



THE GIGATONNE POTENTIAL OF THERMOCHEMICAL FUELS

MASH MAKES
POWER

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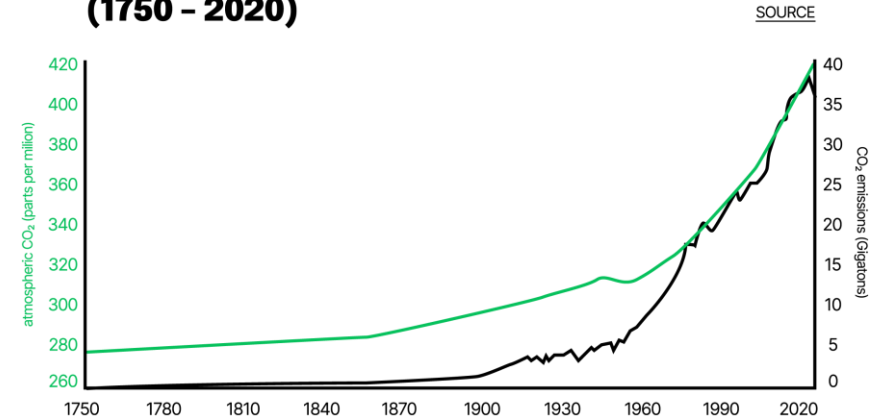
THE CHALLENGES AND OPPORTUNITIES OF THE GREEN TRANSITION

The bad news: Global warming, disruptions in global energy supply chains and a lack of options for transitioning hard-to-abate industries.

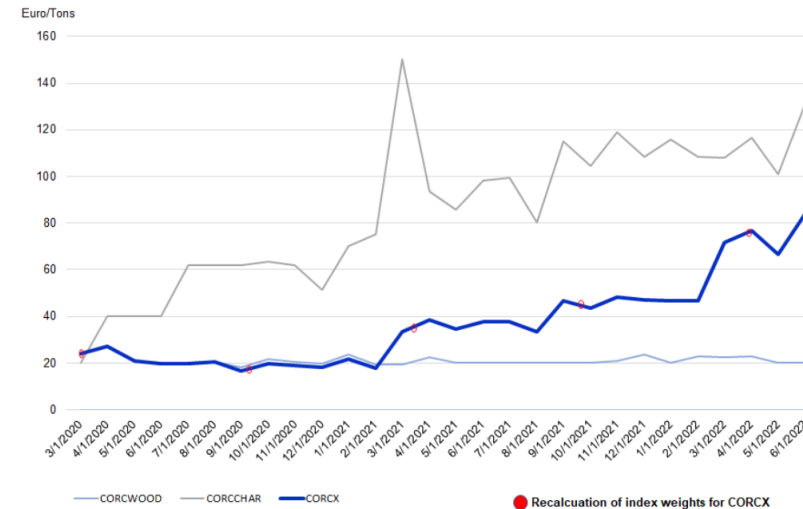
The good news: Above factors expediting the green transition. The global markets are responding and the cost of CO2 is shooting up. However, demand is clearly outpacing supply.



CARBON DIOXIDE EMISSIONS AND ATMOSPHERIC CONCENTRATION (1750 - 2020)



CO2 Removal Certificate Weighted Index Family (CORCX)



A NEW, GROUNDBREAKING CONTENDER: MASH MAKES

This platform has the potential of becoming a main driver in the future energy mix, while at the same time doing the heavy lifting on the carbon sequestration task facing the globe.

MASH has spent the last 7 years perfecting this platform and is now ready to scale it commercially.

BIOMASS RESIDUES



LEFTOVERS FROM SUGARCANE PRODUCTION



SHELLS FROM CASHEW NUTS



WEED



ALGAE FROM OCEANS

ETC



VALUABLE COMMODITIES



BIOCHAR



BIOFUEL



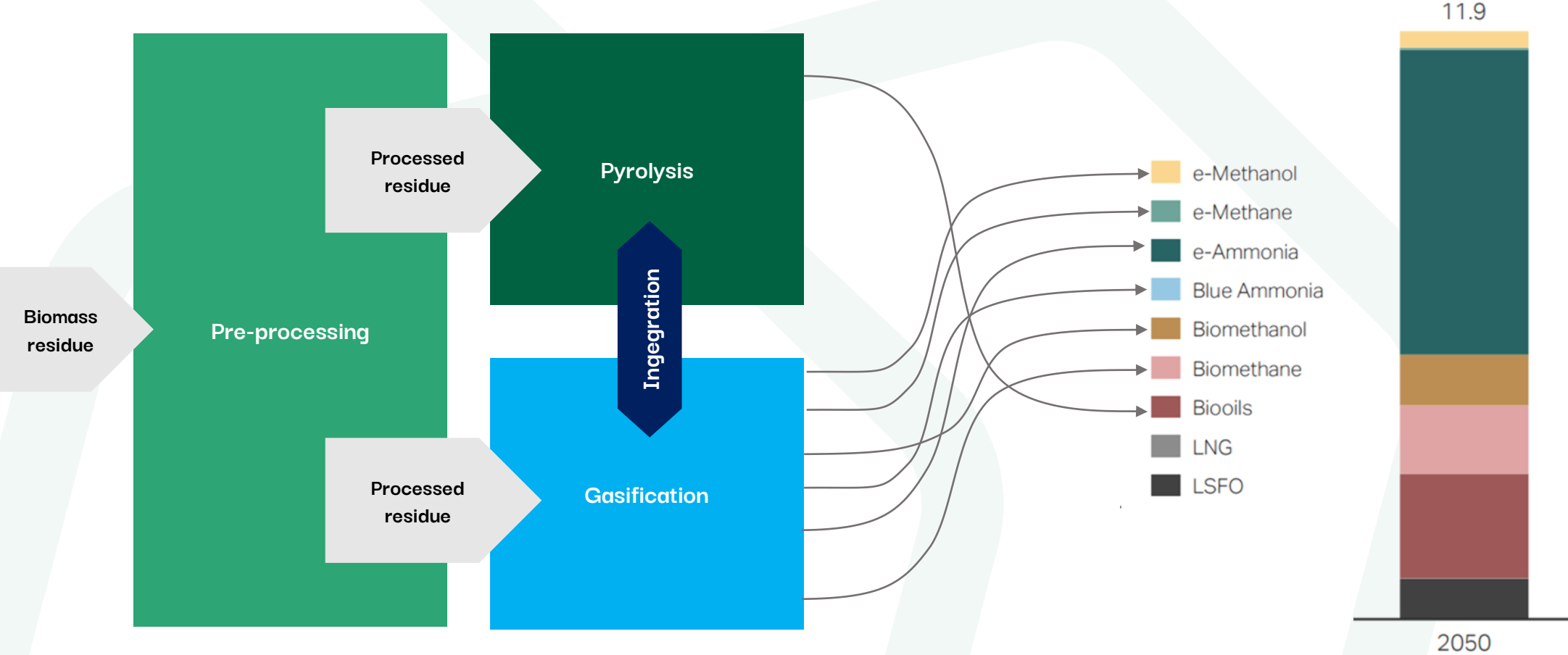
BIOWATER



BIOHYDROGEN

Net CO2 negative

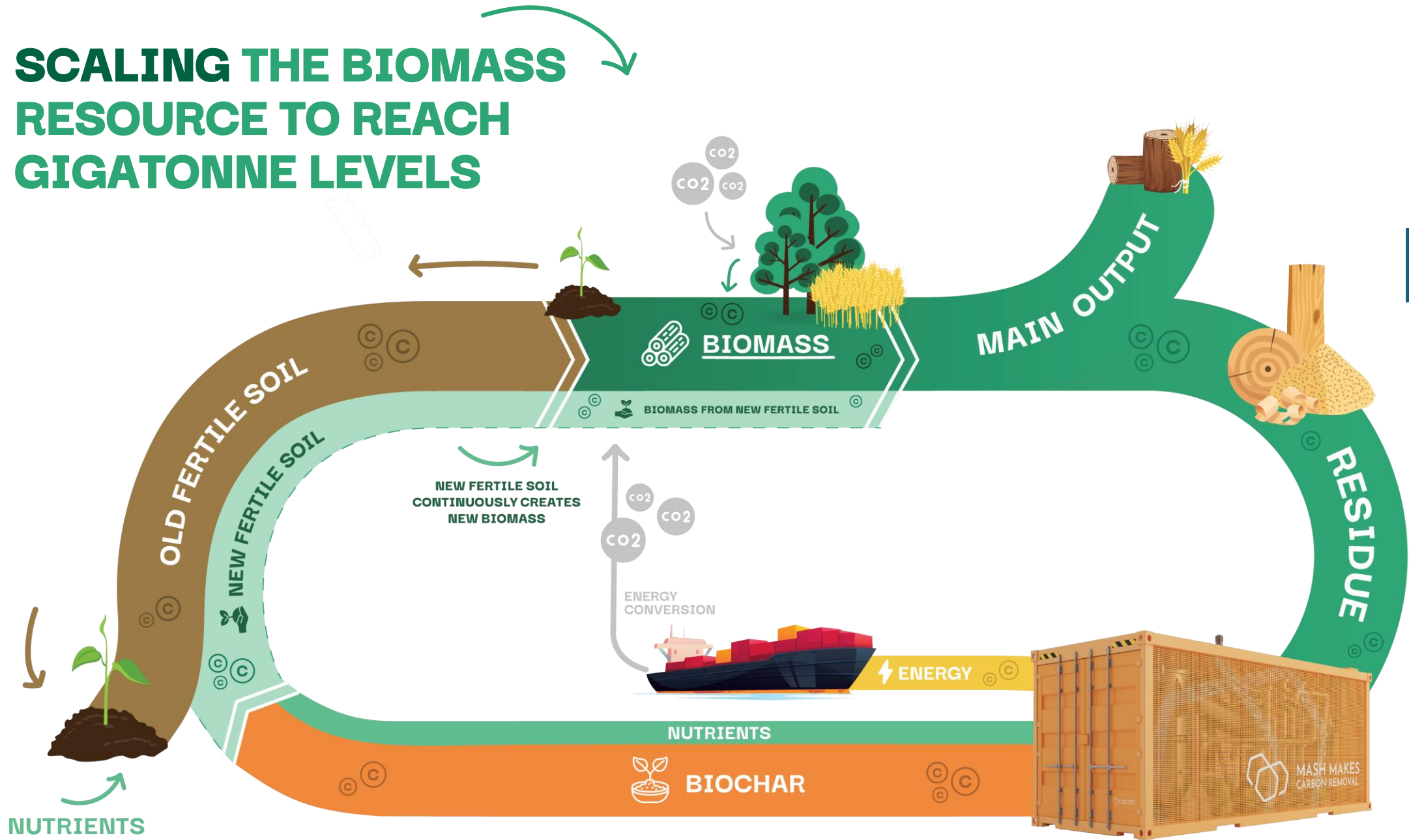
Mapping Tech to Shipping's Future Fuel Mix



**A GAME-CHANGING
CO-PRODUCT:
BIOCHAR**



SCALING THE BIOMASS RESOURCE TO REACH GIGATONNE LEVELS



Featured in



GIVING GREEN.earth

BUSINESS INSIDER

FASTCOMPANY



World Changing Ideas 2022

OUR FIRST COMMERCIAL SITE (India)



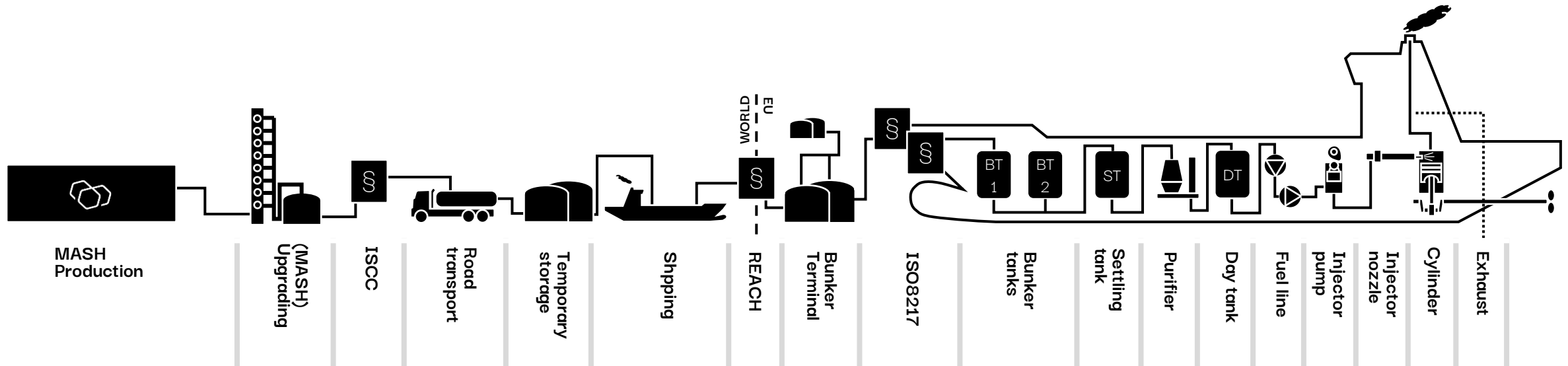


PERMANENT TEST VC APPARATUS
1 MM OR VC= 0.0001 KG/CM²

UNDERSTANDING THE FUEL LIFECYCLE

To sell the fuel (or at least to keep selling it) we need to ensure that our product is compliant with all aspects of its intended lifecycle, from production to final combustion (and exhaust). The graphic below shows a generic overview of such a lifecycle for shipping. This sector is chosen because it is (and has been) our main focus, but also because it can be seen as a "worst case" scenario in terms of the requirements met – at least compared to our other options. For instance, using the fuel in boilers would impose only a subset of the requirements related to the below lifecycle, but no new elements.

As the fuel moves toward the cylinder of the vessel, it is faced with legal requirements (denoted by a "§") and various technical requirements such as blending with other fuels, stability under storage, separability of sludge and behavior at ever escalating temperatures and pressures, culminating at 1500 bar and 90 deg C. This isn't even counting the actual conditions under combustion in the cylinder.



THE LEVEL OF VALIDATION FOR EACH MASH PRODUCT

Using the same, lifecycle phases we can map what we know about our fuel (and other fuels like CNSL). The table below shows where the products fail (or are expected to) and where they succeed. In this regard, it is worth noting that the main issues all relate to the part of the lifecycle that unfolds on the ship. This in itself is an impressive feat as most other pyrolysis fuels would fail much sooner than this.

Having said this, the issues observed in e.g. the MAN ES engine test were significant and disqualifying. Not in the least because, we are now aware that similar issues were observed on commercial vessels using CNSL and cardanol (sometimes without the shipowner being aware of this).

As is also apparent, some of the results are about to come in due to the testing currently under way in Khopoli (see next slide). At present, we are expecting that our **base washed pyro oil used in conjunction with CNSL is the first candidate to achieve full compliance.**

		(MASH) Upgrading	ISCC	Road transport	Temporary storage	Shipping	REACH	Bunker Terminal	ISO8217	Bunker tanks	Settling tank	Purifier	Day tank	Fuel line	Injector pump	Injector nozzle	Cylinder	Exhaust	
Formulation 1	+ Diesel	No	***	Green	Green	Green	**	Green	Green	Green	Yellow	Red	Green	Yellow	Red	Red	Green	Green	
Formulation 2		Yes	***	Green	Green	Green	**	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Green	Green	
Formulation 3		No	***	Green	Green	Green	**	Green	Green	Green	Green	Green	Green	Green	Yellow	*	*	*	Green
Formulation 4		Yes	***	Green	Green	Green	**	Green	Green	Green	Green	Green	Green	Green	Green	*	*	*	Green
Cardanol		No	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Green
CNSL		No	***	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green
Formulation 1		+ MeOH	No	***	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

Degree of compliance

Assessed outcome

* Preliminary tests due by Jan 18th 2023

** Requires clarification on strategy; 2-18 months

*** New certificate to be developed for SPV1 site.

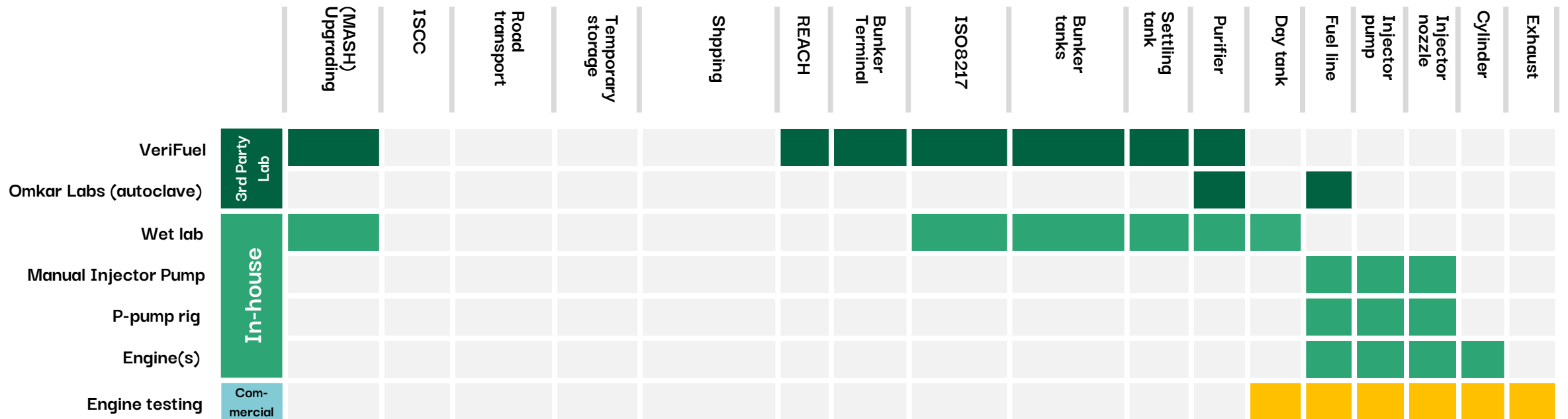


WHAT WE ARE DOING TO VALIDATE OUR PRODUCT

In MASH, we have been looking to establish an in-house test capability that allows us to do as close to end-to-end validation of a fuel. This capability means that we can provide reassurances to our clients while at the same time communicating clearly what the limitations are for using the fuel and which procedures should be observed to avoid issues when using it.

In the last months, we have been particularly focused on enabling validation of the on-vessel conditions (high pressure, temperature and blending) that the fuel is subjected to.

These capabilities and the associated expertise have put us on the radar with Maersk and companies like FinCo who are looking to us for solutions for e.g. CNSL use.



 Area covered



LAUNCHING OUR FIRST THERMOCHEMICAL FUELS

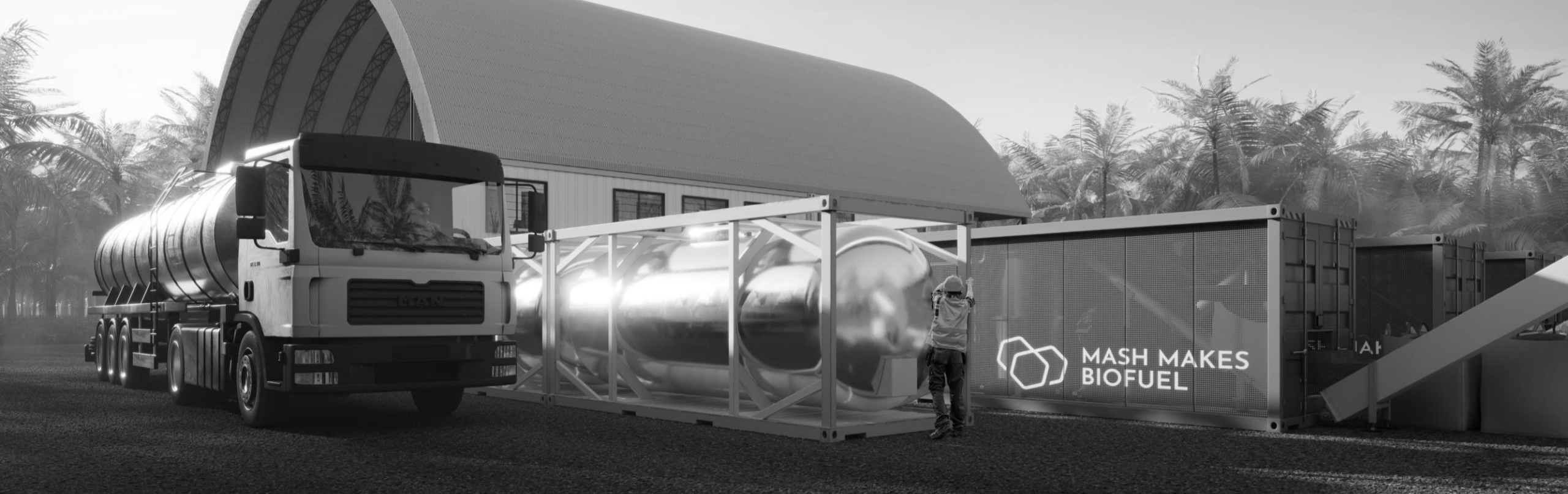
- Over the past years, we have executed a large number of tests for various fuel formulations.
- Based on this, we have brought products to market in two segments:
 - **Burner / furnace fuel applications.**
 - **Refinery feed (FCC).**
- Both are ISCC EU- and REACH compliant.

**Boiler Biofuel
Brochure**



**FCC Feed
Brochure**





**Boiler Biofuel
Brochure**



**FCC Feed
Brochure**



THANKS!

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