PROGRAMME

Thursday, 7 March 2019

12:30 – 13:00 Registration

13:00 – 13:30 Opening session

- Welcome & introductory remarks by the moderator
  Setting up scene, purpose and objectives of the know-how transfer event (Manfred Seitz, PDI)
- Keynote opening speech
  EU support initiatives for inland vessels modernisation (Hugues van Honacker, DG MOVE/EC)
  Activities in the framework of CCNR (Gernot Pauli, CCNR)

13:30 – 14:15 Inland vessel modernisation projects & initiatives

- GRENDEL – Green and efficient Danube Fleet
  Insights into the GRENDEL project, a unique project in the Danube region addressing environmental & economic performance of Danube fleet (Charlotte Siot, PDI)
- Fleet modernisation initiatives in France
  Insights into the state aid scheme in France and inland vessels modernisation initiatives triggered & facilitated through public support (Eloi Flipo, VNF)
- A battery powered ferry as a successful example for an Interreg funded project
  New technology in pilot deployment through Interreg and insights into to diesel-electric, cabin vessels, solar powered, etc. (Kai Buchloh, Schiffstechnik Buchloh GmbH u. Co. KG)

14:15 – 14:45 Setting the framework of the event

- Non-Road Mobile Machinery (NRMM) Directive and implication to the inland shipping
  NRMM: Challenges, solutions & outlook for different technologies (Khalid Tachi, EICB)
  NRMM: Comments from manufacturers industry (Klaus Poepsel, EUROMOT)
- GRENDEL Innovation Factsheets & collection of technological requirements of Danube fleet feeding to State Aid schemes *(Benjamin Friedhoff, DST)*

14:45– 15:15 Coffee offered by organiser

15:15 – 16:30 Future-oriented & innovative solutions for inland waterway transport sector

- *Cold-ironing as sustainable & eco-friendly shore-side power supply – effects on pollution, fuel consumption & emissions (Christoph Kreuzinger, Würzburger Hafen, Germany)*
- *The first steps of our journey towards autonomous vessels (Stephan Stout, DAMEN, Netherlands)*
- *Ambient Water Transmissions (Dominik Cofalka, Reintrieb, Austria)*
- *On the way to zero emission shipping: hydrogen in combustion engines (Igor Sauperl, Large Engines Competence Center, Austria)*

16:15 – 17:00 Industry show-cases and projects

- *CLean INland SHipping „CLINSH" (Frank Appelman, Province Zuid-Holland)*
- *Waterbus in Slovakia: Regular service line on Danube river (Gabriel Meszaros, PRODANUBIA)*
- *Q&A*

17:00 Closing of the day

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Know-how transfer event on modernisation of Danube fleet

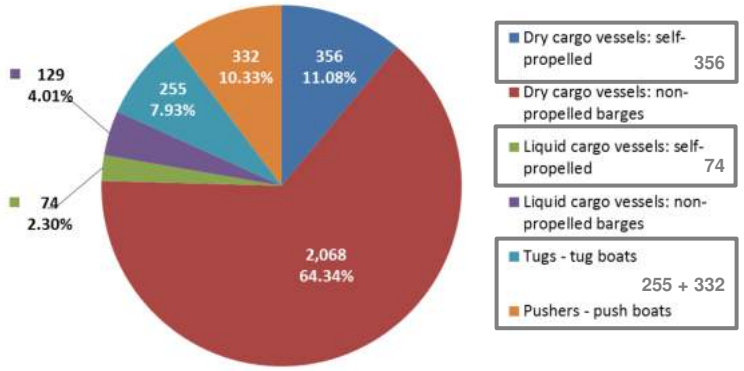
Manfred SEITZ

Project co-funded by European Union Funds (ERDF, IPA)

07 March 2019 – Vienna – Austria

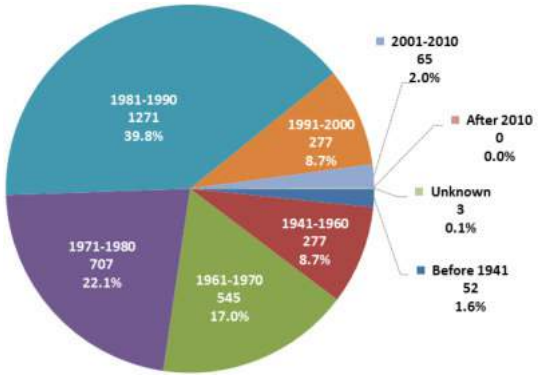
Danube cargo fleet: structure & challenges

Types of Danube inland vessels (3,214 vessels)



Source: Danube Commission. Figures 2016. Chart: Pro Danube

Age of Danube inland vessels



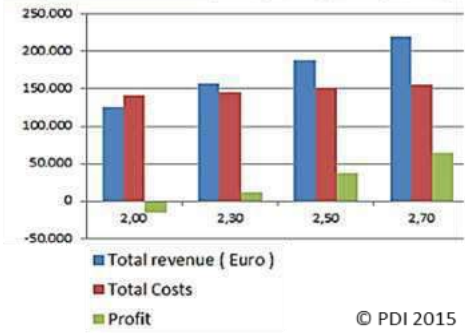
Source: Danube Commission. Figures 2016. Chart: Pro Danube

Challenges

- **Insufficient waterway maintenance**
  - *Little operating profits*
  - *Almost no fleet investment, mainly repair*

Profitable navigation requires sufficient draft

Draft	2,00	2,30	2,50	2,70
Total Revenue (Euro)	125.700	157.125	188.550	219.975
Total Costs (Euro)	140.863	145.891	150.919	155.947
Profit	-15.163	11.234	37.631	64.028
Profit %	-12,06%	7,15%	19,96%	29,11%
Profit per to	-2,53	1,50	4,18	6,10



© PDI 2015

- **Reduction of air pollutant emissions**
  - *to be competitive (environmentally) to road & rail*
  - *to be compliant with Stage V of NRMM (for new engines)*
  - *to be politically supported & socially accepted*
- **Need to adapt fleet to new markets**
  - *RORO, container, biomass, biofuels, LNG & other gases, chemicals, fertilizers, high & heavy*
  - *quality requirements beyond current equipment & service levels*

Motivation: Policy initiative based on cooperation & commitment

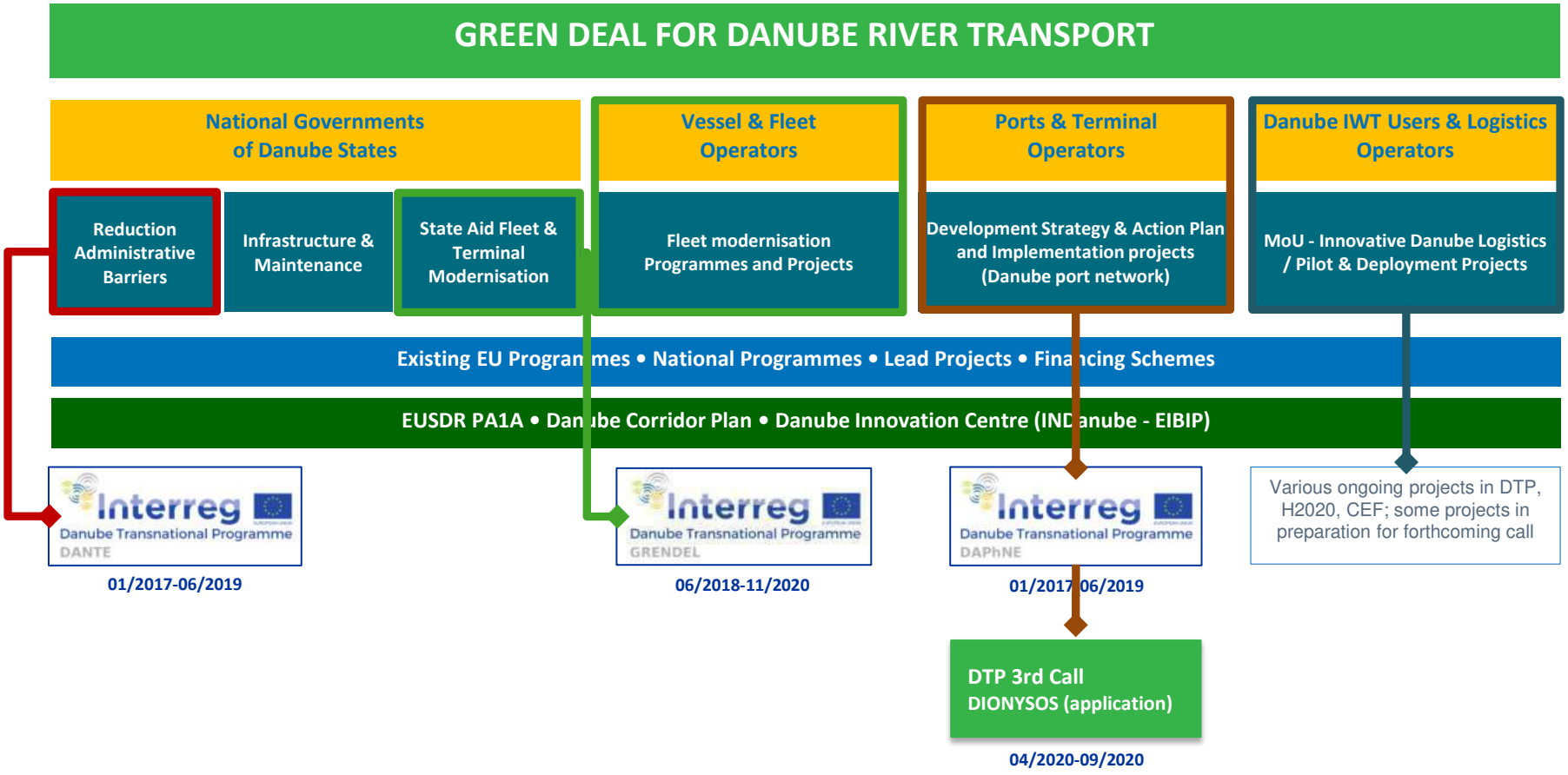


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Photo: © NAVROM

GRENDEL "Green and efficient Danube fleet"

Towards modernisation & greening of Danube inland waterborne sector and strengthening its competitiveness

www.interreg-danube.eu/grendel

Project co-funded by European Union Funds (ERDF, IPA)

CCNR Activities
in Support of Innovation and Greening
Know-How Transfer Event
Modernisation of Danube Vessel Fleet

Vienna, 7-8 March 2019

Gernot Pauli
Chief Engineer

CCNR
CENTRAL COMMISSION
FOR THE NAVIGATION OF THE RHINE

CCNR October 2018 **Mannheim ministerial declaration**

WE emphasise the need for up-to-date, workable and ***harmonised environmental and safety regulations in Rhine and inland navigation****.*

To further improve the ecological sustainability of inland navigation, we task the CCNR to develop a roadmap in order to

- ***reduce greenhouse gas emissions by 35% compared with 2015 by 2035,***
- ***reduce pollutant emissions by at least 35% compared with 2015 by 2035,***
- ***largely eliminate greenhouse gases and other pollutants by 2050.***

WE point to the need for ***new financial instruments*** *(as existing instruments have shortcomings in financing greening techniques)* ***to achieve these environmental objectives*** *and entrust the CCNR with the task of leading this development.*

WE call on the CCNR to press ahead with development of ***digitalisation, automation and other modern technologies****, thereby contributing to the competitiveness, safety and sustainability of inland navigation. […]*

EU

EU
Member States

CCNR
CENTRAL COMMISSION FOR THE NAVIGATION OF THE RHINE

CCNR
Member States

CESNI
European Committee
for drawing up standards in the
field of inland navigation

WORKING GROUP (PT)
Technical requirements

WORKING GROUP (TI)
Information technology

WORKING GROUP (QP)
Professional qualifications

WORKSHOPS

MEETINGS

HEARINGS

CESNI

Strategic guidelines for CESNI/PT 2019-2021

A **PREPARE AND ADOPT STANDARDS** in the field of technical requirements for vessels

- regular revision of ES-TRIN
- **new technologies and innovation (i.e. alternative fuels)**
- digitalisation of inland navigation (i.e. automatisation)

B **SUPPORT PROPER IMPLEMENTATION OF STANDARDS** in the field of technical requirements for vessels

- maintenance of quality standards
- preparation of explanatory notices
- deliberation on the uniform interpretation and application of the standards
- preparation of audit guidelines
- **deliberation on derogations and equivalences for a specific craft**

C **PROVIDE ADVICE AND ANALYSIS** on technical requirements

- **deployment of new technologies and alternative fuels**
- **reduction of the environmental impact of IN**

Innovation and greening are in the genes of CESNI/PT

- Uniform technical requirements for ensuring safety of inland navigation vessels
- Includes in standardised way the requirements of EU directive 2006/87 and Rhine Vessel Inspection Regulations (RVIR=RheinSchUO)
- Concrete result of successful cooperation in CESNI, notably between European experts and shipping industry
- ES-TRIN 2017/1 now available in additional EU languages: BG, CZ, HR, HU, IT, LT, PL, RO and SK as well as in RU

ES-TRIN is not binding per se → CCNR, EU, other international organisations and states can apply this standard by referring to it in their respective legal frameworks

Directive 97/68/EC

replaced by

Regulation (EU) 2016/1628 on pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery (NRMM)

Rhine Vessel Inspection Regulations (RVIR)

Requirements concerning emission limits and type-approval procedures

given up to allow harmonized regulation

Scope of regulation

- Emission limits, type-approval procedures
- Diesel engines, (EU) also (natural) gas engines and dual fuel engines
- Market access (EU) vs. installation onboard (CCNR)

EU Regulation

- Same emission limits for all types of engines for inland navigation vessels
- ! **Very ambitious emission limits,** engines equipped with complex **exhaust after treatment systems** (catalytic converters, filters)
- Possibly **double investment cost**, change in operational cost unclear, **limited choice**
- Allowable methane slip for gas / dual engines overcompensates possible CO_2 reductions

Regulation (EU) 2016/1628

⇒ Approach is driven by “placing on the market” of engines

⇒ Engine type-approval certificate (Stage V)

ES-TRIN (Chapter 9)

⇒ Safety requirements for installation of engines on board.
Approach is driven by “periodic inspection of the vessel”

⇒ Vessel certificate

Existing engine + after treatment system

⇒ can achieve similar performance as Stage V
(but legal recognition is pending)

Catalogue of FAQ

⇒ To help understand and interpret the applicable requirements to engines

⇒ New version to be published by end of March 2019

⇒ Available in EN, FR, DE, NL

⇒ CESNI website : www.cesni.eu
(under activities / technical requirements)

⇒ EUROMOT website : www.euromot.eu
(under publications and events)

Next step: Possibly inclusion of administrative process for verification of NRE & Euro VI solutions for inland navigation propulsion

Derogations (exemptions) are a central element in the chain of technical innovation

Directive (EU) 2016/1629
RVIR

EC: Art. 25 Directive (EU) 2016/1629
CCNR: Art. 2.21 RVIR

INVEN-TION

PROJECT

CESNI DERO-GATION

PILOT

CESNI EXPE-RIENCE

CESNI REGU-LATION

DIFFU-SION

Important example

Next step: CESNI will publish a guide on derogations

Sound experience with LNG propulsions (fully covered by the legal framework)

- Reduction of air pollutants, but further work to reduce GHG (methane slip)
- Additional ecological benefits possible with bio-gas

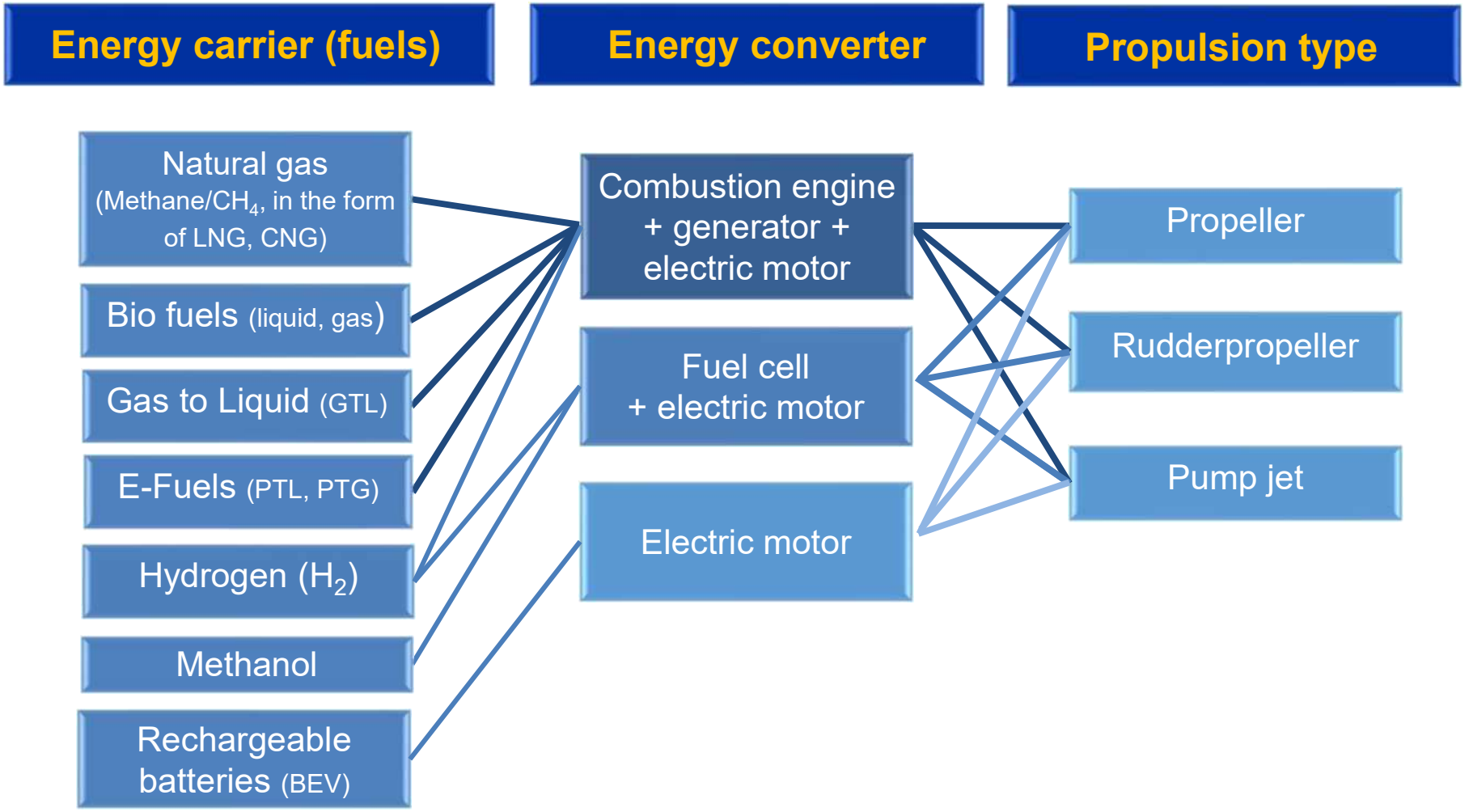
On-going pilot projects with methanol, hydrogen or full electric (Derogation procedure for vessel certificate)

Modular and progressive approach: "electrical power source + electric engines"

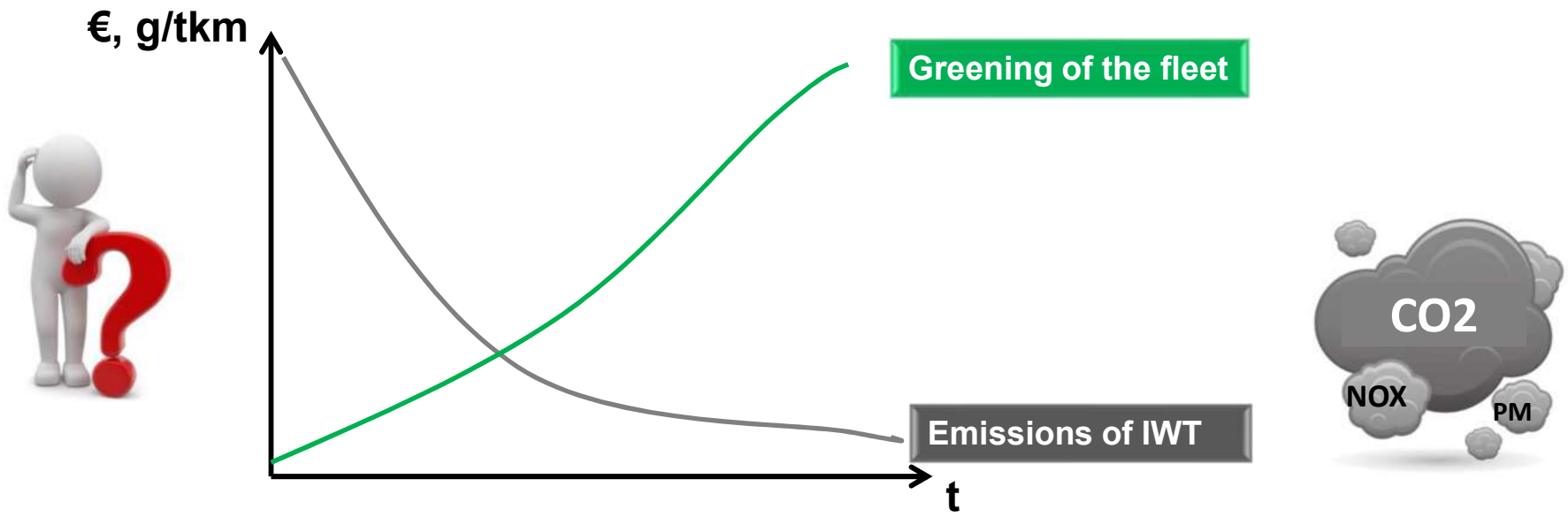
- Power source can evolve upon technical progress
- Great variety of possible combinations/solutions
- Only certain combinations technically and economically sensible

Next step: Stimulate pilot projects to demonstrate operational solutions and better understand possible problems in preparation of regular deployment

Elements for *alternative* electrical propulsion system in inland navigation



- **Not yet satisfactory tools for funding (grants) and financing (loans/own capital) for large scale greening of the fleet**



- CCNR *forum for discussion* between EU and CCNR Member States, sector and industry representatives, EU Institutions and other stakeholders
- CCNR supports developing of financing solutions

✓ **Pre-study to identify technical content of the comprehensive study**

✓ **Comprehensive study will analyse & advise on financial approach & instruments to enable IWT industry to make the transition towards zero-emission inland navigation**

- **CCNR strongly supports *zero emission vision* of inland navigation**
- **CCNR has developed important tools together with partners for innovation and greening**
- **CCNR ready to support modernisation of Danube vessels fleet**
- **CCNR eager to learn from Danube fleet developments**

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GRENDEL “Green and efficient Danube fleet”

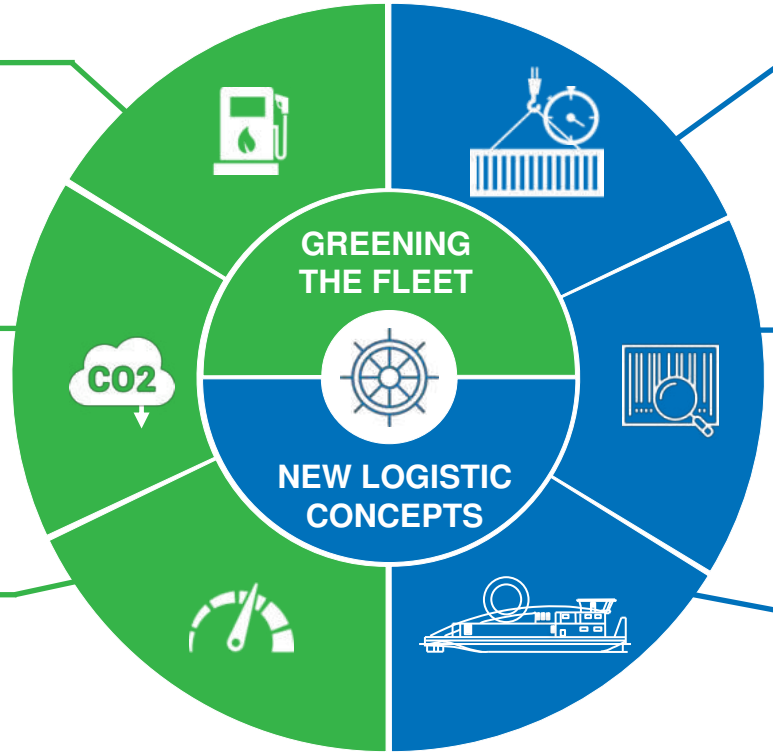
DTP2-052-3.1-GRENDEL

Know-how transfer event on the modernisation of Danube vessels fleet
Charlotte SIOT

Project co-funded by European Union Funds (ERDF, IPA)

07 March 2019 – Vienna – Austria

Fields of action for Danube fleet modernisation



Use of alternative fuels

LNG/CNG • Bio-fuels • Methanol • Ethanol • Hydrogen • GTL

Air pollutant emissions reduction

Alternative technologies • After-treatment • New engine concepts and optimisation

Energy consumption reduction

Energy-efficient navigation • Energy efficient ship design • Hybrid/diesel-electric propulsion • Electric propulsion

New logistics concepts

Synchromodality • DINA • Advanced RIS • Digital market places for cargo flows

New cargo flows

Find your (water)way • New market segments: (containerised) LNG as cargo | steel & cars | continental cargo flows

New vessel concepts

Optimal cargo load • Automation of navigation / vessel-trains

GRENDEL: Project key facts

PARTNERS

FUNDED PARTNERS

- Fleet owners & operators
- Innovation & technology organisations
- IWT development agencies
- Education institutes
- Ship design experts
- River commission (Danube Commission)

ASP

ASSOCIATED STRATEGIC PARTNERS

- Ministries & their implementing bodies
- Other fleet owners & operators

BUDGET

1.8 MEUR

- ERDF contribution: 85%
- IPA contribution: 85%
- State contribution: up to 15%
- Own contribution: up to 15%

TIME

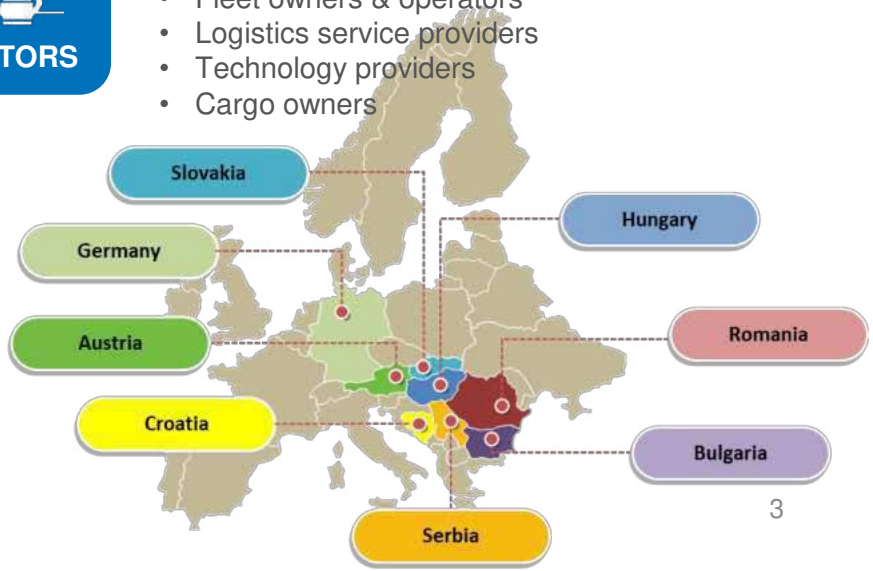
6.2018 - 11.2020

- 30 months of working & cooperation together

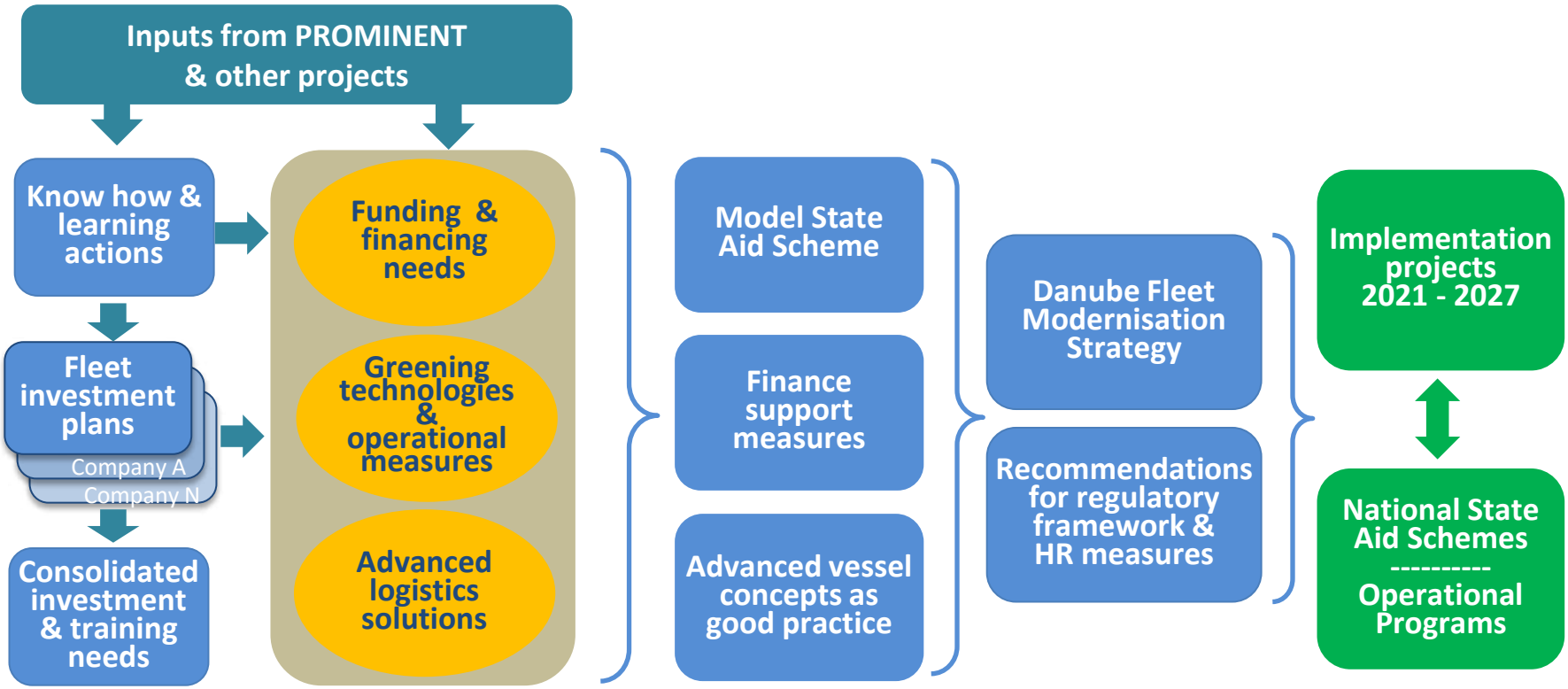
ACTORS

NON-FUNDED STAKEHOLDERS

- Fleet owners & operators
- Logistics service providers
- Technology providers
- Cargo owners



GRENDEL: Work approach



GRENDEL: Outputs

FLEET INVESTMENT PLANNING

- Know-how transfer events
- Technological Factsheets & other documents
- Consolidated Investment &Training requirements

PREPARATORY ACTIONS

- Advanced green vessel & operational concepts
- Guidelines for transport & logistics management
- Support to fleet owners & operators (financing instruments)

REGULATION & STRATEGY

- Public consultations
- Model State Aid scheme & other public support measures
- IWT Fleet Modernisation Strategy & Recommendations

GRENDEL: State Aid schemes (starting point)

CZ state aid scheme

Reduction of environmental impacts & energy consumption

Aimed at reducing the environmental impacts of IWT **by reducing emissions of gaseous and particulate pollutants** from internal combustion engines & auxiliary motors and reduction of energy consumption.

Examples:

- **low-emission engines,** auxiliary motors
- **modernising propulsion equipment**
- vessels conversions to a **new fuel** e.g. LNG
- **hydrodynamics** improvements

Modernisation of vessels to increase multi-modality of freight transport

Aimed at **increasing the involvement of waterway transport in the multimodal transport chain** by making the vessels more **competitive, operationally flexible and secure**

Adaptation of the fleet to **new market requirements** in order to expand into new markets RORO, container, biomass, biofuels, LNG & transport of other gases, chemicals &others goods with quality (control) requirements which cannot be matched with current equipment

Examples:

- **lightweight stacking covers** for the hold (cargo compartment)
- **raising hatchways**
- **transportation frames for passenger cars**
- broadening a vessel (push boats) or prolonging a vessel
- **digitalisation**

Modernisation of vessels leading to increased safety of IWT

Examples

- **bow steering equipment**
- **outer plating**
- **electrical wiring**

GRENDEL: State Aid schemes (timeline)

Preparatory works:
- Inventory on past, existing & upcoming State Aid measures
- 2 State Aid workshops (first one on 26.03.2019)
- „State Aid meetings“ with European Commission services
- Analysis of impact and compatibility of proposed State Aid measures

Model State Aid scheme & public support measures

available on 30.04.2020

- ***Model which considers investment priorities*** *of Danube inland waterway transport sector*
- *With a summary on other innovative financial instruments*

Draft State Aid scheme developed based on the model prepared

ready on 30.11.2020

- *Will be prepared by* ***at least one*** *participating state*

Objective that the Model State Aid scheme will be implemented in as many Danube states as possible with the support of EU funds.

Project co-funded by European Union Funds (ERDF, IPA)

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Towards modernisation & greening of Danube inland waterborne sector and strengthening its competitiveness

www.interreg-danube.eu/grendel

Project co-funded by European Union Funds (ERDF, IPA)

Modernisation of the fleet & Innovation
VNF Funding scheme 2018 – 2022 in France

Plan d'Aide à la Modernisation & à l'Innovation (PAMI)

summary

IWT French market situation & developments

Issues related to the IW fleet operating on the French inland waterways :

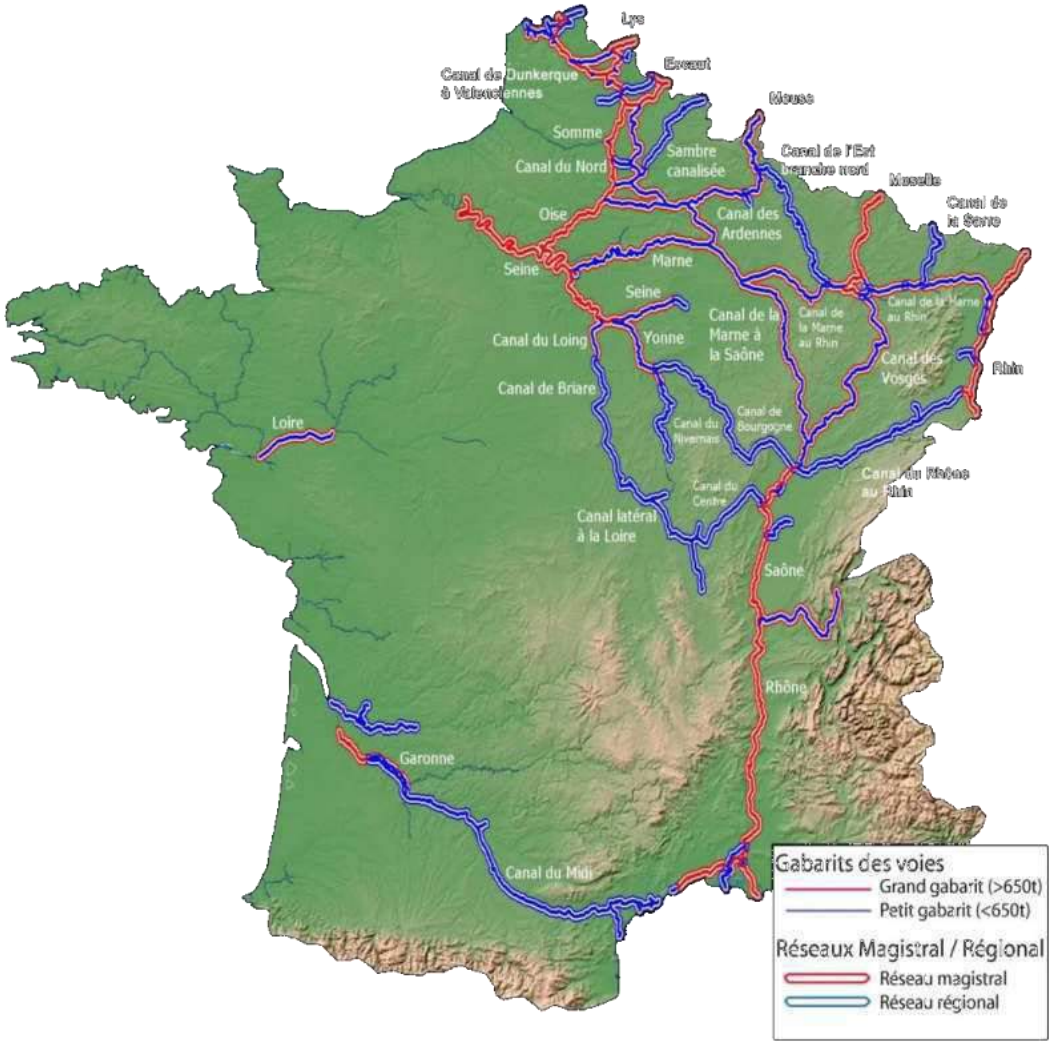
- Number of barges
- Types of barges
- Engines environmental performances

Agreed targets for a new IWT fleet modernisation support scheme

- Improve the IWT fleet's environnemental performance
- Better integrate the IWT in the supply chain (city logistics, containers)
- Facilitate innovation to reach those 2 goals
- Encourage business takeover by new entrepreneurs

Design of a new IWT freight fleet funding scheme

IWT French market situation & developments

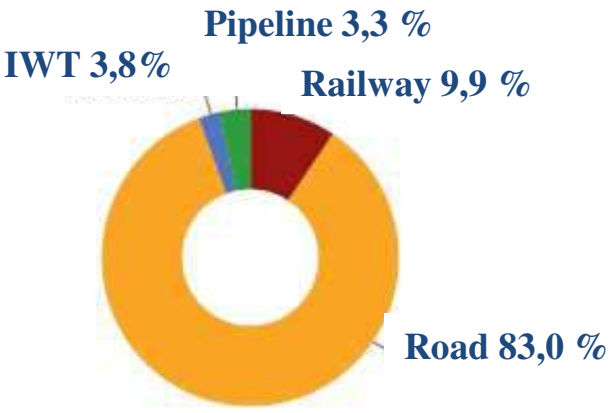


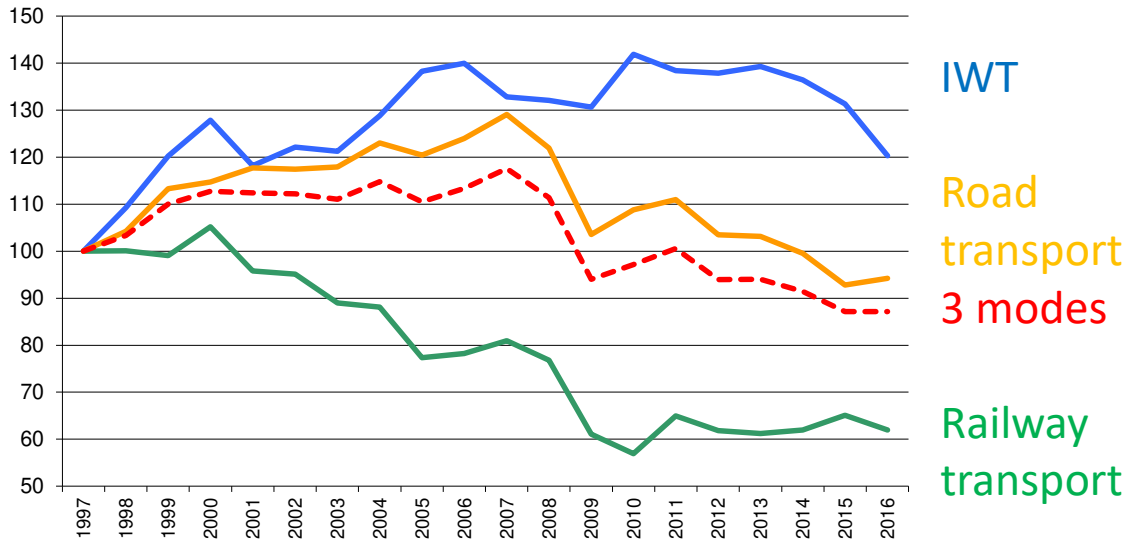
2018 IWT fleet on French waterways :

- About 60 000 voyages, out of which 30 000 by french flag barges & the rest by EU members flags barges ;
- about 2 560 boats, 50 % french – 50 % other EU members flags.

IWT French market situation & developments

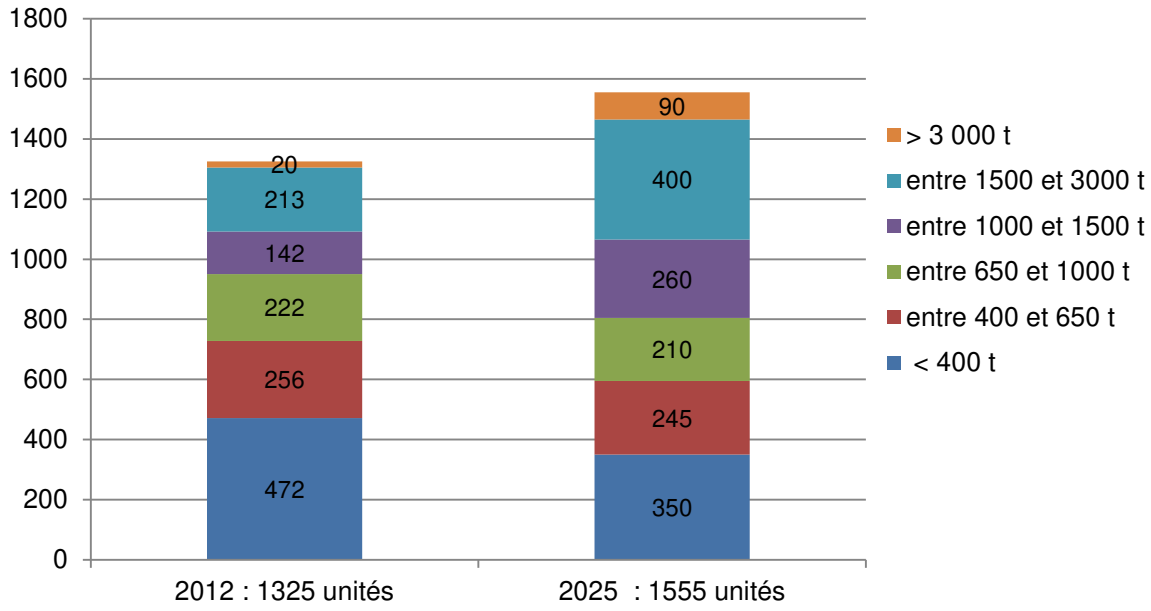
Parts modales terrestres en 2013
En %





Issues related to the IW fleet operating on the French inland waterways – **number of barges**

IW fleet operating on VNF network expected developments by 2025 – Seine-Scheldt impact



Challenges to address (fleet's capacity)

- Need for an additional 0.7 Mt transport capacity
- Need for construction of new vessels
- Fleet Freycinet renewal need (heavy lifts, urban logistics…)

IWT French market situation & developments – **barges types**

Increasing markets – new requirements

Project cargo – **context :** increasing trend of project cargo elements (eg : windmills components

Containers regular services – **context :** saturation in seaports, increasing size of sea ships

IWT French market situation & developments – **barges types**

Waste transport & city logistics – **context :** increasing population in large cities

Design of a new IWT freight fleet funding scheme

Dedicated workshop – April, 2016 in Paris

- **Purpose : submit a agree upon IWT fleet issues & requirements**

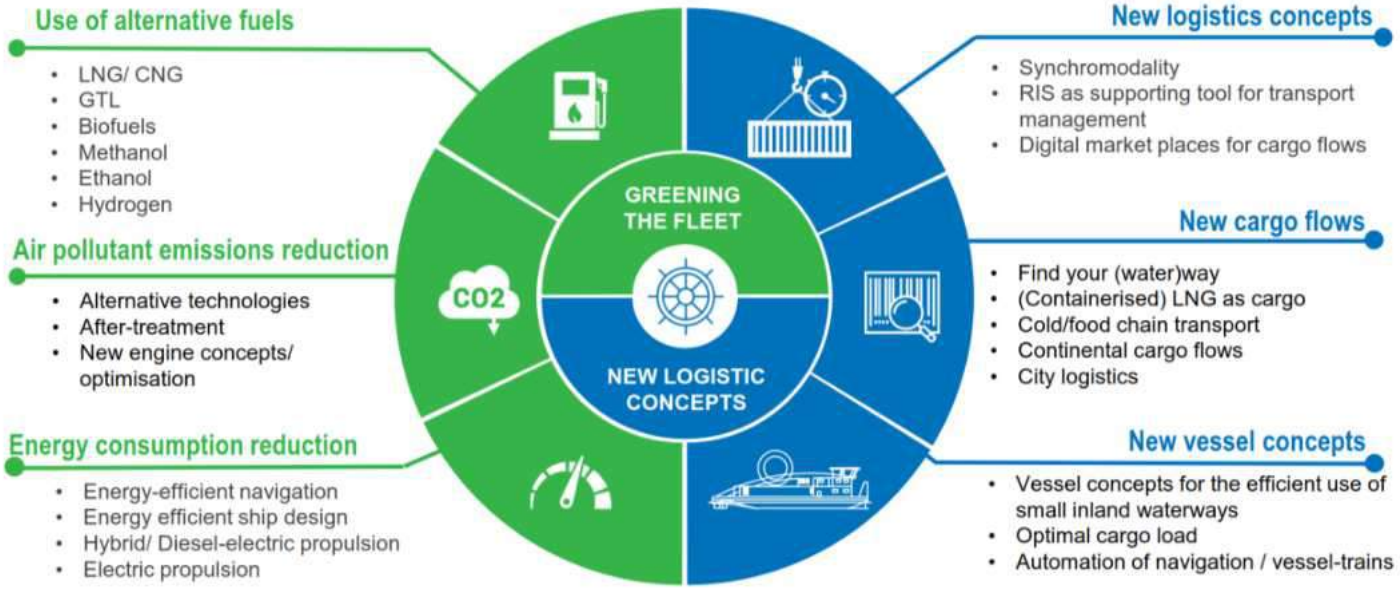
- **Participants :**
  - One engine supplier, one depollution kit supplier,
  - Ship owners (SMEs & industrial shipping companies national federations),
  - 2 Shipyards,
  - CEREMA (transport ministry engineering consultant specialized in ports & IWT)
  - VNF

Outcome : a four parts funding scheme with :

- dedicated budgets & provisional expenses,
- Potential co-financing organisations

Part A : improve the IWT fleet's environmental performance

- **Reduce pollutant consumption and emissions**
  - Rate: 50 % (engine has to comply with NRMM/stage V specifications)
  - Max. : 70 000 €*
- **Reduce and treat water or waste releases**
  - Rate : 30 %
  - Max. : 70 000 €
- **Adapt barges for better hydrodynamics**
  - Rate: 30%
  - Max. : 150 000 €
- **Optimize on-board energy management**
  - Rate: 30%
  - Max. : 40 000 € / boat



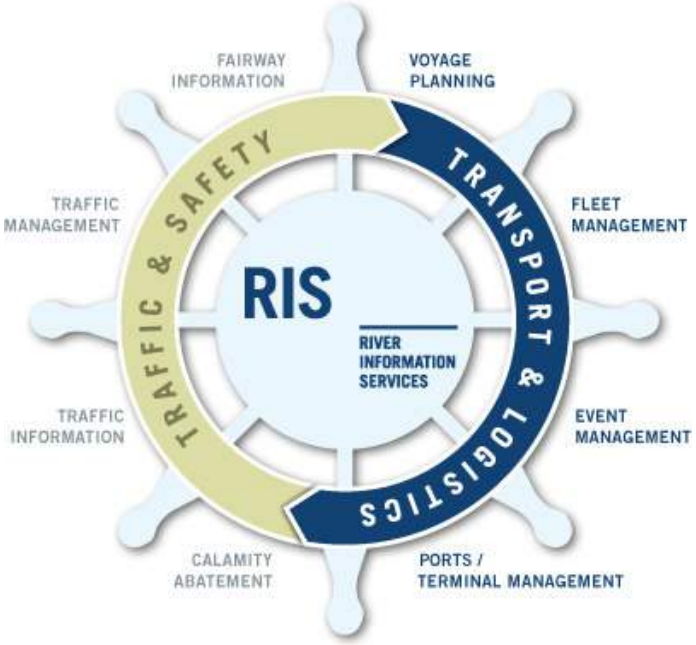
Part B : strengthen IWT integration in the supply chain

1. **Adapt boats to catch new business or secure existing traffic**
   - Rate : 30 %
   - Max. : 230 000 € / boat

2. **Build or acquire boats to catch new traffic**
   - Rate : 50 % for the studies / 20 % construction
   - Max. : 100 000 € / 200 000 €

3. **Build or adapt units to serve seaports**
   - Rate : 50 % for the studies / 20 % construction
   - Max. : 100 000 € / 400 000 €

- **Acquisition of sailing assistance instruments or software**
  - Rate : 30 %
  - Max. : 30 000 €



Part C : Renewal of the actors

- **Purchase of the first boat**
  - 80 €/TPL
  - Max. : 20 % of barge purchasing price or 60 000 €
  - No DWT limit

- **Eg :** purchase of a 38,50 m long « Freycinet » :

Estimated cost 120 000 € / DWT : 380 t

Subsidy amount estimate :

- 1st calculation mode : € 80 € * 380 t = € 30 400 ;
- 2nd calculation mode : 20% x € 120 000 € = € 24 000 (limited to € 60 000) ;

➢ Lowest of the 2 results = **€ 24 000**

Part D : facilitate innovation in IWT

- **This PART of the PAMI is open to non-freight barges operators, provided innovation may be transfered to freight units (technically & economically feasible)**

- **Eligible projects may cover the following activities :**

  - The experiment of a new or existing technology, not implemented in the IWT industry yet,

  - R&D based upon new technologies to address specific issues in the IWT industry.

- Rate : 50 % (65 % incl. Potential additional subsidies)
- Max. : 100 000 €

PAMI methodology (1/2)

1) application

- VNF's calls for projects : twice a year (except 2018 é 2022)
- Projects & applications for subsidies to be left at one of VNF branches (largest & most complext projects to send to VNF headoffice)
- Provided the application is complete, VNF branch **acknowledges receipt – no commitment from VNF**

2) Evaluation :

VNF evaluates the project through 4 criteria, and gathers a jury :

-One representative of each VNF branch involved in the PAMI,
-Two representatives from VNF headoffice,
-One representative of the transport ministry, in charge of technical specifications & barges' environmental performance.

PAMI methodology (2/2)

3) Contracts :

VNF branch manager or CEO (depending on project's amount, signs one of the 2 documents :

- either signs up a *décision* (subsidy provisional amount < 23 000 €) or *contract* (>23 000 €), in which case only invoices relating to orders placed **later than**(voir ci-dessus) sont éligibles à l'aide au titre du PAMI.

notice : VNF takes a mortgage on the barge value (or any other company's asset) for all subsidies reaching or exceeding a € 50k amount

- **or** rejects the application

4) Project completion :

Le porteur de projet dispose d'un **délai** pour présenter les factures, qui varie selon le type de projet (voir page n°11).

Budget & Co-financement

Some of the 12 French **regions** :

- Ile-de-France (1st French region : greater Paris)

- South French region (ex-PACA)

issue : to point out eligible barges (only those sailing within the regions' areas

National organisations :

Evaluations & adjustments

Thank you for your attention.

Eloi FLIPO, head of cargo development department,

VNF headoffice, F-62 400 BETHUNE.

+33.3.59.41.30.65

Eloi.flipo@vnf.fr


Schiffstechnik
BUCHLOH

A battery powered ferry as a successful example for an Interreg funded project

Kai Buchloh
Managing Director
B.Eng Schiffbau und Meerestechnik
Schiffstechnik Buchloh GmbH u. Co.KG.

The company

An older picture of the team

Schiffstechnik Buchloh

- Founded in 1994
- Employees/ Qualifications:
  - 4 Naval Architects
  - 1 Technician
  - 2 Draftsmen
  - 1 Assistent

References E-mobility

Our knowledge for your vessel

- 11 full-electric powered vessels (10 battery, 1 fuel cell + battery)
- Ferries, Day tour vessels, work boats
- Pax: 20 -180
- Length: 10-40 m

References E-mobility

BVG Fähren 1-4

Sunje

Solaris

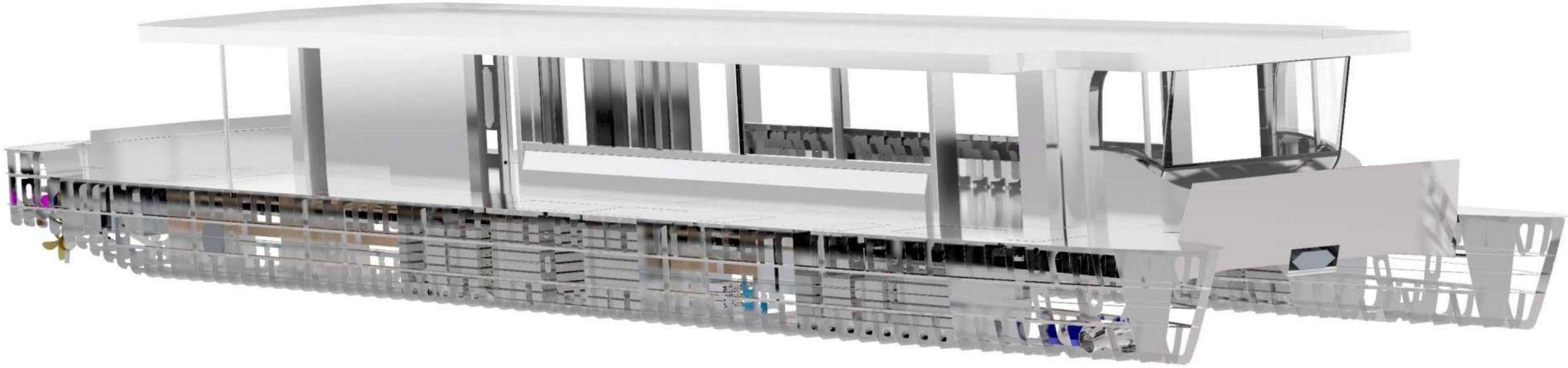
Alsterwasser Hamburg

Dienstboot Rappbode

Autostadt Wolfsburg

References E-mobility

Current projects



Sankta Maria II

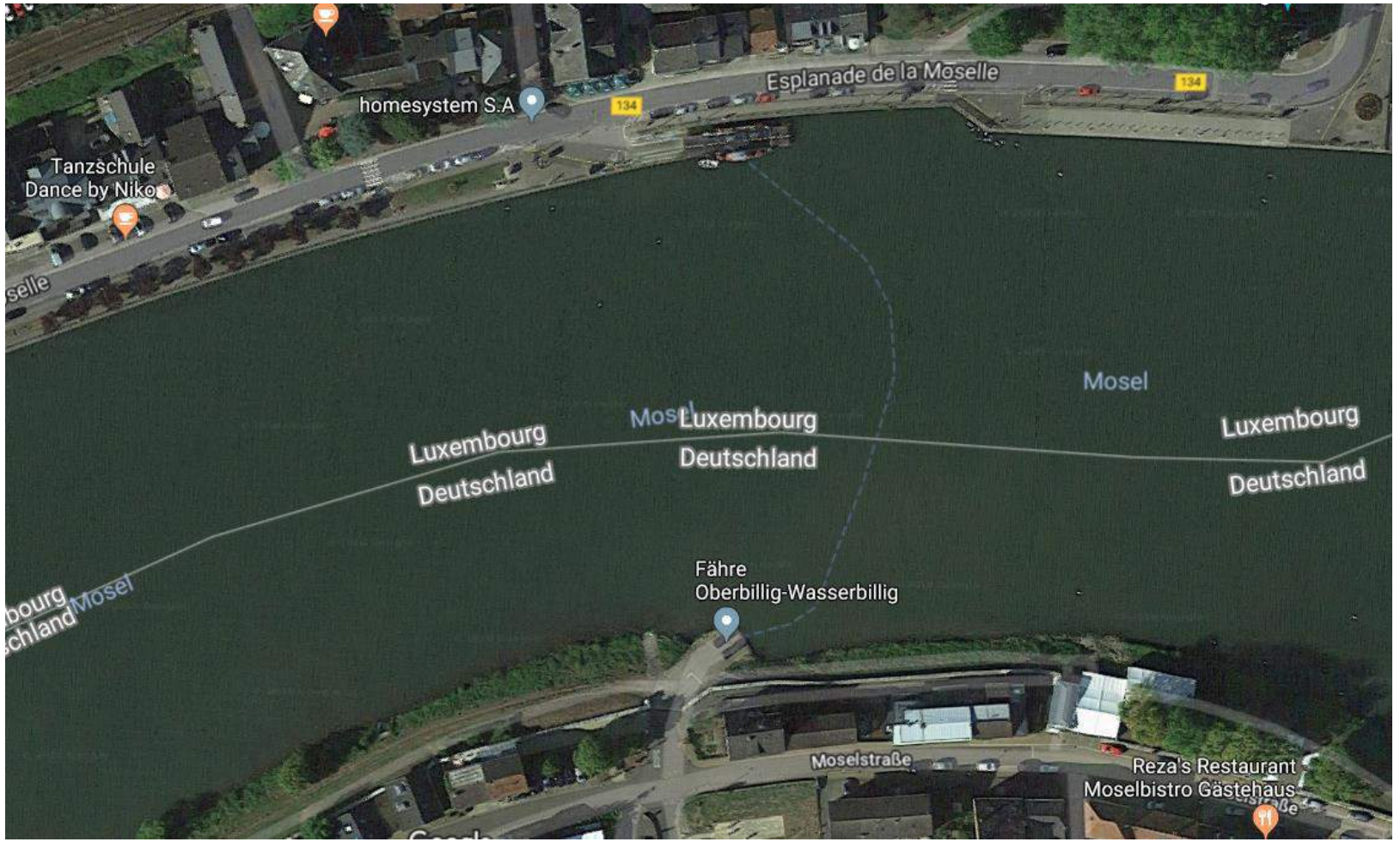
Sankta Maria Oberbillig - Wasserbillig

Main diemensions:

Pax:	45
Cars:	6
Heaviest vehicle:	12t
Length over all:	28.00 m
Length in water line:	17.00 m
Beam over all:	8.90 m
Beam in the water line:	7.90 m
Depth	1.25 m / 1.40 m
Beam moulded:	5.10 m
Draught:	0.83 m
Payload:	25 t


Schiffstechnik
BUCHLOH

Environment and operational conditions



General

- Short distance
- Few traffic
- Low current
- Short distance to grid connection

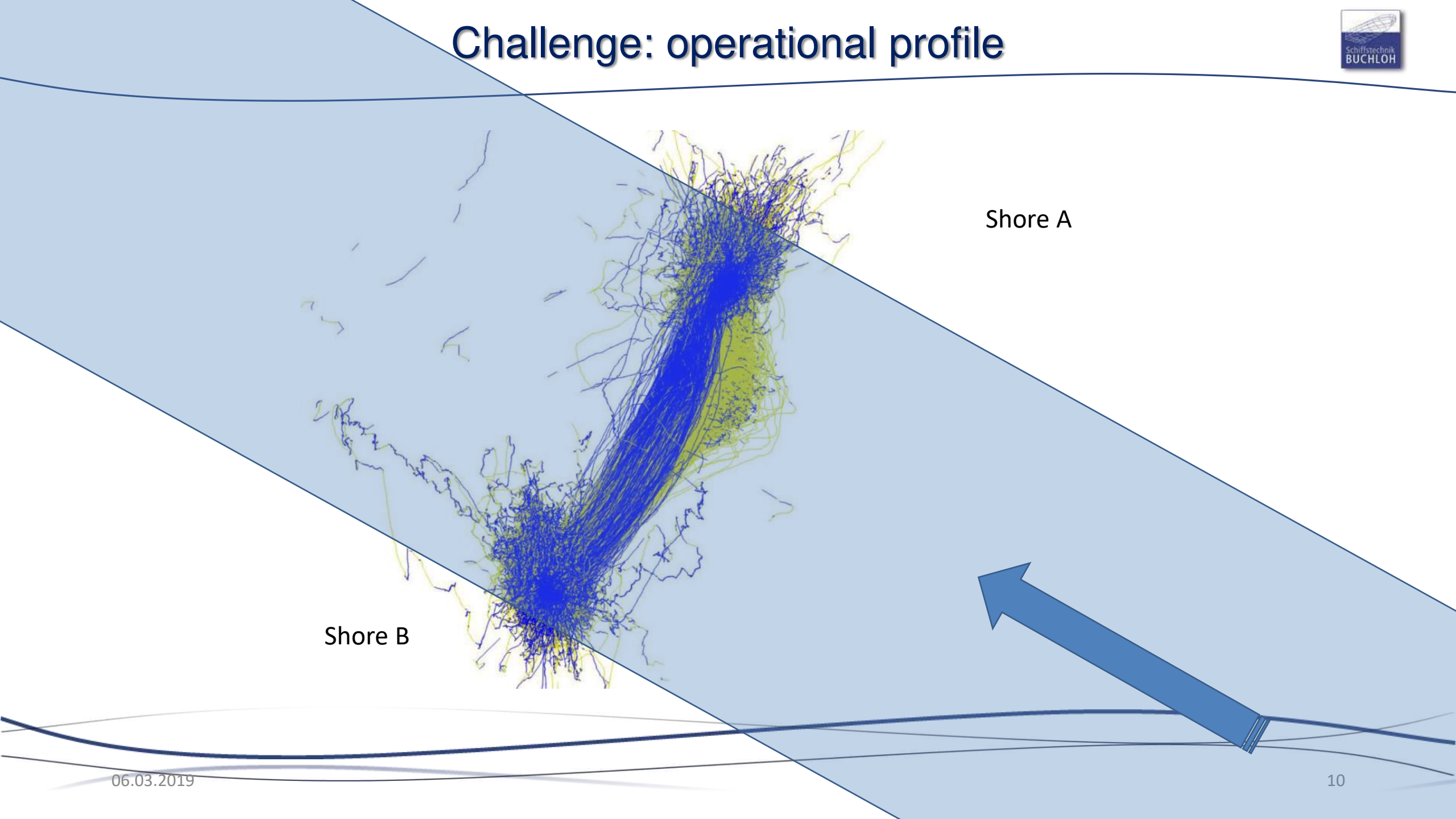
Harbour Mertert:

- Short distance
- Protection from high waterlevels
- Electrical Infrastructure

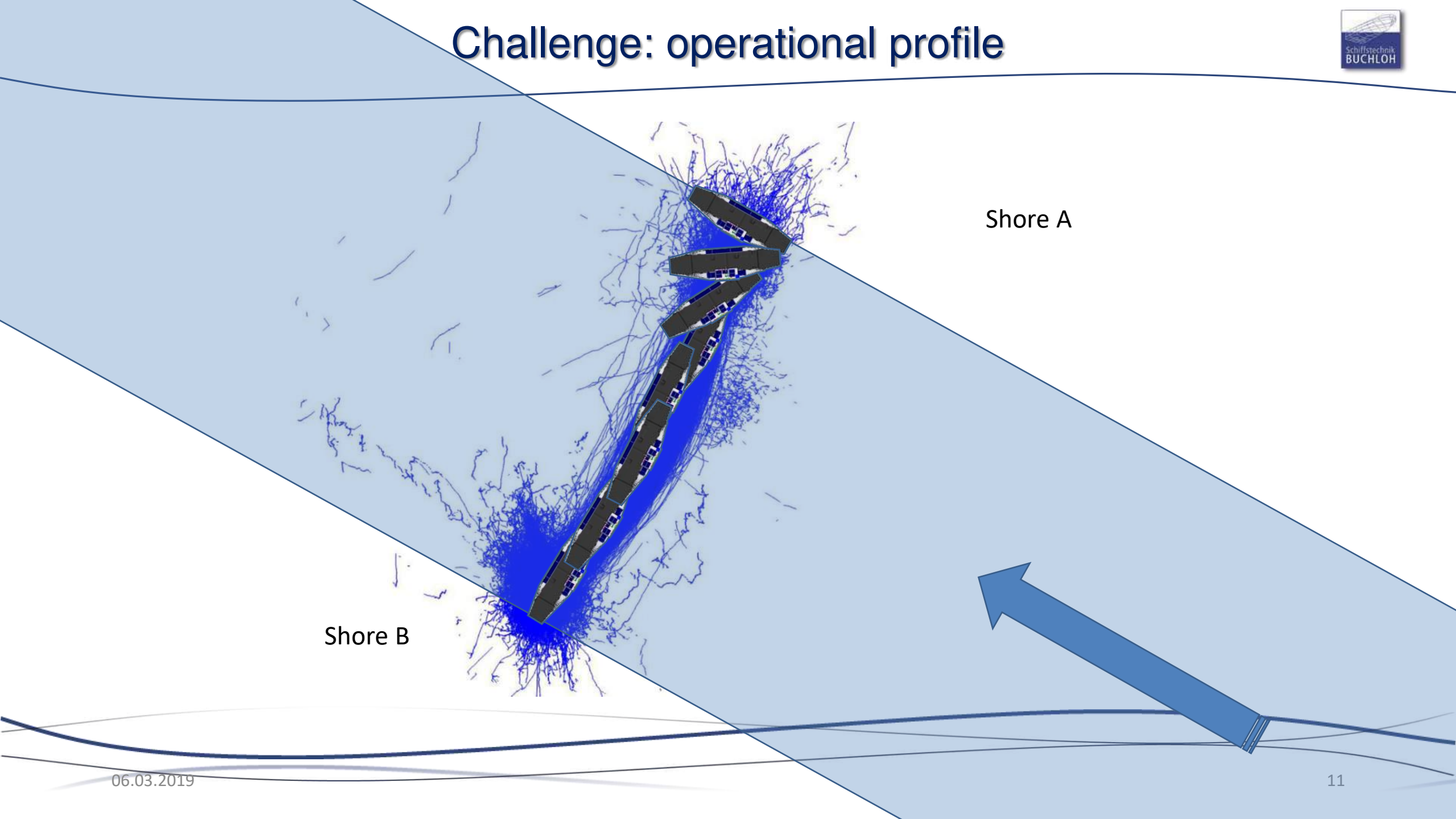
River dam Trier:

- Easy forecast for waterlevels
- Easy forecast for traffic
- Low current even at high waterlevels

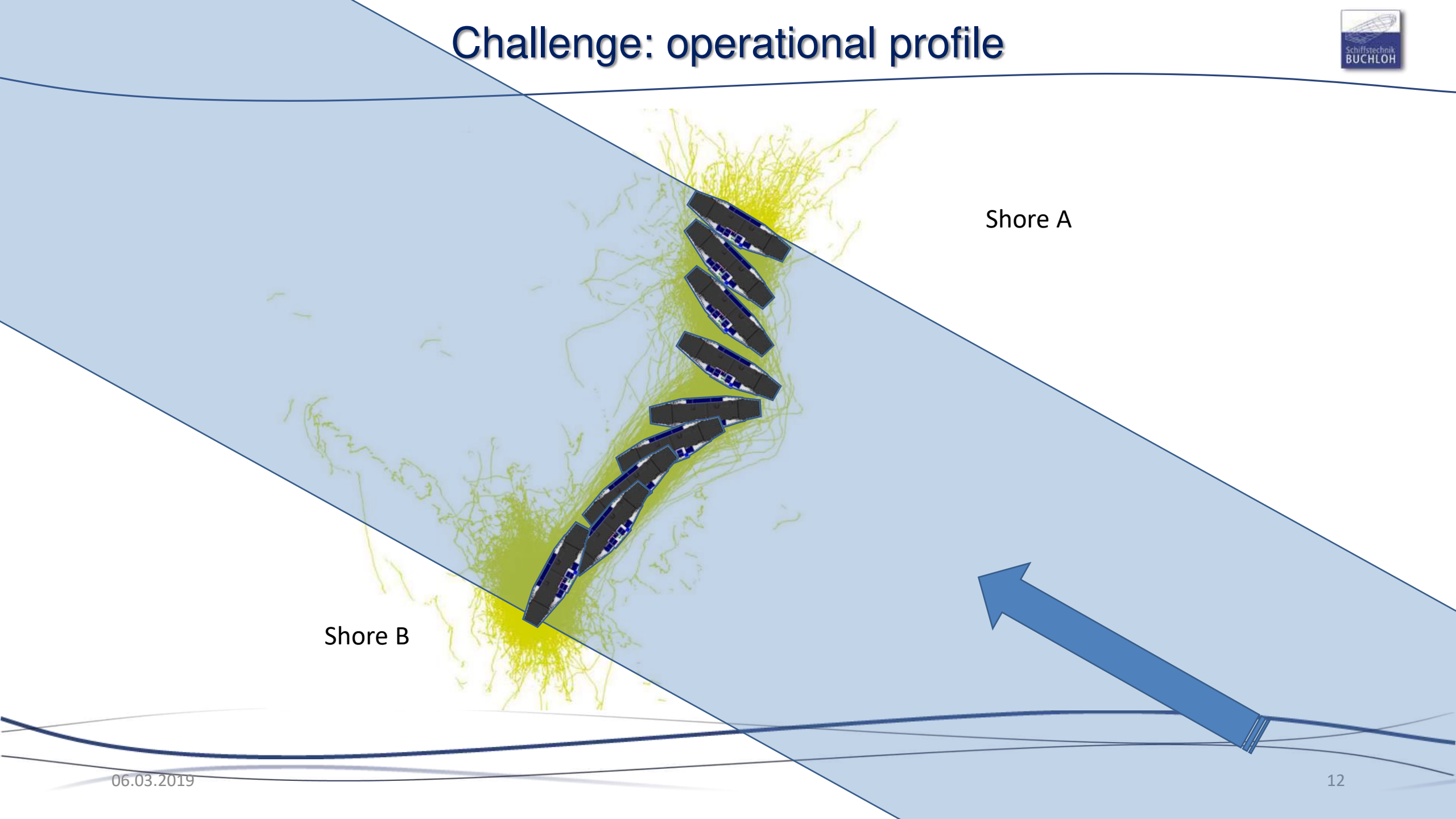
Challenge: operational profile



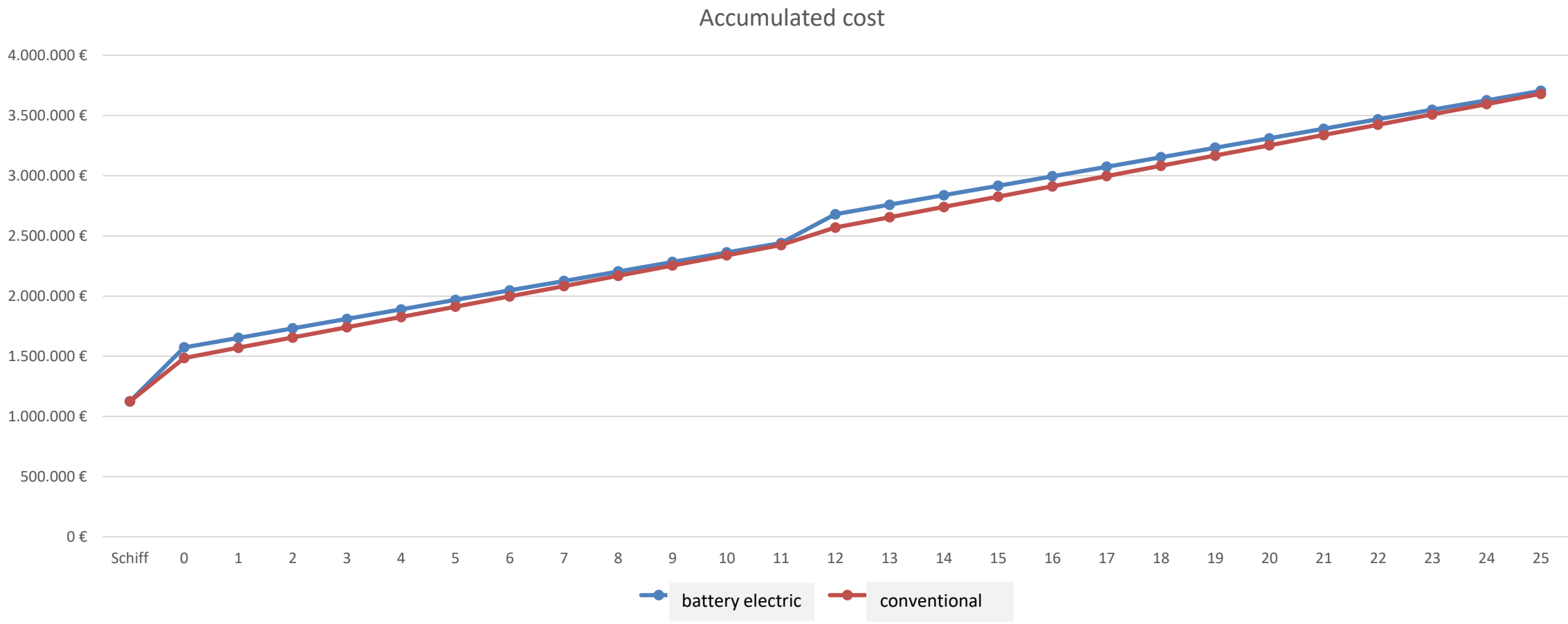
Challenge: operational profile



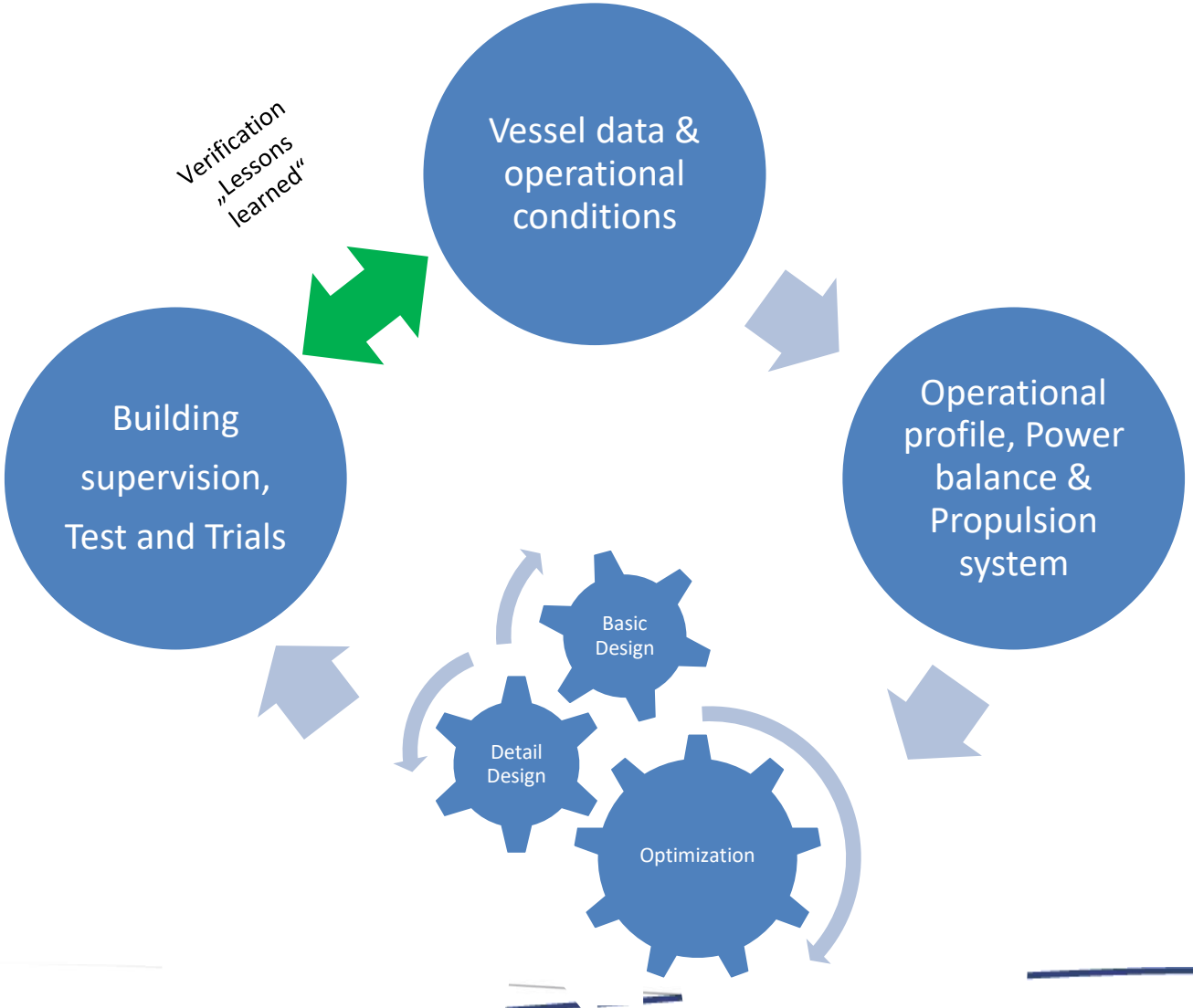
Challenge: operational profile



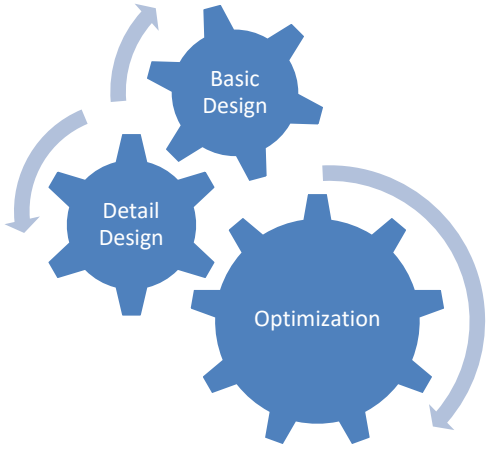
Profitability analysis

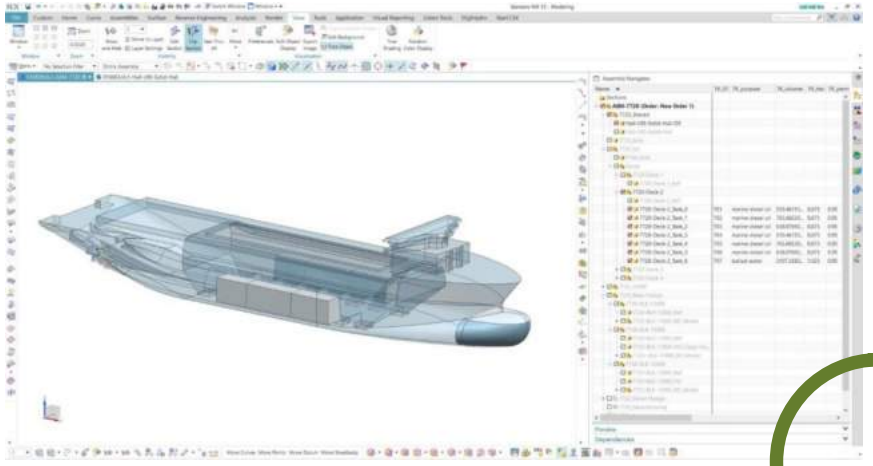


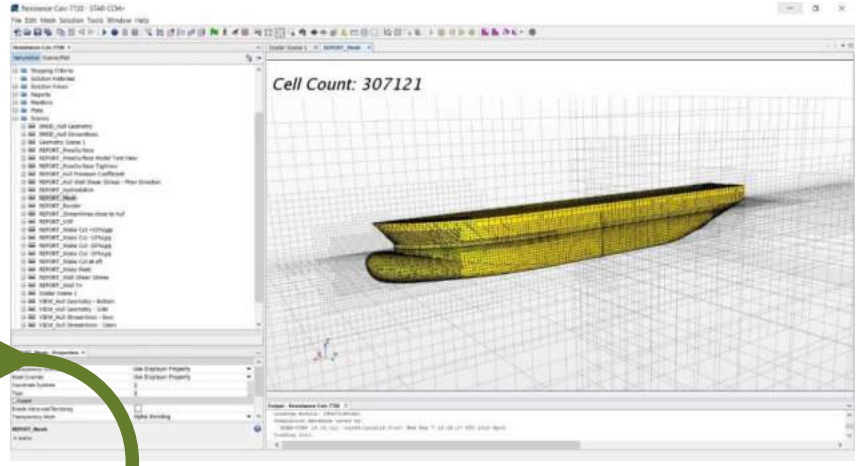
Naval Architecture for electric vessels



Integrated basic design





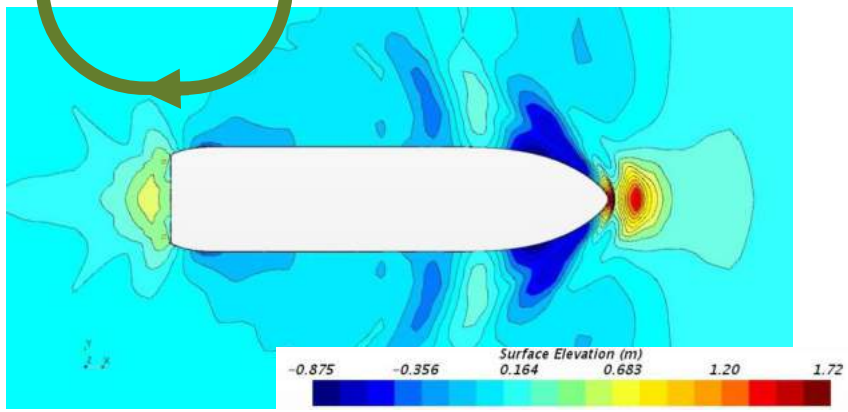


Hull design and room definintion

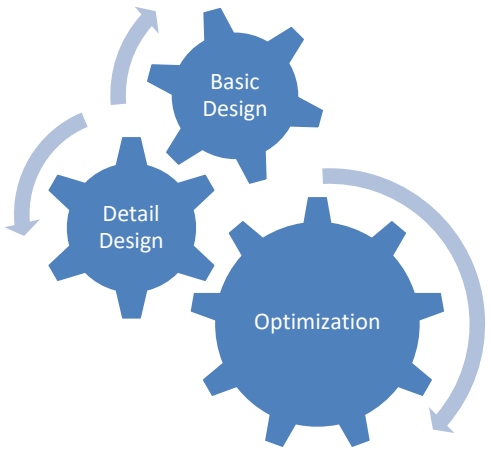
Hydrostatics

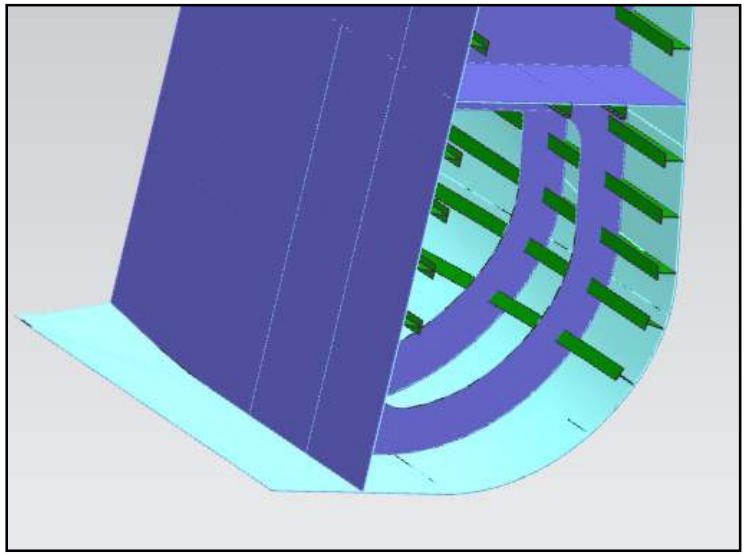
Hydrodynamics

Global strength



Parametric detail design

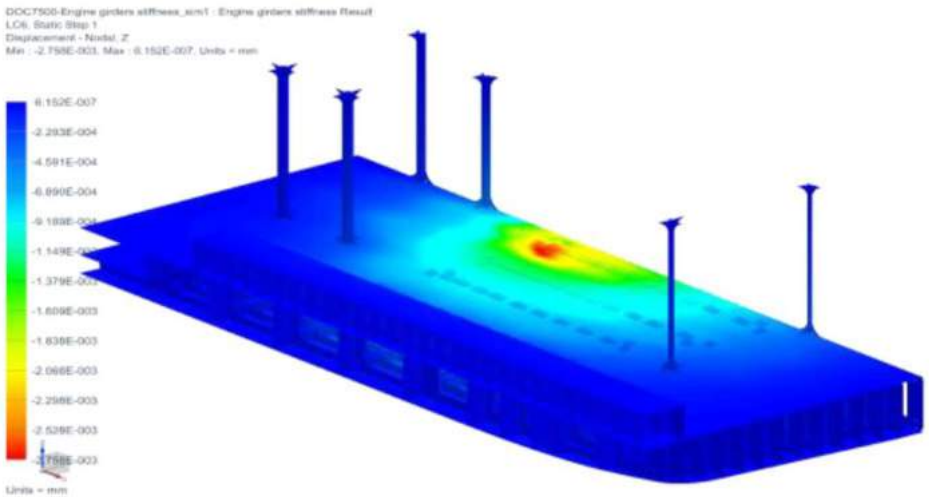




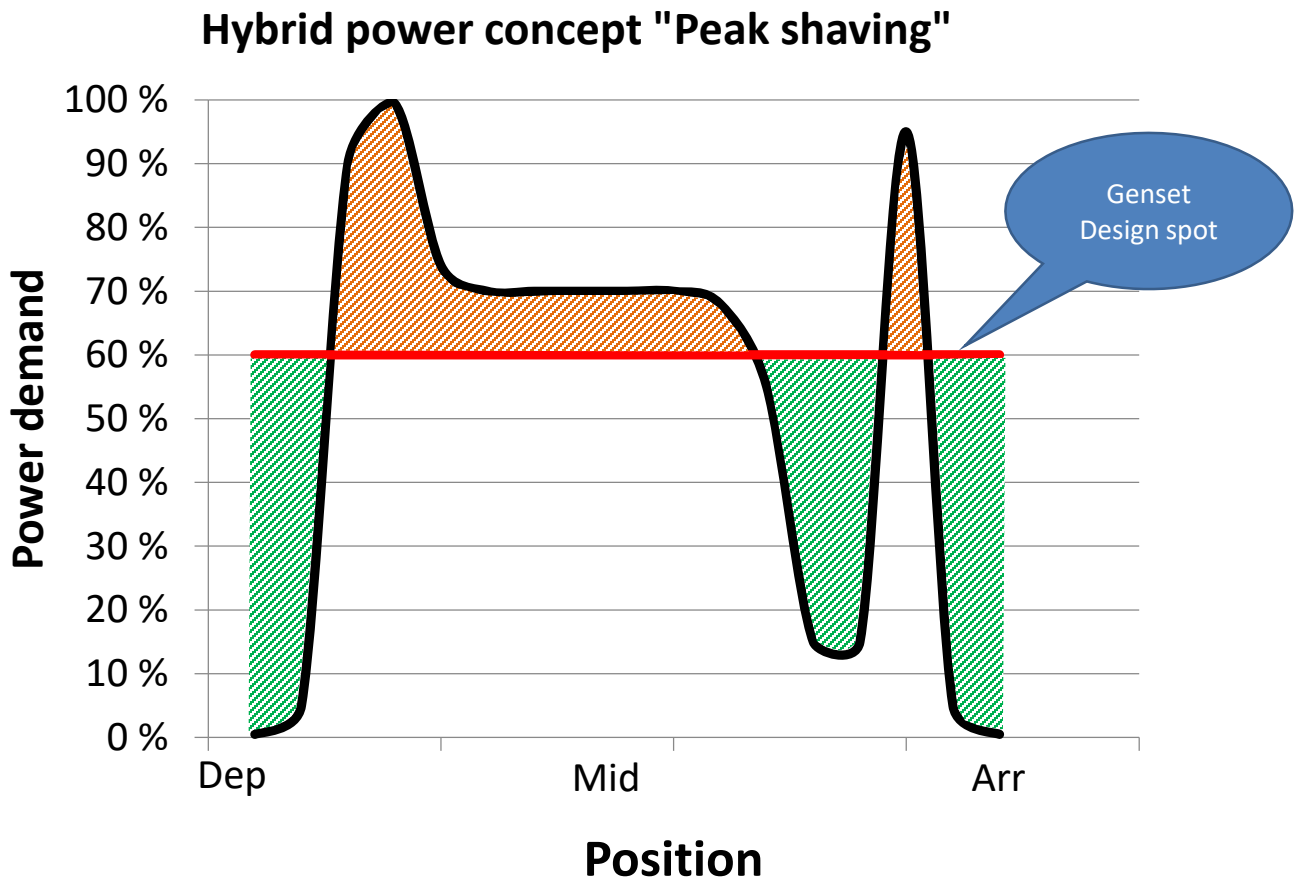
Structural optimization for actual loads

Detail design

Global and local strength analysis



Is the battery always a suitable solution ?



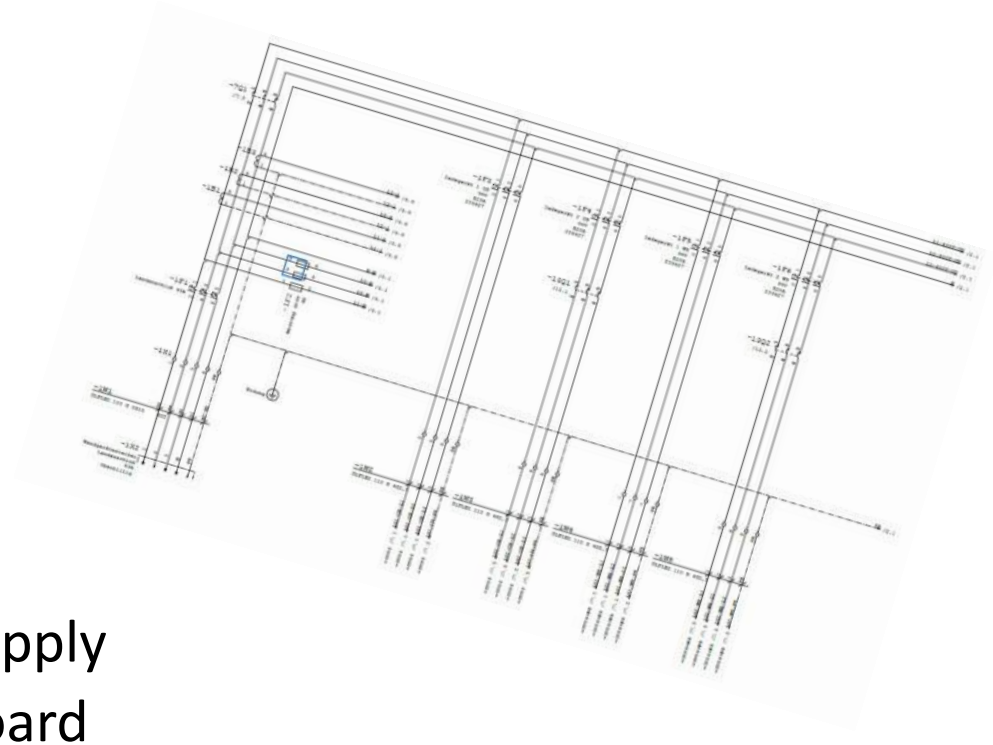
- Diesel electric system
- Static load on Gen-Set
- Red = Battery is discharged
- Green = Battery is charged

Challenges in the design of electric or hybrid vessels

- Old or insufficient rules
- Minimization of power consumption
- Minimization of CAPEX
- Capture of a detailed operational profile
- Translation of a captured operational profile into new conditions (changes in capacity etc.)

News

Electrical engineering



- Current flow drawing
- Schemes drive train
- Schemes lighting
- Schemes on-board power supply
- Power balance for on board power supply
- Partlist for electrical consumers on board
- Specification of electrical components and intigration into the 3D model

Schiffstechnik
BUCHLOH

Thank you for your attention !

Interreg
Danube Transnational Programme
GRENDEL

Non-Road Mobile Machinery (NRMM) Directive and implication to the inland shipping

Challenges, solutions & outlook for different technologies

Vienna, 7 March 2019

European Inland Barging Innovation Platform (EIBIP)

The Project is funded by the European Union

NRMM Stage V: Regulations

European Commission

CCNR
COMMISSION CENTRALE
POUR LA NAVIGATION DU RHIN

Port of Rotterdam

NRMM Stage V: The Task

IWP, IWA engines emissions in g/kWh		CO	NOx	HC	PM	PN	A
Reg (EU) 2016/1628	19-75 kW	5,0	Σ: 4,7		0,3	-	6,0
	75-130 kW	5,0	Σ: 5,4		0,14	-	6,0
	130-300 kW	3,5	2,1	1,00	0,1	-	6,0
	>300 kW	3,5	1,8	0,19	0,015	$1x10^{12}$	6,0

NRMM Stage V: IWW Engines

Authorized engines for inland navigation
- IWP en IWA
- NRE
- EURO VI

Source EC presentation

EIBIP
EIBIP | European Inland Barging Innovation Platform
The Project is funded by the European Union

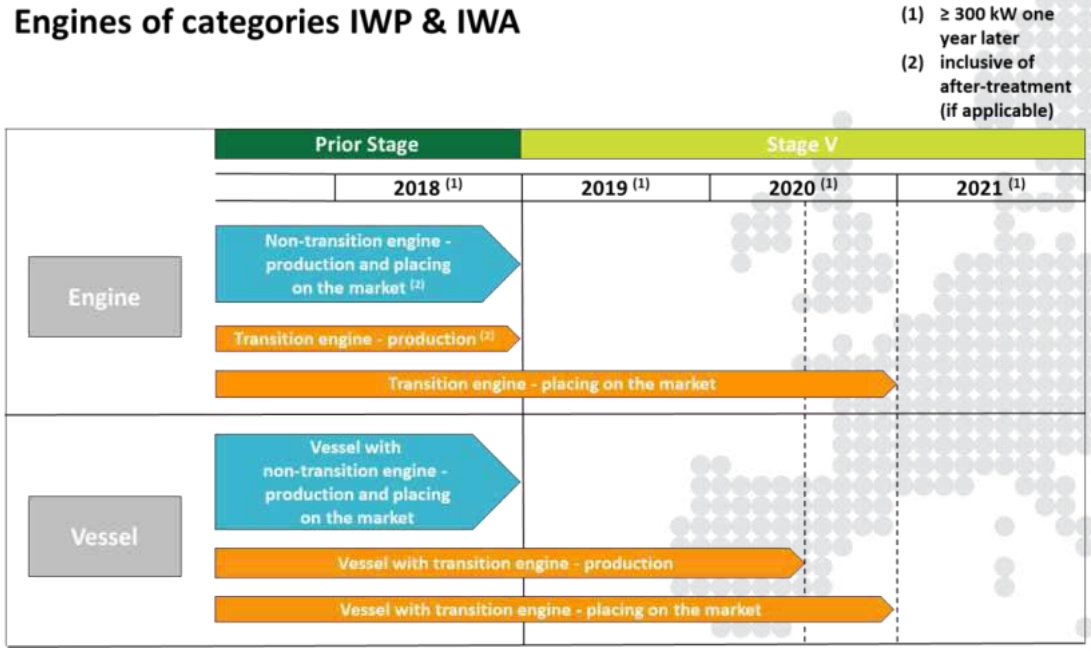
NRMM Stage V: Reference Fuels

Fuels for testing compression-ignition engines:
- **Diesel (non-road gas-oil)**
- **Ethanol for dedicated compression ignition engines (ED95)**

Fuels for testing spark ignition engines:
- **Petrol (E10)**
- **Ethanol (E85)**

Gaseous fuels for single-fuel and dual-fuel engines:
- **LPG**
- **Natural Gas/ Biomethane**

NRMM Stage V: Transition Periode



Source FAQ CESNI/PT

NRMM Stage V: In Practice

NRE marinisation

Rules for classification

NRMM Stage V: In Practice

EURO VI marinisation

ms. Noord
2 x MX11-210 kW propulsion
Installed April- 2017


ms. IJmeer
2 x MX 11 -240 kW Propulsion
Installed March 2018


ms. Liane
1 x MX11 – 240 Propulsion
Installed April 2018


ms. Wantij
2 x MX13 – 355 kW Propulsion
Installed June 2018


ms. Airset
2 x MX 11 – 240 propulsion
2 x MX 11 – 270 pump drive
1 x MX 11 – 320 generator
Installed July 2018

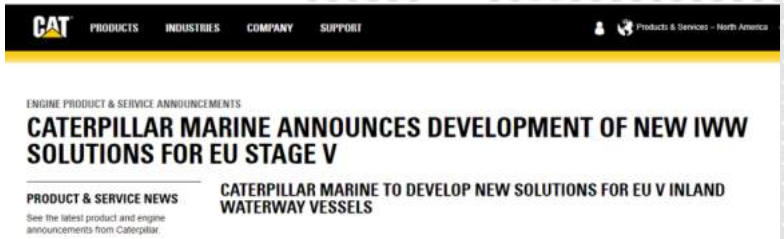

TNO RDW

NRMM Stage V: In Practice

IWP/IWA

KOEDOOD DIESELSERVICE B.V.

YES MARINE POWER

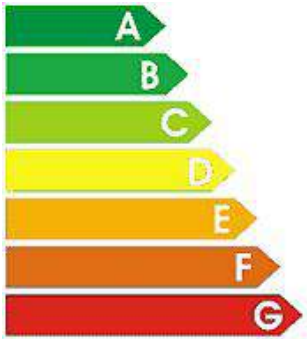


NRMM Stage V: Meet (not Comply)

IWP/IWA

NRMM Stage V: Performance Label

Performance Label: Air&Climate for the existing the fleet
Onboard Monitoring / Meriodic Measurements



The Project is funded by the European Union

Khalid Tachi
Phone: +31 10 798 98 30
E-mail: info@eibip.eu
www.eibip.eu

Interreg
Danube Transnational Programme
GRENDEL

Towards green, efficient and competitive river Danube transport

GRENDEL Innovation Factsheets & collection of technological requirements of Danube fleet feeding to State Aid schemes

KNOW-HOW TRANSFER EVENT
MODERNISATION OF DANUBE
VESSELS FLEET

Benjamin FRIEDHOFF (DST)

Project co-funded by European Union Funds (ERDF, IPA)

07 March 2019 • Vienna • Austria

Not all ships are like…

Source: www.emsbv.nl

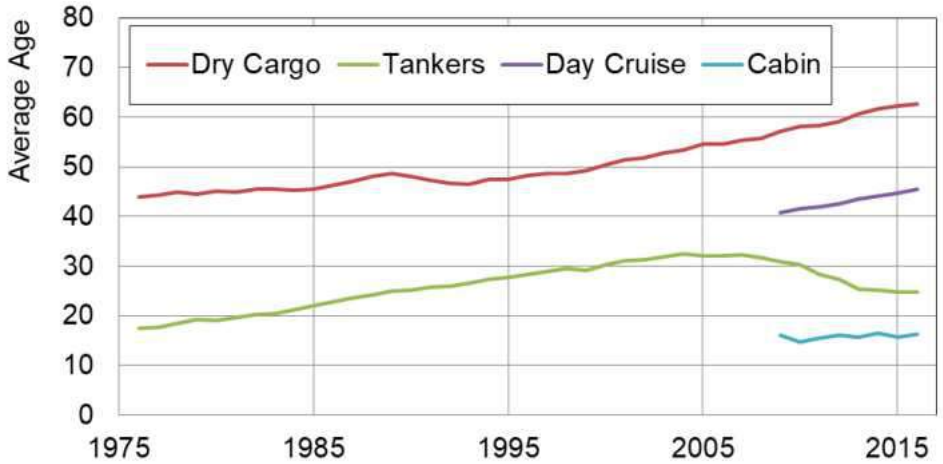
Source: www.teamcoshipyard.nl

Source: www.binnenvaartkrant.nl

Some look rather like…

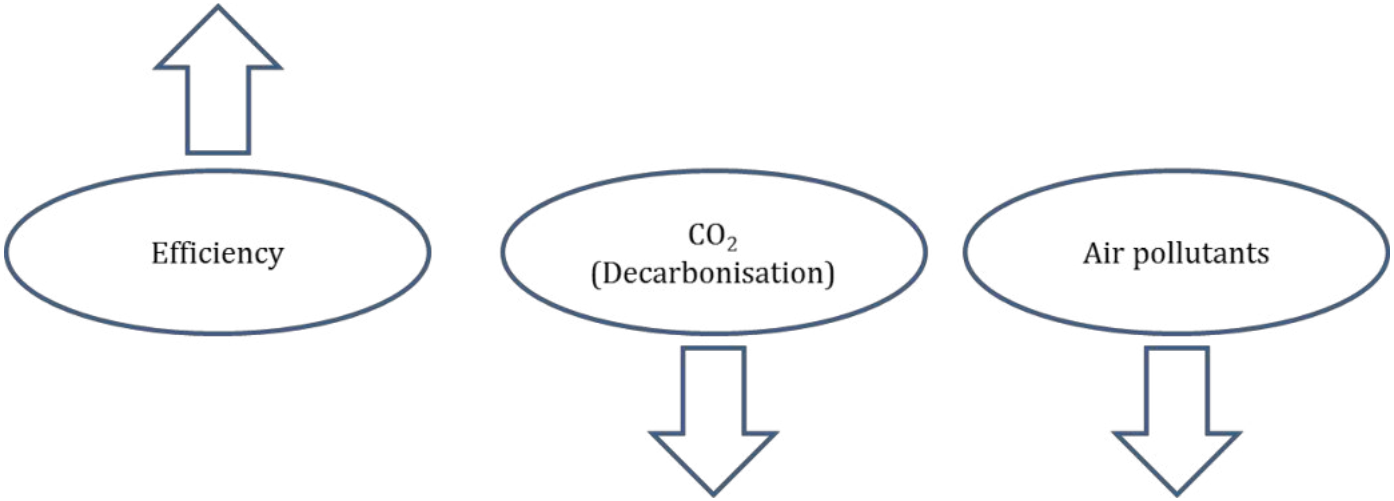
Not only on the Danube…

Franada	ENI 04009670
Length	65 m
Breadth	8 m
DWT	699 t
Built	1912
Power	275 kW



Motivation

- Inland ships have extremely long lifecycles.
- Road transport is catching up in emission of air pollutants.
- Spreading of stage V engines takes a lot of time.
- IWT sector has to invest for greening and new markets.



- NO_x and PM harm locally (including the crew).
- Energy efficiency helps the ice bear and the operator.

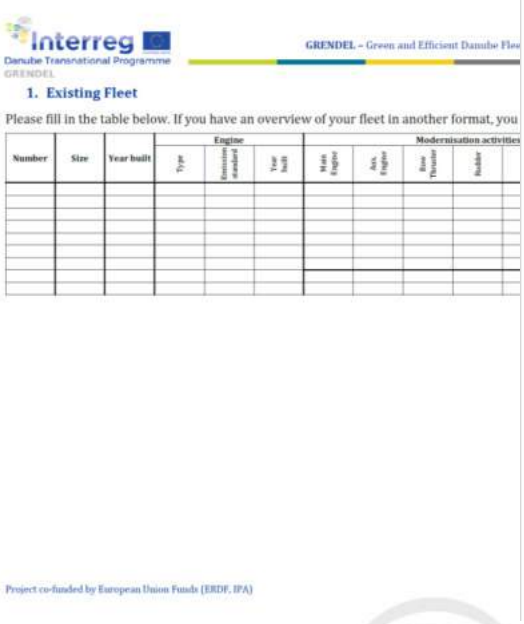
Project co-funded by European Union Funds (ERDF, IPA)

Ex ante fleet investment plan questionnaire

- Objective: Assessment of current CAPEX plans of shipping companies
- Structure: General information on fleet, company profile and individual ships
  Questions on the current strategy of fleet maintenance and renewal
- Outcome: Long term modernization strategies are not the standard.
- Investment decisions require understanding of technologies.


Fleet investment plan question

GRENDEL Green and efficient Danube Fleet


1. Existing Fleet

Please fill in the table below. If you have an overview of your fleet in another format, you

Number	Size	Year built	Engine			Modernisation activities				
			Type							

Project co-funded by European Union Funds (ERDF, IPA)


2. Origin of your fleet and typical decommissioning of vessels

If you buy new vessels or decommission fleets, what are the most common actions you take?
Please rate from 1 (very rare procedure) to 10 (most common procedure).

Action	1	2	3	4	5	6	7	8	9	10
Buy new-built vessels										
Buy used vessels										
Decommissioned vessels are sold										
Decommissioned vessels are scrapped										

3. How long do you usually keep vessels within your fleet?

4. What are your reasons to decommission a vessel?

When you decommission a vessel, what describes your reasons to do so best? Please rate from 1 (very rare) to 10 (most common).

Reason	1	2	3	4	5	6	7	8	9	10
Vessel too old (refurbishment not economic)										
Vessel too small (operation not economic)										
Emission standard too low										
Image										


5. What would describe your maintenance strategy best? Multiple answers are possible.

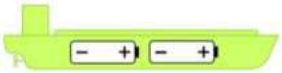
- ☐ Fixed maintenance intervals for the whole vessel (general overhaul).
- ☐ Fixed maintenance intervals for certain parts.
- ☐ Maintenance only in case of a failure.
- ☐ Parts are replaced when a damage is irreparable.
- ☐ Parts are replaced according to manufacturer recommendation or after a predefined lifetime.
- ☐ Other:_____
- ☐ ...

6. What are your investment priorities?

Please rate from 1 (lowest priority) to 10 (highest priority).

Reason	1	2	3	4	5	6	7	8	9	10
Modernisation requirements (refurbishment and renewal)										
Increase environmental performance										
Increase economic performance										

Know-how transfer



INNOVATIVE DANUBE VESSEL

- Dedicated selection of measures for the Danube region.
- Promotion and know-how transfer for stakeholders.

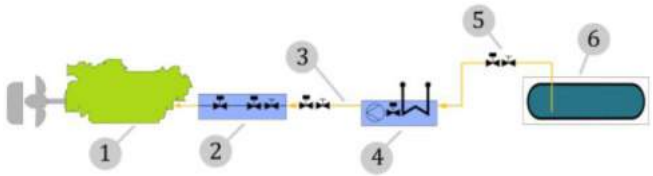
Fact Sheets available

TECHNOLOGICAL FACTSHEETS

Modernisation of Danube inland vessels

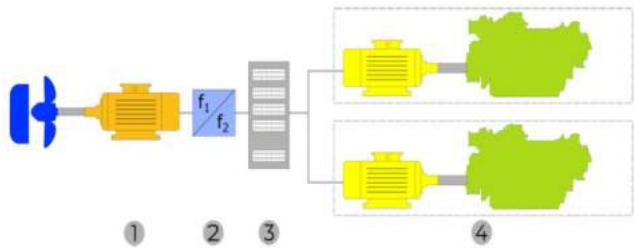
FACT SHEET N° 1

GAS AND GAS-ELECTRIC PROPULSION



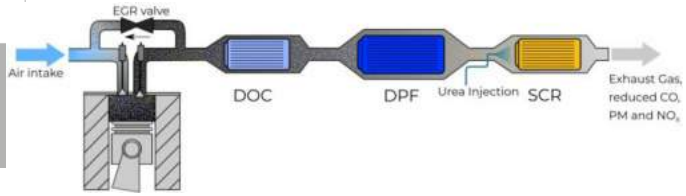
FACT SHEET N° 2

DIESEL-ELECTRIC PROPULSION



FACT SHEET N° 3

AFTER-TREATMENT



Fact Sheets coming soon

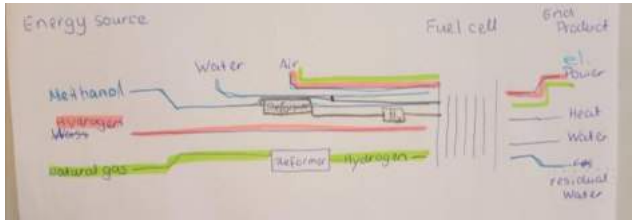
No 4: Drop-In (bio)Fuels

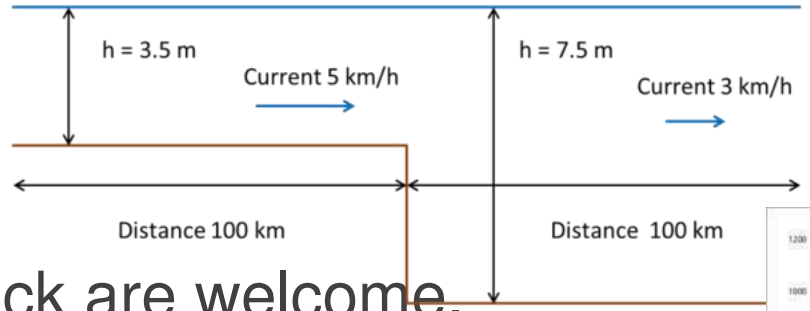
No 5: Battery Electric Propulsion

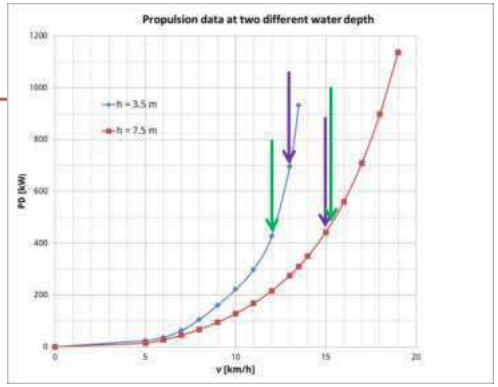
No 6: Fuel Cells

No 7: Euro VI Truck Engines

No 8: Energy Efficient Navigation







→ Input and feedback are welcome.
Fact sheets will be updated!

http://www.interreg-danube.eu/news-and-events/project-news/3694

Fleet Investment Plan Template

Detailed investment planning in different categories for 10 years period

Maintenance for existing devices and equipment (Refurbishment)
- Repair
- Overhaul
- Exchange

Equipment in focus:
- Gear boxes,
- Propellers, nozzles, bow thrusters,
- Main and aux. engines
- Electric works
- Rudder system,
- Anchors and anchor chains,
- Navigation equipment

Installation of new equipment and devices (Renewal)
- New equipment, that has not been on the vessel before

Equipment in focus:
- New gear boxes,
- Improved propellers,
- Nozzles, bow thrusters,
- New main and aux. engines
- Electric works, automation
- Improved rudder system
- Exhaust-after treatment
- New alternative fuel
- RIS related equipment

Work concerning the whole ship
- Major conversion

Work in focus:
- Docking
- Hull repair / refurbishing
- Improved aft section
- Improved bow section
- Broadening / Prolonging
- Reconstruction of electric wiring

Cargo Compartment

Work in focus:
- Mod. Hatchways
- Mod. to RoRo
- Prov. Power & Air conditioning

Activity 3.2: Fleet Investment Plan Template

VESSEL CAPEX PLAN	Project No.	2019		2020		2021		2022		2023		2024		2025		2026		2027		2028-2030		Total	Remarks
		Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding	Cost	Funding		
Vessel #1																							
Repair																							
Gear boxes																							
Propellers, nozzles supply, installation																							
Bowthruster																							
Machinary, electric works																							
Rudder system general repair																							
Main engine general repair																							
Anchors and anchor chains																							
Radar																							
Auxilary engine																							
Overhaul																							
Gear boxes																							
Rudder system																							
Anchors and anchor chains																							
Radar																							
Auxilary engine																							
Installation of new devices																							
New engines																							
Propellers, nozzles supply, installation																							
Bowthruster																							
New auxilary engine(s)																							
New main engine																							
Rudder system																							
Exhaust after-treatment																							
New alternative fuel equipment																							
Work concerning the whole ship																							
Docking																							
Hull repair																							
Improved aft section																							
Improved bow section																							

…all feeding into the development of a model State Aid Scheme…

Questions

Benjamin Friedhoff
Head of Hydrodynamics

Development Centre for Ship Technology and Transport Systems
Oststr. 77, 47057 Duisburg, Germany
T + 49-203-99369-29
E friedhoff@dst-org.de W www.dst-org.de

Photo: © NAVROM

GRENDEL "Green and efficient Danube fleet"

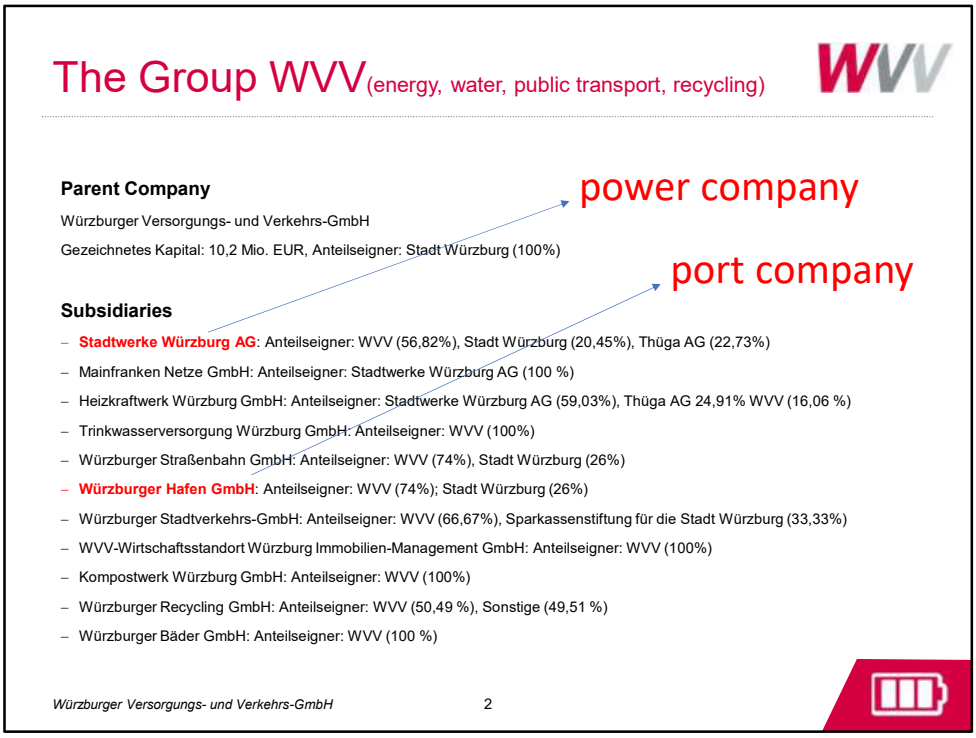
Towards modernisation & greening of Danube inland waterborne sector and strengthening its competitiveness

www.interreg-danube.eu/grendel

Project co-funded by European Union Funds (ERDF, IPA)

Energie. Verkehr. Umwelt.

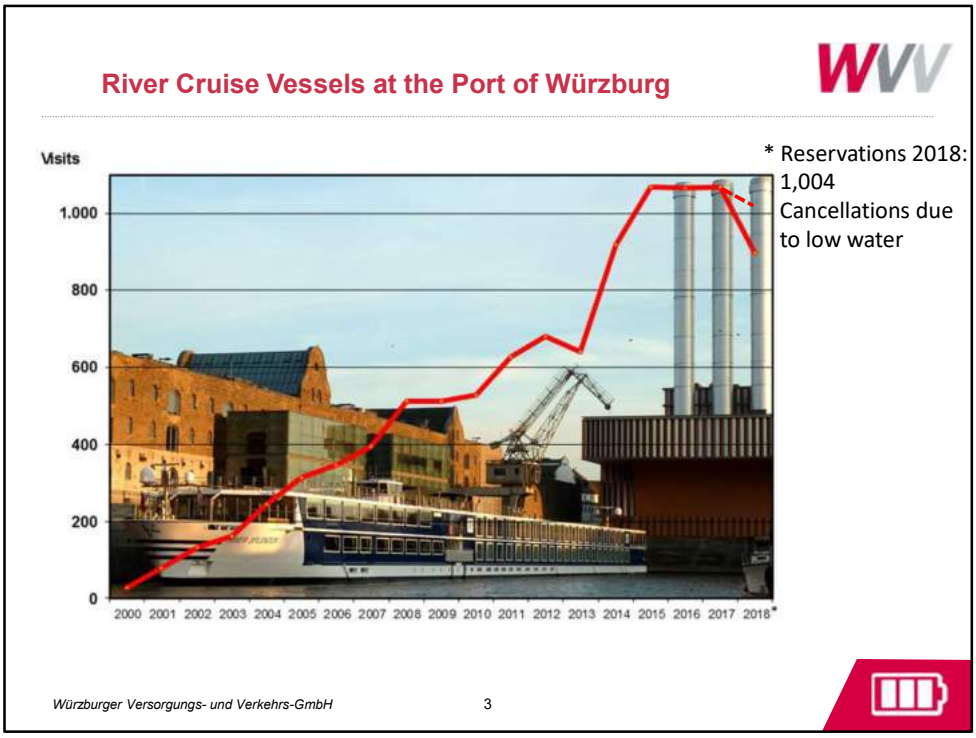
Shore Power System for Inland Waterways Vienna 2019-03-07



A little bit about me!
This is the group where I work. Just the red ones are important.
I work for the power company and the port company in Würzburg.

For over 10 years we have been learning
and getting better and better at shore power.

So why we had to been getting better?



This is a the wonderful story from the river cruise business

These are the numbers from Würzburg.
We see here comparing 2000 to 2018 that there have been 1000 more visits!
I know that in Vienna there are more than 1000 ships per year,
But you can see the development.

We asked ourselves how we could make it more environmentally friendly.
We also sell energy? So we think that we can use shore power!
And then we made it become reality.

What is shore power?

With shore power, while the vessels are docked, they can stop the engine and use green power.

So what is shore Power. Sometimes they call it Cold Ironing.

And this is not only for image improvement purposes.
You can save a lot of dieselfuel.

Reasons

- To avoid noise pollution
- To avoid fine dust (PM)
- To avoid nitrogen oxides (NOx)
- To avoid carbon emissions (CO2)
- To avoid vibrations

The reasons to be greener in the waterway business.
Maybe some of you know about the bans European cities put on diesel cars…
Well, it is the same story on the waterways.

So yes, we also use diesel fuel on the river.
We can see how to avoid these things.

Differences

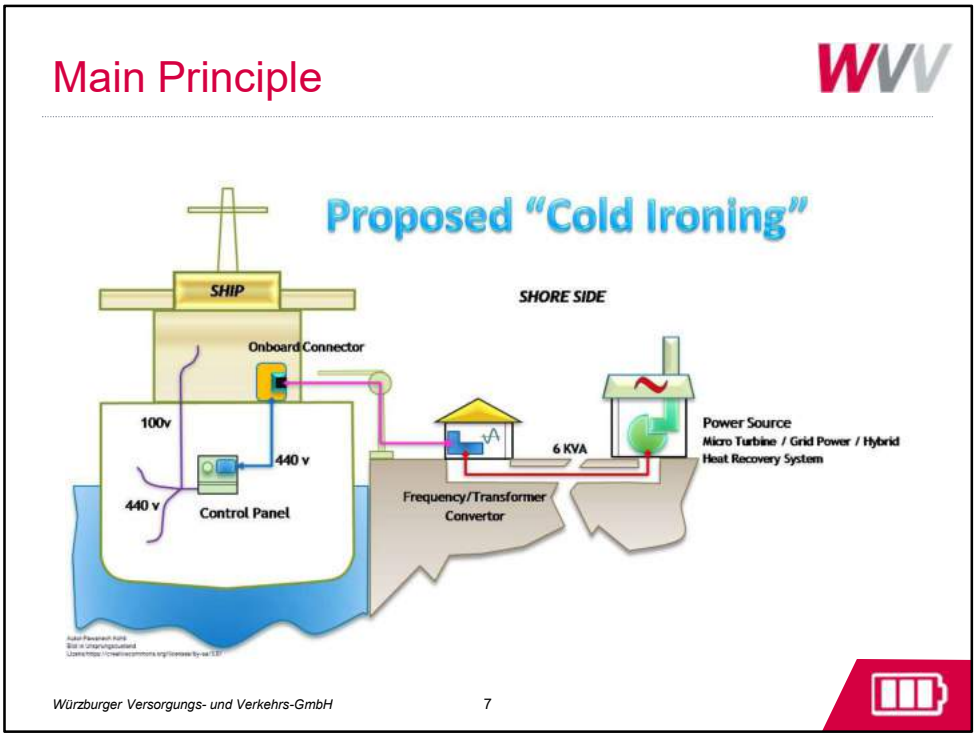
Type of Ships	Power	Plug Connection
Sports boats	0-16A	CEE 230 V (blue)
Cargo vessels	20-100A	CEE 400V (red)
River cruise vessels	300-800A	Powerlock 400V

Sports boats need up to 16 ampere,
which they usually get with the blue connector.

Cargo vessels and the smaller white fleet need a little bit more.

And for river cruise ships you need a lot more power.
Here, these connectors became standard. They are called Powerlock.
Here, 5 cables are connected and the crew can handle it easily.
For all connections you need about 20 minutes.
If you put all 5 lines in one cable it is too heavy.
They are all low voltage systems because it is safer.

From now I'll talk about the last one,
because there is so much energy in this power supply.



Here you see the shore power system

At the moment, we are talking about directly using the energy for kitchen, light, air conditioning and the other hotel needs on board.

But maybe in the future shore power can also be used for charging batteries.

The investment would vary widely. I can´t give you any numbers because it is not a one-size-fits all model.
The bigger part of the investment in the shore power system is for the transformer and cables underground.
I call it the public part.
Most of the time you need your own transformer station for the system.
Think about it. 3 or 4 ships need more energy than a small village.
That‘s why you need your own transformer.

You have to talk with your local power company about the possibility of getting a transformer.
Is it possible? What do you need to make it possible?

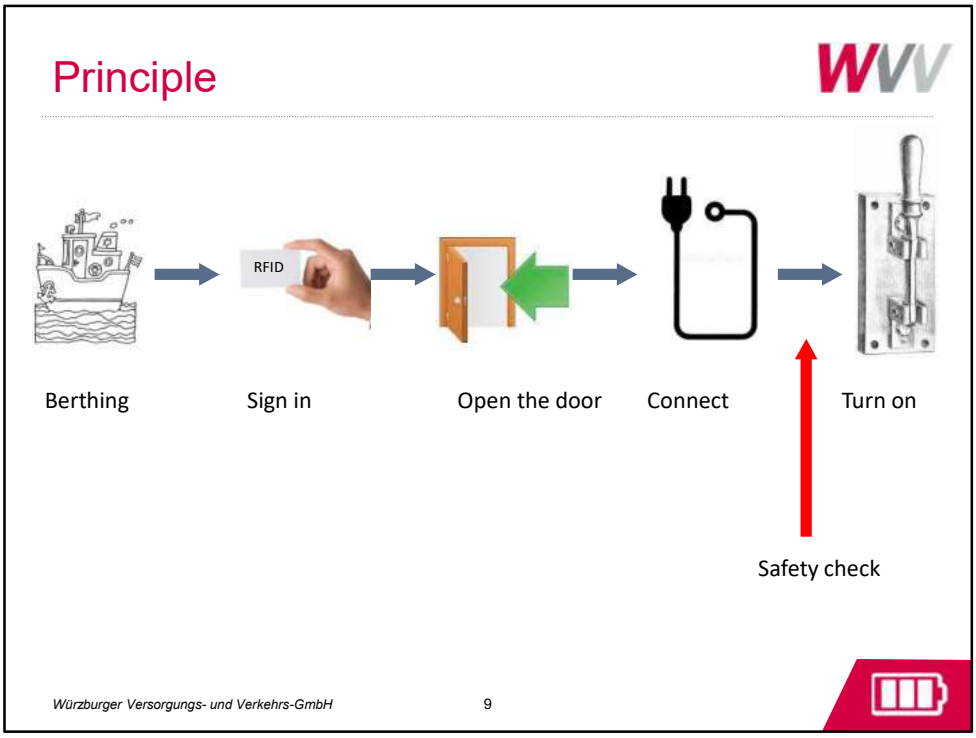
The “Energy Terminal“

This is our product. 2 powerlock systems in 400A each.

It is set up along the European waterways.
Moselle, Rhein, Main and Danube hopefully soon.

And now a praise to the shipping companies.
The ships can do that. All of them have the onboard systems.
They have enough cables.
So we need more shore power stations along the rivers.

Then we will become greener.



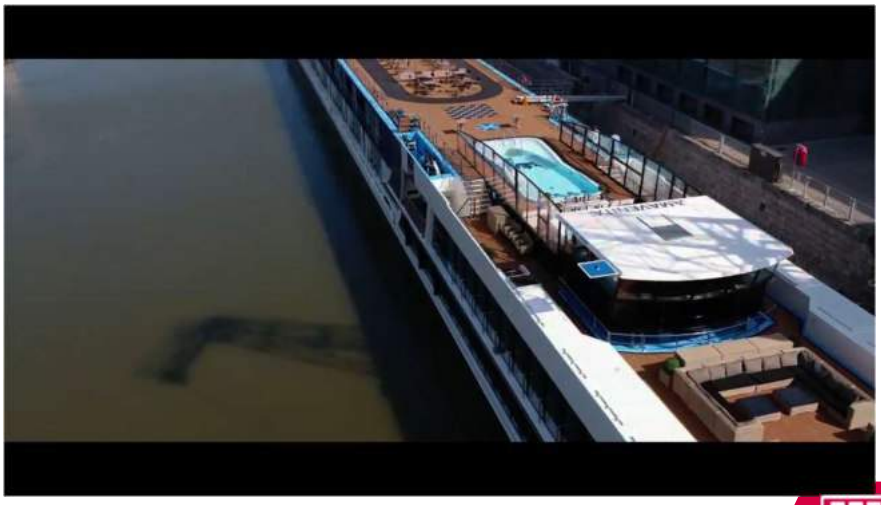
Now a little bit more about the principle.

It has to be easy! Or the ship staff will not implement it.

When the ship lands for the first time
give the captain the instructions and the chip card.

After that the crew can use the system without staff on site
…no key, no staff very easy and very fast

Clip



For better understanding here is a short clip.

Sorry the clip is in German but pictures says more than words

https://www.youtube.com/watch?v=eEW9sHu5Bfs&t=14s

EU Declaration of Conformity **CE**

EN Norm 61439-1, 61439-2

IEC-60309-Standard

DIN EN16840


EU - Konformitätserklärung

If you want to build your own shore power system
you have to observe some standards.
You have to register the system with the CE in the European Union
and ensure conformity with the standards.

You need the box
and you need software
for billing for the services and monitoring the electricity meter.
Those are the two parts of the system.

The Message

It is possible to use shore power

It is a little bit complicated to set up your own system but you can buy ready made systems.

And it is safe, profitable and green!

If you want to know more visit our homepage!

KNOW-HOW TRANSFER EVENT: MODERNISATION OF DANUBE VESSELS FLEET

STEPHAN STOUT, THURSDAY 7 MARCH 2019, VIENNA

DAMEN

AUTONOMOUS SHIPPING

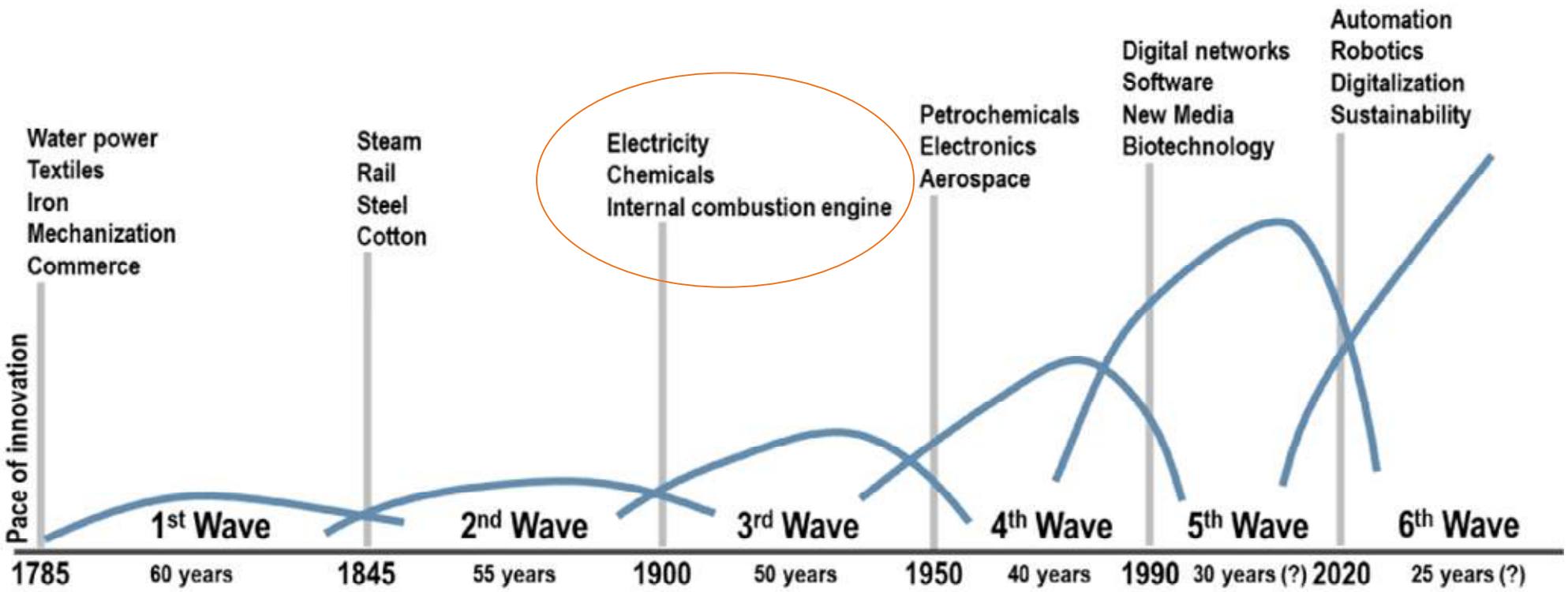
- Damen is making its first steps towards autonomous vessels…..
- But is this really the future? Why should we be interested?

INNOVATION

"New idea, creative thoughts, new imaginations in form of device or method"

The application of better solutions that meet new requirements, **unarticulated needs**, or existing market needs.

INNOVATION


Water power
Textiles
Iron
Mechanization
Commerce
Steam
Rail
Steel
Cotton
Electricity
Chemicals
Internal combustion engine
Petrochemicals
Electronics
Aerospace
Digital networks
Software
New Media
Biotechnology
Automation
Robotics
Digitalization
Sustainability
Pace of innovation
1st Wave
2nd Wave
3rd Wave
4th Wave
5th Wave
6th Wave
1785
60 years
1845
55 years
1900
50 years
1950
40 years
1990
30 years (?)
2020
25 years (?)

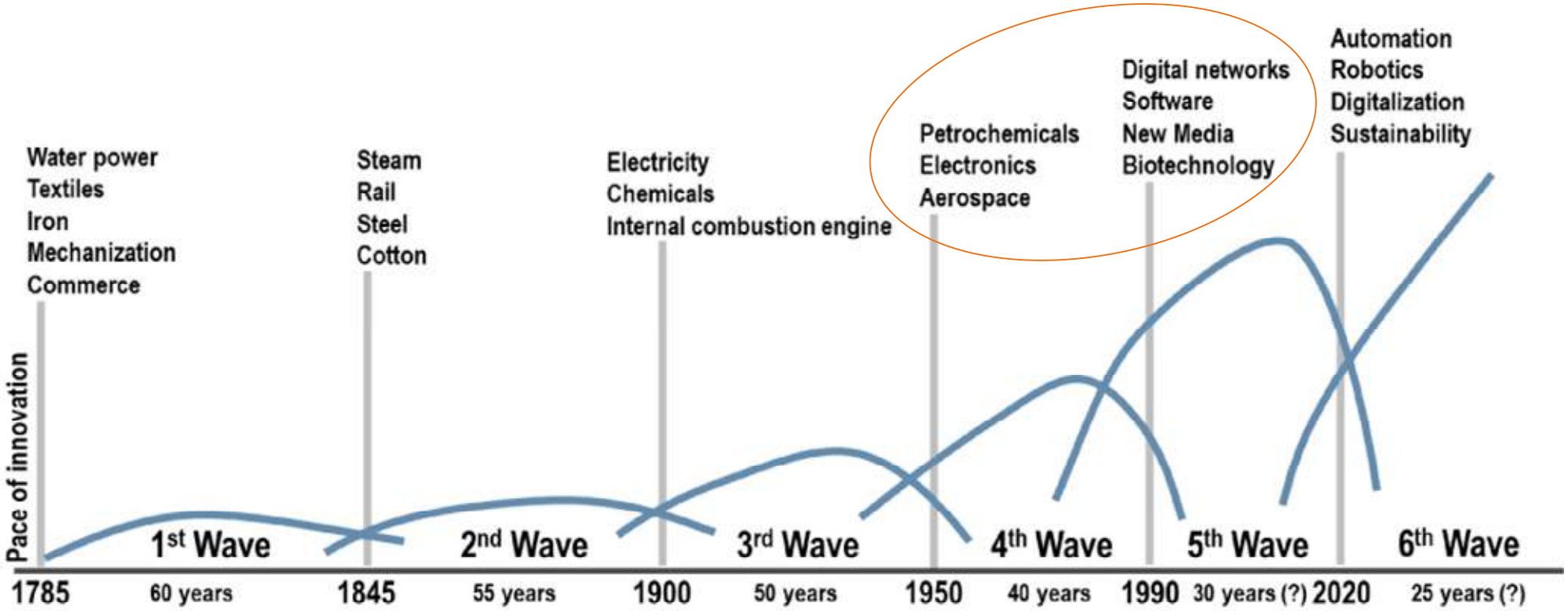
INNOVATION

Easter morning 1913: 5th Ave, New York City.
Spot the horse.

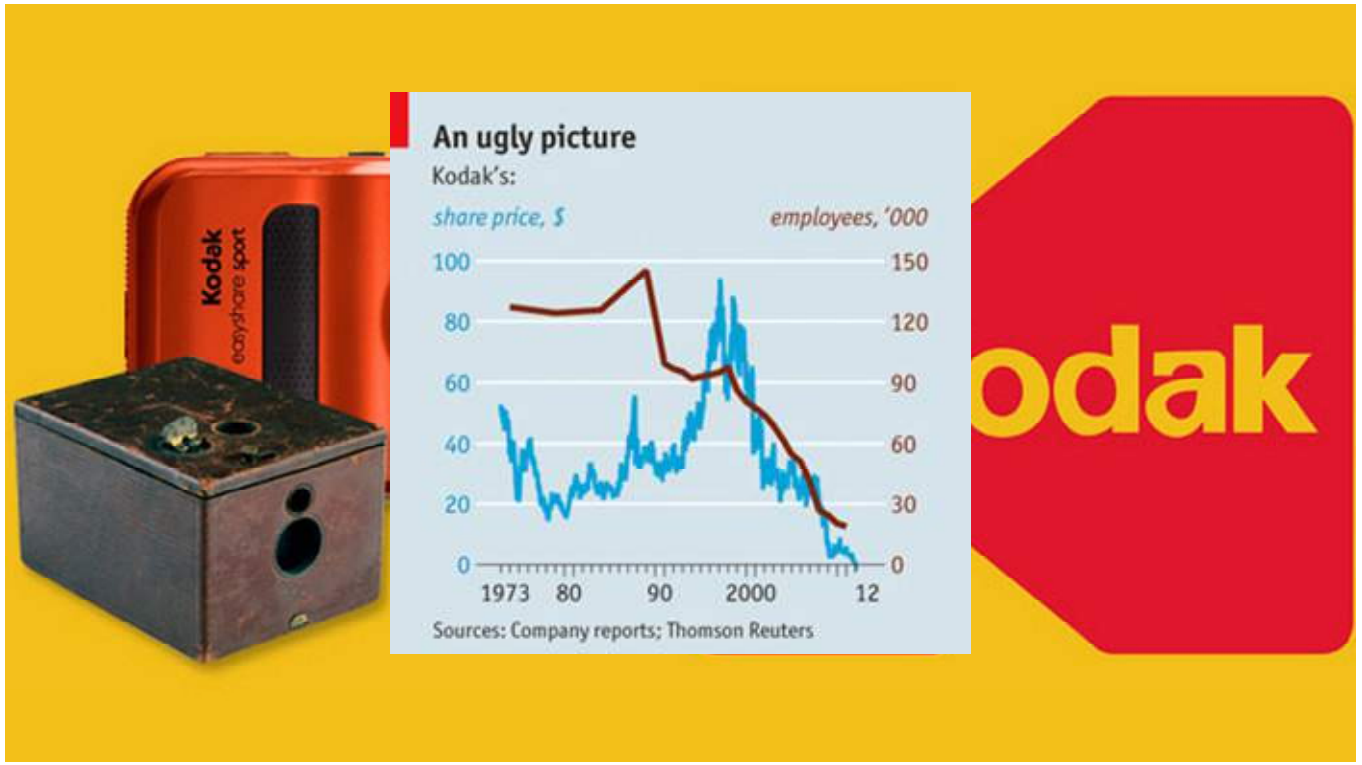
Source: George Grantham Bain Collection.

Source: US National Archives.

INNOVATION


Water power
Textiles
Iron
Mechanization
Commerce
Steam
Rail
Steel
Cotton
Electricity
Chemicals
Internal combustion engine
Petrochemicals
Electronics
Aerospace
Digital networks
Software
New Media
Biotechnology
Automation
Robotics
Digitalization
Sustainability
Pace of innovation
1st Wave
2nd Wave
3rd Wave
4th Wave
5th Wave
6th Wave
1785
60 years
1845
55 years
1900
50 years
1950
40 years
1990
30 years (?)
2020
25 years (?)

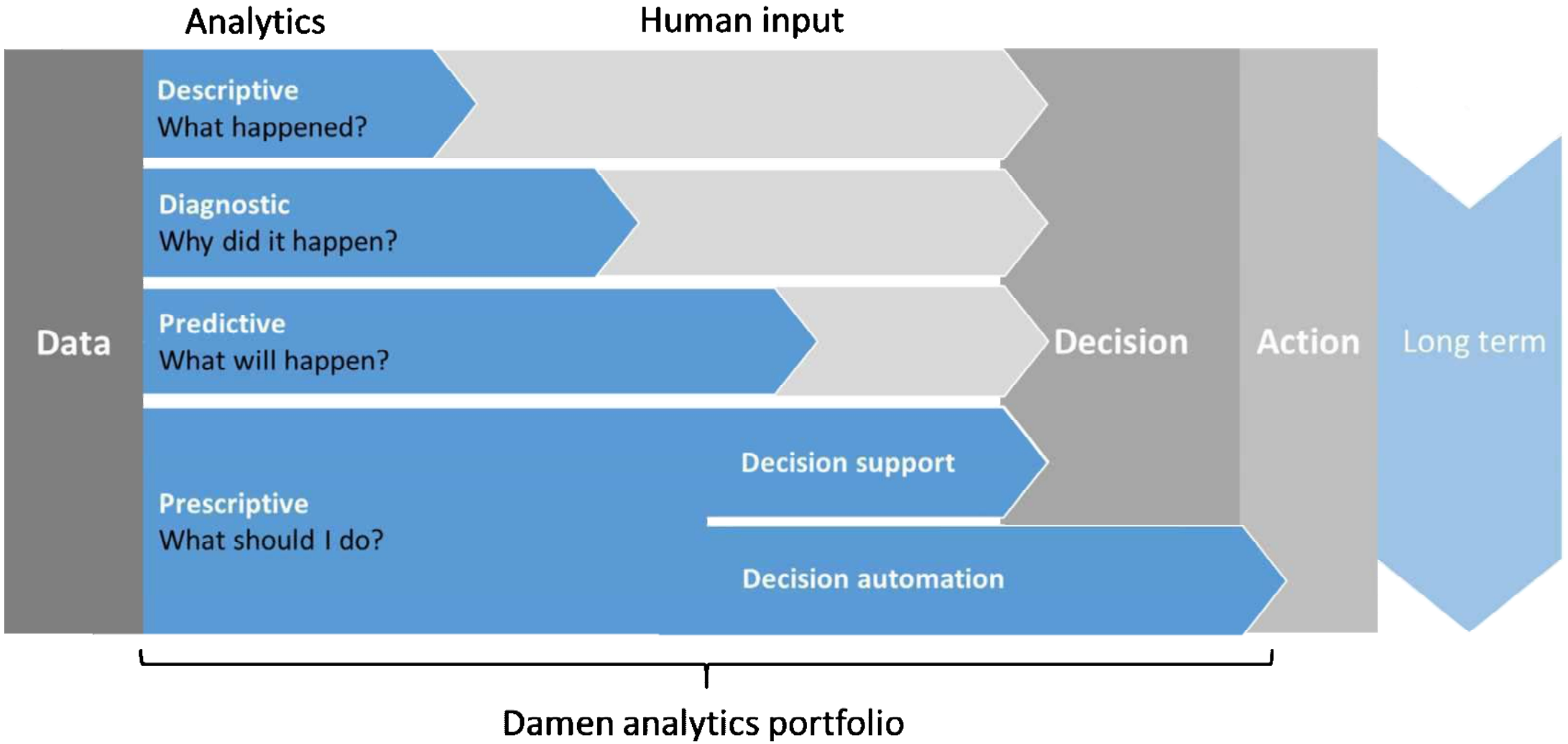
INNOVATION


Kodak
easyshare sport
An ugly picture
Kodak's:
share price, $
employees, '000
100
80
60
40
20
0
150
120
90
60
30
0
1973
80
90
2000
12
Sources: Company reports; Thomson Reuters
odak

AUTONOMOUS SHIPPING

- Damen is making its first steps towards autonomous vessels…..
- But is this really the future? Why should we be interested?
- The answer is clear: in order to survive, we **must** be interested

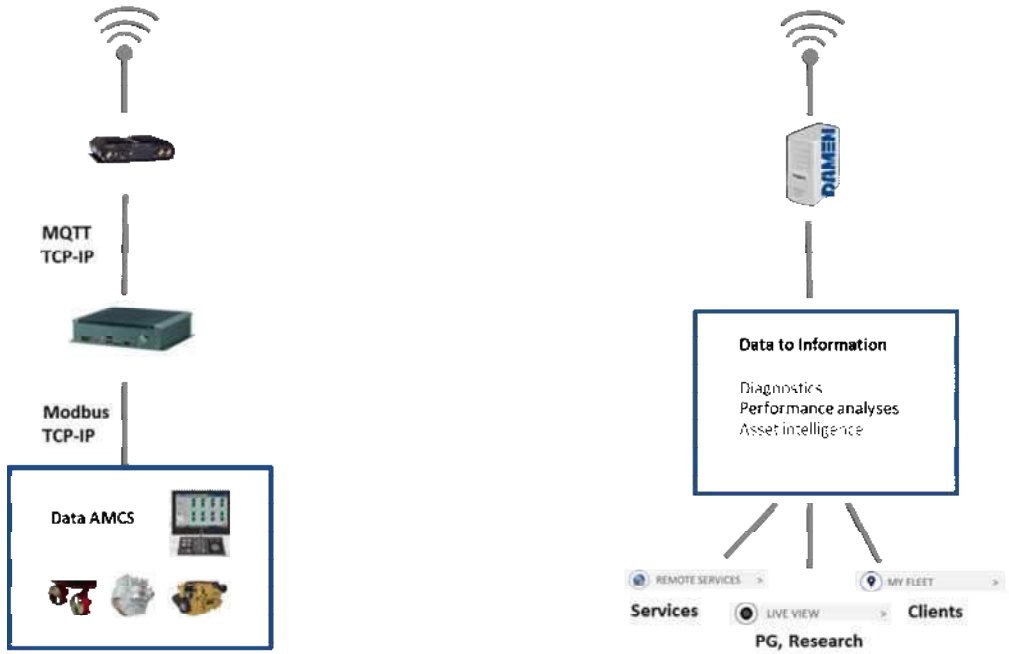
AUTONOMOUS SHIPPING: HOW?



AUTONOMOUS SHIPPING: HOW?

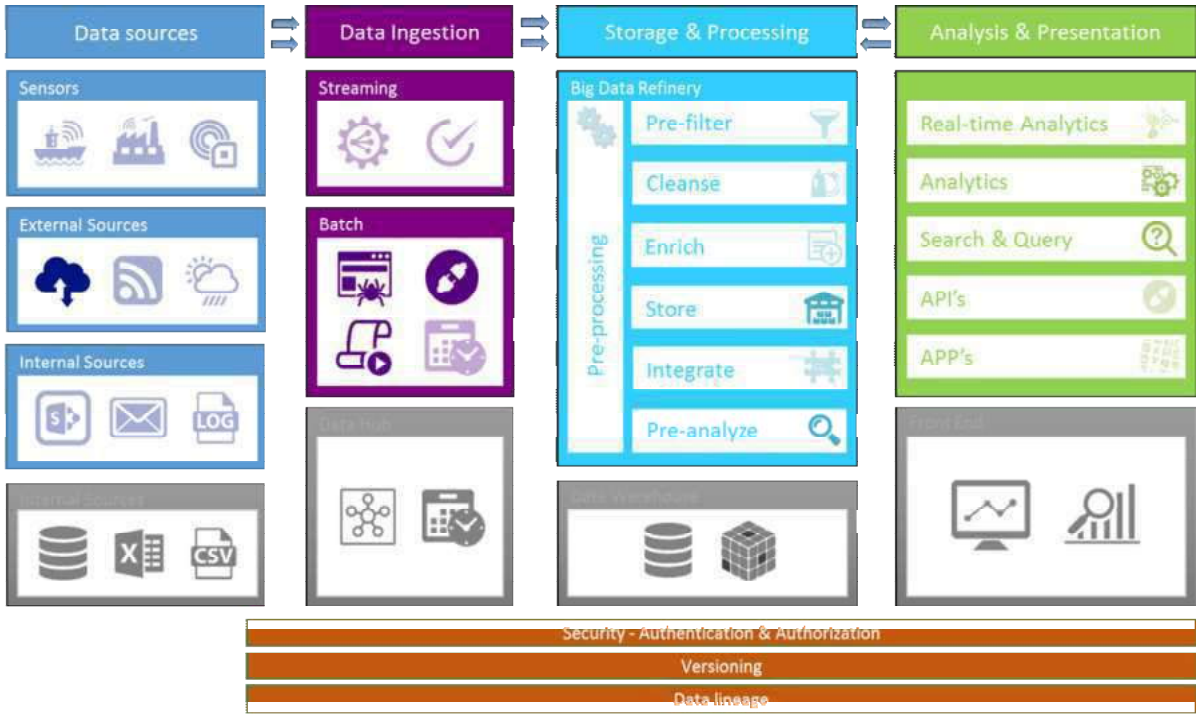
- STEP 1: CONNECTING THE VESSEL TO THE CLOUD
- STEP 2: TRANSFER DATA TO INFORMATION
- STEP 3: ENRICH THE VALUE BY ADDITIONAL DATA TRANSFER
- STEP 4: PROCESS & VISUALIZE THE INFORMATION
- STEP 5: PROVIDE ADVICE BASED ON THE INFORMATION
- STEP 6: ACT BASED ON THE INFORMATION

STEP 1: CONNECTING THE VESSEL TO THE CLOUD

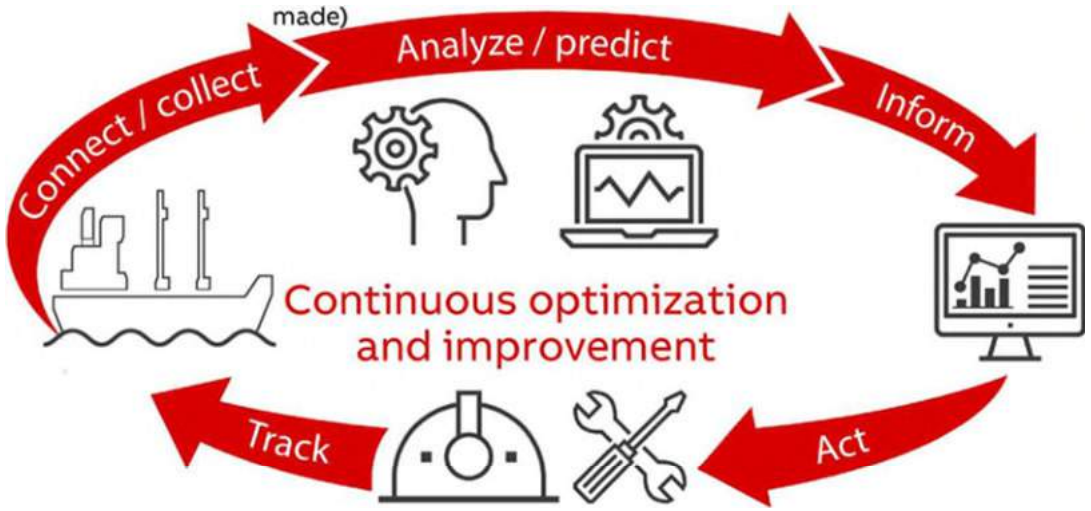


SELECTING THE RIGHT GATEWAY SOLUTION

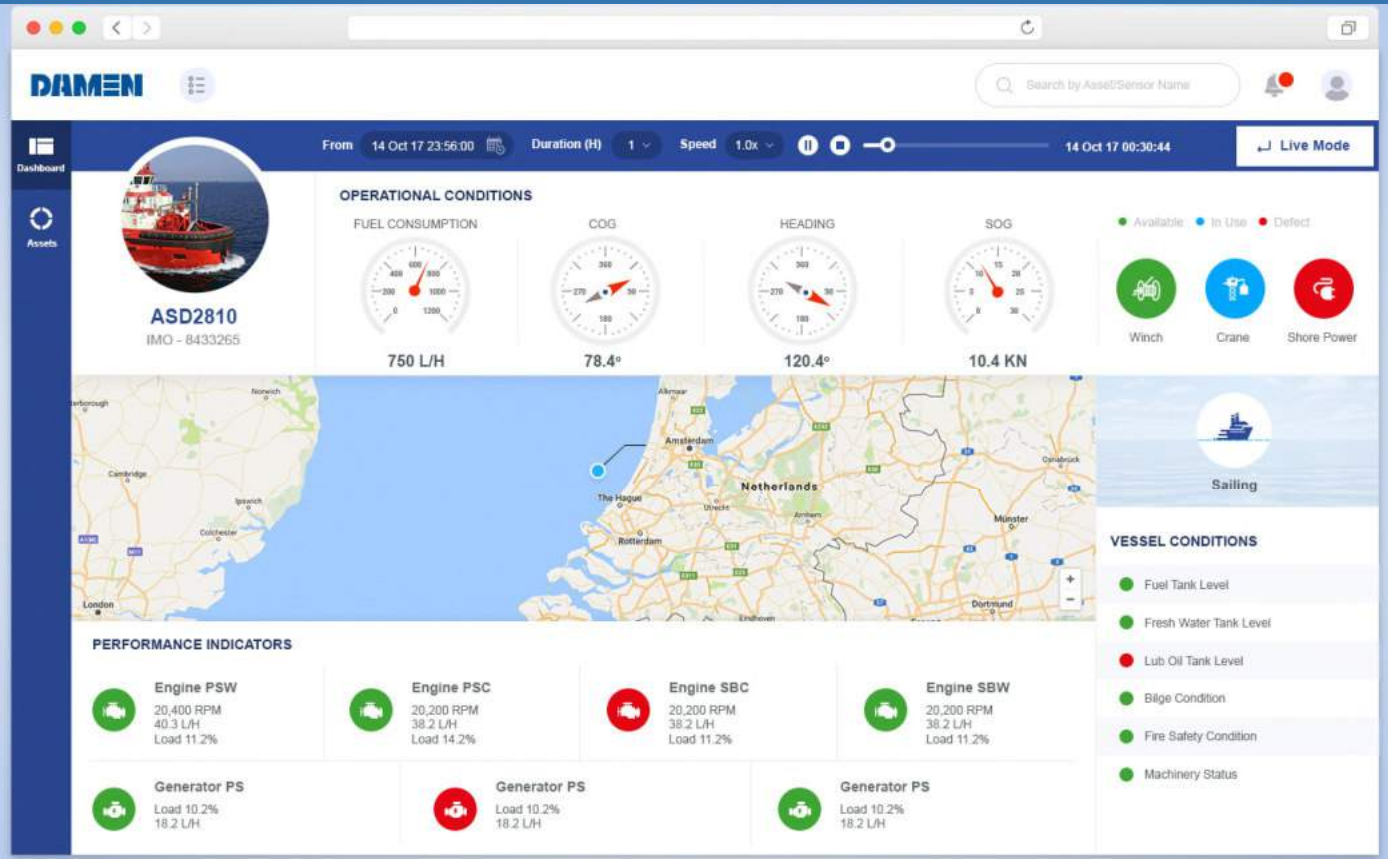
STEP 2: TRANSFER DATA TO INFORMATION



STEP 3: ENRICH THE VALUE BY ADDITIONAL DATA TRANSFER



STEP 4: PROCESS & VISUALIZE THE INFORMATION



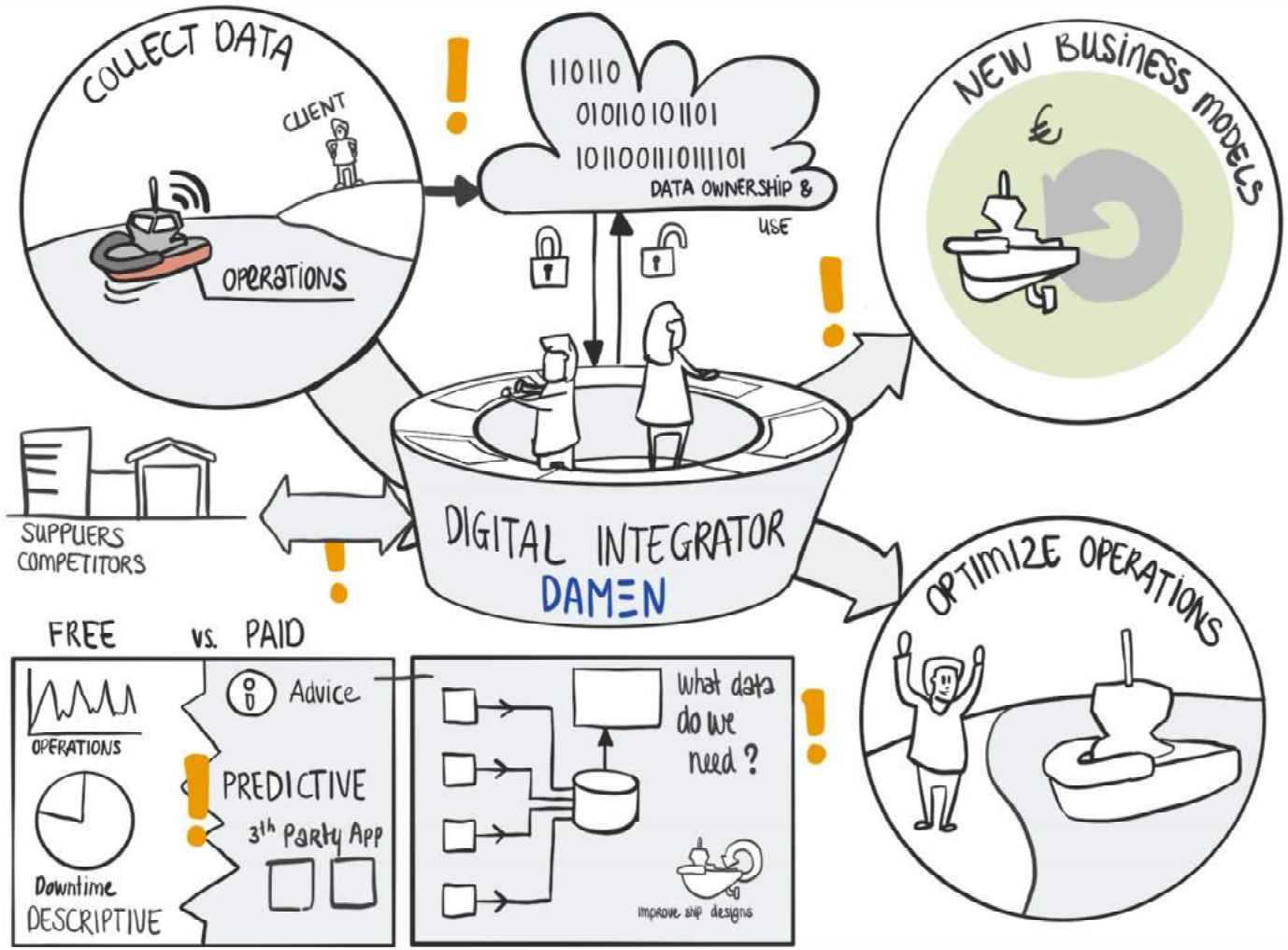
STEP 5: PROVIDE ADVICE BASED ON THE INFORMATION

PROVIDE ADVICE FROM SHORE

STEP 6: ACT BASED ON THE INFORMATION

DECISION SUPPORT / DECISION AUTOMATION

DAMEN DIGITAL: CONNECTED VESSELS



CONCLUSION

- Embrace new technologies and innovations
- Outside-in approach
- We are ready for the future

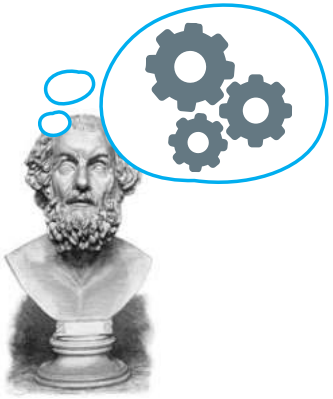
REINTRIEB
AMBIENT WATER TRANSMISSIONS

PRESENTATION
AMBIENT WATER TRANSMISSIONS & SIDE-BY-SIDE PROPELLER

PA1a Working Group Meeting on Fleet Modernisation Vienna, 7th March 2019

A sticky problem …

REINTRIEB
AMBIENT WATER TRANSMISSIONS



Since the Greeks invented gears …

… engineers have been trying to find ways to use them without breakage.

Modern gears are lubricated (and cooled) with highly noxious oil.

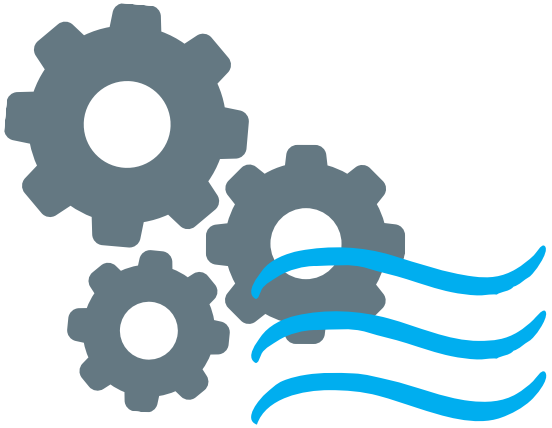
Sad but true: oil is highly problematic for the environment, the climate, humans and animals.

And: Oil is expensive to buy, to store and to dispose off …

Wouldn‘t it be great to replace the expensive, toxic oil in gears with something environmentally friendly and cheap?

Our solution is water!

REINTRIEB
AMBIENT WATER TRANSMISSIONS



We have developed a method to lubricate gears with ambient water.

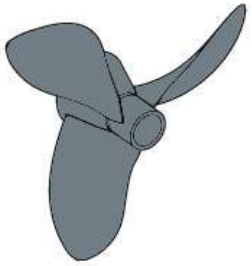
Based on this we are developing the first high-performance (!), oil free (!!), water lubricated gear box in the world.

This invention has enormously disruptive potential in the propulsion technology, particularly in maritime propulsion systems.

Welcome to the world of REINTRIEB

Water lubrication in maritime propulsion

REINTRIEB
AMBIENT WATER TRANSMISSIONS



1 Depending on the system one or several transmissions are used in maritime propulsions.

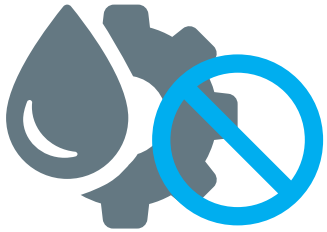
2 Due to a lack of alternatives, they are all lubricated with highly noxious oil.

3 Ensuring that no toxic oil escapes into the seas or the rivers is technically complicated and costs a lot of money.

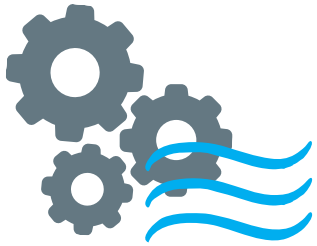
4 But we all know that there are no perfect seals. Something always leaks. Everywhere, everyday, around the world.

5 As a consequence ship owners and carriers are confronted with high fines, evens bans for some waterways and a bad public image …

6 … and our fresh water reserves are being regulated and protected more and more.

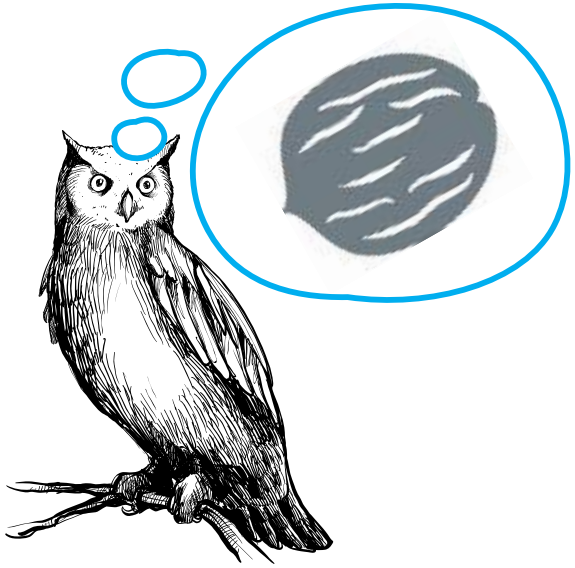


7 Vice versa: If tiny amounts of water leak into your gear, the consequences are costly: expensive repairs, even dry dock and business interruption.



8 If maritime gears are lubricated with water instead of oil, all these problems would be addressed and solved at once.

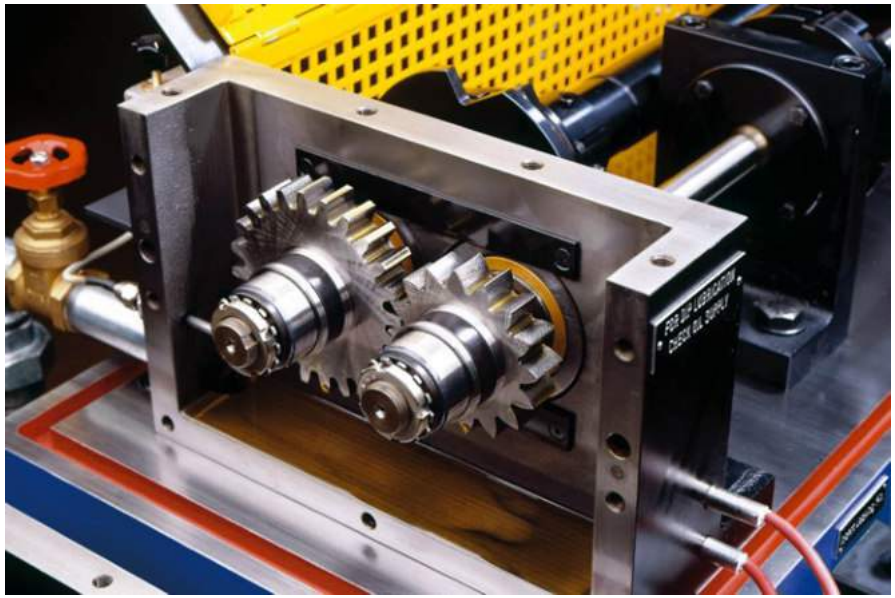
A hard nut to crack…



Before any ship in the world is launched with an ambient water transmission, we need a proof-of-concept.

We have assembled a team of maritime engineers and conducted many, many tests to make sure that our water transmissions work …

Where we stand…



- The most important hurdle on the way to the proof-of-concept has been taken: The scuffing safety test conducted by the FZG institute of the Technical University Munich.
- Our asset: European Patent EP 2 614 000 B1 awarded to Reintrieb on 14 February 2018 (more patents pending)

Roadmap for „Proof of Concept“ and beyond

REINTRIEB
AMBIENT WATER TRANSMISSIONS

Already achieved:

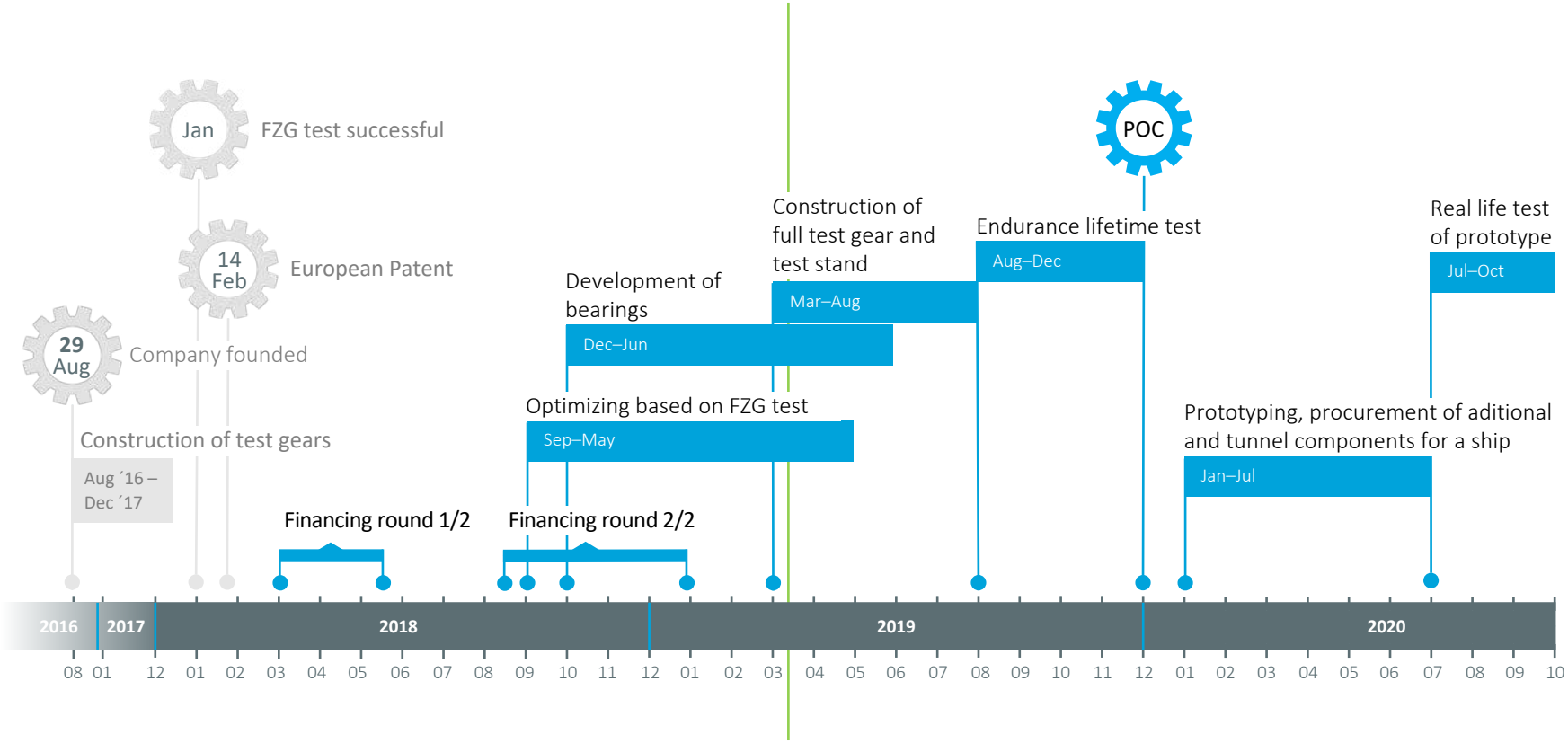
- Scuffing Safety
- Corrosion free gear casing

Currently testing:

- Water lubricated bearings

Still to do (Fall 2019):

- Endurance lifetime test



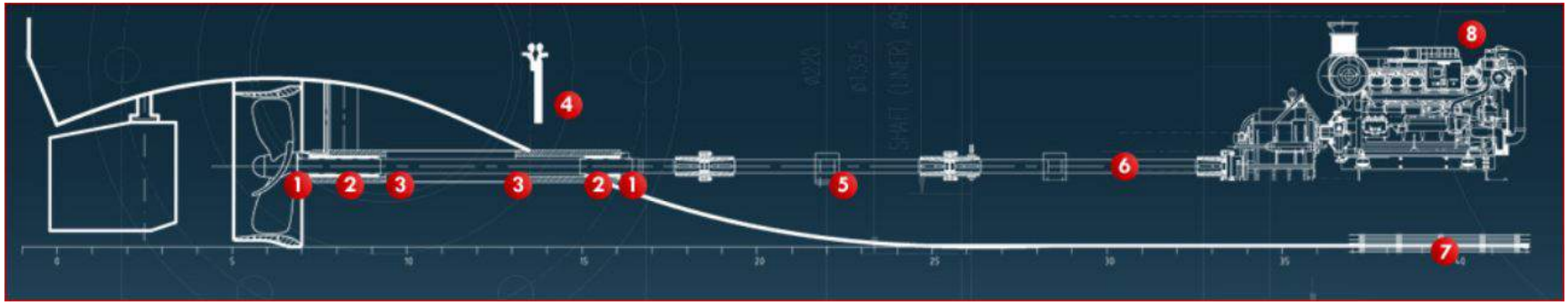
REINTRIEB

AMBIENT WATER TRANSMISSIONS

REINTRIEB SIDE-BY-SIDE PROPELLER

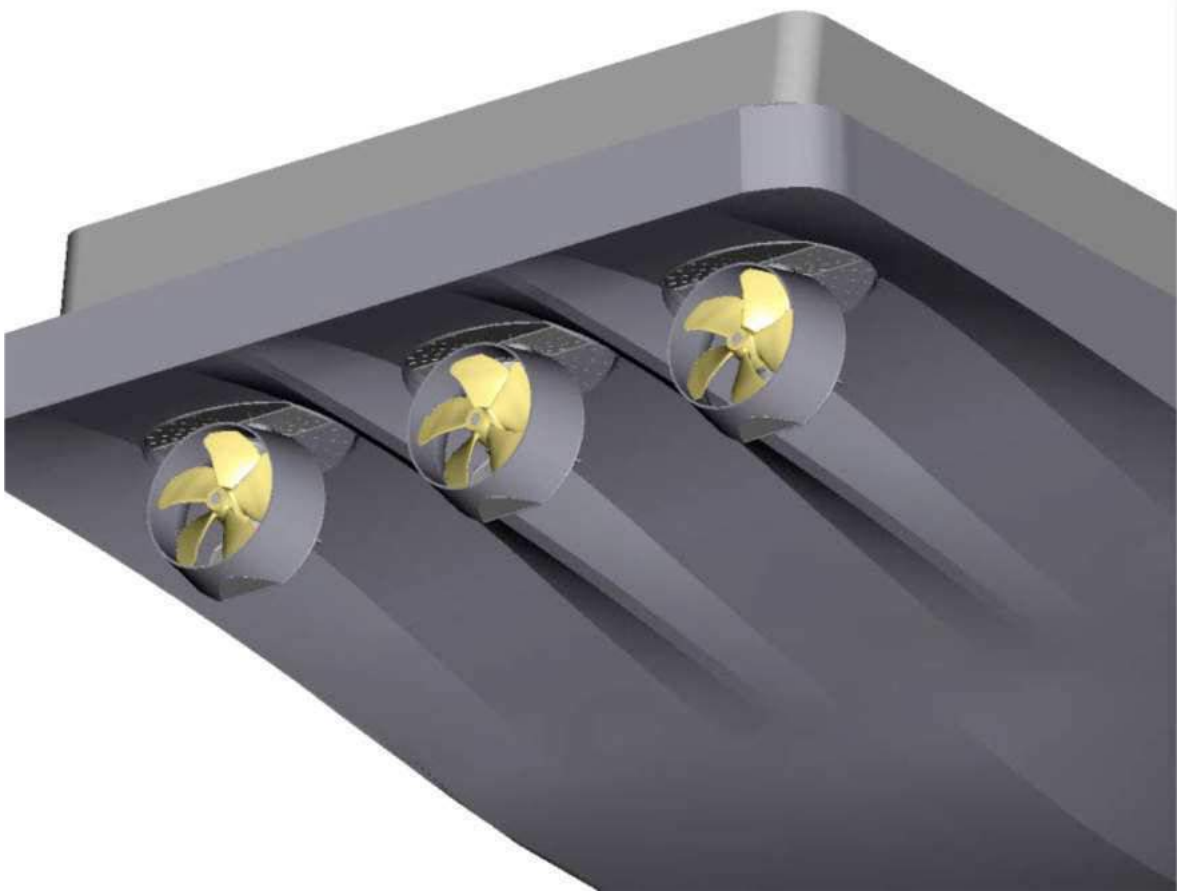
Typical (direct) propulsion configuration

REINTRIEB
AMBIENT WATER TRANSMISSIONS



Current Rudder Propeller Systems

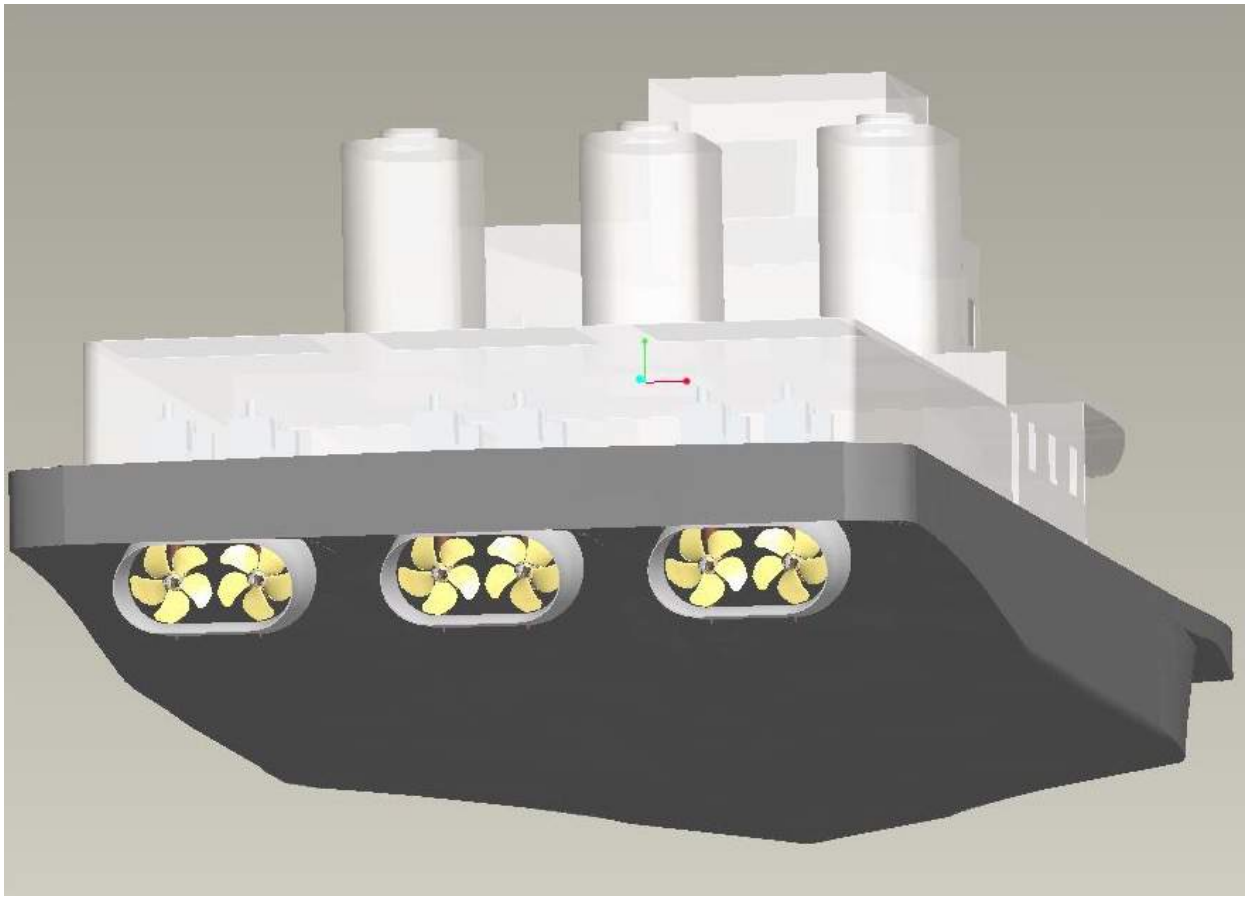
REINTRIEB
AMBIENT WATER TRANSMISSIONS



- Actual cargo vessel on Rio Tinto

Possible Side-by-Side Construction

REINTRIEB
AMBIENT WATER TRANSMISSIONS



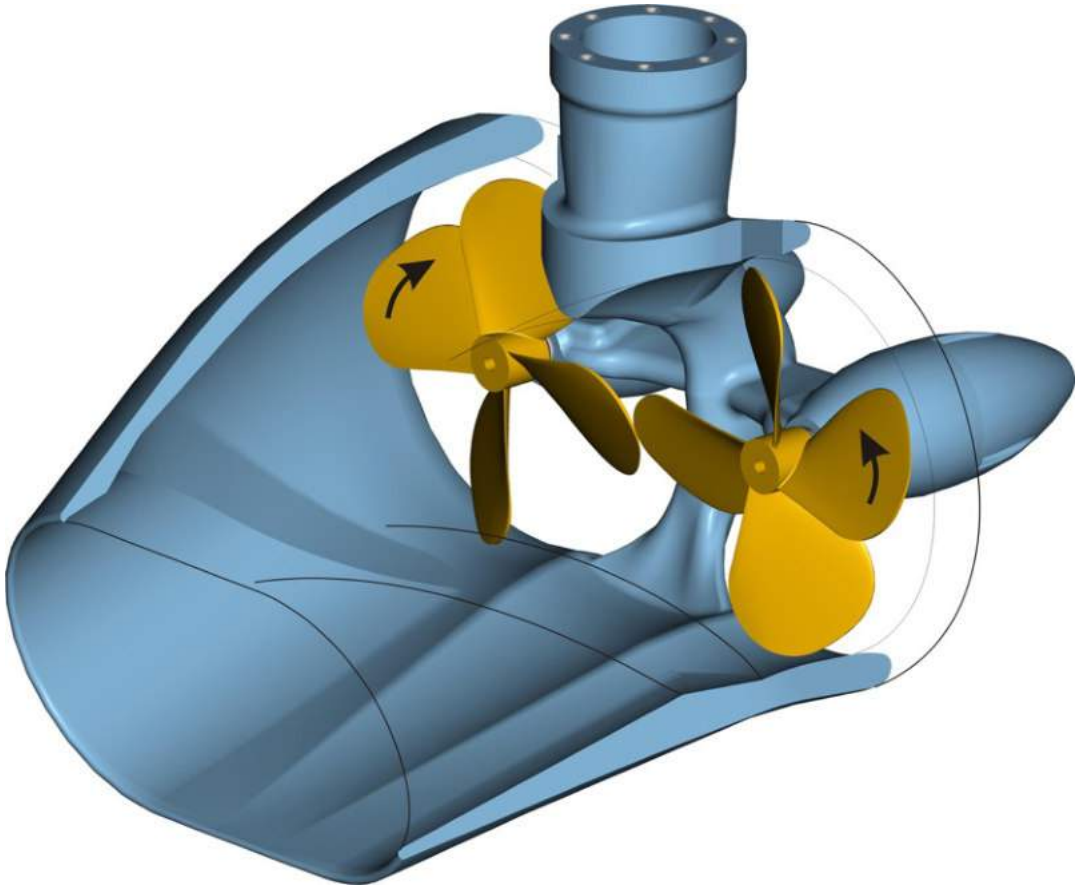
- Study for same cargo vessel with Reintrieb Side-by-Side Propellers

Advantages Side-by-Side Construction

REINTRIEB
AMBIENT WATER TRANSMISSIONS

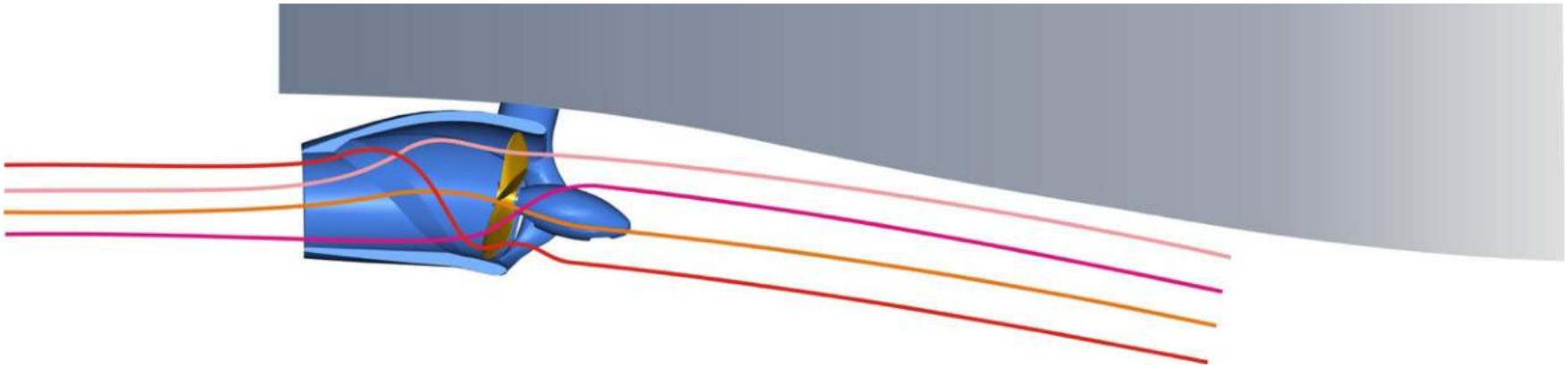
- Same efficency with shorter build (75% of current propeller diameter)
- Able to operate at lower water levels (i.e. draught)

Side-by-Side 3D test model



- Schematic

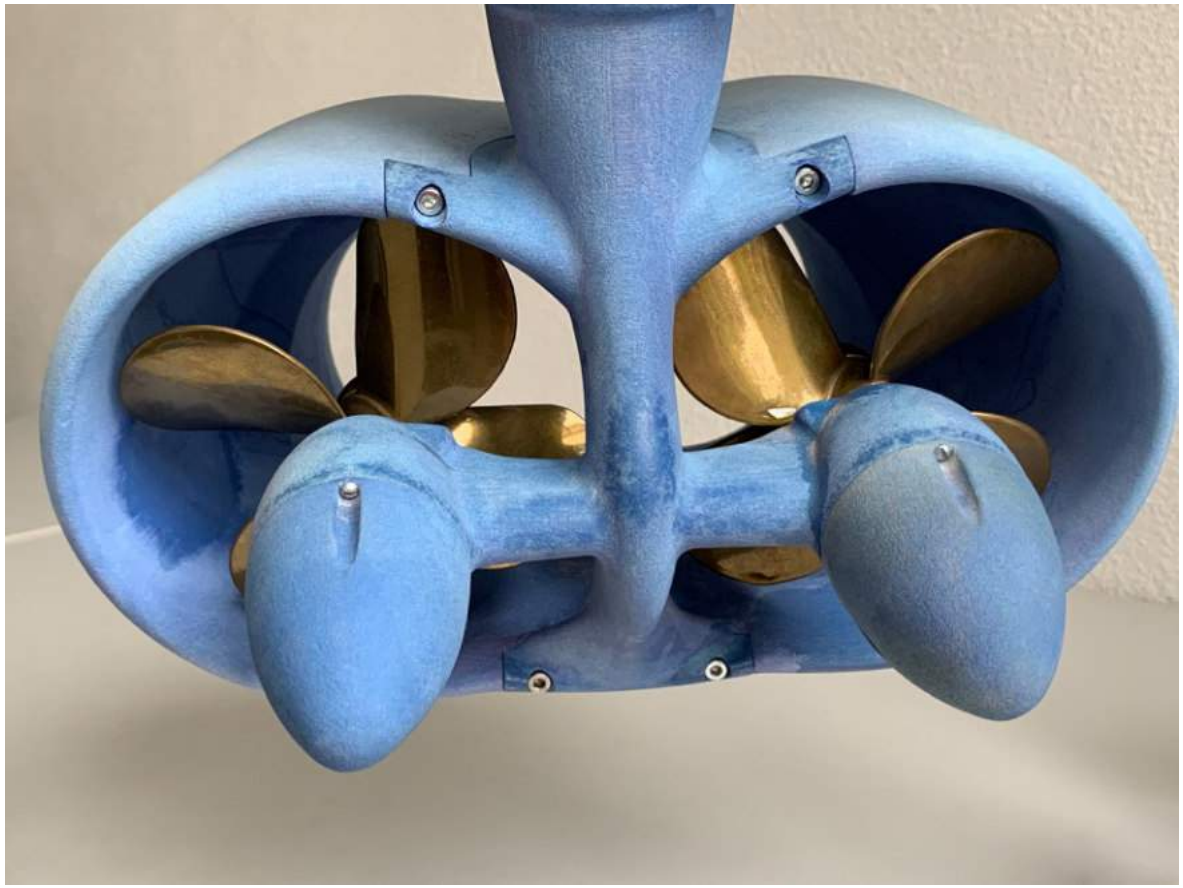
Side-by-Side 3D test model



- Water Flow Calculations

Side-by-Side 3D test model

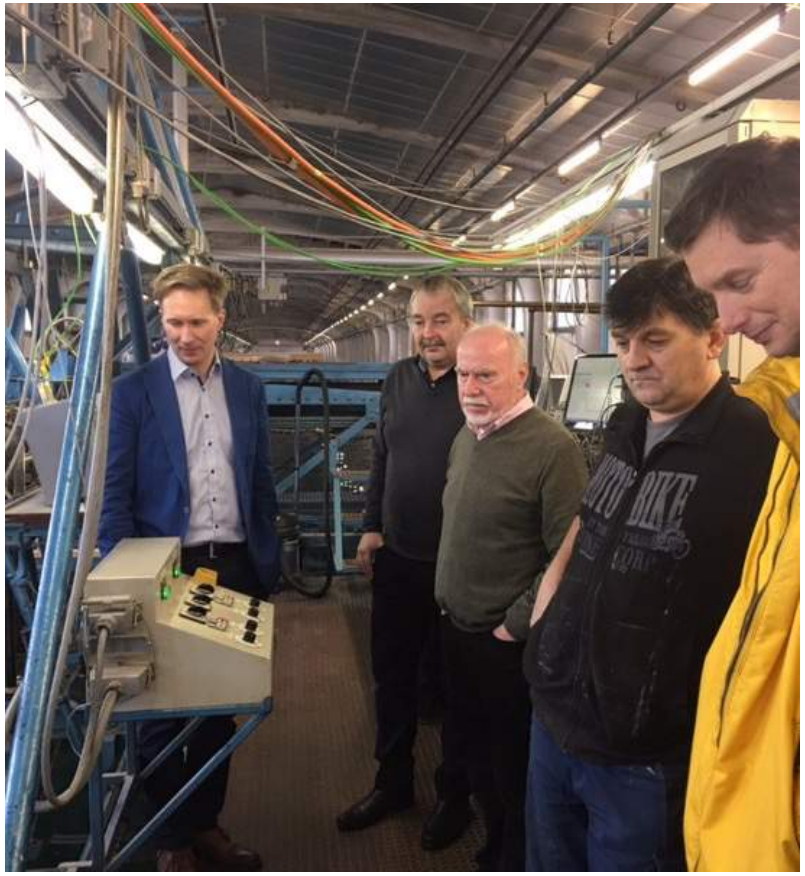
REINTRIEB
AMBIENT WATER TRANSMISSIONS



- Test Model – Front View

Side-by-Side tests

REINTRIEB
AMBIENT WATER TRANSMISSIONS



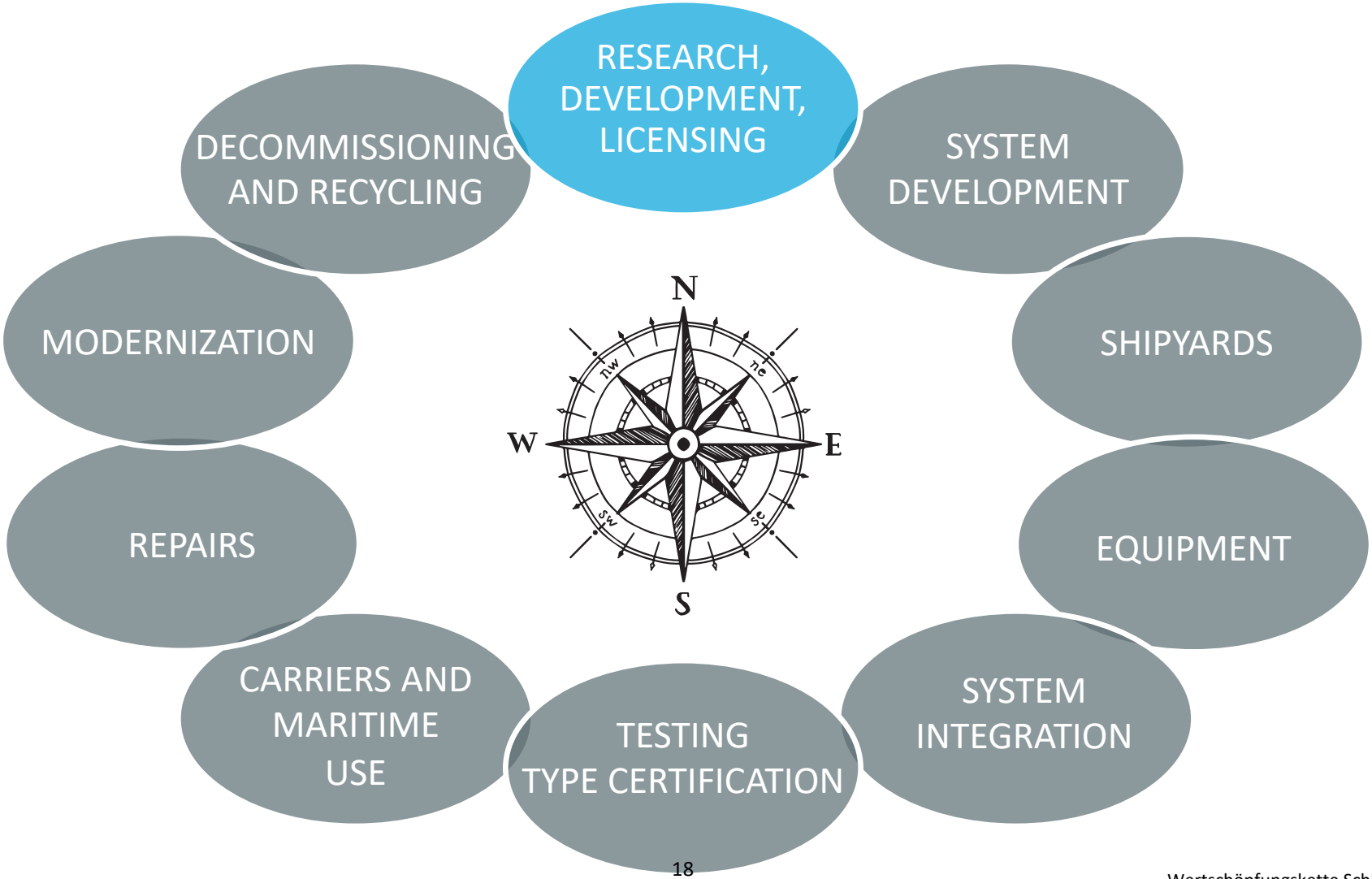
- Primary air tests
- Current water tests (Feb 2019)

Side-by-Side tests

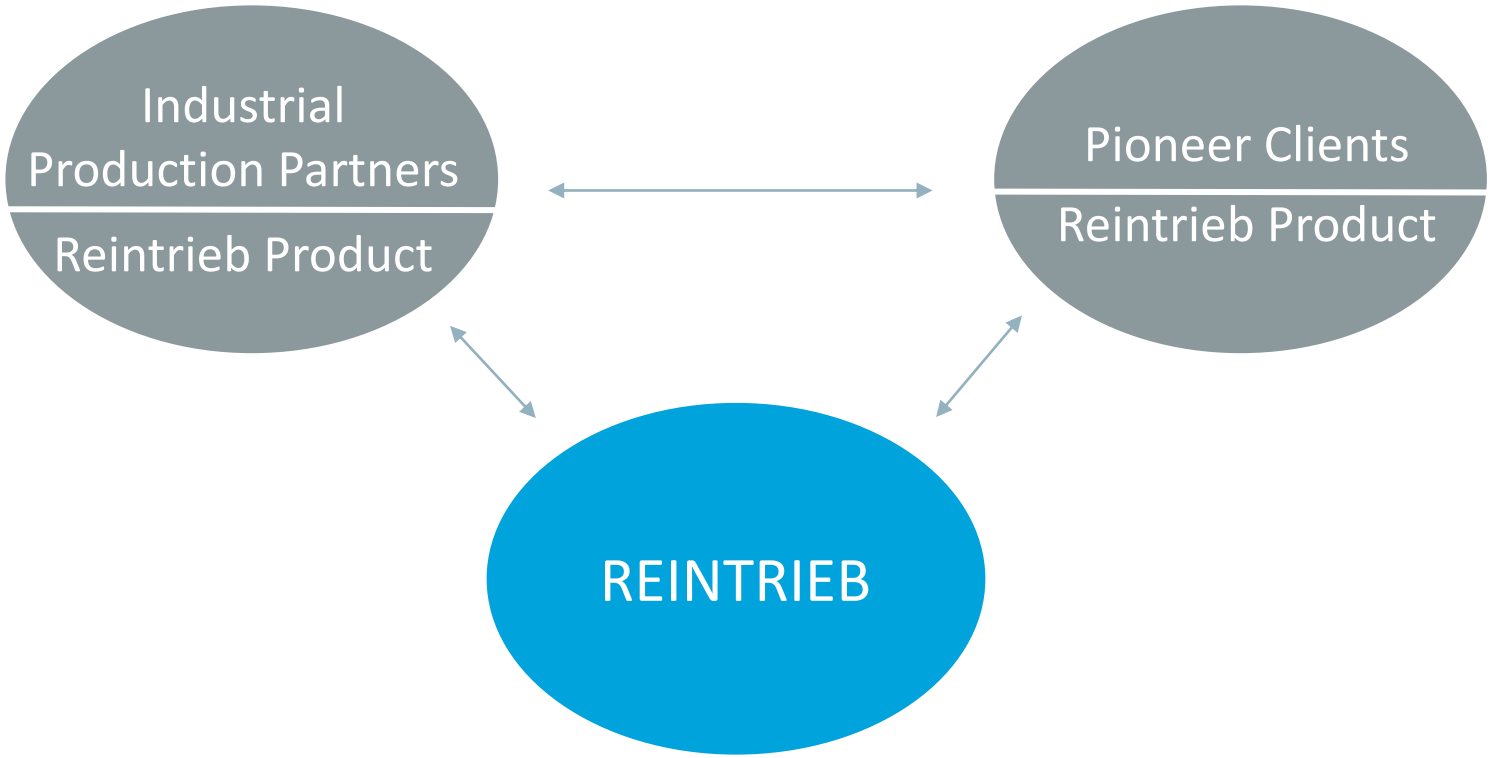
REINTRIEB
AMBIENT WATER TRANSMISSIONS

- Current water tests

Reintrieb in the maritime value chain



What we are looking for…



REINTRIEB
AMBIENT WATER TRANSMISSIONS

Thank you for your interst and attention

Please fill out our questionnaire!

Legal Disclaimer

Quelle: Hafen von Triest 1912 / Alexander Kircher

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HyMethShip

HYDROGEN IN COMBUSTION ENGINES

MODERNISATION OF DANUBE FLEET
Know How Transfer Event, Vienna, 7-8 March 2019

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 768945

LCC Large Engines Competence Center

As the leading research institution for large engine technologies, we serve as a global innovation hub for sustainable energy and transportation systems. Our research focus is on the massive reduction of CO_2 and pollutants towards zero emissions. Key features are the use of renewable energy sources as well as the optimization of the overall system by closing resource loops.

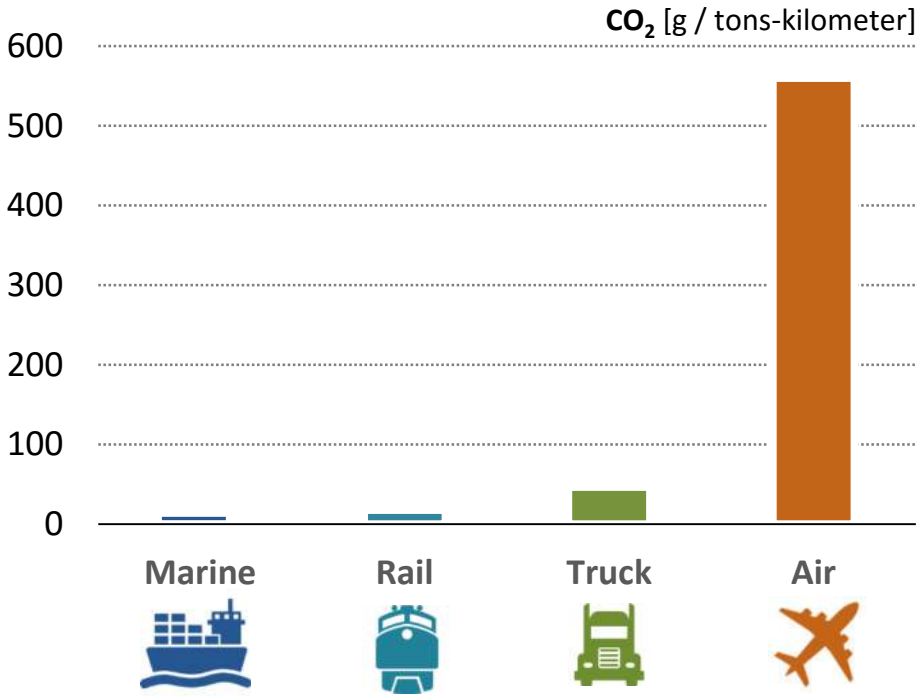
PARTNER NETWORK

Shipping

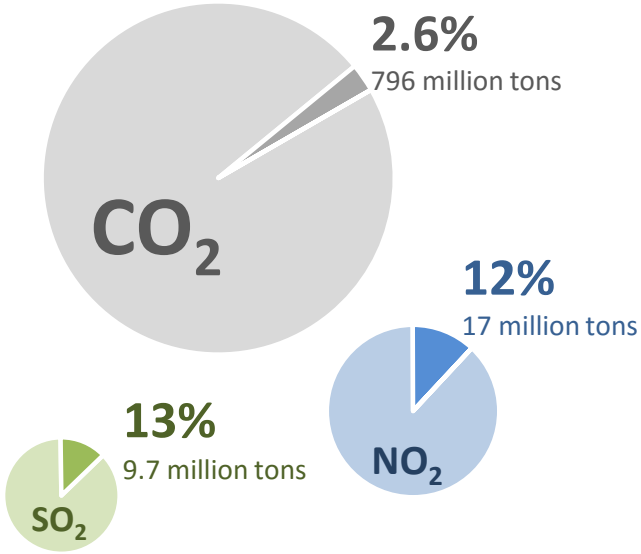
Perception

Transportation Sector Emissions

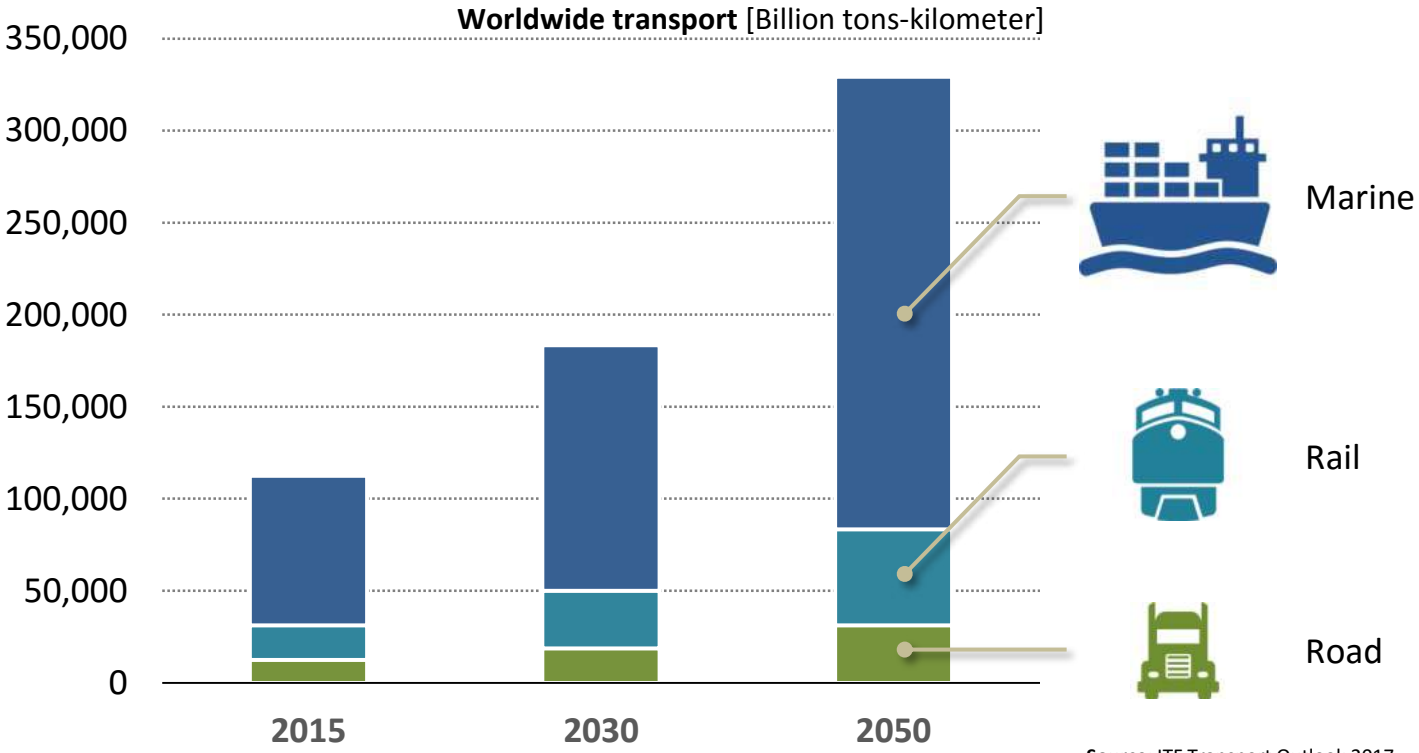
Facts



Percentage of ship emissions vs. total global emissions

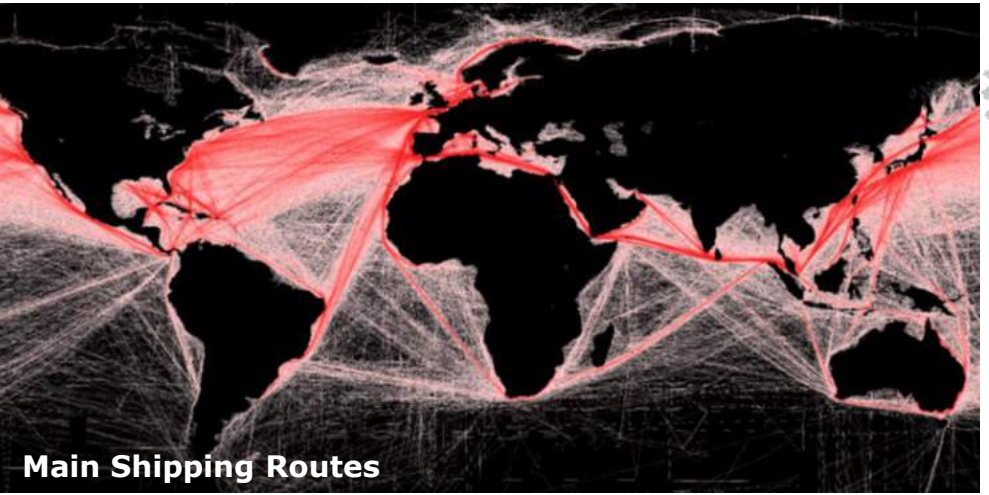


Development of Transport



Source: ITF Transport Outlook 2017

Ship Emission Regulations



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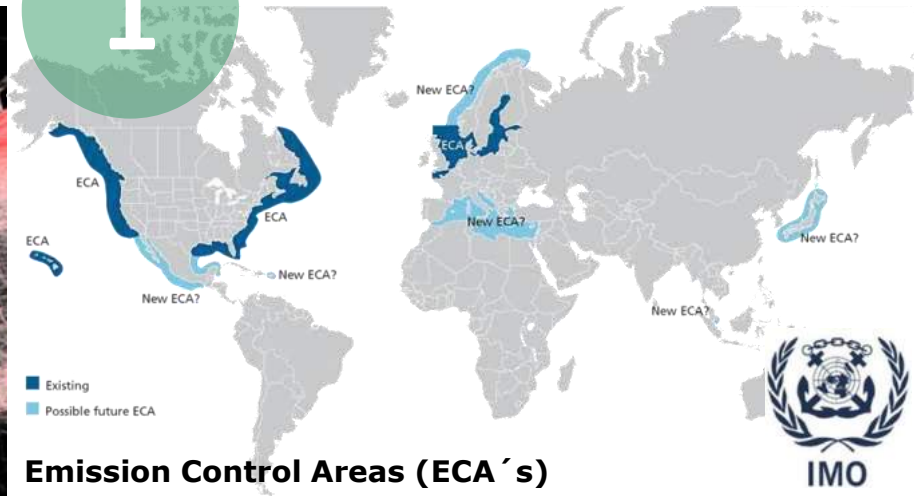


Emission Control Areas (ECA´s)

IMO

October 2016

2 **Global Sulphur Cap 2020**

… the decision to implement a global sulphur limit of 0.50% m/m (mass/mass) in 2020 …

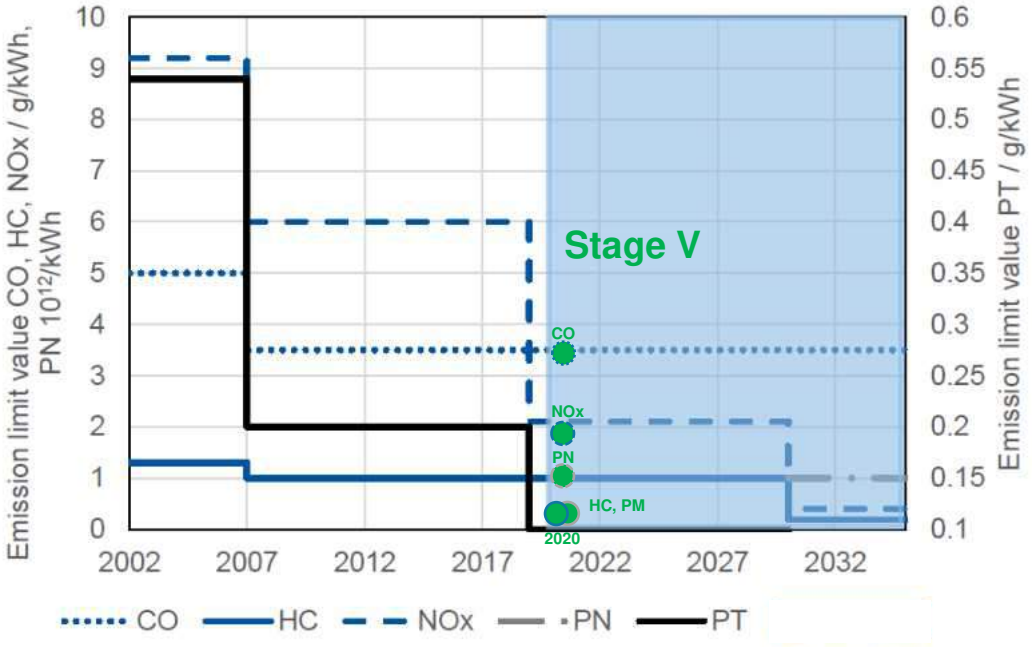
April 2018

3 **GHG Target 2050**

… to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 …

Emission Limits for IWT

Stage V emission limit values for engines > 130 kW



Source: Perspectives for the Use of Hydrogen as Fuel in Inland Shipping, MariGreen 2018

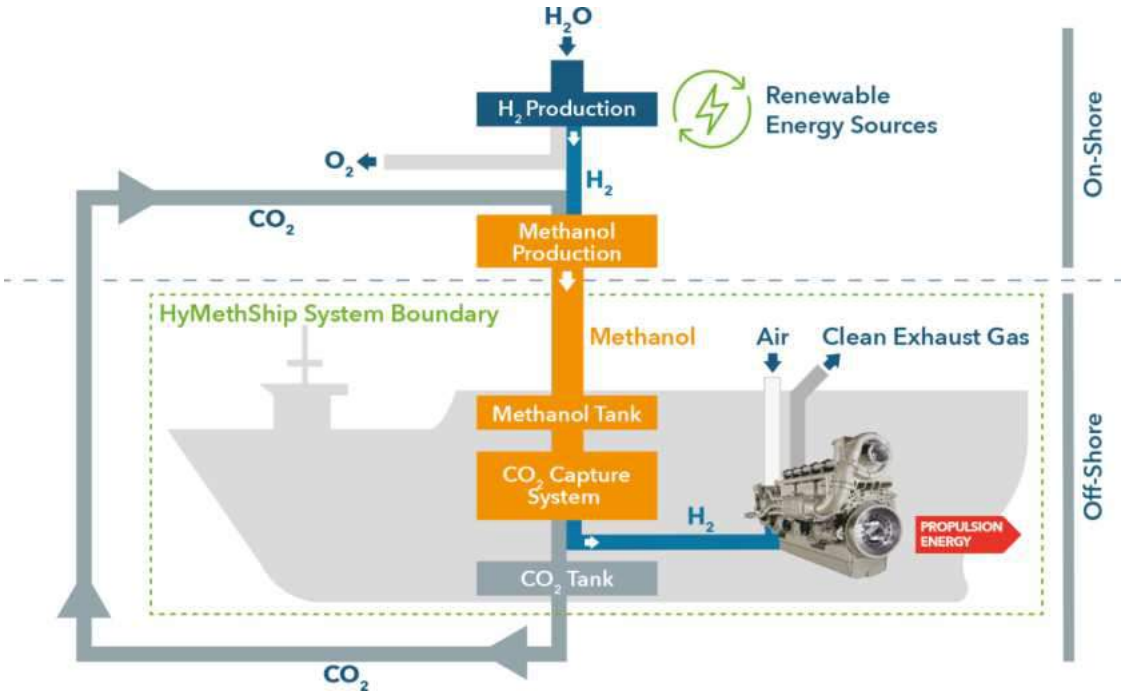
Category	Net P	Date	CO	HC[a]	NOx	PM	PN
	kW		g/kWh				1/kWh
IWP/IWA-v/c-4	P ≥ 300	2020	3.50	0.19	1.80	0.015	1×10^{12}

[a] A = 6.00 for gas engines

Source: https://www.dieselnet.com/standards/eu/nonroad.php#vessel

Emission-free Ship Propulsion

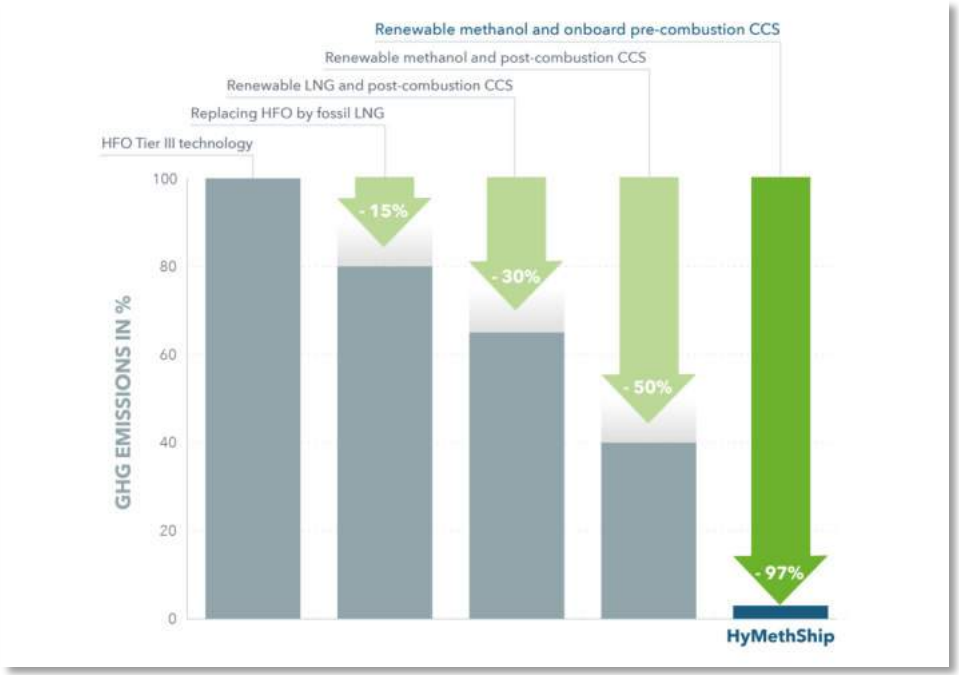
The Concept



Goals and Objectives

Emissions reduction

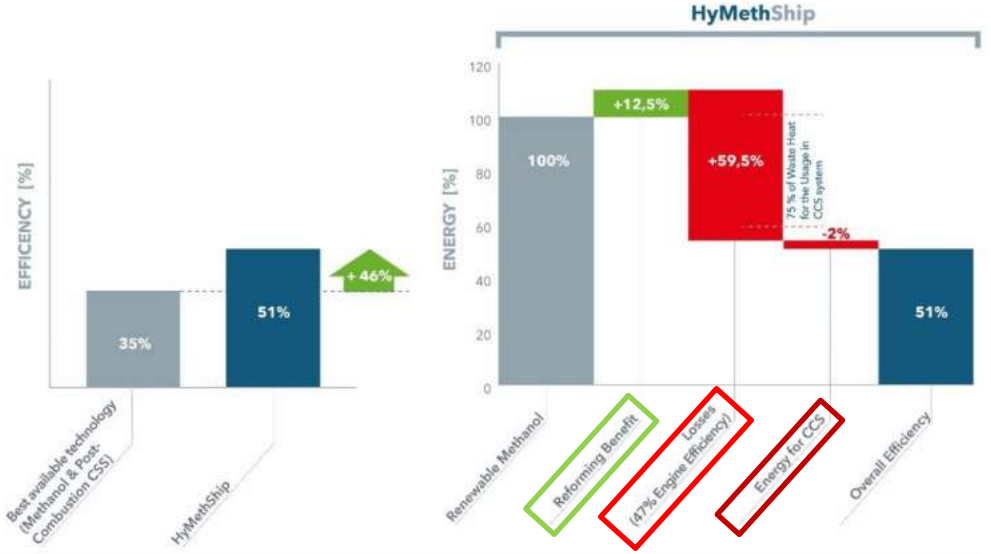
- 97% reduction in GHG emissions
- Elimination of SO_x and PM emissions
- Minimization of NO_x emissions



Goals and Objectives

Increase in efficiency

- 45% increase in efficiency compared to the technology with conventional CO_2 capturing



$CH_3OH + H_2O \rightarrow CO_2 + 3\ H_2$ - a higher energy gain from methanol than direct burning ($\Delta H_r \approx 50$ kJ/mol)!!

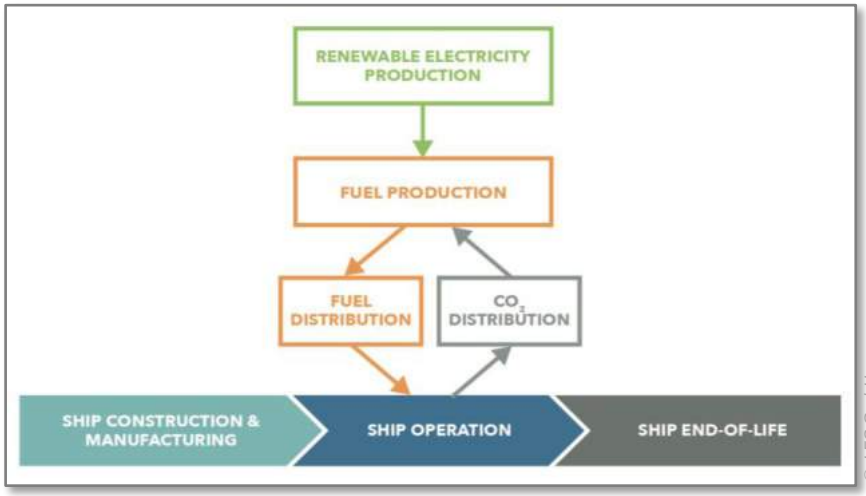
App. 75% of the waste heat is used for the methanol reforming and carbon capturing process

2% of the generated mechanical energy is used for the auxiliary devices

Goals and Objectives

Proof of environmental, economic, and safety performance

- Life Cycle Assessment (LCA)
- Life Cost Assessment (LCC)
- Hazard Identification (HAZID)
- Hazard and Operability Study (HAZOP)



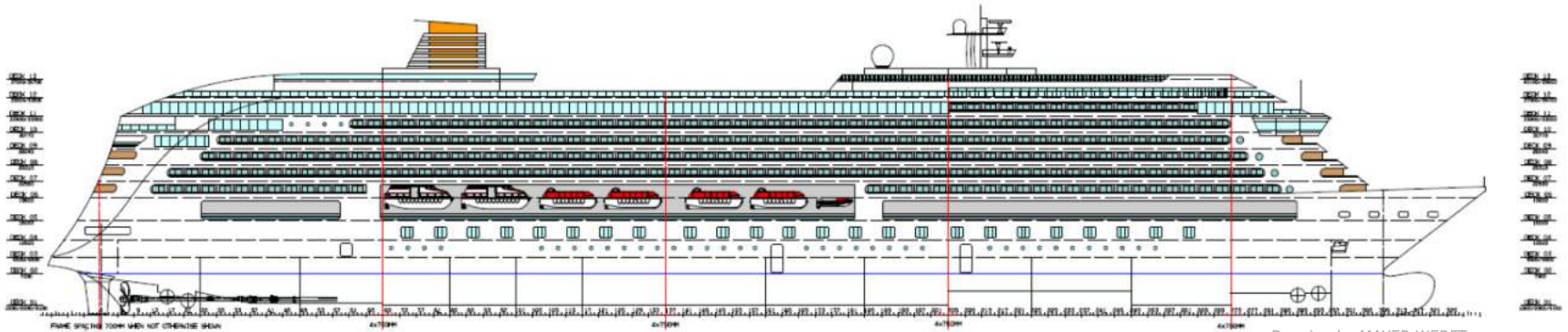
© LEC GmbH

Photo by EXMAR

Goals and Objectives

Detailed design for a case study ship

- The HyMethShip system is expected to be applicable to different vessel types (passenger vessels and ferries, roro cargo vessels, container vessels, tankers, bunkers, car carriers, and larger offshore support vessels) as it is based on a conventional reciprocating engine currently in use on the majority of ships.
- Detailed design for a case study ship that uses the HyMethShip system will provide a practical example of how the system can be integrated into and operated on a ship

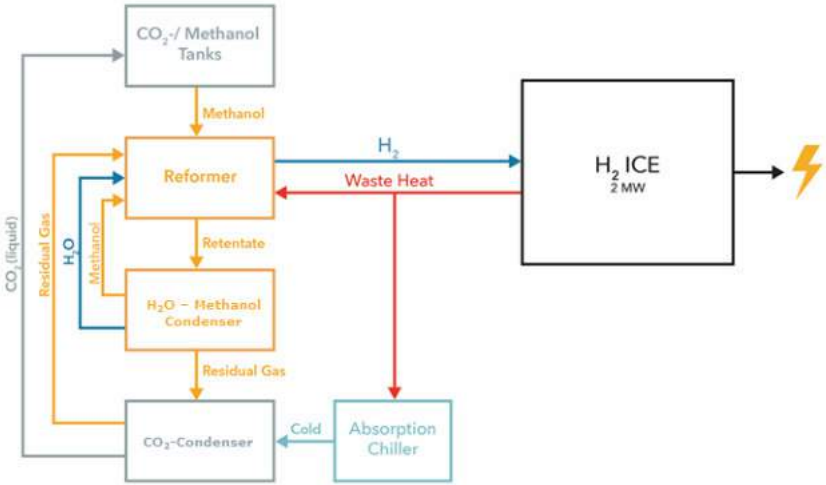


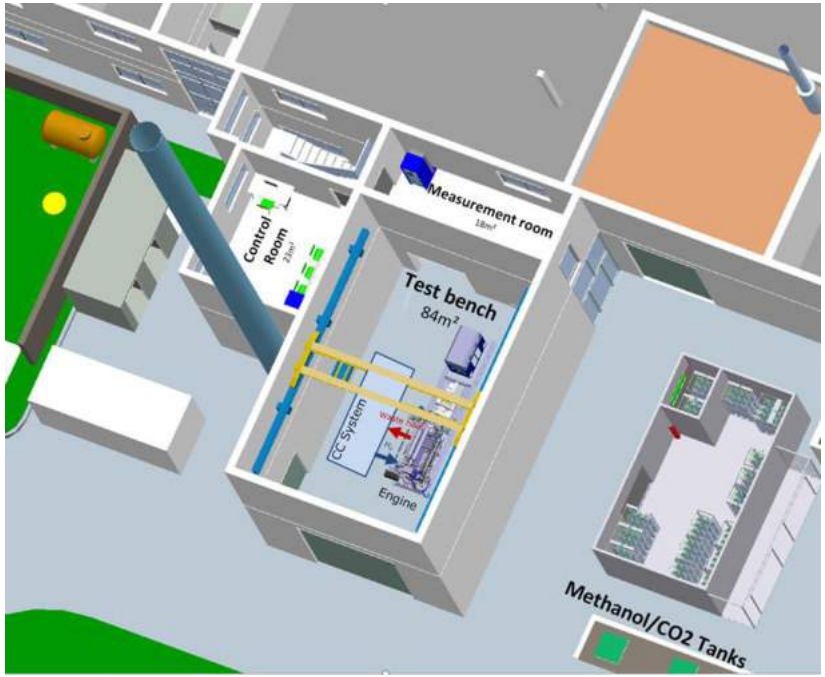
Drawing by MAYER WERFT

Goals and Objectives

System demonstrator

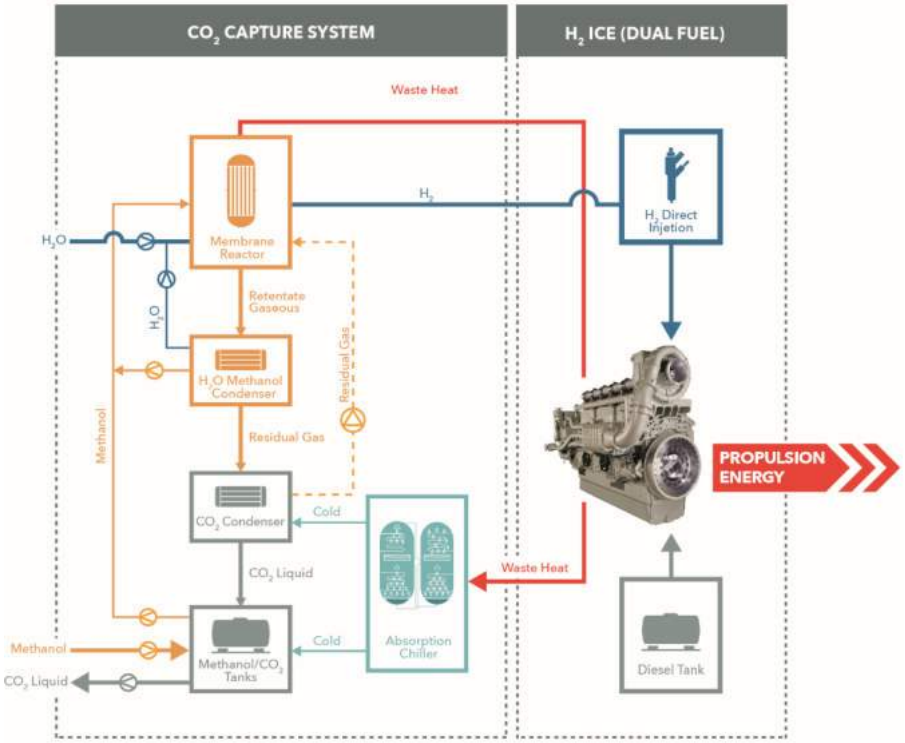
- The HyMethShip demonstrator is a full-scale onshore propulsion system with an engine power output of 1-2MW
- All relevant marine requirements will be considered in the designing phase of the system components





Project Introduction

On-board setup

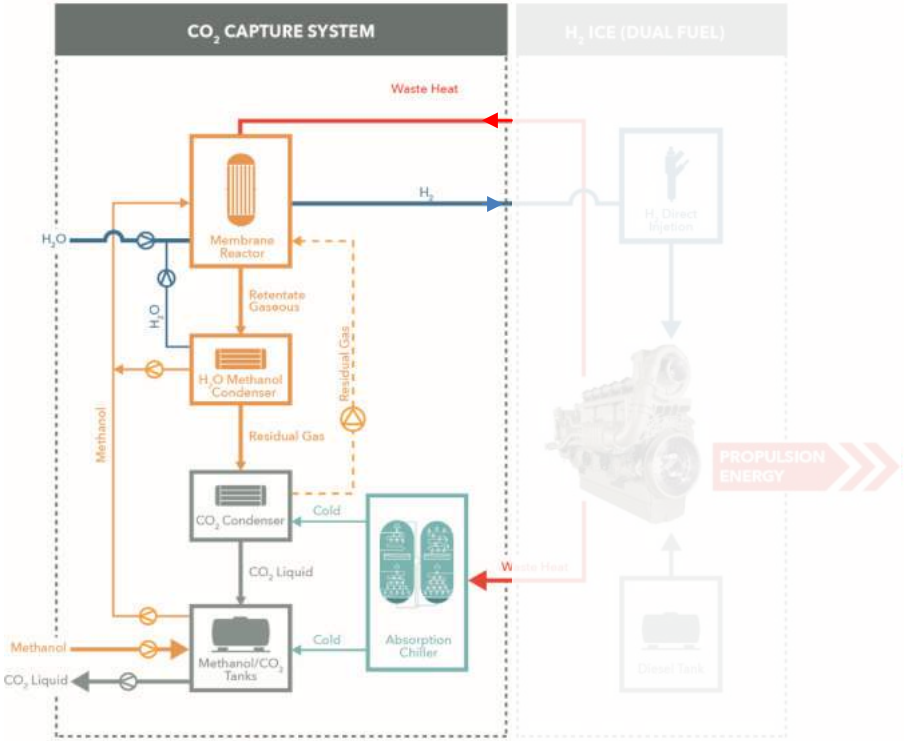


© LEC GmbH

- Pre-combustion Carbon Capture System
- Dual fuel (diesel/methanol, H_2) ICE
- Control, monitoring and safety system

Project Introduction

Carbon Capture Process

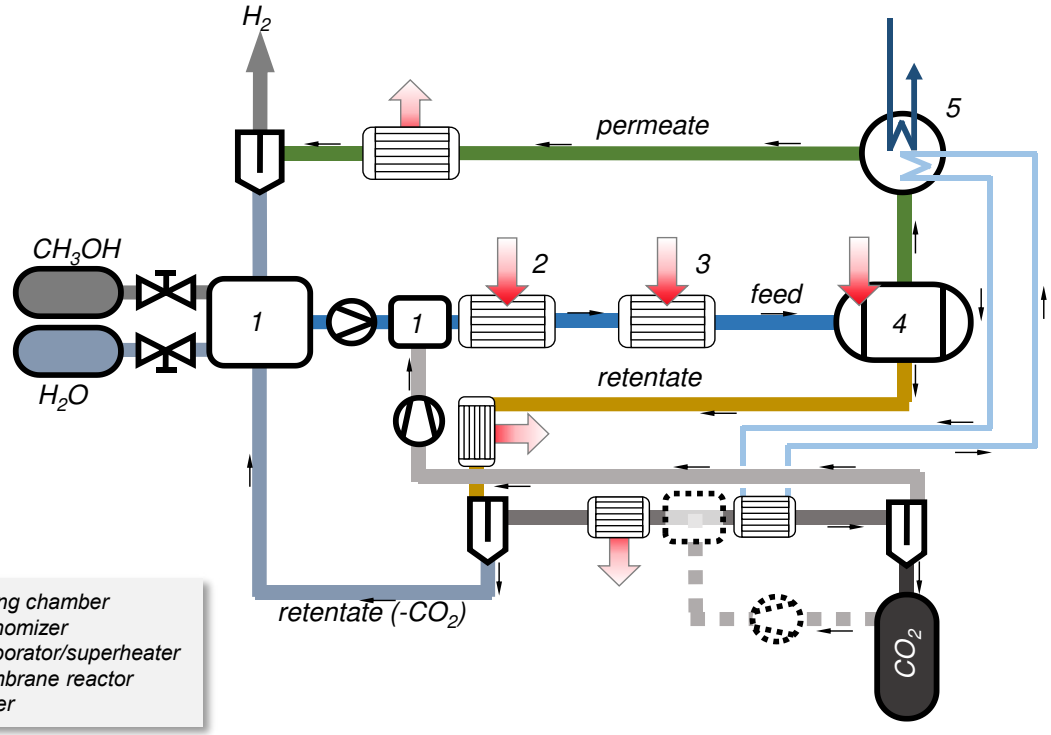


- Receiving liquid methanol from the tank system
- Supplying engine with fuel (H_2)
- Feeding liquid CO_2 back into the tank system

Project Introduction

Carbon Capture Process: Key technical challenges

- Providing the required heat transfer into the membrane reformer (heat input from the reaction and the permeate stream)
- Controlling the chemical and physical parameters of the streams (chemical composition, partial pressures, etc.)

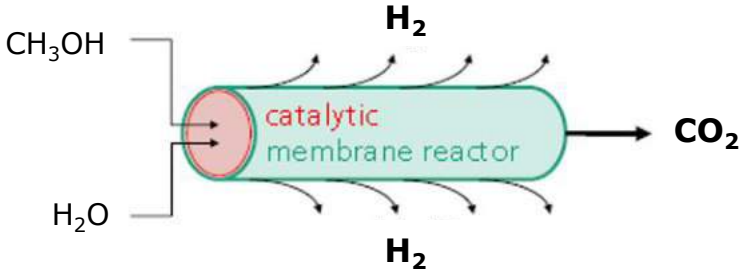


Project Introduction

Methanol reformer

Two processes in the same reactor:

- Catalytic methanol reforming ($CH_3OH + H_2O \rightarrow CO_2 + 3H_2$)
- H_2 separation via membrane permeation



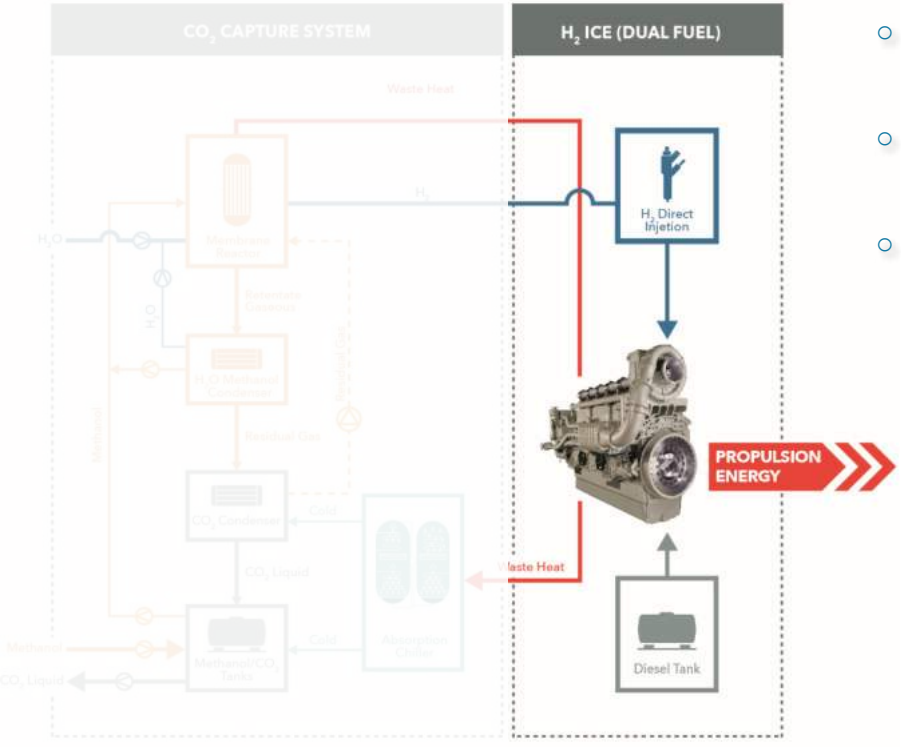
Ceramic-based carbon membrane technology:

- Free of precious metals
- Small to install (higher throughput)
- High H_2 pressure (10-20 bar)
- Low risk of poisoning (e.g. from CO or traces of sulfur)

Photo by Fraunhofer IKTS

Project Introduction

H2 internal combustion engine



© LEC GmbH

- State-of-the-art engine upgraded to operate on multiple fuels
- Main fuel: H_2 (generated on-board by the methanol reformer)
- Backup and/or pilot fuel: diesel and/or methanol

Project Introduction

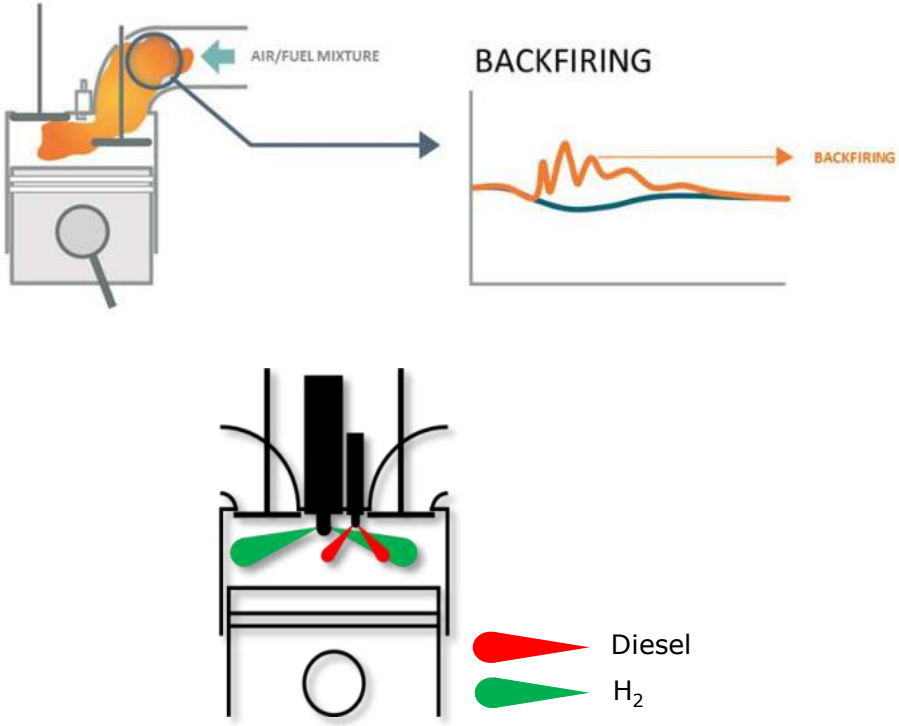
Dual-Fuel ICE

Hydrogen (main fuel)

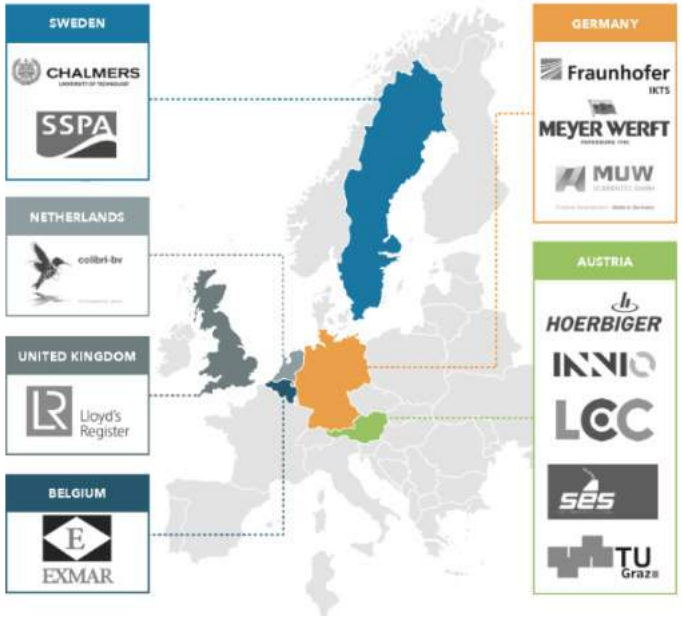
- Hydrogen at medium pressure level of 10 to 20 bar is injected into the combustion chamber early in the compression stroke
- Spark ignited or ignition with diesel as pilot fuel (~1-3%) is considered.

Redundancy

- Diesel combustion - the diesel injector is capable of providing maximum flexibility in terms of injected fuel mass to enable injection of diesel quantities ranging from 1% to 100% (full diesel backup) of the total fuel energy
- Methanol combustion - spark ignition system is used for hydrogen as well as for methanol combustion. Reduced emissions of NO_x, SO_x and PM, no bunkering of diesel required (reduced tank space).



Powerful Consortium



13 top-class partners

from 6 EU member states

represent the complete system

This powerfull consortium guarantees the transfer of innovation to the market

Project Team

Project Kick-Off: July 4. – 5., 2018

www.hymethship.com

Contact:

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Email: igor.sauperl@lec.tugraz.at
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Project & Dissemination Coordinator:
LEC GmbH
Inffeldgasse 19, A-8010 Graz
www.LEC.at

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Know-How Transfer Event
Modernisation of Danube Vessels Fleet

7 March 2019

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

CLEAN INLAND SHIPPING (CLINSH)

The main objective:

Improve air quality in urban areas by accelerating emission reductions in Inland Waterway Transport.

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

CLean INland SHipping main objectives

- *demonstrate the environmental impact of emission reduction technologies, alternative fules and OPS in real world conditions*
- *Develop models on how emission reduction can be applied to the existing European IW fleet in relation to costs and benefits,*
- *Increase awareness and support among ship-owners and policymakers on cleaner inland shipping*

Partners in:
** Belgium*
** Germany*
** Netherlands*
** UK*

Budget: € 8,5 mio

Lead partner:
province of South Holland

Co-funding from the EU LIFE Programme.

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Approach of CLINSH fleet

- *Emission reducing technologies and alternative fuels are continiously monitored and discontiniously measured in practice on the CLINSH ships, until June 2020.*
- *In this way the effectiveness and the operating costs of different emission reduction technologies are tested.*
- *Measurement results are collected in a database, analysed and policy recommendations will be formulated, to provide a tool for policymakers, harbours, shipowners, etc.*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Collected data

- *Continuously with sensor: NO_X, O_2*
- *Discontinuous (three times): PM, CO*
- *Calculated: CO_2*
- *Fuel consumprion, pressure Rpm, sailing speed, engine load, tonnage, gps*
- *Socio-economic data*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Refit vessels

Vessels refitted with a 50% CLINSH contribution: 11 (+1 reference vessel)

- *After-treatment (SCR+DPF): 5*
- *(including 1 with EURO VI engine + 1 reference vessel)*
- *Fuel-Water Emulsion: 2*
- *Hybrid / diesel electric: 1*
- *GTL: 2*
- *HVO (biodiesel): 1*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Monitoring vessels

Vessels already equipped with emission reduction technology: 22

- *SCR (DPF): 6*
- *GTL: 4*
- *Diesel electric: 4*
- *Hydrogen injection: 2*
- *LNG electric 1*
- *Parallel monitoring LNG (liquified natural gas): 1 (+ 1 reference vessel)*
- *Parallel monitoring diesel electric: 1 (+ 1 reference vessel)*
- *Test ship*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

New tender

- *New tender: opening March 11 th, closing April 22th*
- *Refit techniques: SCR/ DPF, FWE & GTL, Euro VI, Full electric, diesel- electric, Hybrid and optimised fuel injection.*
- *Monitoring: LNG, CNG, Euro VI, Hybrid, CCRI, CCRII*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

OPS: Onshore power supply

- *NOx reduction through installation of OPS*
- *Demonstration project in the Port of Ghent with two installations (4 connection points)*
- *Pilote "OPS as a service": private parties offering OPS on private quays in Nijmegen and Ghent*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Lessons learned so far

- *Tenderprocess has to be user friendly*
- *Technical and organisational challenge to install the equipment on the ships and validate the data*
- *Need for incentives to stimulate greening transition: no approved certification for adjustments on engines afterwards*

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

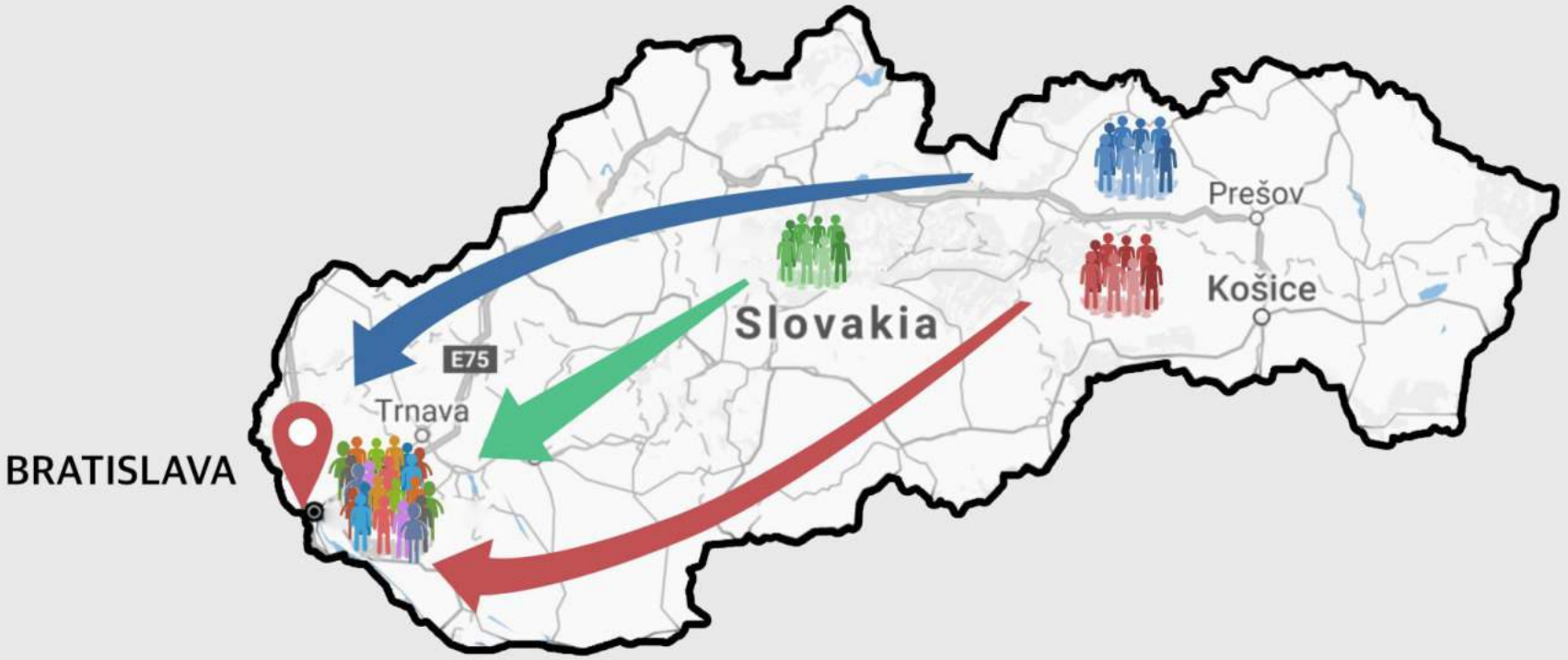
Midterm conference CLINSH

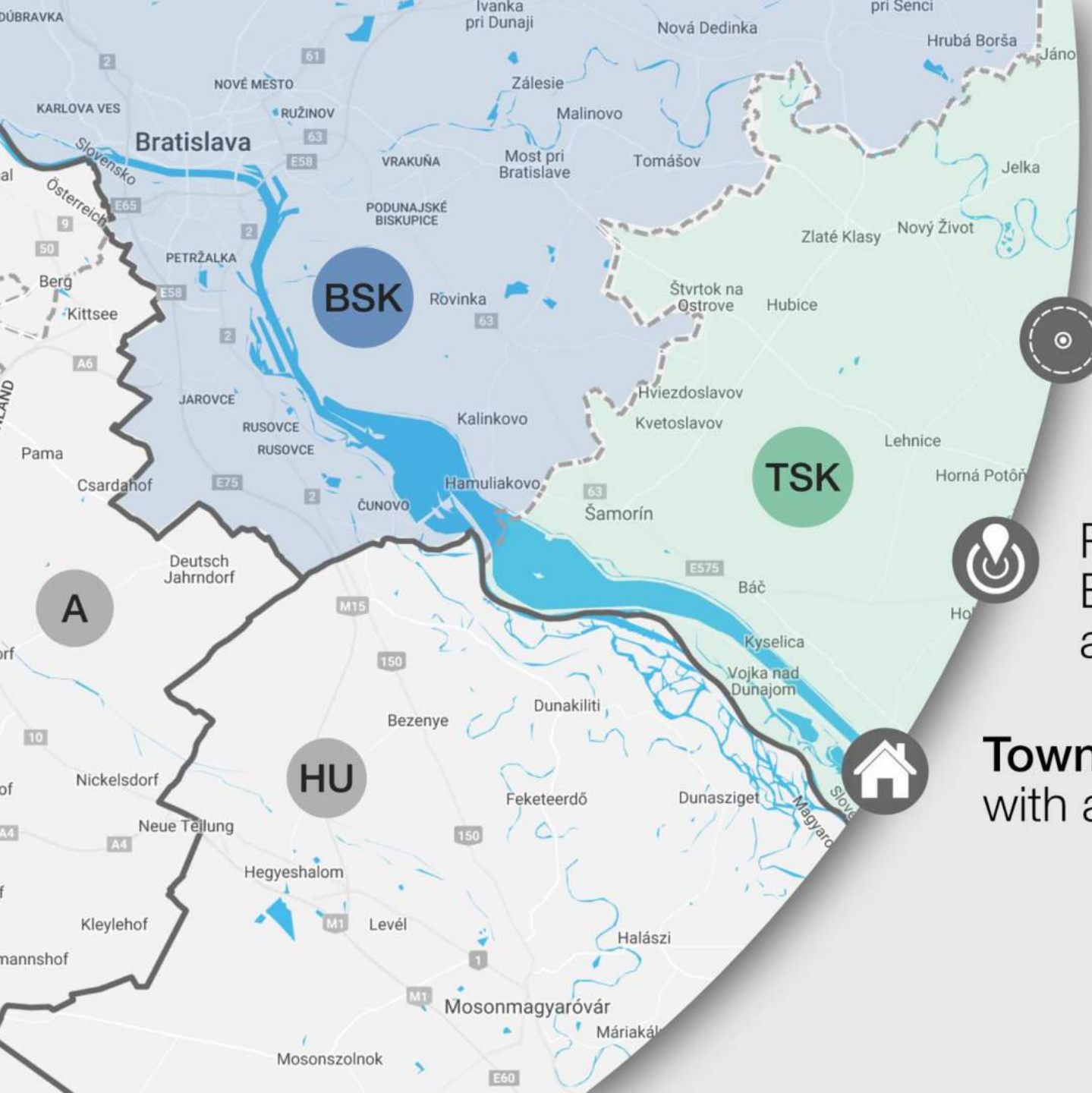
- *On March 13th in Brussels*
- *Provisional results CLINSH*
- *What needs to be done to accelerate the greening transition?*


DUNAJ
BUS
PRO DANUBIA
ZDRUŽENIE OBCÍ PRE MIESTNU DOPRAVU PO DUNAJI
ASSOCIATION OF MUNICIPALITIES

Over the **last 10 years**

Significantly high increase in the **population of Bratislava** and the **surrounding regions**





"DANUBE region"

A territory overlapped by
2 self-governing **regions**

Reaching up to **50 km** away from Bratislava in Southeast direction along the Danube river

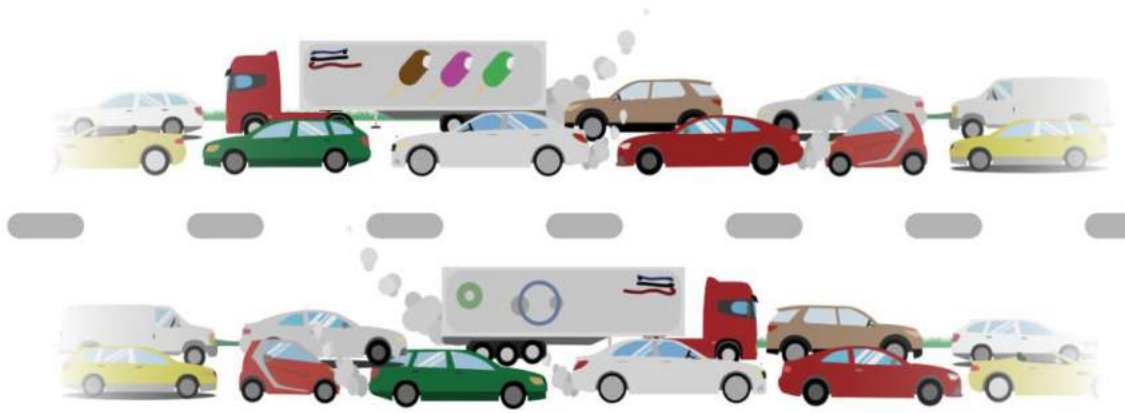
Towns and **villages**
with appr. **70.000** residents

2 hours of traveling in **traffic jam**
every working day

BRATISLAVA

from 06:00 - 09:30

MORNING



DANUBE
region

from 15:00 - 18:30

AFTERNOON

PRO DANUBIA

ZDRUŽENIE OBCÍ PRE MIESTNU DOPRAVU PO DUNAJI

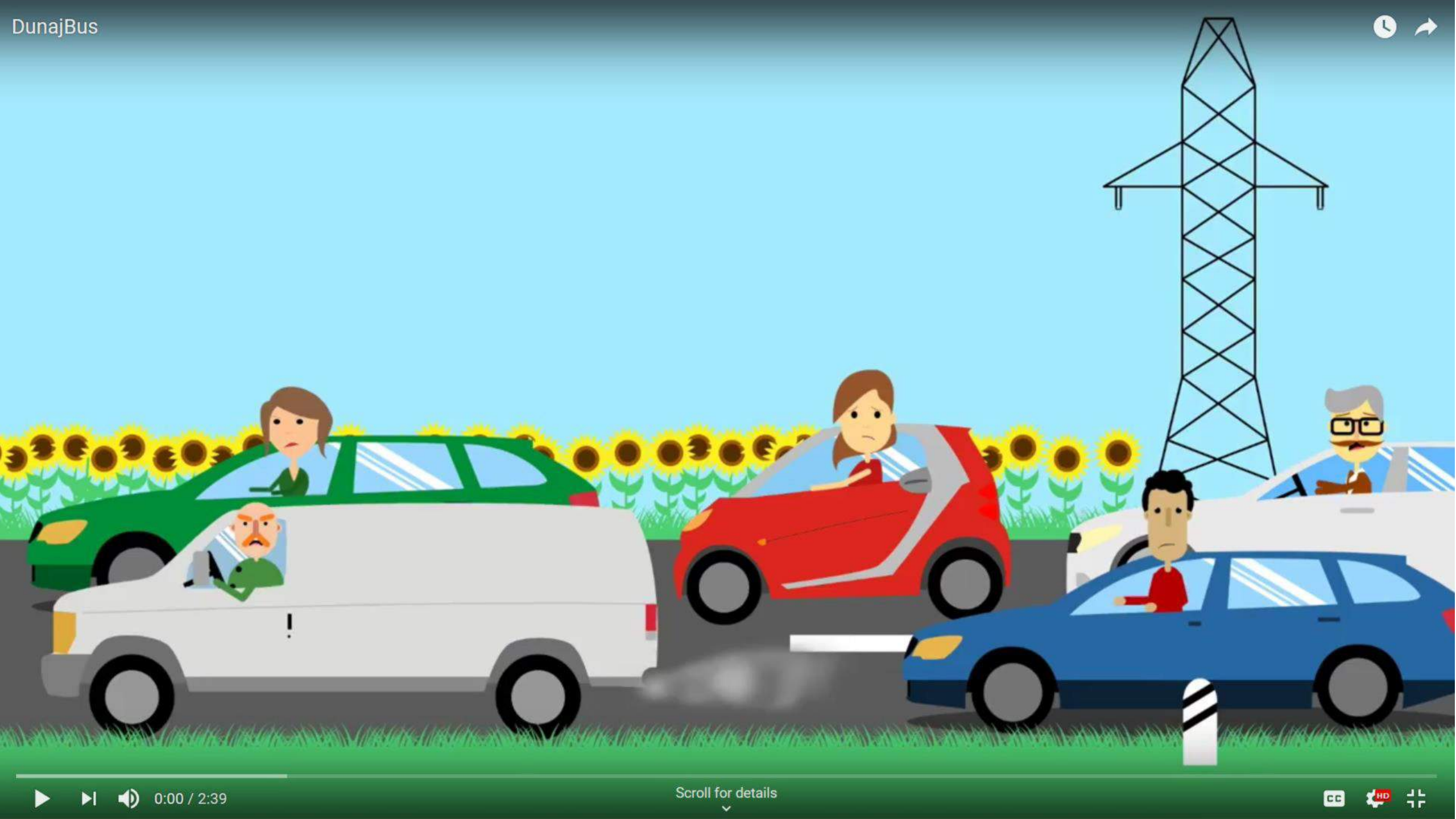
ASSOCIATION OF MUNICIPALITIES

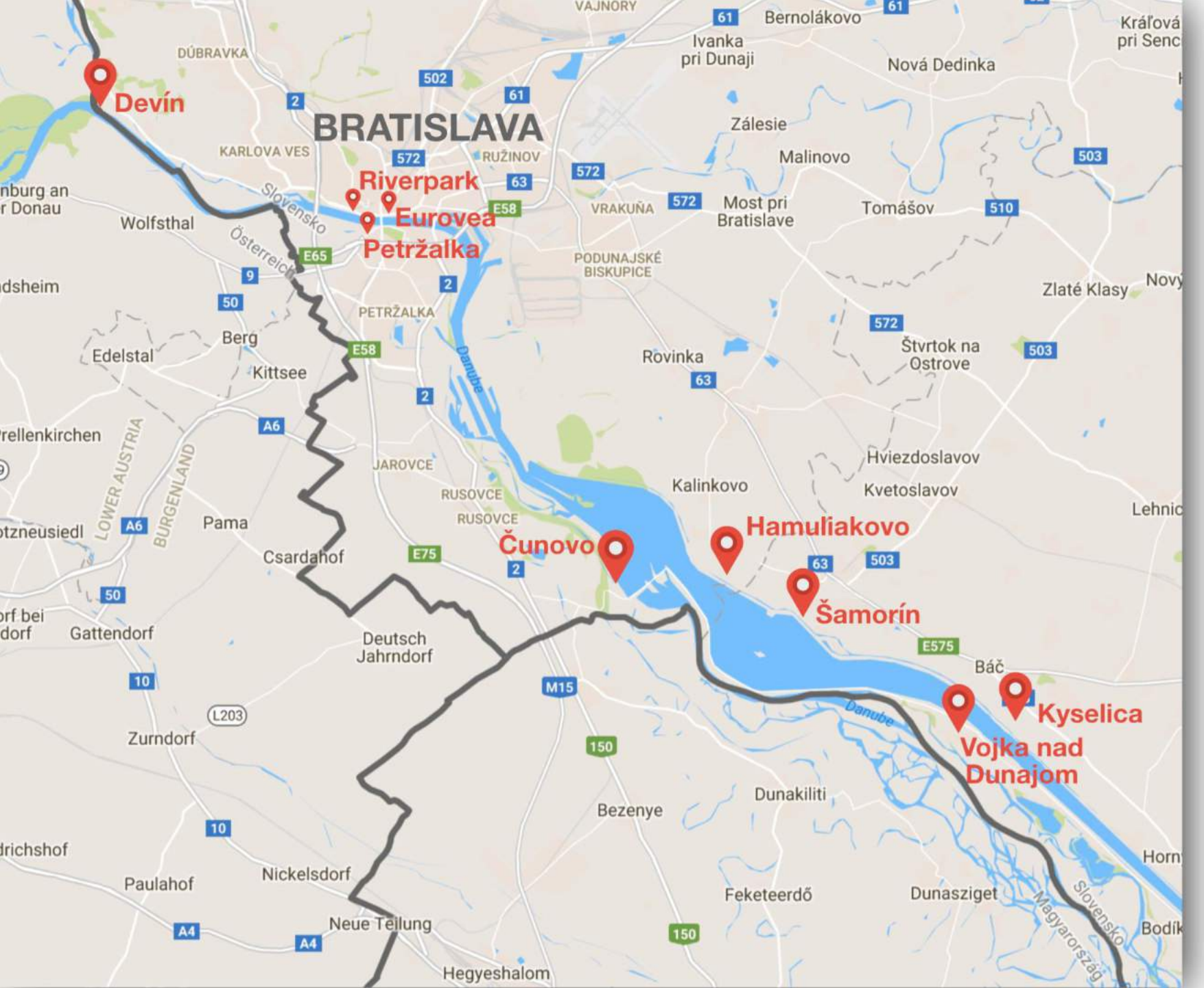
Established by towns and villages in the Danube region

Seeking for **solutions** to find an **alternative** way of **public transportation**

DANUBE river as a **WATERWAY**

Public survey in June 2017 -
Professional estimation of the usability


DunajBus
0:00 / 2:39
Scroll for details



9 Locations water bus STOPS

DUNAJ BUS

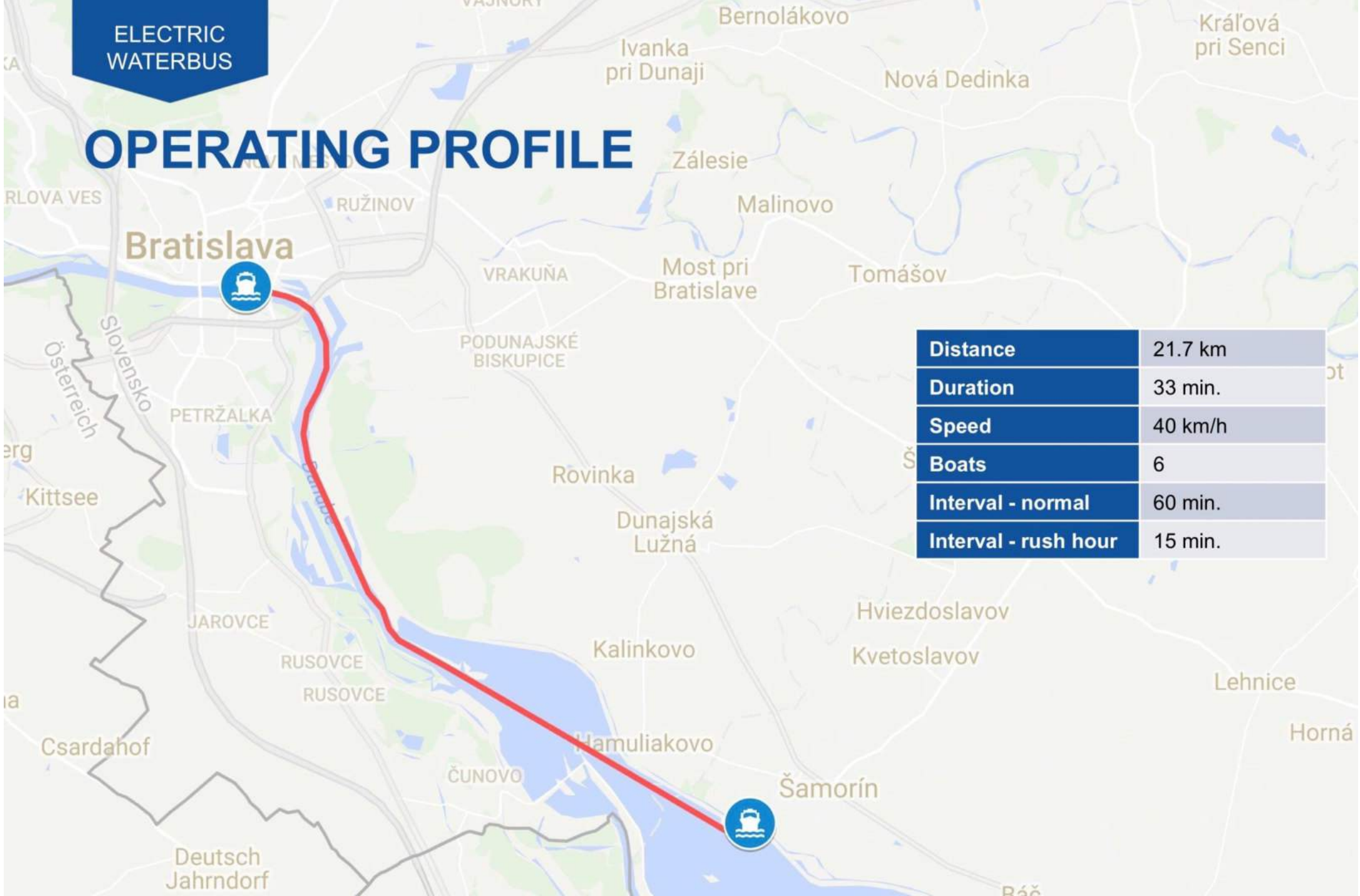
6 VESSELS

- Depart every **15 minutes** in the morning and afternoon rush hours
  - from 06.15 - 09.30 from a “Danube region” to Bratislava
  - from 14.30 - 18.30 from Bratislava to the “Danube region”

- High speed **Hybrid** boats with a **40 km/h** cruising speed
  - catamaran hull (river keeping, speed, economy)
  - 80-100 seating passengers (add. 40 standing)
    30 bicycles
  - all year round operation - heating/air conditioning

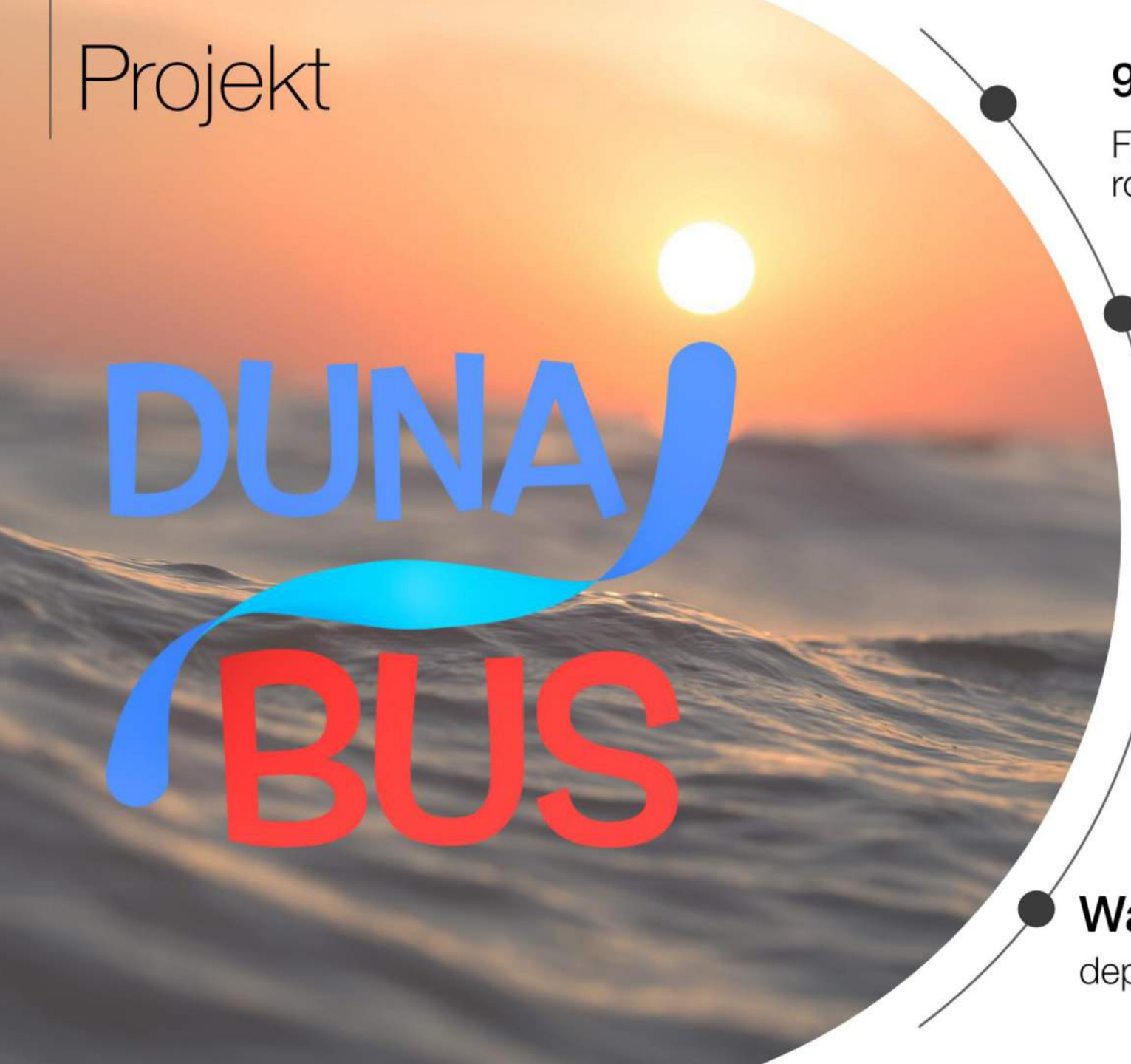
ELECTRIC WATERBUS

OPERATING PROFILE



Distance	21.7 km
Duration	33 min.
Speed	40 km/h
Boats	6
Interval - normal	60 min.
Interval - rush hour	15 min.

Projekt



9|6 TERMINALS

Floating docking pontoons with all year round services

6 Hybrid VESSELS

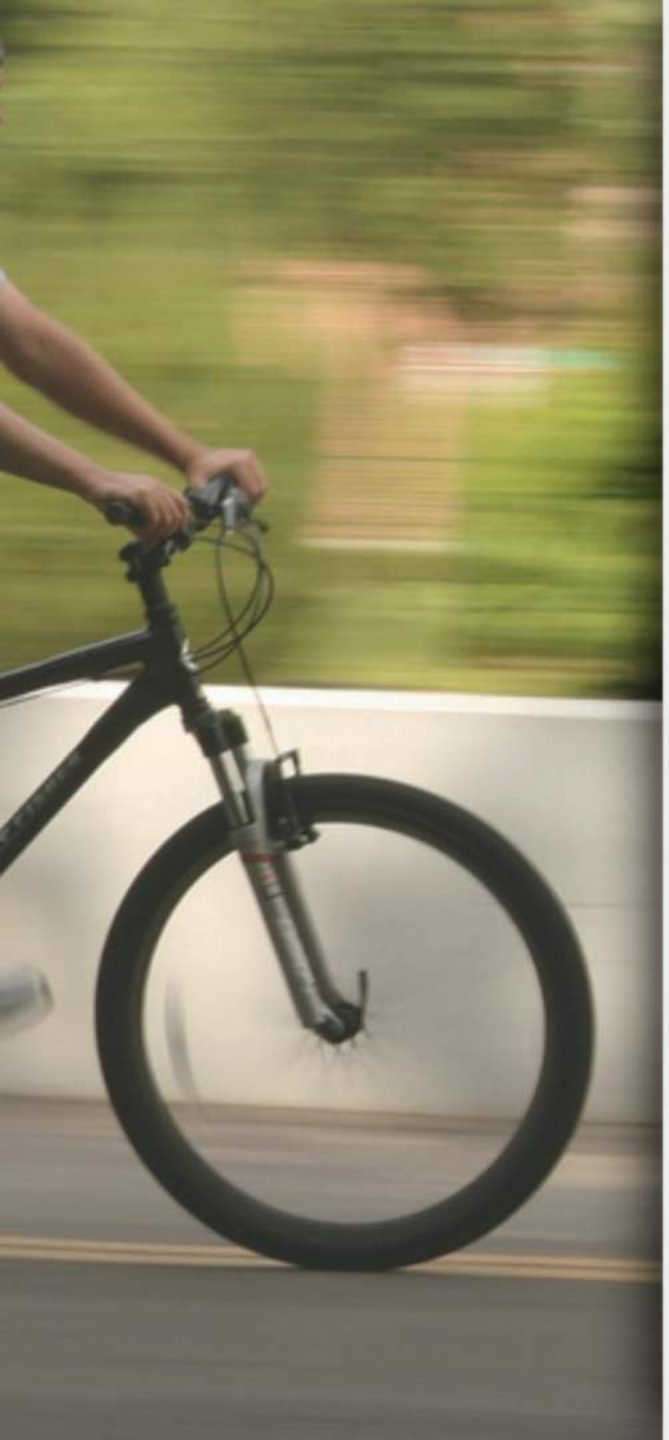
High speed catamaran boats with a capacity of 100 seating passengers (additional 40 standing) and 30 bicycles

PARK & RIDE

parking lots with public boat transport connections that allow commuters and other people heading to Bratislava area to leave their vehicles and transfer to a waterbus

Wave breakers and depot/maintenance **shipyard**

COMMUTER SEATING



KEY SOCIAL ECONOMIC BENEFITS ENVIRONMENTAL IMPACT

- Significantly **LESS TIME** of traveling daily to work or school

  Instead of 2-3 hours **ONLY** 30 minutes

- **Saves** the environment

  Instead of 1.000 engines **ONLY** 12 engines + LNG / Fuel cell ready

- **Connects** cycling routes

  Tens of kilometers of national and international cycling routes

Bratislava Integrated Transport

- ONE ticket for more means of public transport
- The ongoing negotiations show the support to integrate DunajBus into the Integrated Transport ...

Danube Transport Day

European Parliament Brussels
23.11.2017

NETIPSH
networking knowledge

Annual Network Meeting
09.04.2018 Slovakia

DUNAJ BUS

Project implementation in 18 to 20 months!

PRO DANUBIA

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