SMASH
20 April 2021

Zulu Associates

ZULU Associates is active as an initiator, developer and operator of innovations in the marine component of logistic chains. Its goal is to enable **zero emission** operation of commercial vessels on short sea, coastal and inland waterways routes through **autonomous operation** and **alternative propulsion**.

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Sustainability

Facts and figures

+1°C

As of 2017 humans are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels.

+20cm

Sea levels have risen by about 20 cm (8 inches) since 1880 and are projected to rise another 30–122 cm (1 to 4 feet) by 2100.

2050

To limit warming to 1.5C, global net CO2 emissions must drop by 45% between 2010 and 2030, and reach net zero around 2050.

1/3

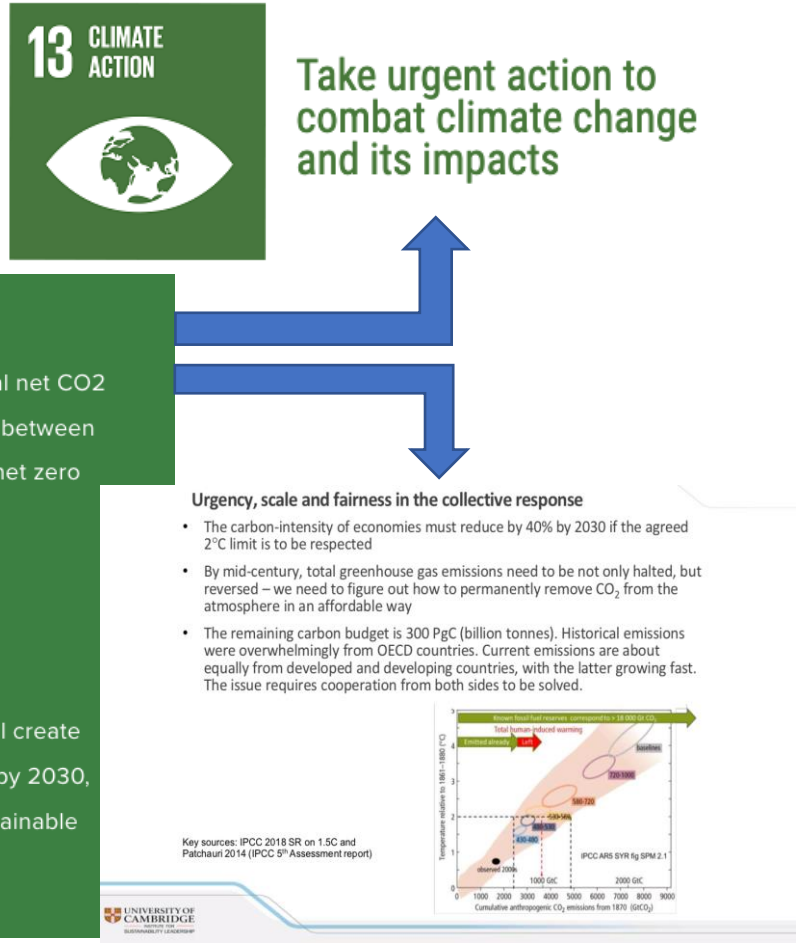
Climate pledges under The Paris Agreement cover only one third of the emissions reductions needed to keep the world below 2°C.

$26 trillion

Bold climate action could trigger at least US$26 trillion in economic benefits by 2030.

18 million

The energy sector alone will create around 18 million more jobs by 2030, focused specifically on sustainable energy.



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Sustainability: European Green Deal

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Autonomous Operations

Autonomous operations enable major cost savings in the operation of vessels, in essence by:

- Lowers the operational cost by eliminating the crew while in transit (salaries, safety equipment, food & beverage, accommodation, transport,...)
- Lowers insurance costs due to improvement of safety due to reduction of human error and no humans on board
- Lowers energy costs (route planning, lower energy needs,…)
- Increases operational efficiency through digital exchanges with other vessels, ports, infrastructures and traffic controllers

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Autonomous Operations

- Autonomous operations allow relatively smaller vessels to be economically competitive with larger manned vessels. This also opens the door to use more sustainable logistic systems:

  - Propulsion systems are smaller and can therefore be sustainable
  - No higher energy needs due to narrow waterways
  - Redundancy is increased
  - No low water issues
  - No need for large infrastructures or terminals, increasing use of IWT

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Definition of Autonomous operation

- Autonomous operation equipment on vessel for present waterway infrastructure
- No crew on vessel during passage/transit
- Remote Control Centres (RCC) in continuous contact for monitoring and control
- Autonomous equipment capable of situational awareness and complexity analysis (levels)
- Situational awareness communicated from vessel to RCC
- RCC intervention in steps pending on operational situation & needs for intervention (human still in the loop)
- Fall back safety action
- Data gathering and exchange with RCC, ports, infrastructure, other vessels and shippers.

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Economics of Autonomous operation

Lower Investment
- Accommodation
- Safety Systems

Higher Investment
- On board AI
- Sensors
- Redundancy
- Communication
- RCC

Margin for increased competitiveness vs crewed vessels & for alternative propulsion

Lower Opex
- Crew Costs
  - Wages
  - Personal Equipment
  - Catering
  - Safety Equipment
- Lower energy needs
- Increase Safety
- More efficient voyage planning

Higher Opex
- RCC costs
- Additional equipment maintenance
- Additional in-port supports
- Communication

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Propulsion and on board energy provision

- Propulsion of the vessel by electric engines.
- Power generation through modular containerised system, allowing for simple “bunkering” or replacement for maintenance or repairs when in harbour.
- Modular system allows for transition to state of the art propulsion without adaptations of vessels.
- Modular system can be provided by third party, allowing to pay for energy used rather than investment.
- Limited shore power when in harbour.

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On board energy provision

Power generation will depend on developments, availability and operational profile of the vessel:

- Low emission diesel
- Diesel burning hydrogen (Internal Combustion Engine – ICE)
  - Grey hydrogen
  - Green hydrogen
- Fuel cells
- Batteries
- Capacitors
- Heat blocks combined with Stirling engines

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Business case

Retrofitting or updating existing vessels to be autonomous and sustainable is economically and technically unviable, because of:

- No crew on board means new design of on board systems to be redundant
- Costs involved in creating digital twin for autonomous operation of each vessel
- Retrofits need each time to be made to measure as each vessel is different
- The hull will not be optimised for propulsion efficiency
- The unused crew accommodation, hotel systems and associated safety requirements remain part of the vessel after the retrofit.

New design : X –Barge & Y Barge

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Continental Inland Shipping Company

X-Barge Y- Barge

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Overview

- X-Barge: a new 1.500t (80 TEU - 45 ft capacity) inland barge, to provide a inland waterway platform initially for container and bulk flows

- Y-Barge: a new 600t (26 TEU) to provide an inland waterway platform initially for container flows, able to operate on small European inland waterways (CEMT 2)

- Both barges designed to be:
  - standardised and assembly line production;
  - modular in equipment to allow ease of maintenance and technical through life maintenance and upgrading;
  - modular and exchangeable energy provision systems;
  - hull design and routing to be energy efficient;
  - digitally connected;

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Business case: replacement segment

The present fleet of inland dry bulk/container barges has an average age of 44 years : the fleet is outdated technically and in terms of performance and sustainability*.

- Many ships are outdated both technically and in terms of performance
- Euro stage 2 diesels are less sustainable than Euro stage 6 diesel truck
- An existing urgent need for fleet renewal or costly refurbishment programmes driven by higher expectations from transport customers and tougher regulations such as Euro Green Deal emissions targets
- Estimated replacement fleet market of 2,000+ vessels
- Time line : 15 years

* See KIM study: https://www.kimnet.nl/publicaties/rapporten/2020/02/06/het-kleine-drogeladingschip-op-de-radar

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Specifications X-Barge

- Length Overall 85.0 metres
- Draft mid. 2.5 metres
- Beam mid. 8.0 metres

- Air draft limit
  (Assumed) 9 metres (ab. WL)
- Service Speed 8 knots
- TEU Capacity 80
- Bulk Capacity 1.500t

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Specifications Y-Barge

- Length Overall 50.0 metres
- Draft mid. 2.5 metres
- Beam mid. 6.6 metres

- Air draft limit (Assumed) 4,5 metres (ab. WL)
- Service Speed 8 knots
- TEU Capacity 26/28
- Bulk Capacity 600t

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