Innovative Solution ID Card

# Nordic Energy Capital (NEC)



VAASA.
VASA.

EUROPEAN
URBAN
INITIATIVE



Co-funded by
the European Union

VAASA.
VASA.

Vaasan yliopisto
UNIVERSITY OF VAASA

EPV

VAASA SÄHKÖ

MERINOVA
TECHNOLOGY CENTRE

4H



# INDEX

1. The innovative solution in a nutshell ..... 6
2. City of Vaasa's vision of the innovative solution and underlying motivation ..... 10
3. Political Leadership at the City of Vaasa ..... 14
4. Context ..... 18
5. Stakeholder Ecosystems ..... 22
6. Digital, green and just aspects of the innovative actions ..... 26
7. Regulatory Frameworks ..... 30
8. Management and governance of the innovative solution ..... 34
9. Resources available ..... 38
10. Sustainability of the innovative solution at the City of Vaasa ..... 42
11. Risks ..... 46
Additional notes ..... 50





> Together, these elements form a transferable and scalable model for data-driven and citizen-inclusive energy transition, combining digital twin simulations, space-data-driven efficiency models and participatory design.

# 1. The innovative solution in a nutshell

**THE NORDIC ENERGY CAPITAL (NEC) PROJECT** aims to create system-level solutions for the urban energy transition in urban areas. Led by the City of Vaasa, the project transforms the Vaskiluoto area of the city into a real-life living lab for experimentation on how to accelerate the urban energy transition through system-level modelling, co-creation and citizen engagement.

At the centre of the solution is the development of a digital twin of the Vaskiluoto energy system. This virtual model supports real-time simulation and optimisation of energy flows, including the integration of high-temperature heat pumps, industrial heat use and district heating. It also supports sector coupling between heat and power and enables exploration of the possibility of converting industrial waste heat back into electricity.

A second core element is the development of an AI-based urban energy efficiency model that combines satellite imagery, IoT sensor data and building-level information. This model is intended to detect and visualise energy loss, identify inefficiencies, predict performance and support timely interventions across the urban area.

The project also develops an interactive public portal, co-created with citizens, to provide understandable and actionable energy insights. Through school workshops, community sessions and co-exploration activities, NEC embeds citizen engagement and improved education pathways into the energy transition process.

Together, these elements form a transferable and scalable model for data-driven and citizen-inclusive energy transition, combining digital twin simulations, space-data-driven efficiency models and participatory design.

“This reflects the city’s view that carbon neutrality cannot be achieved through infrastructure alone, but also requires citizen engagement, education and locally relevant data tools.”





# 2. City of Vaasa's vision of the innovative solution and underlying motivation

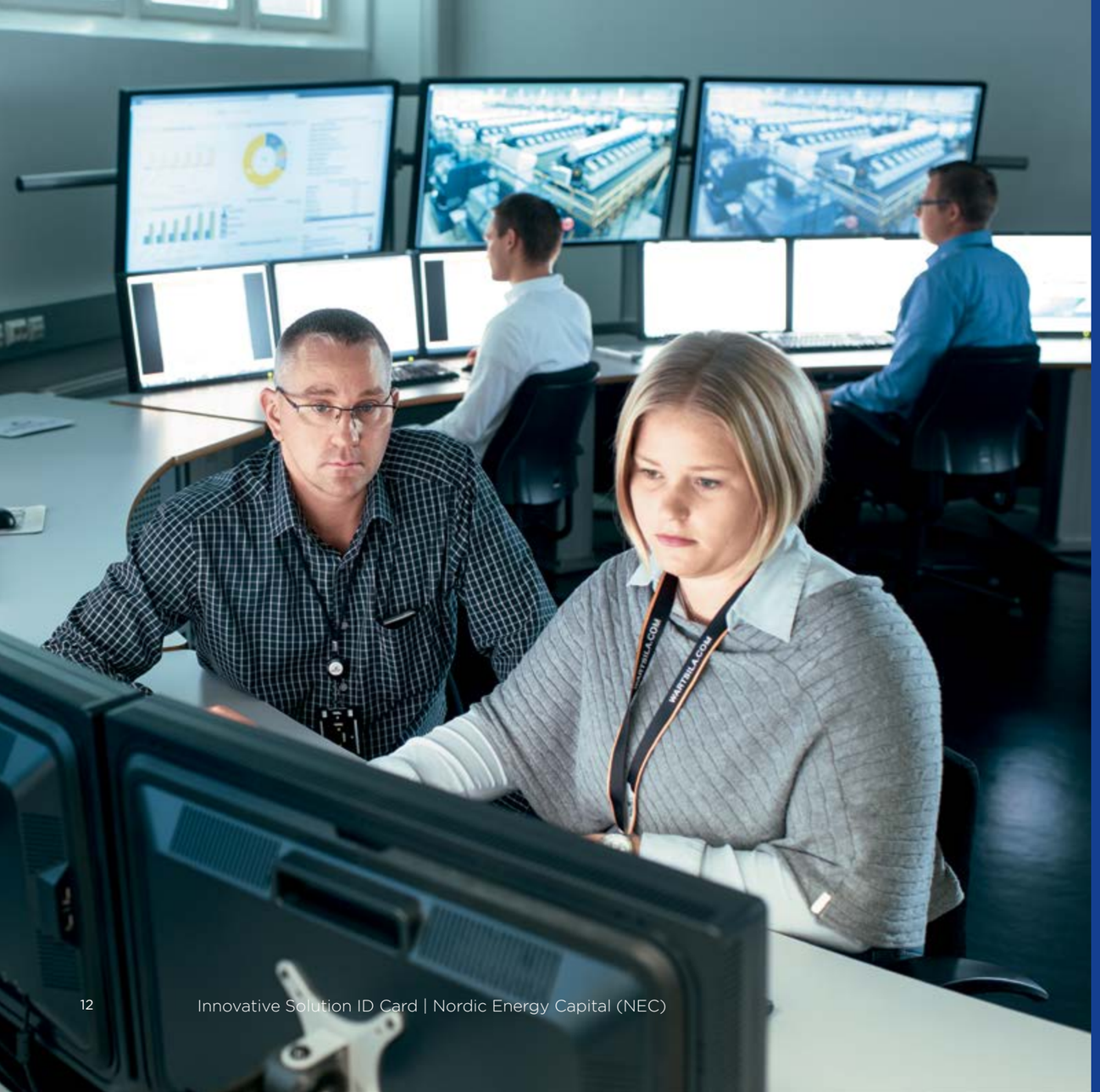
**FOR THE CITY OF VAASA**, NEC is a practical instrument to support its goal of becoming carbon neutral before 2030 and to strengthen its strategic positioning as the "Nordic Energy Capital."

In this context, the project marks another important step building on an existing trajectory, with a proven track record of innovation, expertise and multi-stakeholder collaboration. Vaasa has been evolving into a hub of energy system integration, flexible power technologies, and industrial know-how for decades, as characterised by the creation of the EnergyVaasa cluster.  The cluster has significant ambitions to address diverse policy challenges around sustainable energy systems, contributing to local, national and European goals in terms of the environment, the economy and security.

The kind of urban energy transition that Vaasa seeks to deliver requires system-level change, which is where the project seeks to make its core contribution. In Vaasa, a large share of local emissions comes from heating buildings and their use of energy, and the city has identified the need to better integrate heat and electricity systems, especially as renewable energy sources such as wind continue to grow.

The project is also motivated by the need to combine technological development with social inclusion. NEC therefore links advanced energy system modelling and data integration with co-creation, awareness raising and behaviour change. This reflects the city's view that carbon neutrality cannot be achieved through infrastructure alone, but also requires citizen engagement, education and locally relevant data tools.

At the same time, the project builds on Vaasa's strong industrial ecosystem and research and development capacity. In this sense, NEC is both a local implementation and a model intended to be scalable and transferable to other European cities.






> NEC is presented not as a standalone technical project, but as part of Vaasa's wider effort to create system-level, scalable solutions for urban energy transition.

# 3. Political Leadership at the City of Vaasa

**THE NEC PROJECT IS INITIATED** and led by the City of Vaasa, which acts as Main Urban Authority and has the leading role in the project. The city is responsible for project management, implementation, coordination and integration of the innovative solution into its broader urban development and climate work.

Political leadership is expressed through the project's direct link to the city's strategic identity as the "Nordic Energy Capital" and its target of becoming carbon neutral before 2030. NEC is presented not as a standalone technical project, but as part of Vaasa's wider effort to create system-level, scalable solutions for urban energy transition.

This leadership is reinforced by the city's long-standing cooperation with local energy companies, research actors and other stakeholders – many of whom are formal partners within the EnergyVaasa cluster – , as well as by the city's participation in European policy and innovation networks. The project also supports and benefits from Vaasa's wider sustainability positioning, including its 2026 European Green Leaf title.

> In this context, NEC responds to a concrete local need: to make the urban energy system more integrated, more efficient, more data-driven and more inclusive, while also generating a model that other European cities can learn from.





# 4. Context

**VAASA IS A MEDIUM-SIZED CITY** on Finland's western coast with around 68,000 inhabitants. Despite its size, it has a strong concentration of energy-related industry, research and innovation and is widely positioned as the "Nordic Energy Capital."

The city's local context is strongly shaped by the EnergyVaasa cluster, which brings together more than 180 companies and around 13,000 employees in energy technology and related fields. The region has a long industrial history linked to ship engines, power machinery and electrical systems, and today combines industrial know-how, public support for energy innovation and higher-education institutions with strong energy-related expertise.

A key part of this context is the Vaskiluoto energy system, which includes combined heat and power production and large-scale thermal storage. The system is built on the unique Finnish Mankala model, under which multiple energy companies jointly own the energy producing company in order to benefit from electricity production at cost price. Each shareholder is obliged to pay the costs incurred by the company's operation in proportion to their ownership and is similarly entitled to the electricity produced by the company according to their ownership.

The energy producing company does not itself make a profit, but passes all costs and benefits to its owners, creating a shared incentive and increased capacity for investments in innovation. This system already provides important efficiency gains, but more analysis and system-level optimisation are needed if the city is to meet its carbon neutrality ambitions and support future sector coupling.

The city is also facing new development dynamics through the establishment of the GigaVaasa industrial park, which will create high energy demand and increase the importance of integrated energy planning, industrial symbiosis and flexible low-emission energy solutions.

In this context, NEC responds to a concrete local need: to make the urban energy system more integrated, more efficient, more data-driven and more inclusive, while also generating a model that other European cities can learn from.





> NEC is implemented through a broad local ecosystem combining public authorities, industry, academia, civil society and transfer partners.

# 5. Stakeholder Ecosystems

**VAASA'S SUSTAINABLE ENERGY ECOSYSTEM** is one of the key strengths underpinning the project. NEC is implemented through a broad local ecosystem combining public authorities, industry, academia, civil society and transfer partners. The City of Vaasa leads the project and provides strategic direction as Main Urban Authority.

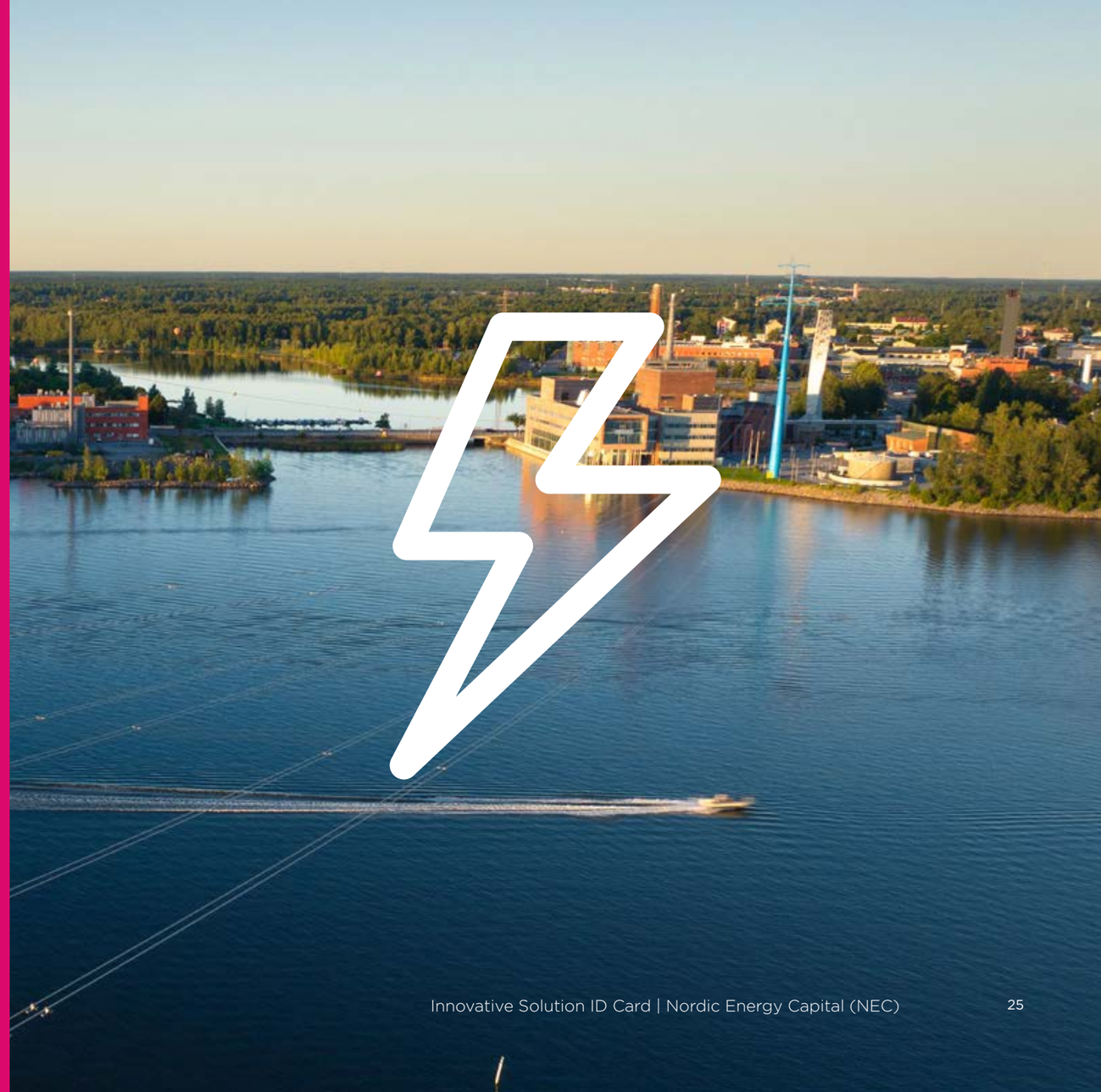
The delivery partners are Oy Merinova Ab, University of Vaasa, EPV Energy, Vaasa Electricity, and Vaasa 4H Association. Together they bring business engagement, research and development capacity, energy infrastructure expertise, operational data, communication capacity, and pedagogical and community engagement know-how.

Merinova, which manages the EnergyVaasa cluster, leads communication, capitalisation and transfer activities and connects the project to a wider network of more than 160 energy-related companies and stakeholders. The University of Vaasa leads the scientific and technical work related to modelling, monitoring and evaluation. EPV Energy and Vaasa Electricity provide infrastructure, operational expertise and data for the digital twin and energy modelling. Vaasa 4H Association is part of the City of Vaasa led citizen co-creation and energy education activities, especially with children and youth.

Stakeholder involvement extends beyond the formal consortium to include residents, schools, youth, immigrants, property owners, housing actors, and the wider EnergyVaasa ecosystem. The project also involves three transfer partners: Umeå, Alcalá de Guadaíra and Fyli which follow the project, test transferability and develop local replication feasibility studies.

“NEC combines digital, green and social dimensions within one urban energy transition model.”





# 6. Digital, green and just aspects of the innovative actions

**NEC COMBINES DIGITAL, GREEN AND SOCIAL DIMENSIONS** within one urban energy transition model.

The digital dimension is central to the project. NEC develops a digital twin of the Vaskiluoto energy system, an AI-based urban energy efficiency model, and an interactive online portal. It also integrates ground data, drone and satellite imagery, building-level data and IoT sensor data into shared digital systems and tools for analysis, monitoring and decision-making.

The green dimension is reflected in the project's focus on improving energy efficiency, supporting renewable energy integration and enabling smarter use of heat and electricity systems – ultimately aiming to reduce greenhouse gas emissions as well as saving costs. Specific focus areas include smart and clean thermal energy, high-temperature heat pump pilots, detection of heat losses and optimisation of urban energy performance.

The just dimension is addressed through inclusive co-creation and education. NEC involves schools, children, property owners, tenants, immigrants and other local groups in shaping the portal and data model, exploring energy data, and identifying potential energy savings. In this way, the project links technical innovation with awareness raising, behaviour change and broader participation in the transition.





> The project does not depend on exceptional legal arrangements.

# 7. Regulatory Frameworks

**NEC OPERATES WITHIN** existing Finnish and European legal and regulatory frameworks related to public procurement, energy systems, digital services, data protection and public administration. All project activities are implemented under standard legal and administrative procedures applicable to the City of Vaasa and the project partners.

Energy-related activities are consistent with wider policy and regulatory frameworks supporting renewable energy, energy efficiency, energy self-sufficiency and the digital green transition. The project is also aligned with EU-level priorities under the European Green Deal, REPowerEU and Cohesion Policy.

Data collection, integration and publication are carried out under established GDPR and data management procedures. Open science practices, FAIR principles and structured data governance are embedded in the project, especially through the work of the City of Vaasa, the responsible partner who led the creation and signing of the Joint Controller Agreement and a (joint) Privacy Notice by all project partners.

The project does not depend on exceptional legal arrangements. Instead, it integrates innovative tools such as digital twins, IoT sensors and satellite-based data analysis into existing governance, technical and educational structures.

> NEC is implemented through a structured governance model led by the City of Vaasa.





# 8. Management and governance of the innovative solution

**NEC IS IMPLEMENTED THROUGH A STRUCTURED GOVERNANCE MODEL** led by the City of Vaasa. The city is responsible for project management, strategic oversight, financial management, procurement and legal procedures. These responsibilities are organised through Work Package 2, which establishes the project management structures and governance framework for the whole implementation phase.

The project is organised through a set of clearly defined work packages: management, monitoring and evaluation, communication and capitalisation, digital twin development, space data for energy efficiency, data co-exploration with citizens, transfer, and closure. Each work package has a designated lead and contributing partners.

The University of Vaasa leads monitoring and evaluation and the two main technical work packages on the digital twin and the energy efficiency model. Merinova leads communication, capitalisation and contributes to transfer. The City of Vaasa leads the citizen co-creation work package and the overall transfer process. EPV Energy and Vaasa Electricity provide technical infrastructure, data and operational input. Vaasa 4H Association supports pedagogical and community engagement activities.

The governance model also includes a Steering Group, project handbook, monitoring plan, risk register, shared coordination tools (including automated deadline reminders) and regular coordination meetings. These arrangements are designed to support quality control, adaptive management and effective coordination across technical, social and transfer-related activities.





> NEC mobilises a broad mix of human, technical, infrastructural and financial resources through the City of Vaasa and its partner consortium.

# 9. Resources available

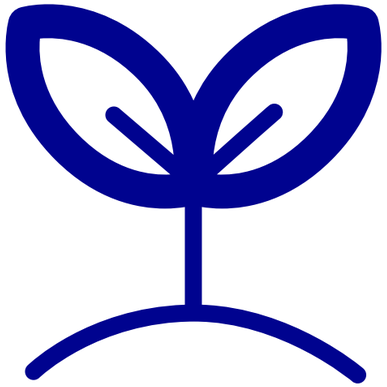
**NEC MOBILISES A BROAD MIX** of human, technical, infrastructural and financial resources through the City of Vaasa and its partner consortium.

The total project budget is 5.39 million EUR (with 80% ERDF co-financing).

Human resources include municipal project management, university researchers, communication and transfer staff, technical personnel from the energy companies, and pedagogical and engagement staff from Vaasa 4H Association.

Technical and infrastructural resources include the Vaskiluoto energy system, the IoT-TICKET platform, digital modelling tools, energy data systems, LoRa-based IoT sensors installed in selected buildings, and energy displays and related devices in public and residential buildings.

The project also benefits from the wider EnergyVaasa ecosystem and the participation of local stakeholders, residents, schools, youth and immigrants, which support both implementation and co-creation.



“NEC is designed so that its main outputs remain in use after the end of the project.”



# 10. Sustainability of the innovative solution at the City of Vaasa

NEC mobilises a broad mix of human, technical, infrastructural and financial resources through the City of Vaasa and its partner consortium.

The total project budget is 5.39 million EUR (with 80% ERDF co-financing).

Human resources include municipal project management, university researchers, communication and transfer staff, technical personnel from the energy companies, and pedagogical and engagement staff from Vaasa 4H Association.

Technical and infrastructural resources include the Vaskiluoto energy system, the IoT-TICKET platform, digital modelling tools, energy data systems, LoRa-based IoT sensors installed in selected buildings, and energy displays and related devices in public and residential buildings.

The project also benefits from the wider EnergyVaasa ecosystem and the participation of local stakeholders, residents, schools, youth and immigrants, which support both implementation and co-creation.



> Ensuring clear and practical use cases for both the digital twin and the interactive portal is essential for the long-term success and impact of the project.

# 11. Risks

**AT STRATEGIC LEVEL**, risks relate to the complexity of achieving system-level energy transition, including the integration of heat and electricity systems, the deployment of new technologies such as high-temperature heat pumps, and the need for detailed techno-economic analysis to support further decarbonisation.

Ensuring clear and practical use cases for both the digital twin and the interactive portal is essential for the long-term success and impact of the project. There is a risk that technically advanced tools may be developed but remain underused if they do not respond to real user needs, which needs to be addressed from the outset.

At implementation level, risks relate to the coordination of multiple partners, the integration of different data sources, and the effective engagement of stakeholders in co-creation activities. The project addresses these challenges through structured management arrangements, including defined work packages, monitoring and evaluation frameworks, and the use of a risk register and continuous performance monitoring.

Additional challenges concern the integration of satellite, sensor and building data into a single system and the development of predictive models and digital tools that are usable in practice. These are addressed through phased development, validation activities and close collaboration between technical partners and stakeholders.

“In this way, NEC is positioned both as a local implementation in Vaasa and as a practical European reference model for system-level, data-driven and citizen-inclusive urban energy transition.”



# Additional notes

**NEC IS STRUCTURED** around a set of transferable pillars that can support learning and replication in other cities. These include digital twin development for heat and power systems, integration of space, sensor and building data, predictive urban energy efficiency modelling, interactive portals for energy data, and inclusive citizen and education engagement.

The transfer dimension is built into the project through structured cooperation with Umeå, Alcalá de Guadaíra and Fyli. These cities represent different urban, climatic and socio-economic contexts and will use NEC's methods and results to develop replication feasibility and opportunity studies adapted to their own local settings.

In this way, NEC is positioned both as a local implementation in Vaasa and as a practical European reference model for system-level, data-driven and citizen-inclusive urban energy transition.

EUROPEAN URBAN INITIATIVE

Co-funded by the European Union

VAASA. VASA.

Vaasan yliopisto

EPV

VAASA SÄHKÖ

MERINOVA TECHNOLOGY CENTRE

4H

Innovative Solution ID Card

# Nordic Energy Capital (NEC)

VAASA.
VASA.