



Supporting Research On Climate Friendly Transport

REACT

Grant Agreement Number 233984

Boating and Canal Navigation as Climate-friendly Transport



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Contributor/s	Vladislav Maraš, Krsta Pašković
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1	Coventry University Enterprises Ltd (Coordinator)	CUE		UK
2	Wuppertal Institute for Climate, Environment and Energy	WI		Germany
3	Geolmaging Ltd	GEO		Cyprus
4	Poliedra - Centri di Conoscenza e Formazione del Politecnico di Milano	POLIE DRA		Italy
5	Arachni Olokliromenes Efarmoges Pliroforikis kai Rompotikis EPE	ARC		Greece
6	University of Belgrade, Faculty of Transport and Traffic Engineering	FTTE		Serbia
7	University of Rijeka	PFRI		Croatia
8	Cardiff University	CU		UK
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BOATING AND CANAL NAVIGATION AS CLIMATE-FRIENDLY TRANSPORT

Prof. Zoran Radmilović, Ph.D.[\[1\]](#), M.Sc. Vladislav Maraš¹,
Krsta Pašković, Eng.[\[2\]](#)



Abstract

Boating and canal pleasure navigation are not main driving forces to increase climate change by greenhouse gas emissions and other human activities as whole. However, the pleasure navigation sector should evaluate the possibilities to contribute to a reduction of anthropogenic GHG emissions to emphasize navigation as an environmentally sound mode. Moreover, the boating and pleasure navigation could be observed as the GHG emitter on two ways as “zero-carbon” navigation or non-motorized navigation (rowboating, sailboating, yachting, rafting) and “low-carbon” navigation or motorized pleasure navigation.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia, e-mail: propeller_danube@yahoo.com

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Abstract (continued)

On the other side, the climate change has a real impact on pleasure navigation with some degree of vulnerability in various and very complex ways. Obviously, potential climate changes and impacts on boating and canal navigation could be recognized in view of the operations and interruptions such as warmer water, extended boating season, periodic canal closings if flooding increases, and in view of the infrastructure such as reduced clearance under waterway bridges, the changes in navigability of canals, the changes in underwater surface and silt, reduced depth of some canals and others.

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Abstract (continued)

The REACT Support Action aims to support multi-stakeholder international collaboration in climate-friendly transport research, enhance EC Member States' research efforts and cooperate with Associated States and the broader international community.

This includes the creation and exploitation of knowledge networks as well as dissemination of state-of-the-art research into alternative mobility solutions and technologies.

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Krsta Pašković, Eng.[\[2\]](#)



INTRODUCTION

"Supporting ReseArch on Climate – friendly Transport" (acronym: REACT) project, a Support Action (SA) co – financed by the Seventh EU Framework Programme, addresses climate friendly transport objectives by linking the strategies for the research and development in transport area to the climate friendliness and European climate policies. The project's vision is to raise awareness and, in parallel, to actively contribute to the shaping of a consensus among EC, Member States and Associated States RTD funding agencies. This could result in a unified and more effective means of addressing climate friendly transport challenges by fully exploiting the resources available. In this way, the project will efficiently address the social and economic imperative to improve quality of life for European citizens and future generations by avoiding resource wastage and fragmentation of research in the crucial issue of climate-friendly transport.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia, e-mail: propeller_danube@yahoo.com



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Krsta Pašković, Eng.[\[2\]](#)



INTRODUCTION (Continued)

The boating and canal navigation sector has more capability to respond to these climate-related drivers, since in most countries adequate water resources infrastructure exists to modify run-off from precipitation. At the same time, complex political, social and environmental factors govern the balance of water resources requirements for navigation against competing needs for water supply, flood damage reduction, hydropower and irrigation.

For these reasons, this paper discusses the Strategic Research Agenda for boating and canal navigation with mitigation and adaptation measures and the aim to support research in climate-friendly boating and canal navigation.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia, e-mail: propeller_danube@yahoo.com



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Krsta Pašković, Eng.[\[2\]](#)



STRATEGIC RESEARCH AGENDA FOR BOATING AND CANAL NAVIGATION

A Strategic Research Agenda represents an identifiable, coherent forward looking and adaptable framework for research at the beginning of the 21st century. It gives a clear signal to all the stakeholders involved of the direction to be taken and the speed of progress needed to be made.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia

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Krsta Pašković, Eng.[\[2\]](#)



STRATEGIC RESEARCH AGENDA FOR BOATING AND CANAL NAVIGATION

The REACT SRA for boating and canal navigation (Fig. 1) considers general REACT SRA as its basic model. It shared with the other European Technology Platforms' SRA the general structure but it adopted a more quantitative and precise method for logically organise the challenges and the features of research areas:

- The high level objective is carbon reduction and derives from a future vision of the relative research sectors concerning climate-friendly transports;
- The targets related to challenges for REACT are the EU target for carbon reduction (i.e. carbon emissions reduction by 20% by 2020,);
- Research areas for REACT are the transport areas that have an impact on carbon reduction.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia

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Krsta Pašković, Eng.[\[2\]](#)



STRATEGIC RESEARCH AGENDA FOR BOATING AND CANAL NAVIGATION

The structure of Agenda is composed by three main parts:

- Research areas
- Indicator definition
- Indicator assessment.

In Fig. 1 the first column indicates the main field:

- Engineering and Information/ Communication Technology (ICT)
- Laws, Economics, Social and Politics Science.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies	
Engineering and Information Technology	Motorised Boating and Canal Navigation	Navigator	Human-machine-waterway/canal interface	Intelligent navigation systems	Navigator assistance, navigation aids, integrated modelling and forecasting tools interfaced with atmospheric models, Route planning parameters on energy consumption, navigation assistance systems	
		Boat / Vessel		New combustion concepts	Extended homogeneous range in diesel engines, low engine-out emissions	
				Advanced fuels and technologies	Fuels and lubricants for advanced Internal Combustion Engines (ICEs)	Adapted fuels for new combustion processes, advanced lubricants and reduced lube oil consumption
				Biomass derived fuels	Optimised land use, Biomass To Liquids (BTL), step-out biomass technologies	
				Design and Materials	Energy saving design and materials	Control systems, renewable materials, recycling
		Energy saving hydrodynamic profile; innovative boat concepts	Improved hull design and smooth bottom paint to reduce drag; environmentally friendly design, manufacturing and maintenance; coating performance for boats, innovative composite materials, ice and flooding control; testing infrastructure			

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Engineering and Information Technology	Motorised Boating and Canal Navigation	Boat / Vessel	Traffic Management	Boating operations and training	Environmental friendly boating operations, manoeuvring, rough weather boating operations, winter navigation, communication systems, river-lake-canal networks
				Pleasure inland navigation	Promotion of pleasure inland navigation, competitiveness of pleasure navigation, innovative and sustainable pleasure inland navigation
			Waste and Emissions Management	Boat emissions reduction systems	Economic retrofit-packages for existing boats/vessels; exhaust gas and water ballast monitoring equipments, end-of-life strategies, recycling operations, oil removal from boatwrecks.
			Propulsion Equipment	Alternative propulsion systems	Non-fossil based propulsion (solar and wind) solutions for economic application on boats, boat propulsion - propellers
			Energy Management Systems	On board power generation and management	Use of fuel cells on boats for climate friendly on board power generation

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Engineering and Information Technology	Motorised Boating and Canal Navigation	Infrastructure / Environment	Design and Materials	Small port operations	Small ports and environment, navigation in small ports
				Oil spill response	Oil spill management, devices, policies
				Manufacturing and maintenance	Cost effective and environmental friendly manufacturing and maintenance

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Engineering and Information Technology	Non-motorized Boating and Canal Navigation	Boats: Sailboats, Yachts, Small fish boats, Rowboats, Canoes, Rafts, Kayaks	Design and Materials	Innovative boat concepts	Improved boat design, lightweight boat components, packing, environmentally friendly design
				Manufacturing and maintenance	Innovative composite materials, end-of-life strategies, recycling operations, renewable materials and energy
		Infrastructure / Environment	Provisions for multi carbon boating	Coasyl Zones, Anchorage, Routes	Benchmarking indicatros, promotion of nulti-carbon pleassure navigation
			Design and Materials	Manufacturing and maintenance	Cost-effective and environmentally friendly manufacturing and maintenance

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Law, Economics, Social and Politics Science	Geography, Spatial Planning	Geography	Optimisation of land and water use	Relation between morphology of the waterway/canal and mobility	Studies on the relation of the morphology of the waterways/canals and mobility
		Spatial Planning	Land and water use	Land and Water Planning	
				Integration of Spatial Planning, Land and Water Planning, Boat Transport Planning and Economic Policies	Legislation on boat transport saving, Spatial planning to promote boating and canal navigation
				Alternative fuels distribution infrastructure planning	
			Mobility planning	Boating traffic planning	Traffic planning, traffic elements, traffic calming, environmental areas, multi-carbon boating areas
				Non - motorised mobility planning	Non-motorized boat planning, infrastructure
				Public inland waterway planning	Inland waterway network planning
		Analysis	Demand generation	Motorised boating demand	
				Non-motorised boating demand	
			Carbon footprint of boating/canal navigation	Environmental parameters on boating/canal navigation	Measurement methods, integration into the information systems
				Gathering of emissions' information along the waterway/canal	Measurement methods, integration into the information systems/platforms for logistic chain
		Management	Mobility Management	Surveys, innovative boating systems organization	Boat-pooling, boat-sharing / chartering
			Boating organisation	Route planning, supplying, provisions	

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Law, Economics, Social and Politics Science	Social Sciences and Education	Education	Campaigning	Awareness and campaign	Awareness / image campaigns for climate friendly navigation, health/fitness campaigns for boating, promotion of boating lifestyles, advertisement, marketing, customer acceptance,
			Fuel efficient navigation	Eco-navigation	Research on parameters of change in mobility behaviour, navigator training for a fuel-saving navigation style
			Mobility education	Sustainable Navigation Education at School	
		Social studies	Social marketing	Initiatives	Initiatives for climate friendly navigation
			Mobility behaviour	Customer Information to promote climate friendly purchase decisions	
				Information to navigators/users	Information on boating/canal navigation system, user-friendly schedules, boat infrastructure maps; Information on long/medium/short distance alternatives for leisure,..

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Law, Economics, Social and Politics Science	Economics	Pricing	Infrastructure pricing	Waterway/canal pricing	Allocation of infrastructure cost
				Small port / marina pricing	
			Taxation	Fuel taxation	Fuel taxation for motor boats, reduction of tax subsidies on diesel oils, if available
				Motor boat taxation	Carbon emission related motor boat tax
			Subsidies	Public navigation funding	Subsidies for public navigation system
				Low carbon technologies funding	Subsidies for development of low emission boating; purchase subsidies
		Analysis	External costs of navigation	Social and ecological costs of motorised navigation, internalisation of external costs	
			Logistics	Sustainable effects of new logistic concepts in navigation; logistic strategic agendas	
			Sustainable navigation and energy systems	Indicators, tools, operational parameters, infrastructure projects, service assessments	Level and quality of service

Main field	Sector	Research Approach	Main Research Area	Specific Research Area	Studies
Law, Economics, Social and Politics Science	Policies	Policy measures	Speed Limits	Motorboat speed limits	
				Inland waterway traffic calming	
			Fleet emission limits	European regulation on emission performance standards for new boats	
				Boat labelling	
			R&D Strategies on navigation emissions reduction		
		Navigation modeling	Standardized approach for navigation modelling		
		Other	Climate-friendly navigation research project effectiveness	Measurement, criteria	
			Trip assistance	Internet shopping	



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Krsta Pašković, Eng.[\[2\]](#)



STRATEGIC RESEARCH AGENDA FOR BOATING AND CANAL NAVIGATION

The second column indicates the general sector:

- Boating and canal navigation for the Engineering and ICT (motorised and non-motorised)
- Disciplines groups for Laws, Economics, Social and Politics Science (Geography, Spatial Planning, Social Sciences and Education, Economics, Policies).

In the third column, there is the research approach:

- For every mode of boating and canal navigation the subdivision includes the three components of the system: boat/ vessel, infrastructure/ environment, navigator.
- For disciplines group, there are the singular disciplines.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

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STRATEGIC RESEARCH AGENDA FOR BOATING AND CANAL NAVIGATION

This structure has been chosen in order to guide experts towards their expertise areas, and it allows to group specific research areas in no more than one category.

In the fourth column there is the main research area. That is the focus of our interest in the sense that the consultation will be aimed to rank the specific research areas and studies (columns 5 and 6).

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INDICATORS DEFINITION AND ASSESSMENT

The indicators could be composed by two main groups as:

- research demand indicators
- impact indicators.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia



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INDICATORS DEFINITION AND ASSESSMENT

The research demand indicators refer to the stage of research activity, differentiating into basic, applied and technical development, into a timeline running till the threshold of 2030. They divide into three parts:

- Basic Research contains theoretical and experimental research based on new knowledge and observable facts.
- Applied research directs towards a specific practical aim or objective.
- Technical Development draws on existing knowledge gained from research and/ or practical experience that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

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INDICATORS DEFINITION AND ASSESSMENT

The impact indicators could be:

- Contribution in reducing GHG emissions;
- Contribution in fostering coastal and land usage;
- Contribution in fostering water usage.
- The choice of impact indicators raises a deep reflection among researches, decision-makers and other stakeholders in order to give priority to research areas, like social and economic indicators.

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CONCLUSIONS AND FURTHER RESEARCH

REACT project has an impact on three main axes:

- Social impact: Climate-friendly transport and mobility issue are a topic of strategic importance for everyday life, with major impact in life of human beings and its quality. REACT project will boast the formulation of scientific Member and Associated States and international networks and capitalize on these networks in delivering the Strategic Research Agenda to be adopted by public stakeholders, in order to diffuse the innovation approaches into the society, more effectively.

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Krsta Pašković, Eng.[\[2\]](#)



CONCLUSIONS AND FURTHER RESEARCH

REACT project has an impact on three main axes (continued):

- Economic impact: Networked research communities and stakeholders with actually different origins, background and economic constellations create a critical mass in climate-friendly transport, boosting competitiveness and effective usage of research resources in the transport industry. Also, the forging of European Commission – Member States – Associated States research networks for conducting research in climate-friendly transport issues, has a near future economic impact as research is ranked first as a competitive tool for economic development and sustainability.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

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Krsta Pašković, Eng.[\[2\]](#)



CONCLUSIONS AND FURTHER RESEARCH

REACT project has an impact on three main axes (continued):

- Research impact: Networked scientists and companies will be supported in the creation of breakthrough knowledge and excellence. Specifically, both ICT tools and human networks are exploited in order to stimulate research and innovation as to cater the society needs and ethics. The exchange of scientific knowledge and the support of collaborative efforts stimulate to potential of accelerating the scientific excellence of research teams.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

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CONCLUSIONS AND FURTHER RESEARCH

Boating is the dominant pleasure navigation mode on inland waterways and is often recognised as a sustainable, relatively energy efficient and relatively environmentally friendly form of navigation. However, boating could be still a considerable source of greenhouse gas emissions. Other environmental problems associated with boating including oil spills, air pollution, anti fouling pollution, dredging, boat scrapping and waste disposal at closed water aquatoriums. In that sense, proposed Strategic Research Agenda can help in both main fields: Engineering and ICT and Social and Politics Science in sustainable development of boating and canal navigation to time threshold to 2030.

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia



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Prof. Zoran Radmilović, Ph.D.[\[1\]](#), M.Sc. Vladislav Maraš¹,
Krsta Pašković, Eng.[\[2\]](#)



Thank you for your attention!

Any questions?

[\[1\]](#) Faculty of Transport and Traffic Engineering, University of Belgrade, Vojvode Stepe 305, 11000 Belgrade, Serbia,

[\[2\]](#) President of Danube Propeller – Nautical Association, Belgrade, Mihizova 22, Serbia

Boating and Canal Navigation as Climate-Friendly Transport

Zoran Radmilovic, Professor, University of Belgrade, Faculty of Transport and Traffic Engineering
Vladislav Maras, and Krsta Paskovic, President of Danube Propeller, Belgrade, SERBIA

z.radmilovic@sf.bg.ac.rs

Boating and canal pleasure navigation are not main driving forces to increase climate change by greenhouse gas emissions and other human activities as whole. However, the pleasure navigation sector should evaluate the possibilities to contribute to a reduction of anthropogenic GHG emissions to emphasize navigation as an environmentally sound mode. Moreover, the boating and pleasure navigation could be observed as the GHG emitter on two ways as "zero-carbon" navigation or non-motorized navigation (rowboating, sailboating, yachting, rafting) and "low-carbon" navigation or motorized pleasure navigation.

On the other side, the climate change has a real impact on pleasure navigation with some degree of vulnerability in various and very complex ways. Obviously, potential climate changes and impacts on boating and canal navigation could be recognized in view of the operations and interruptions such as warmer water, extended boating season, periodic canal closings if flooding increases, and in view of the infrastructure such as reduced clearance under waterway bridges, the changes in navigability of canals, the changes in underwater surface and silt, reduced depth of some canals and others.

In this paper, we are presenting some research results including specially water transport and navigation from European Union project under the title "SUPPORTING RESEARCH ON CLIMATE FRIENDLY TRANSPORT" (acronym: REACT) in Seventh Framework Programme (2009-2011). The consortium of this project is composed of the following partners: Coventry University Enterprises Ltd (coordinator), Wuppertal Institute for Climate, Environment and Energy, Germany, GeoImaging Ltd, Cyprus, Poliedra, Italy, Arachni Ltd, Greece, Faculty of Transport and Traffic Engineering, University of Belgrade, Serbia, Faculty of Maritime Studies, University of Rijeka, Croatia, Cardiff University, UK, OIKON Ltd, Croatia.

The challenges of environment protection are complex and diffuse, and so cannot be solved at the level of the individual country or pollutant. The solutions are to be found within systematic multi-disciplinary research and within the application of the concept of sustainable development with collective, societal action.

The REACT Support Action aims to support multi-stakeholder international collaboration in climate-friendly transport research, enhance EC Member States' research efforts and cooperate with Associated States and the broader international community. This includes the creation and exploitation of knowledge networks as well as dissemination of state-of-the-art research into alternative mobility solutions and technologies.

Zoran Radmilovic, full professor of The Faculty of Transport and Traffic Engineering, University of Belgrade and a regular member of the Serbian Academy of Engineering since 2008, was born in 1944. in Belgrade.

He finished elementary school and the First Belgrade Gymnasium in Belgrade. He graduated in 1969., received master degree in 1979, and Ph.D. degree in 1989, all from The Faculty of Transport and Traffic Engineering, University of Belgrade.

He completed more specialization courses in the field of water traffic and transport (Norwegian Institute of Technology, Department for port and ocean engineering, Trondheim, 1979-1980, 6 months, the issue of specialization: Indicators that reduce the port throughput), and the Middle and Upper Danube (Serbia, Croatia, Hungary, Slovakia, Austria and Germany, from 1977 to 1984, 12 months, the issue of specialization: Inland Navigation).

He started his professional activity in Shipping and dredging company in Belgrade, working as a freelance engineer in the planning, development, design and production of building materials since 1970 to 1974. He is with The Faculty of Transport and Traffic Engineering, University of Belgrade from 26 December, 1974. He was elected in all the titles at The Faculty of Transport and Traffic Engineering: Research and Teaching Assistant (1974-1979), Senior Researcher (1979-1989), Assistant Professor (1989-1994), Associate Professor (1994-2000), and Full Professor (2000-2009).

Prof. Zoran Radmilovic has gained the reputation of one of the recognized scientists, experts and pedagogues in the water traffic and transport. He has published many scientific papers in leading international journals in the field of inland waterway transport, which are cited by databases Google Scholar, Scopus and Web of Science.