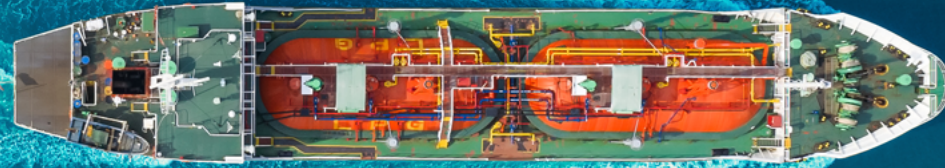


# UREAGENERATOR – THE NEXT STEP IN MARINE EMISSION REDUCTION.



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HOW CAN THE MARINE INDUSTRY  
REDUCE EMISSIONS, INCREASE  
OPERATIONAL FLEXIBILITY AND  
REDUCE COSTS?

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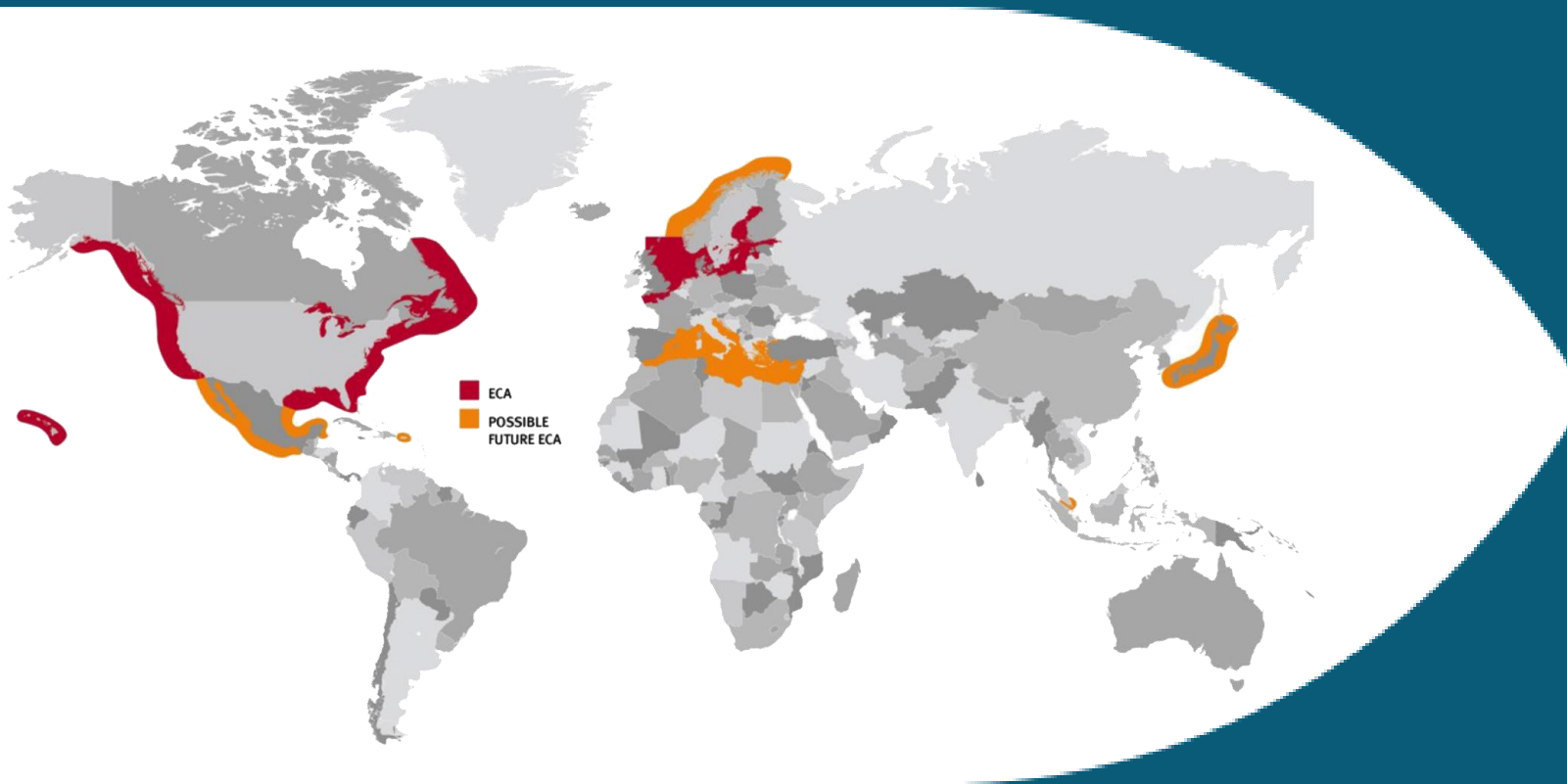
# WATER, WATER EVERYWHERE

(The Rime of the Ancyent Marinere, 1798)

Having spent many years in the marine industry I have concluded that most ships spend a lot of time in water.

Why therefore do we deliver thousands of tonnes of urea based emission control chemicals over many thousands of kilometres to vessels all over the globe every year which contain 60% water when there is water readily available pretty close by?

# CURRENT AND POSSIBLE SOX & NOX EMISSION CONTROL AREAS (ECA)



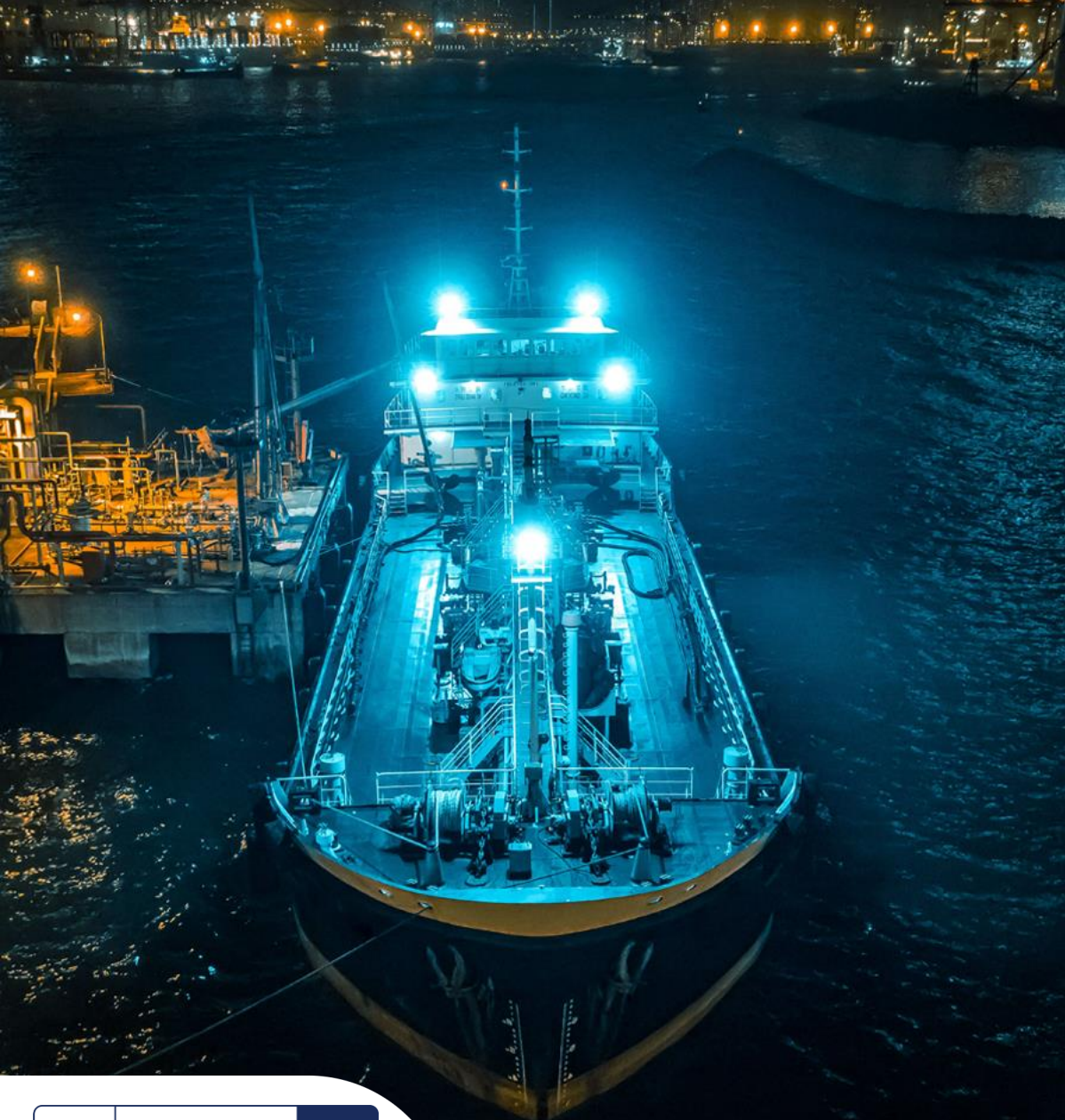
A marine engine installed on a ship constructed on or after the following dates and operating in the following ECAs shall comply with the Tier III NO<sub>x</sub> standard ( 3 exceptions):

1st January 2016 and operating in the North American ECA and the US Caribbean ECA.

1st January 2021 and operating in the Baltic Sea ECA or the North Sea ECA.

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# NOX REDUCTION IN AN ECA

There are a number of credible ways to comply with the NOx Tier III emission standards including alternative fuel e.g. low pressure gas engines, exhaust gas recirculation, scavenge air moisturising however selective catalytic reduction (SCR) systems are the most popular with 1,976\* systems fitted to existing vessels and 1,083\* planned for new build vessels.

More than 80%\* of the vessels fitted with SCR systems use a urea based solution which when combined with the catalyst reduce the NOx content of the exhaust gas whilst not impacting the basic engine design or combustion process.

\*Source Clarksons Research

\*\*Source Marine Insight



# MARINE UREA SOLUTION (AUS40)

The specification of AUS40 is controlled by ISO-18611 which details the concentration of technically pure urea (40%) and pure water (60%)

AUS40 is typically delivered from the urea blending facilities to the vessels in bulk by road tanker trucks and / or special barges or in 1,000L IBCs / Totes. Logistics costs are a high proportion of the delivered AUS40 cost. The availability & supply of AUS40 is challenging in many ports.

Every 1,000L of AUS40 delivered contains 600L of water. 1,000kg of pure urea once blended will create 2,240 litres (~2,500kg) of AUS40

If the current 1,976 ships use 30,000 litres of AUS40 per annum we are transporting around 36 million litres or 36,000 tonnes of water every year between the onshore blending facilities and vessels.

**WHY DON'T WE BLEND THE AUS40 ONBOARD OUR SHIPS?**

# ONBOARD AUS40 BLENDING



What do we want to achieve? Framing the concept: the idea!

Opportunity Statement: Blending AUS40 onboard needs to:

1. Reduce the weight of the product being transported to the vessel by 60% (no water) - less weight = less trucks and barges = 60% less emissions and less costs.
2. Allow greater control over availability = improve global supply options = less risk = better compliance.
3. Allow better quality control and shelf life issues - reduce cost risk = less cost.
4. Not adversely impact day to day shipboard operations and resources
5. Reduce the weight of the product onboard – less weight = more cargo = more revenue.
6. Reduce costs – save money



## TECHNOLOGY READINESS LEVEL



## WHAT DO WE DO NEXT?

Fluechem applies the TRL process to all its technology related business and projects:

**Idea:** input from shipowners, crew and Fluechem's operational team (>12 years AUS40 experience.)

**Prototype:** de-risk the project by using existing land based technology applied in a different environment.

**Validation:** extensive testing and operational experience.

**Production:** Feasibility study identifies the optimised system to realise the most benefits. Technical partnerships reduce production risks.



# WHAT DO WE DO NEXT?

## Key feedback to address:

1. We don't like CAPEX!
2. What are the real savings – emissions and costs?
3. How will it fit on my ship - size?
4. Can it be retrofitted and installed at sea - how?
5. Where do I get urea prills?
6. Where do I store urea prills onboard?
7. More equipment - more maintenance - more failures - more risk – more worry!
8. The crew are all busy and we have limited resources!



# WHAT DO WE DO NEXT?

## One size does not fit all!

- Early concepts were sometimes too big – fully containerised 10,000l AUS40/day = a vessel using approx. 200m<sup>3</sup> fuel/day.
- Secondary concepts missed the fundamentals – how do you fill the unit with prills?



# PROTOTYPE AND VALIDATION



Technical partnership with Aran SRL in June 2021

Applying existing AdBlue® technology to the marine environment.

## Key features

1. Single design with flexible capacity 500L AUS40/day to 5,000L AUS40/day to optimise CAPEX.
2. Stand alone unit with single control panel interface;
3. Compact modular design to allow vessel retrofits;
4. Ability to use vessel pot water or option for RO unit;
5. Manual 25kg bag feeding unit or semi-automatic 1,000kg big bag feeding unit;

**Unit on test for >1 year with 99.8% availability and reliability.**

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# PRODUCTION

Detailed design & functional specification agreed with customer

Vessel specific interfaces agreed: base plate and service connections

Control interface and protocols specified

Schedule & milestones agreed including FAT requirements

Own fabrication and assembly allows effective QA/QC control and project management

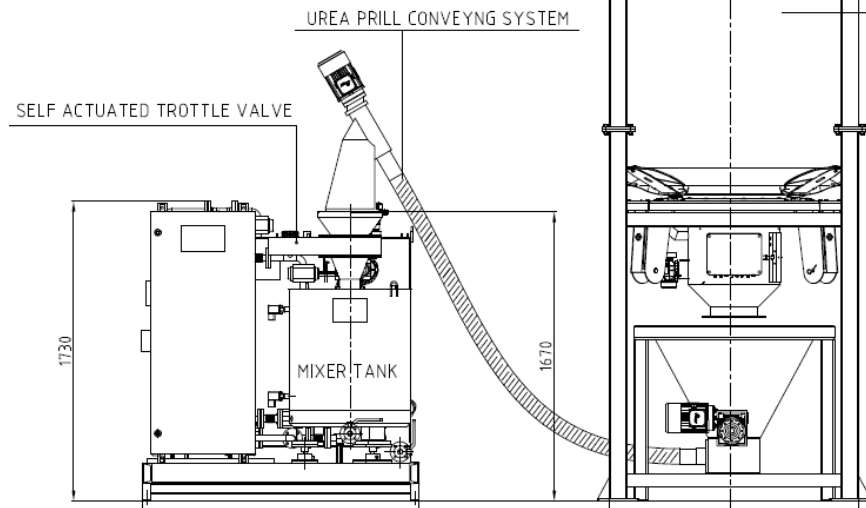
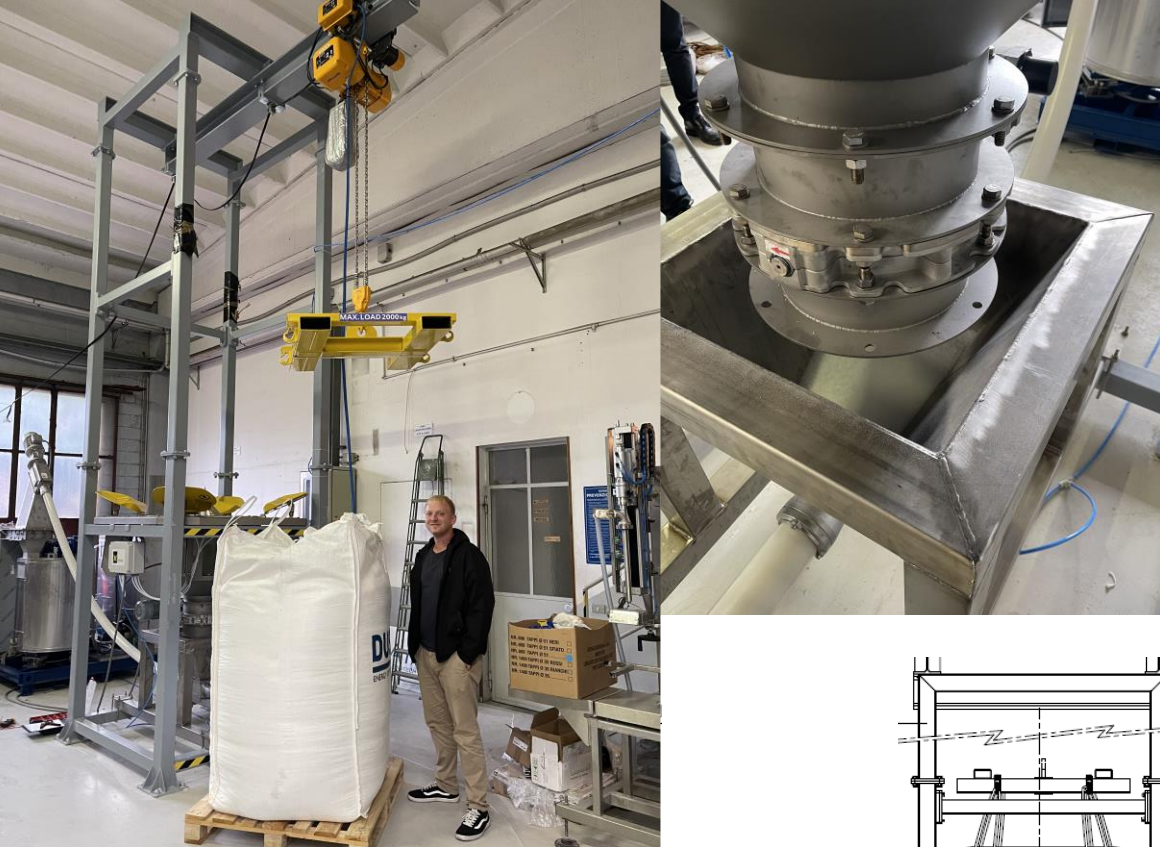
# UREAGENERATOR SYSTEM

Engineering completed for multiple designs including fully integrated systems including automatic “big bag” loading and transfer systems

Units can be supplied EXW delivery or installed under a full turnkey solution

24 hour FAT to AUS40 ISO Standards can include specific components or full systems

Ability to include Class Society rules if installed in a “hazardous” area



# TYPICAL BUSINESS ASSESSMENT

Business Case	Cost saving UreaGenerator vs. Supply of Bulk AUS40 (including CAPEX)		
	Annual Saving (\$)	Annual Saving (%)	Total Cost Saving for the Period (\$)
Case 1. CAPEX amortised over 5 years using Houston as a reference port for the supply of AUS40 / urea prills	\$130,930	46.05%	\$654,650

- 50,000 dwt tanker
- AUS40 consumption av. 600L/day/pa
- Supply of bulk AUS40 / Urea Prills at Houston
- 1,500l/day UreaGenerator amortised over five years
- TCO all lifecycle CAPEX and OPEX costs using WACC – payback less than 1 ½ years

# HAVE WE REALISED THE “OPPORTUNITY”

Element	Measure	Result
Reduce the weight of the product being transported to the vessel by 60%	AUS40 liquid 10 lorries and launches reduced to 4 urea prills deliveries (saving ~12mt CO <sup>2</sup> pa*)	✓
Reduce the weight of the product onboard	Storage volume reduced by 50m <sup>3</sup> = 55mt	✓
Allow greater control over availability	Urea prills generally available – AUS40 blended as required	✓
Allow better quality control & shelf life issues	AUS40 only blended when required. Quality measured onboard	✓
Not adversely impact day to day shipboard operations and resources	Big bag loading system needs refilling every 3 ½ days. <2hrs planned maintenance pm. Loading operations reduced	✓
Reduce costs	Business case assessments carried out for all proposals – annual savings ~\$131k/pa	✓

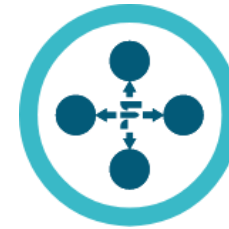


# WHO IS FLUECHEM?

- Fluechem is a global leader in delivering practical & cost-effective marine emission and compliance chemical solutions to the challenge of IMO environmental compliance, promoting cleaner air and water for all.
- Driven by our eight core strategic USP's, we offer bespoke delivery solutions & on-board ship blending systems, for the abatement of SOx & NOx exhaust gas emissions and ballast water treatment chemicals.
- We supply to over 200 ports in 50 countries with a specific expertise in the delivery of Caustic Soda 50% (Sodium Hydroxide) & Urea Solution (AUS40).
- Our global team helps manage risk, reduce operating costs & maintain regulatory compliance.
- Come and see us a stand 19



EXPERIENCE



INDEPENDENT



CUSTOMER DRIVEN  
SOLUTIONS



SECURITY OF SUPPLY



DYNAMIC  
ORGANISATION



QUALITY DELIVERY



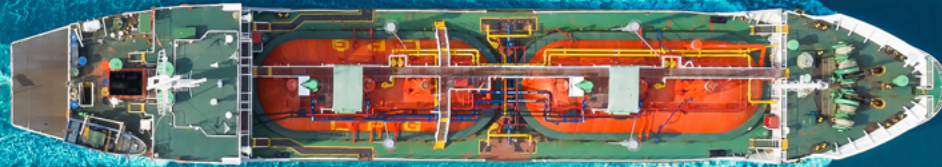
INNOVATION



VERSATILITY

**FLUECHEM**

# THANK YOU



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