

PROMINENT March 2018

The **PROMINENT** project entered the final phase of the project duration. Over the last three years, the project has been able to deliver substantial results and besides prepared the roadmap for roll-out of the end products. Energy-efficient navigation, emission after-treatment of diesel engines, LNG as alternative fuel as well as right-sizing and hybrid concepts are the core technologies for which **PROMINENT** has been preparing standardization and mass roll-out. Technologies, combined with certification, monitoring and enforcement regimes as well as the preparation of mass implementation combined with policy recommendations to support market uptake, formed the core elements of the **PROMINENT** project. Since the implementation of innovation needs to be combined with the use of the technologies by the human factor, dedicated activities have been exploited in the area of digital education tools.

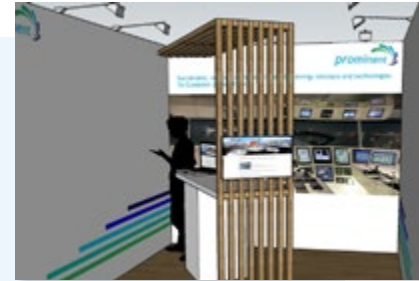
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PROMINENT At TRA

During the Transport Research Arena 2018 (16th - 18th of April 2018), **PROMINENT** will broadcast its results. During the week, amongst others, the following activities are foreseen:

- Monday the 16th until Thursday the 19th of April 2018 > Stand at the TRA 2018 of **PROMINENT**;
- Monday the 16th of April 2018 > Final Consortium Meeting;
- Monday the 16th of April 2018 > Visit of Commissioner Bulc to the **PROMINENT** stand at the TRA 2018;
- Tuesday the 17th of April 2018 > Final Event of the **PROMINENT** Project;
- Wednesday the 18th of April 2018 > Presentation of the **PROMINENT** results during a session on “Achieving a zero-emission ship - electrification, alternative fuels, green retrofits and newbuilds”;
- Wednesday the 18th of April 2018 > Danube vessel operator - equipment manufacturer seminar”.

More information about the events will be published on the website of **PROMINENT** soon. Furthermore an invitation for the final event on the 17th of April 2018 is attached to this newsletter.



WP 2

Costs and benefits of emission reduction

The work on the implementation of emission-reducing technologies has a two way approach. On the one hand, the technological development of these technologies, resulting in more standardised solutions. On the other hand, the costs and benefits of applying these technologies are assessed. Earlier on, the cost-benefit analyses of after-treatment and energy-efficient navigation were published. Recently also the cost-benefit analysis of the application of LNG was published and this analysis is now available on the **PROMINENT** website.

Ultimate situation

The technologies and concepts studied and demonstrated in **PROMINENT** aim at fuel savings and a reduction of air pollutant and greenhouse gas emissions. The ultimate situation is to achieve both by the application of (a combination of) these concepts. In general, the concepts

aiming at fuel saving can achieve a positive business case more easily. Energy-efficient navigation and the right-sizing of over-dimensioned engine driveline have a potential of reducing fuel consumption and consequently reducing the operating costs of the vessel operations. For hybrid and diesel-electric configurations, the

impact on the fuel consumption of a vessel depends heavily on a set of factors (vessel type, operational profile, the combination with other technologies).

Benefits

For technologies aiming to reduce the emissions of vessels, the business case is more complex. With the application of after-treatment systems the investment and operating costs of the vessel operations will increase. However, there are several reasons to apply these technologies. They are very effective in reducing air pollutant emissions. So, it is also one of the most effective solutions to come

to the new NRMM Stage V emission standards. Besides, some (slight) benefits can be achieved, like the reduction on port dues or combining it with the fuel optimisation of some types of engines, which even can result in fuel savings in some segments.

For the application of LNG, there is potentially a business case for certain vessel types, especially with a higher fuel consumption. The higher investment costs of applying an LNG configuration compared to the application of a regular diesel engine can be compensated by the savings on fuel costs. This can be achieved by a relatively lower fuel price for LNG compared to diesel. In the cost-benefit analysis of LNG, four scenarios are assessed, based on one litre diesel with a price advantage for LNG between 5 and 25 eurocent. Three different LNG configurations are assessed, with a dual-fuel engine configuration as the most common configuration.

The same vessel types and representative journeys as in the previous cost-benefit analyses are used. However, for LNG the costs and benefits are assessed for the larger vessel types (with a maximum payload of at least 2,500 tonnes and an average fuel consumption above 300 m³) and 23 representative journeys operated by these types of vessels. The possibility of a positive return on investment of an LNG configuration strongly depends on the fuel consumption and the fuel price scenario. The outcomes of this analysis can be found in the report: http://www.prominent-iwt.eu/wp-content/uploads/2018/02/2017_08_27_D2.6_Ex-ante_cost-benefit_analysis_of_business_cases_for_LNG.pdf

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WP3

Type approval for 'Retrofit Emission Control device'

During the last four months progress was made with this type approval procedure for retrofit emission control devices (REC). This TA procedure is meant to create an alternative option to clean up the engines of existing vessels to Stage V emission levels. Stage V is the newest regulation for new engines sold in 2019 or 2020 onwards. It replaces the CCNR II legislation.

Type approval procedure

A type approval approach was chosen in order to be able to give the emission reduction performance an official status and also a good quality stamp. Based on such a type approval procedure public parties or client of ship owners could give ship owners a financial incentive because of its better environmental performance. The type approval will specify important environmental requirements such as compliance with Stage V limit values, durability requirements, ambient operation conditions and diagnostics. There was a continued dialogue with important stakeholders such as the CESNI/PT (in particular the CESNI/PT committee), EURO-MOT and German and Dutch ministries.

The proposed type approval procedure is based on UNECE R132, which was implemented for RECs for road vehicles

and land-based mobile machinery. The proposal is to implement this new type approval as a CESNI ES-TRIN standard (European Standard laying down Technical Requirements for Inland Navigation vessels). This can be implemented much faster than a new UNECE regulation. The Dutch government has put forward its desire to continuously monitor the (NO_x) emissions of vessels rather than using an official type approval procedure. The **PROMINENT** team still sees the added value of a TA procedure. Especially to make sure that good products are entering the market. It sees on board monitoring (also demonstrated in **PROMINENT**) as an important complementary way to secure low NO_x emissions.

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WP 4

Digital Education Tools

The prototype of the e-SRB and E-Logbook is completed and is currently being tested by means of pilots on inland vessels in the Rhine and Danube region. The first installation on board of pilot vessels took place in November 2017. Different types of vessels from barge operators such as Interstream Barging, Thyssenkrup Veerhaven, Navrom and a private-owned vessel are involved. Also training vessels from STC Group are involved in the pilot, which also gives students the possibility to get familiar with the future systems of administration on board. During the pilot a close cooperation with the crew gives the opportunity to continuously evaluate and improve the system.

During the pilot different updates and improvements have already been made. Besides the system on board, also an online tool has been developed, which makes it possible to access the necessary information online from any place.

Pilot CoP Logistics Education

During the final event in Vienna, the Community of Practice (CoP) and Case Studies will be tested by means of an international pilot with students from education institutes in the Netherlands, Austria and Romania. A total of six students



Simulations on fuel-consumption savings

The evaluation of fuel-consumption savings achieved by an optimised sailing policy is extremely challenging in inland navigation as it depends on continuously changing framework conditions like hydrological parameters (water depth, flow velocity, etc.), the surrounding traffic, the sailing schedule and the ship's load-case, influencing the fuel consumption. Performing simulations contribute to the approximate quantification of these savings.

Rhine vessels

For the Rhine, the simulation environment was adapted and used to quantify the influence of different sailing policies on fuel consumption decoupled from other effects. Five different sailing policies were investigated comprising:

- sailing with constant speed through water;
- sailing with constant speed over ground;
- sailing with constant delivered power;
- sailing with constant rate of revolutions (rpm);
- sailing with minimised average Froude number based on the water depth (Fnh8).

The simulations revealed that sailing with constant speed through water or constant speed over ground results in the most significant fuel savings, depending on the sailing duration permitted. For a selected vessel, the simulations revealed also that sailing 10 % longer than the minimum possible time results in a reduction of fuel consumption by 30 %.

will work together on a case study in which a company will be advised about a transport strategy. The students will use their knowledge about the Inland Shipping modality, gained during self-study in the online learning environment, to define a transport strategy of exporting large agricultural machines from Austria to Ukraine. The students work together by using the CoP and the online blog during the 6 weeks of preparation. On the 16th and 17th of April the students meet in Vienna to complete their work on the transport strategy and prepare the presentation to the company, the problem owner. The presentation will be given on the 17th of April, during the final event.

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Danube vessels

An assessment of the fuel-consumption-reduction potential was carried out for a Danube vessel sailing between Regensburg and Budapest on the Upper Danube, using the modelling approach of Via Donau. The operational cases comprise:

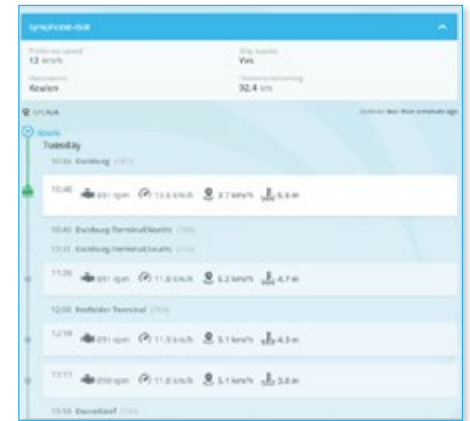
- operation of a Johann Welker vessel (extended) as pushed convoy consisting of the motor cargo vessel under consideration and a lighter;
- operation of the motor cargo vessel as single vessel.

In all cases considered, the reduction of the brake power and the speed over ground lead to a significant reduction in fuel consumption, ranging from 8.7 % up to 25.5 %. The motor cargo vessel in single operation showed an excellent relationship between increase in sailing time and reduction of fuel consumption. Roughly, one may say that 1 % increase in sailing time leads to a reduction in fuel consumption by 4 %. The relationship becomes little less favourable for sailing at the highest navigable water level (HNWL).

Pushed convoy

For the pushed convoy comprising the motor cargo vessel and the lighter, the reductions in fuel consumption could be achieved only by rather high increases in sailing time, becoming highest for sailing at HNWL. 1 % increase in sailing time lead to approximately 1.5 % reduction in fuel consumption at the low navigable water level (LNWL) and an artificial mean water level (MWL).

Simulation is no measure to increase the energy efficiency of inland waterway transport by itself. The results for fuel consumptions corresponding to different sailing policies and average speeds demonstrate the importance of deliberate voyage planning and smart



Real time trip advice

sailing. They can be used to make people like the crew sailing aboard or the schedulers ashore aware of these saving potentials.

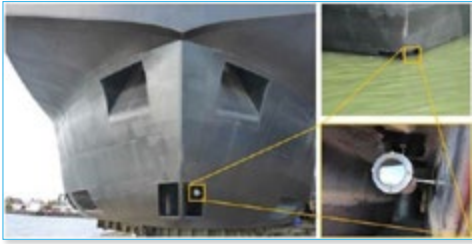
Tool for energy-efficient navigation

A user friendly web interface was developed to help boat masters on-board or trip planners estimate fuel use and NOx emissions for an upcoming trip, including alternative arrival times for corresponding fuel savings. Boat masters can be provided with track advice in real time. The website connects to a simulation model that combines the technical specifications of the vessel with water conditions along the track, and optimises the track based on fuel consumption. A tool for the evaluation of the vessel performance has also been developed with interrelation to the on-board tool.

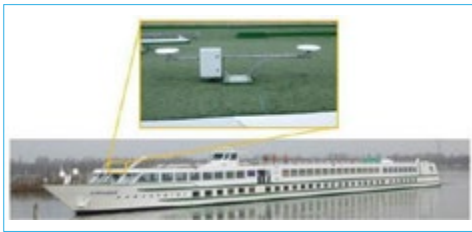
Shipborne measurements

The first time, a highly accurate single beam echo-sounder technology was applied in commercial vessels navigating on the Rhine, using the technology and following the principles of professional surveying. The echo sounding results derived deliver reliable data of the river bed topography. After only one year of operation of one vessel an average coverage of the fairway with echo sounding data in the German part of the river Rhine of 70 % was achieved. The methodology used provides highly accurate and up-to-date data on bed elevation in the fairway. Taking into account corrections for pitch and roll, the overall averaged difference be-

tween the on-board measurements and multi-beam soundings of the year 2014 amounts to 2 cm.



GPS array installed on the passenger ship FGS Symphonie



1D-flowmeter installed in the bow thruster channel of GMS Monika Deymann

If several vessels are equipped with appropriate measurement techniques, navigational relevant data can be collected in short time periods and over large areas of the fairway. In a next step, a workflow for an automatic plausibility check and processing of the collected data has to be developed and this data has to be provided to the boatmasters in a suitable manner.

Since January 2016, on-board monitoring has been taking place for a group of ten vessels of the Romanian shipping company NAVROM sailing mainly on the Middle and Lower Danube. The measurements performed aimed at analysing the engine performance of the vessels and navigation conditions such as waterway depth and flow velocities. The measurements collected were stored in a database with over 100 000 hours of data utilised in this pilot for estimation of the waterway

depths at the city of Corabia in Romania, which is considered a bottleneck due to the shallowness of the Danube there.

The usefulness of the data and the quality of the depth estimates indicate that the method developed may be suitable to be used in other bottlenecks of the Danube as well. In a further step, it may be thought of extending the procedure for the creation of a waterway map with depth contours, demanding, however, a significant amount of efforts and resources. The measurement can also support waterway managers in planning and monitoring their maintenance tasks.

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WP 6

First results of the pilots for roll-out

In the WP 6 Roll-Out the results of the pilots are currently reviewed. There is good progress and already quite interesting results, such as the indication that the SCR system developed in PROMINENT does even reach NOx levels which are in the range of EURO VI trucks (0,4 grams NOx per kWh). Moreover, the monitoring pilots show interesting diagrams on the real power usage and emission levels for different types of vessels and sailing profiles. This is vital input for greening options such as optimising engine size/ configuration, energy efficient navigation, applicability of hybrid concepts as well as the effectiveness of SCR systems.

Another part of the work in WP 6 is the assessment of financing options and needs to enable roll-out of the greening technologies. It is clear that additional incentives are required to provide the framework conditions for greening the fleet. Furthermore, a tool is being prepared to support ship-owners in the investment decisions. This is called 'I-STEER' which is an acronym for 'Investment Support Tool for Emission and Energy Reduction'. This tool is under development and is based on the validated findings of the PROMINENT research and

pilots. The ship owner will get an overview of the various greening options and will be able to make for his situation an assessment on the feasibility/appliability. It is foreseen that EIBIP (European Inland Barging Innovation Platform, www.eibip.eu) will maintain and manage the I-STEER tool after ending of PROMINENT from 1st of May onwards.

Roadmaps

Last but not least, in March and April 2018, the results of the PROMINENT project from other Work Packages are

being reviewed. Currently conclusions will be drawn and recommendations will be made for the follow-up actions. Roadmaps will be prepared for the topics:

- Certification, monitoring and enforcement emission limits
- Engine room improvements
- Skilled workforce and quality job
- Energy efficient navigation

In order to have a solid base for conclusions and recommendations and embedding of follow-up activities, there is coordination and interaction with other projects and initiatives such as GLEC, the Green Deal COBALD in The Netherlands, and projects CoVadem / NOVIMAR, CLINSH, CEF LNG Breakthrough, EIBIP and CESNI.

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