SH2IPDRIVE

HYDROGEN FOR MARITIME

EU Hydrogen Week 2022

SH2IPDRIVE

26/10/2022

This project has received funding from the Ministry of Economic Affairs and Climate Policy, RDM regulation, carried out by the Netherlands Enterprise Agency.

SH2IPDRIVE = Sustainable Hydrogen Integrated Propulsion Drives

Solutions for Zero Emission propulsion and energy systems for vessel running on H2.

Improve the position of H2 as an alternative energy carrier in the Maritime industry.

Part of the Dutch Maritime Masterplan Emissionless Maritime sector (achieve at least 30 emissionless vessels in 2030).

cooperation
of 25 companies & knowledge institutes

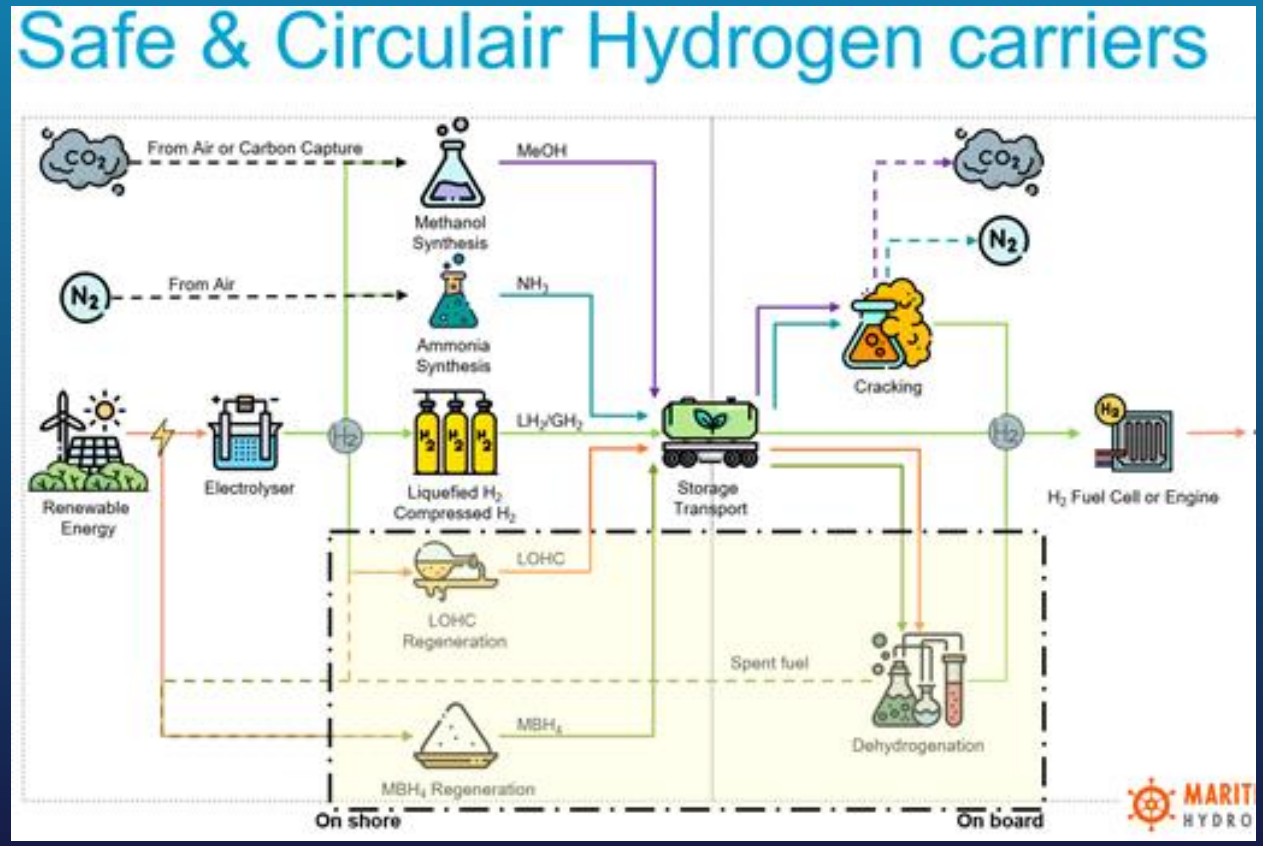
START
November 2021

FINISH
October 2025

Targets SH2IPDRIVE

Develop new solutions for different H2 bunker and storage systems:

- **Compressed H2.**
- **Liquid H2.**
- **Liquid Organic Hydrogen carriers.**
- **Boorhydrides.**



Targets SH2IPDRIVE

Upscaling of the fuel cell technology.

Develop validated concept designs for:

- Shortsea shipping
- Passenger vessels
- Inlandwaterway vessels
- Special purpose vessels (e.g. **dredgers**)

Provide safe and certifiable solutions.

Partners

Future Proof Shipping	Future Proof Shipping	Royal Roos	royal roos
Technische Universiteit Delft	TU Delft	Solid Hydrogen	Maritime Hydrogen
Nedstack Fuel Cell Technology	Nedstack PEM Fuel Cells	Universiteit van Amsterdam	Universiteit van Amsterdam
MARIN	MARIN	Voyex	VOYEX Hydrogen Powered
Koedood	Koedood Marine Group	Encontech	Encontech B.V. Energy Conversion Technologies
Van Dam		Technische Universiteit Eindhoven	TU/e
Holland Shipyards	Holland Shipyards Group	Universiteit Twente	University of Twente.
TNO	TNO innovation for life	Rivermaas	
Van Halteren Technologies	VHT Van Halteren Technologies	IHC Holland	IHC
Cryovat Internationaal	Cryovat full range in cryogenics	Shell	
H2Storage	h2storag	Concordia Damen	Concordia Damen
H2 Circulair Fuel	H2Circular Fuel	DMO	
H2FUEL Cascade	H2FUEL-SYSTEMS Making Hydrogen work		

Innovative hydrogen technology

WP1

BUNKER & STORAGE SYSTEMS
Leader: Shell
Partners: FPS, TUD, Bosch, Cryovat, H2Storage

WP2

HYDROGEN CARRIERS
Leader: TU Delft
Partners: H2 CiF, H2FUEL, Royal Roos, SH, UvA, Voyex

WP3

FUEL CELLS
Leader: Nedstack
Partners: FPS, TUD, UT, Koedood, TNO, Encontech, TU/e, Shell

Modelling, validating and evaluating integrated hydrogen systems

WP4 **DATA COLLECTION & SYSTEM VALIDATION**
Leader: MARIN **Partners:** TUD, Rivermaas, DMO

WP5 **SYSTEM INTEGRATION**
Leader: Koedood **Partners:** FPS, TUD, MARIN, Bosch, Voyex, Shell

Validating hydrogen systems in sea trials

WP6 **MODULAR TESTING**
Leader: Van Dam **Partners:** TNO

Application of validated hydrogen systems in ship design

WP7 **SHIP DESIGN**
Leader: Holland Shipyards **Partners:** FPS, IHC, Shell, Concordia Damen

WP8 **SAFETY**
Leader: TNO **Partners:** FPS, TUD, MARIN

SH2IPDRIVE
HYDROGEN FOR MARITIME

INLAND VESSEL (RETROFIT) | **INLAND VESSEL (NEW)** | **SHORT SEA VESSEL** | **PASSENGER VESSEL** | **SPECIAL PURPOSE VESSEL**

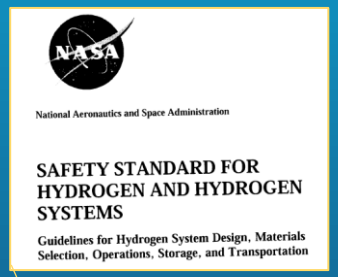
MARITIEM MASTERPLAN NET ZERO 2030

Today's status

WP8: Equivalent safety

heat exposure fatalities

RISK MATRIX SAMPLE			SEVERITY				
			1	2	3	4	5
			Negligible	Minor	Moderate	Major	Cata-strophic
LIKELYHOOD	7	> 1					
	6	$10^{-1} - 1$					
	5	$10^{-2} - 10^{-1}$					
	4	$10^{-3} - 10^{-2}$					
	3	$10^{-4} - 10^{-3}$					
	2	$10^{-5} - 10^{-4}$					
	1	$10^{-6} - 10^{-5}$					



H_2 fuel system description

HAZID

Sandia National Laboratories

HyRAM

Reduce risk

Determine probabilities

Determine consequences

Risk assessment

Consolidate design

Questions and comments