Project idea form - small projects

Version 2.1

Registration no. (filled in by MA/JS only) _____

Project Idea Form

Date of submission 05/06/2025

1. Project idea identification

Project idea name	From Sewage to Safety: Sustainable Road Heating with Hybrid Sewage Heat Pump Technology
Short name of the project	THERMSEW
Previous calls	yes ○ no ◉
Seed money support	yes ○ no ◉

2. Programme priority

	3. Climate-neutral societies

3. Programme objective

	3.2. Energy transition

4. Potential lead applicant

Name of the organisation (original)	Danmarks Tekniske Universitet
Name of the organisation (English)	Technical University of Denmark
Website	https://www.dtu.dk/
Country	DK

Type of Partner	Higher education and research institution

Contact person 1	
Name	Mouadh Rafai
Email	moura@dtu.dk
Phone	+4531800835
Contact person 2	
Name	Yupeng Dong
Email	yuedo@dtu.dk
Phone	*(max. 100 characters incl. spaces)*

Which organisation(s) in the planned partnership take part in a project within the Interreg Baltic Sea Region Programme for the first time? Please list the respective partners.

Norwegian University of Science and Technology, Norway
Technical University of Denmark, Denmark
Ruhr-Universität Bochum, Germany

5.1 Specific challenge to be adressed

In the Baltic Sea Region, harsh winter conditions and recurring frost-thaw cycles lead to significant challenges for road infrastructure and public safety. Traditional methods of de-icing—such as chemical salts and fossil-fuel-based heating systems—pose long-term environmental risks, damage road materials, and contribute to greenhouse gas emissions. These methods are increasingly unsustainable, especially for municipalities striving to meet climate neutrality targets. At the same time, vast amounts of low-temperature energy remain untapped in urban wastewater and sewage systems. While sewage water holds great potential as a stable and renewable heat source, its use for infrastructural heating—particularly for roads and sidewalks—remains largely underdeveloped in the region. Integrating this energy into surface heating systems requires innovative technical, planning, and governance solutions that address complex stakeholder needs across municipalities, utility providers, and transport infrastructure managers.
Our project addresses the gap between renewable thermal energy potential from sewage systems and its application for road safety. By developing and piloting a hybrid sewage water-based heat pump system for road heating, we aim to reduce the environmental footprint of winter maintenance, enhance road durability, and improve public safety. This system integrates photovoltaic-thermal (PVT)

support to ensure performance during peak demand.
The primary target groups are municipal infrastructure authorities, public utilities managing sewage and district heating systems, road maintenance agencies, and regional planners. Secondary beneficiaries include residents, commuters, and vulnerable groups particularly affected by icy road conditions. Through this initiative, we aim to foster cross-border innovation and promote scalable solutions for sustainable urban infrastructure in the Baltic Sea Region.

5.2 Focus of the call

Our project supports the cohesive development of small and rural municipalities in the Baltic Sea Region by introducing an innovative and scalable solution for sustainable winter road maintenance. These areas often face financial and technical barriers to implementing climate-friendly infrastructure. At the same time, they manage decentralised wastewater systems that represent untapped energy sources. By piloting hybrid sewage-based heat pump systems for road heating, combined with photovoltaic-thermal energy and smart control, we aim to offer a low-emission, cost-effective alternative to fossil-fuel or salt-based de-icing methods. This technology can be adapted to local sewage infrastructure and scaled to suit smaller road networks.Through knowledge transfer, training, and local pilot actions, our project will empower rural authorities and utilities to apply renewable heating systems that enhance road safety, protect water and soil quality, and lower operational costs. In doing so, we foster climate resilience, technological uptake, and inclusive development—ensuring that smaller places are not left behind in the green transition.

6. Transnational relevance

Denmark, Germany and Norway face common climate-related challenges in road maintenance and energy transition. Severe winters in the Baltic Sea Region result in high energy demand for de-icing infrastructure, while traditional methods relying on fossil fuels and chemical salts are environmentally harmful and increasingly unsustainable. At the same time, both countries have underused renewable thermal sources—particularly low-temperature energy embedded in sewage systems.Transnational cooperation is essential to develop viable solutions that address shared needs in energy efficiency, infrastructure resilience, and climate adaptation. Neither country alone has yet integrated sewage-based heating into road infrastructure at scale. By combining Danish experience in wastewater heating production and recovery, Norvegian expertice in road and ice-damage mitigation of infrastructure and German expertise in system modelling as well as the joint expertise in monitoring, the project accelerates innovation across borders.This cooperation allows partners to co-develop, pilot, and evaluate a hybrid sewage-heat pump system enhanced by solar PVT input under different climatic, regulatory, and infrastructural conditions. The cross-border approach ensures the solution is not only technically robust but also adaptable to varied governance structures and market conditions in the Baltic Sea Region. Through joint knowledge creation and testing, the project supports capacity-building for municipal and regional actors. It helps unlock a renewable, local energy source while improving road safety and reducing environmental impacts—delivering long-term benefits that transcend national borders.

7. Specific aims to be adressed

Building trust that could lead to further cooperation initiatives
The project brings together interdisciplinary partners from DK, NO and DE to jointly address a shared climate and infrastructure challenge: sustainable winter road maintenance. Through the co-development and piloting of an innovative hybrid sewage-based road heating system, partners build trust by aligning technical solutions, regulatory perspectives, and stakeholder needs. Joint activities such as transnational field testing, knowledge exchange, and stakeholder workshops foster long-term collaboration between public authorities, utilities, and research institutions.This collaboration strengthens mutual understanding of regional priorities and builds the foundation for future cooperation on climate resilience, integrated energy systems, and sustainable urban infrastructure across the Baltic Sea Region.By engaging municipalities and utilities in all three countries, the project also creates a trusted network that can accelerate the transfer and scaling of innovative solutions in future.

Initiating and keeping networks that are important for the BSR

(max. 1.000 characters incl. spaces)

Bringing the Programme closer to the citizens
The project brings the Programme closer to citizens by directly addressing everyday challenges related to road safety, energy efficiency, and winter mobility. By piloting a sustainable road heating system powered by local renewable sources—sewage and solar energy—the project offers tangible benefits for commuters, pedestrians, and vulnerable groups affected by icy surfaces. Citizens will see visible results through safer, ice-free roads and sidewalks, while municipalities reduce their environmental footprint. Public outreach, local workshops, and demonstration sites will engage residents in the pilot areas, raising awareness of renewable energy use in urban infrastructure. Through citizen-focused communication, the project promotes the Programme's values of sustainability and innovation, and shows how European cooperation delivers practical improvements to local communities.

Allowing a swift response to unpredictable and urgent challenges

The project strengthens municipalities' capacity to respond swiftly to urgent challenges caused by sudden frost, snow, and freeze-thaw cycles. These extreme weather events are increasing in frequency due to climate change and often result in dangerous road conditions, traffic disruptions, and accidents. Our hybrid sewage- and solar-powered heating system offers a sustainable and automated solution for de-icing roads and walkways without relying on manual intervention or fossil fuels. By integrating real-time monitoring and control, the system can respond quickly to changing weather, ensuring continuous safety and functionality. The transnational cooperation enables knowledge exchange and joint development of resilient technical and operational strategies, helping cities across the Baltic Sea Region to adapt their infrastructure and maintenance practices to unpredictable climate-related challenges.

8. Target groups

The project addresses a broad ye

t clearly defined group of stakeholders who are directly affected by winter-related infrastructure challenges and who have the competence and mandate to act on them.Primary target groups include:
Municipal infrastructure departments and public road authorities, who are responsible for winter maintenance and road safety. These actors are at the front line of implementing surface heating systems and can benefit directly from more efficient and sustainable de-icing solutions.
Wastewater utility providers and district heating operators, who manage access to the sewage heat source and are key to integrating hybrid heating systems into existing infrastructure.
Urban and regional planners, who can incorporate sewage-based heating into long-term strategies for sustainable infrastructure and climate adaptation.

These groups are essential for piloting, upscaling, and mainstreaming the solution in practice and policy.
Secondary target groups include:Technology providers, such as engineering companies and SMEs, who will benefit from new markets and will be involved in the design and technical development of the hybrid heating solution.Academic and research institutions, who will contribute to system optimisation, environmental assessment, and performance monitoring.Decision-makers at the regional and national level, who can create enabling frameworks for investment and regulation.The project will actively involve these groups through co-design workshops, technical development activities, pilot implementation, policy dialogues, and joint evaluation of system performance. Special attention will be given to the replicability and upscaling potential of the solution in other urban areas of the Baltic Sea Region.

	Please use the drop-down list to define up to five target groups that you will involve through your project's activities.	Please define a field of responsibility or an economic sector of the selected target group	Specify the countries and regions that the representatives of this target group come from.
1.	Infrastructure and public service provider	increasing lifespan and safety of infrastructure	Denmark, Norway, Germany
2.	Local public authority	safer, more resilient and sustainable city	Denmark, Norway, Germany
3.	Higher education and research institution	transfer of knowledge, application related research and teaching	Denmark, Norway, Germany
4.	Small and medium enterprise	new markets, design and technical development	Denmark, Norway, Germany

5. Regional public authority	create enabling frameworks for investment and regulation	Denmark, Norway, Germany

9. Contribution to the EU Strategy for the Baltic Sea Region

Please indicate if your project idea has the potential to contribute to the implementation of the Action Plan of the EU Strategy for the Baltic Sea Region (https://eusbsr.eu/implementation/).

yes ◉ no ◯

Please select which policy area(s) of the EUSBSR your project idea contributes to most.

PA Energy

PA Bio-economy

PA Innovation

The MA/JS may share your project idea form with the respective policy area coordinator(s) of the EUSBSR. You can find contacts of PACs at the EUSBSR website (https://eusbsr.eu/contact-us/).

☐ If you disagree, please tick here.

10. Partnership

Lead Partner: Technical University of Denmark (DTU), Denmark
Dr. Mouadh Rafai is a leading expert in experimental and numerical investigations of energy geostructures and in-situ heat pump systems. His expertise in monitoring and modelling the thermal performance of subsurface systems forms the cornerstone of this project.
Prof. Dr. Yupeng: He brings extensive experience in infrastructure modelling, particularly for bridges and foundation systems, contributing essential know-how in structural integration of energy systems.

Project Partner: Norwegian University of Science and Technology (NTNU), Norway
Prof. Dr. Rao Martand Singh has over 15 years of international research experience in geothermal energy systems, including energy piles, ground source heat pumps, and in-situ field testing. His work on road icing and de-icing strategies using renewable subsurface energy will significantly strengthen the project.

Project Partner: Ruhr University Bochum (RUB), Germany
Dr.-Ing. Merita Tafili specializes in constitutive and finite element modelling of thermo-hydro-mechanical soil behaviour and soil-structure interaction, particularly in the context of ground source

heat pump systems coupled with energy geostructures.
Prof. Dr.-Ing. habil. Torsten Wichtmann is a recognized authority in experimental soil mechanics, with particular expertise in advanced testing methods and the development of innovative laboratory equipment.

Together, the interdisciplinary expertise of the project consortium spans all relevant domains—from experimental testing and field validation as well as monitoring to advanced modelling and infrastructure design. The close interrelation of the partners' research areas ensures a strong and coherent approach that will drive the project's success.

11. Workplan

Our project develops, pilots, and promotes a hybrid renewable energy system that utilizes low-temperature heat from sewage water for road de-icing, supported by photovoltaic-thermal (PVT) elements. The system targets energy efficiency, infrastructure safety, and climate neutrality in urban areas facing harsh winters and recurring frost-thaw cycles.

Main Activities and Outputs
The project will begin with a joint feasibility assessment of technical, environmental, and regulatory preconditions in the partner countries. This includes mapping suitable urban contexts for the integration of sewage-based heating systems.
We will then design and pilot a hybrid system combining a sewage heat pump and PVT support. The pilot will be installed in Denmark and monitored over a winter season. Performance metrics will include energy savings, temperature control efficiency, and operational reliability.

Parallel to the pilot, the project will develop:
A technical design guideline for integrating sewage-based systems into road and bridge infrastructure
A decision-making toolkit for municipalities and infrastructure operators
Policy briefs to address governance, data-sharing, and inter-agency cooperation

Target Group Involvement
Municipal infrastructure departments, utility companies, and road maintenance agencies will be directly involved in testing and validating the system. They will contribute data, co-develop planning processes, and assess operational implications. Regional planners will participate in transnational workshops focused on regulatory adaptation and spatial integration.
Regular co-creation workshops and knowledge-sharing webinars will ensure that end users are part of the innovation process and that the system design is replicable and scalable.

Use of Final Outcomes
Municipalities and utility providers across the Baltic Sea Region will be the main users of the outputs, particularly in cities with winter maintenance challenges and ambitious climate targets. Engineering firms and infrastructure planners will benefit from the technical guidelines, while policymakers can use the governance recommendations to support the roll-out of climate-friendly energy infrastructure.
The final results will be disseminated through a transnational stakeholder forum, an online knowledge hub, and input to national and regional infrastructure strategies.

12. Planned budget

ERDF budget (planned expenditure of partners from the EU)	EUR 440,000.00
Norwegian budget (planned expenditure of partners from Norway)	EUR 50,000.00
Total budget (including preparatory costs)	**EUR 490,000.00**

13. Project consultation

Please indicate if you wish to have a consultation (online meeting) with the MA/JS to discuss your project idea

yes ◉ no ◯

14. Questions to the MA/JS

Questions related to the content of the planned project	Pilot Scope & Eligibility: Are there specific technical or legal limitations on pilot installations (e.g., use of public roads, energy systems) within the Scheme that we should consider? Output Format Requirements: Is there a preferred format or standard for technical guidelines and decision-making tools produced in the project? Policy Briefs: Would the development of local or national policy briefs be considered a relevant and eligible output under this call? Replication Potential: How important is the cross-regional replication of our solution? Should we plan specific activities (e.g., demo events, replication manuals) to address that? Communication Expectations: What communication and visibility actions are expected beyond regular dissemination (e.g., citizen involvement, media engagement)?
Questions related to budgeting and expenditure	Both Denmark and Norway are in the interreg Baltic Sea Region, while Bochum is not. Is it a problem?
Any other questions	Is there time to follow up in case this small project is successfully funded and delivered, with a more sophisticated program like Photovoltaic/ thermal based-energy piles: A hybrid system for Energy storage and de-icing (HybStore-PTEP)

15. Additional information

Recently, the three universities have successfully collaborated and addressed several common

challenges related to ground source heat pump and energy piles. And currently we are involved in a european project "CA21156 - european network for FOstering Large-scale ImplementAtion of energy GEostructure (FOLIAGE)" to address the challenges related to technical and non-technical barriers for implementation at a large scale.

Your account in BAMOS+

Please remember that to officially submit your application you need to access our electronic data exchange system BAMOS+. More information about the process of applying for your account in BAMOS+ you will find here:
https://interreg-baltic.eu/gateway/bamos-account