2030) vs 2008 (EEXI & CII)
2023	Phase 3 EEDI into force demanding up to 50% reductions in new buildings (containers)

(*): Energy Efficiency Design Index
(**): Ship Energy Efficiency Management Plan

IMO's check points:

Year	Target	Aim
2030	-20%	-30%
2040	-70%	-80%

Two ways for single goal



Circular Economy

The Repsol Commitment Net Zero Emissions by 2050

Low carbon fuels for transportation

	Sustainable biofuels and Residue to fuel	Hydrogen and E-fuels
	**Renewable diesel,** ETBE, Ethanol, FAME, BioLPG	**E-diesel, e-gasoline, hydrogen**
	**Renewable diesel,** FAME, Biomethane	
	**Biojet**	**E-jet,** hydrogen
	**Biobunker, Renewable Diesel,** biomethanol, biomethane	**E-diesel,** e-metanol
	Bionaphtha y naphtha circular	E-Naphtha

From 1998 | 2021 | 2026

Circular Economy

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Tech routes for alternative fuels

Route	WASTE USED	TECHNOLOGY	MARKET
Lipidic	 Used cooking oil and lipidic residues from agriculture & farming	**Hidrogenation**	▪ Light Duty, Heavy Duty and Marine : HVO-**renewable diesel** ▪ Aviación: HEFA-**SAF** ▪ Biopropane y bionaphtha for **petchem industry** and **hydrogen production**
Biologic	 OF-MSW, industrial organic waste Residues from agriculture and cattle	**Anaerobic digestion y fermentation**	▪ **Biomethane** for heavy industry, maritime, industrial and residential. ▪ **Bioethanol** for gasoline production and SAF. ▪ **Fertilizers and biochar** as by-prods
Thermo-chem	 Municipal solid waste Agro residues	**Gasification and pirolisis**	▪ **Renewable diesel** for heavy duty and maritime ▪ **Aviation**: FT and ATJ ▪ Biopropane and bionaphtha for **industria petchem industry** and **hydrogen** production ▪ **Renewable methanol** for shipping and petchem
E-fuel	 CO_2 H_2O Renewable power	**E- fuels**	▪ E-naphtha for gasoline and for the **petrochemical industry** ▪ **E-diesel** for light and heavy transport and marine ▪ **E-jet for aviation**

What is Repsol doing in low carbon fuels?

Project	Technology	Feed Stock	Product	Capacity	Comments
C-43	HEFA	UCO & lipidic waste from agriculture & farming	HVO & SAF	350 kta	Mature tech. Limited feedstock avails
Ecoplanta	Gasification	Solid urban waste and Forrest residue	Methanol	250 kta	Two different grades. Doping with H_2 (colors).
Genia	Fermentation	Farming & agricultural residues	Biomethane	1,5 TWha	19 plants in progress (development phase)
PNOR-syn	E-tech	H_2 & CO_2	Gasoline	2,1 kta	100 MEUR investment
PNOR-pyr	Pyrolisis	Urban solid waste	Off-gas	10/100 kta	20 MEUR investment for phase 1
Electrolyzers	Electrolisys	Sun & water	H_2	Several ones	First electrolyzer alkready working in Bilbao (2,5 MW)

Thank you

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