European Commission

Clean energy for EU islands: Guidelines for Net-zero Entrepreneurial Zones in Pašman and Tkon

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Guidelines for Net-Zero Entrepreneurial Zones
in Pašman and Tkon

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Abbreviations

BAS	Building automation system
DHW	Domestic hot water
DR	Demand response
EE	Energy efficiency
ESS	Energy storage system
EV	Electric vehicle
EZ	Entrepreneurial zone
HVAC	Heating, ventilation, and air conditioning
HRV	Heat recovery ventilation
kW	Kilowatt
kWh	Kilowatt hour
kWp	Kilowatt peak
LED	Light-emitting diode
nZEB	Nearly zero-energy buildings
PV	Photovoltaic
RE	Renewable energy
SEZ	Special Economic Zone

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Executive Summary

The municipalities of Pašman and Tkon, located on the Croatian island of Pašman, are initiating efforts to develop net-zero entrepreneurial zones. The goal of these initiatives is to promote sustainable business and construction practices as well as economic growth, while integrating renewable energy sources, energy-efficient building designs, and low-carbon transportation systems. Although both municipalities aim to make these zones models of sustainability, balancing economic expansion with environmental stewardship, the development models differ for each. In Pašman, project developers will acquire land directly from the municipality, whereas in Tkon, land acquisition is facilitated through private ownership. The Pašman entrepreneurial zone will cover an area of 2.8 Ha, while the one in Tkon will cover 2.36 Ha.

This feasibility study assesses the optimal approaches for creating net-zero economic zones in Pašman and Tkon, including the identification of key strategies for reducing carbon emissions, optimising energy consumption, and implementing renewable energy solutions across the zones.

The study provides the following recommendations:

1. **Adopt an integrated planning approach**
   Ensure urban planning incorporates sustainability across energy, buildings, transportation, and space management. Along with key net-zero strategies, such as energy-efficient buildings, sustainable mobility and on-site renewable energy generation, consider issues related to soil permeability, heat island effect, the well-being of workers and occupants, etc.
2. **Use procurement requirements aligned with objectives**
   Consider procurement policies that prioritise energy efficiency, sustainable materials, and certified building practices (e.g., EDGE Advanced certification). For instance, include provisions within requests for proposals for developers and contractors to commit to net-zero energy goals, specifically regarding zero-energy buildings and renewable energy.
3. **Require nearly-zero energy buildings (nZEB)**
   Require that all buildings included in the economic zones be designed according to Croatia's "Guidelines for Nearly Zero-Energy Buildings" to maximise energy efficiency of buildings, minimise primary energy needs and reduce reliance on the main electricity grid.
4. **Maximise the use of renewable energy and optimise electricity demand**
   Optimise the use of rooftop and parking lot carport solar PV systems, incorporate energy storage, and collaborate with local utilities for grid integration. Optimise electricity demand within the economic zones to maximise the use of on-site renewable generation by promoting the implementation of building automation systems (BAS), demand response technologies and strategies, as well as energy monitoring and management systems.
5. **Find all available funding sources, both at the national and EU level**
   Assign dedicated resources, either within municipalities or local consultants, to identify and monitor funding opportunities like EU Green Deal grants, Horizon Europe, or national recovery plans to support the development of net-zero economic zones.
6. **Offer financial and non-financial incentives**
   Offer financial incentives, such as tax breaks, reduced permit fees, subsidies, or access to low-interest capital, for energy efficiency measures that exceed existing requirements, as well as for on-site renewable energy generation and demand optimisation strategies. Include non-financial incentives such as expedited permits or technical support.
7. **Promote community engagement and awareness**

Actively involve residents and businesses through public forums, awareness campaigns, workshops, and digital platforms to ensure the zones align with local needs. Educate stakeholders on the benefits of net-zero initiatives to foster buy-in.

8. **Integrated mobility solutions**
   Prioritise public transit, cycling, and pedestrian-friendly infrastructure to reduce vehicle emissions. Include provisions for electric vehicle (EV) charging stations and shared mobility hubs.
9. **Workforce training and capacity building**
   Invest in training programs for building designers, developers, contractors and workers focused on energy-efficient building practices, renewable energy technologies, and optimal building operation to help support a skilled local workforce.

1. Introduction

The municipalities of Pašman and Tkon, on the Croatian island of Pašman, are initiating efforts to develop net-zero entrepreneurial zones. The goal of these initiatives is to promote sustainable business and construction practices as well as economic growth, while integrating renewable energy sources, energy-efficient building designs, and low-carbon transportation systems. Although both municipalities aim to make these zones models of sustainability, balancing economic expansion with environmental stewardship, the development models differ for each. In Pašman, project developers will acquire land directly from the municipality, whereas in Tkon, land acquisition is facilitated through private ownership.

The primary objective of this feasibility study is to assess the optimal approaches for creating net-zero economic zones in Pašman and Tkon. This includes the identification of key strategies for reducing carbon emissions, optimising energy consumption, and implementing renewable energy solutions across the zones. The study aims to evaluate the technical, financial, and logistical aspects of integrating sustainable practices in these zones, taking into account local conditions, infrastructure requirements, and potential regulatory challenges. Additionally, the study explores the potential for fostering public-private partnerships and securing the necessary funding to support the development of these zones.

Key outcomes for this feasibility study include a set of recommendations for the design and implementation of zero-energy buildings, strategies for maximising on-site renewable energy generation, and sustainable mobility solutions. The study also outlines the financial implications of the proposed initiatives, including potential costs and benefits, possible funding sources, and incentive structures. Furthermore, the study offers a framework for stakeholder engagement, ensuring that both businesses and residents are actively involved in the planning and development process.

2. Entrepreneurial Zones

The municipalities of Pašman and Tkon are currently planning the development of two new entrepreneurial zones (EZ) to promote business growth and economic development on the island with the aim of creating an appealing and sustainable investment environment for companies. More specifically, the EZs will focus on economic activities such as artisan and crafts workshops, small production facilities and office buildings, and they will aim to achieve net-zero greenhouse gas emissions. Such zones aim to balance economic growth with environmental sustainability by implementing strategies such as renewable energy adoption, a focus on energy efficiency, and carbon emissions reduction initiatives. The Pašman EZ will cover an area of 2.8 Ha, while the one in Tkon will cover 2.36 Ha.

2.1. Net-Zero Entrepreneurial Zone Principles

To achieve the net-zero goals for the new EZs in Pašman and Tkon, planning efforts will need to follow an integrated approach to sustainability. Although designing energy-efficient buildings and incorporating renewable energy sources are crucial aspects to the development of these EZ, a holistic approach is required to address all aspects of environmental impact and resource use across the entire zones and to create lasting benefits that support economic resilience and environmental responsibility. Key focus areas for this integrated development approach, based on best practices, include:

→ **Using an integrated planning approach:** An integrated approach increases overall efficiency of the economic zone, reduces costs, and ensures that every system within the EZ —energy, buildings, mobility—works in harmony.
  - **Sustainable mobility:** Efficient, low-carbon transportation options are essential for reducing emissions and supporting a sustainable zone.
  - **Reducing the heat island effect:** By mitigating heat islands, the zone can reduce overall cooling demand, enhance air quality, and create a more comfortable environment for residents and workers.
  - **Collaboration among EZ stakeholders:** Achieving net-zero goals requires strong partnerships among businesses, government bodies, residents, and organisations within and around the EZs.
  - **Well-being of workers in the EZ**: Prioritising the health and well-being of people working within the EZs fosters a productive and resilient economy.
  - **Procurement Best Practices:** Key criteria for selecting builders and projects in net-zero EZ should include certifications such as EDGE Advanced, LEED, or BREEAM[1], which ensure high standards in energy efficiency, water conservation, and materials use.
  - **Shared waste and wastewater management:** Centralised, shared systems for waste and wastewater treatment offer economies of scale and environmental benefits. By treating and recycling water on-site or reusing waste streams as resources (e.g., converting organic waste into biogas), the zones can conserve resources, reduce pollution, and support circularity goals.

→ **Energy Components:**
  - Energy efficiency and energy conservation behaviour
  - Maximising on-site renewable energy production
  - Optimisation of energy demand through building automation, demand response technologies and energy monitoring and management
  - Decarbonised heating and cooling systems

→ **Zero-energy buildings:** Buildings should be designed to produce as much energy as they consume, achieving a net-zero energy status. This involves using passive design principles (high-efficiency envelopes), high-efficiency systems, and maximising on-site solar PV generation (on rooftops, in parking lots, etc.). By reducing overall energy demand in buildings and supplying what is needed from renewable sources, zero-energy buildings will significantly contribute to the net-zero targets of the overall EZs. More details on zero-energy buildings are presented in Section 3.3.

While most of the considerations above can apply to both EZs, some may only apply to one of the zones, given their different contexts (e.g. public or private land ownership, different sizes or geographies of the zones, etc.). Notes to that effect are included in Section 3.

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[1] The Edge Advanced certification (Edge Certification Level 2) focuses on improving energy, water and material efficiency. See https://edgebuildings.com/certify/certification/.
The LEED certification (Leadership in Energy and Environmental Design) is a widely used green building rating system. See https://www.gbci.org/#leed and https://www.usgbc.org/leed.
The BREEAM certification (Building Research Establishment Environmental Assessment Methodology) assesses the sustainability of buildings based on several categories. See https://bregroup.com/products/breeam.

2.2. Examples of Net-zero Entrepreneurial Zones and Climate-neutral Island Initiatives

2.2.1. Trakia Economic Zone in Bulgaria

The Trakia Economic Zone (TEZ) in Bulgaria is a private-public partnership for one of the largest industrial zones in Eastern Europe, which includes cooperation with municipalities. The economic zone aims to become carbon neutral by 2040[2,3].

→ Renewable Energy Integration: TEZ is expanding its renewable energy capacity by constructing two additional solar power plants with capacities of 20 MW and 5 MW. Currently, 25% of companies within the zone utilise energy from rooftop solar installations.
→ Innovative Heating and Cooling Solutions: Schneider Electric, a company operating within TEZ, has implemented Bulgaria's first geothermal installation to meet its heating and cooling requirements, showcasing a commitment to sustainable energy practices.
→ Green Hydrogen and Biomethane Projects: In collaboration with Citygas Bulgaria, TEZ is investing over EUR 20 million in the production of green hydrogen and biomethane, aiming to diversify energy sources and reduce carbon emissions.
→ Comprehensive Sustainability Charter: In May 2023, TEZ introduced its Carbon Neutrality and Sustainability Charter, endorsed by 22 companies. The charter encompasses 12 components, including supply logistics optimisation, e-mobility innovations, professional education, digitalisation, social responsibility, efficient use of local resources, and technology transfer.
→ Water Resource Management: A significant initiative involves eliminating the use of potable water for industrial purposes. TEZ is collaborating with the local water supply operator to develop sustainable solutions for industrial water needs.

Relevant Considerations for Tkon and Pasman

→ **Net-zero Goals**
  - Localised Renewable Projects: Tailoring photovoltaic energy to local demand is replicable in both zones.
  - Circular Resource Management: Introducing recycling and reuse initiatives for industrial byproducts can align with net-zero goals.
  - Collaboration with Eco-Innovators: Partnerships with green technology companies to co-develop solutions like hydrogen or battery storage can accelerate progress.

→ **Challenges:**
  - Lack of Expertise: Both zones may face similar issues with limited local expertise in climate-focused fields, especially in Tkon, where private land ownership could fragment efforts.
  - Funding Gaps: Like TEZ, initiatives in Tkon and Pasman may rely heavily on private funding, with municipal or EU support filling key gaps.

→ **Solutions:**
  - Public-Private Partnerships (PPPs): TEZ's success with PPPs suggests that Pasman, with municipally owned land, could prioritise partnerships to fund and manage green initiatives.
  - Skills Development: Establishing vocational training centres, as done in Rakovski, could upskill workers and attract green industries in both zones.

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[2] https://balkangreenenergynews.com/trakia-economic-zone-in-bulgaria-aims-to-become-carbon-neutral-by-2040/
[3] https://www.europarl.europa.eu/RegData/etudes/STUD/2022/699628/IPOL_STU(2022)699628_EN.pdf

- Tailored Renewable Energy Projects: Tkon and Pasman can learn from TEZ's use of photovoltaic plants and local renewable generation tailored to business needs.

→ **Lessons Learned:**
- Long-Term Planning: Both zones should adopt measurable, phased climate goals (e.g., renewable energy targets like TEZ's 40% by 2025).
- Investor Attraction: Highlight eco-friendly infrastructure and low-carbon policies to appeal to sustainability-conscious businesses, as TEZ has successfully done.
- Municipal Support: Strong municipal backing for infrastructure and permitting is critical, especially for Pasman, where the municipality owns the land.

2.2.2. Special Economic Zones in Latvia, Lithuania, Poland and the Canary Islands

Latvian Special Economic Zones[4]

→ **Overview:** Latvia has five Special Economic Zones (SEZs), including Riga Free Port, Ventspils Free Port, and zones in Liepāja, Rēzekne, and Latgale. These zones aim to attract investment, develop infrastructure, create jobs, and promote exports.

→ **Incentives:** Up to 80% corporate tax rebates, with 100% property tax reductions in Rēzekne and Latgale. Salary rebates are available in these two zones.

→ **Focus Areas:** Coastal zones prioritise trade, logistics, and manufacturing, while inland zones focus on wood processing, food production, and metalworking.

→ **Challenges:** Infrastructure gaps and competition from neighbouring SEZs limit their effectiveness. Recommendations include infrastructure investments and enhanced incentives.

Lithuanian Free Economic Zones (FEZs)4

→ **Overview:** Lithuania's seven FEZs, including those in Kaunas and Klaipėda, focus on regional industrial growth and employment. Klaipėda emphasises plastics, renewables, and the automotive industries.

→ **Governance:** Managed by private zone management companies through public tenders, supported by EU and state funds.

→ **Incentives:** 0% corporate tax for 10 years, followed by a 7.5% rate for six years, plus 0% property and dividend taxes.

→ **Impact:** Klaipėda and Kaunas attract the most investments, contributing €740 million in value-added benefits from 2002–2017. Expanding plots and infrastructure are recommended for growth.

Polish Special Economic Zones4

→ **Overview:** Poland's 14 SEZs were established to boost investment and reduce unemployment, especially in poorer regions. A 2018 law expanded SEZ incentives nationwide.

→ **Incentives:** Tax exemptions (corporate, personal, and real estate), state aid covering 25–70% of investments, with more support in high-unemployment areas.

→ **Economic Impact:** SEZs attracted €20 billion in investments by 2012 and created 16,000 jobs in 2017. Regions with SEZs show higher productivity and employment spillovers.

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[4] POLICY BRIEF - European Special Economic Zones.
https://archive.espon.eu/sites/default/files/attachments/Policy%20Brief%20SEZ%20corr%2003-12.pdf

→ **Challenges:** Some studies show regional economic disparity and limited investment outside SEZs. SEZs are considered among the most effective globally.

Canary Islands Special Economic Zone4

→ **Overview:** Established in 2000 to support economic development through special fiscal policies for its isolated geography.

→ **Incentives:** 4% corporate tax rate (Spain's is 25%), exemptions on property transfer taxes, dividend taxes, and capital gains taxes, requiring a €50,000 investment and three jobs.

→ **Economic Impact:** SEZ companies represent 0.5% of businesses but account for 2.7% of turnover and 1.9% of wages in the region, with higher productivity and wages than local firms.

→ **Investment Efficiency:** SEZ investments generate more jobs per euro of public funding than other public programs in the Canary Islands.

Relevant Considerations from the Economic Zones in Latvia, Lithuania, Poland and the Canary Islands

→ **Territorial Coverage:** In Pasman, the municipality's direct control aligns with the recommendation for centralised administration, enabling clear land-use planning and regional promotion. Tkon could benefit from a clear framework for privately owned plots to ensure consistency.

→ **Governance:** Tkon may consider a public-private collaboration model to streamline negotiations with private landowners. Pasman could adopt blended governance for greater flexibility with municipal-owned land.

→ **Differentiated Incentives:** Both municipalities can align incentives with local priorities, such as larger tax breaks for underdeveloped zones or employment-based rebates to attract businesses.

→ **Economic Assessments:** Pasman and Tkon should conduct economic impact assessments tailored to their unique land acquisition processes to ensure effective resource allocation and investment attraction strategies.

- Identify gaps in infrastructure (e.g., transport, utilities) that could influence investor interest and prioritise their development within the economic zones.
- Assess which industries are likely to benefit most from the EZ incentives and their capacity to generate jobs and exports.

3. Key Technical Elements of Pasman and Tkon Net-zero Entrepreneurial Zones

This section provides more details on the key elements that the municipalities of Pašman and Tkon should consider for the net-zero EZ. While most of the considerations below can apply to both EZ, some may only apply to one of the two zones, given their different contexts (e.g. public or private land ownership, size of the zones, etc.). Notes to that effect are added below, where relevant.

3.1. Integrated Planning Component

Designing a net-zero EZ requires that municipalities look far beyond the energy performance and GHG emissions of individual elements within the zone. For instance, while net-zero buildings are important, all elements of the zone – energy, buildings, mobility, water, and waste management – should be considered holistically and planned using an integrated approach. An integrated approach ensures that every component within the economic zones works in harmony. By viewing these components as interconnected rather than isolated, planners can design a zone that optimises resource and energy use, reduces emissions, and maximises overall efficiency. The following subsections provide details on some strategies for consideration during the planning phase.

3.1.1. Soil Permeability

Maintaining soil permeability is essential in the planning of sustainable urban areas, such as EZ, to reduce the impact caused by urbanisation on nature. Soil permeability allows rainwater to naturally infiltrate the ground, replenishing groundwater supplies and reducing surface runoff that can lead to flooding. Permeable soils also help filter pollutants, improving water quality and supporting healthier ecosystems. In urbanised areas, impermeable surfaces like concrete and asphalt can exacerbate flooding and water contamination, while also contributing to the urban heat island effect.

To achieve greater soil permeability, planners can incorporate permeable paving materials for roads, walkways, and parking areas that allow water to seep through to the underlying soil. Examples of such materials include porous brick, stone aggregates, open-joint bricks, etc. Green infrastructure solutions, such as rain gardens, bioswales, and green roofs, can further manage stormwater while adding greenery and habitat to the zone. Additionally, preserving natural vegetation and open green spaces minimises surface hardening, ensuring that a portion of the land remains permeable and supports both environmental and community well-being.

3.1.2. Heat Island Effect

The heat island effect is a phenomenon whereby some urban areas become significantly warmer than their surrounding rural areas, primarily due to human activities and infrastructure. This effect occurs because typical building materials like asphalt, concrete, and brick absorb and retain heat from the sun and slowly release it into the surroundings, thereby raising local temperatures. This heat re-emitting phenomenon happens significantly more so in urban areas than in natural landscapes such as forests and water bodies. Limited urban green spaces and vegetation reduce natural cooling from plants and soil, further intensifying heat. Common causes include dense road networks, expansive parking lots, and large rooftops, all of which absorb and re-emit heat. Additionally, waste heat from vehicles, factories, and air conditioning units contributes to higher temperatures, which creates a feedback loop that increases energy demand for cooling. Reducing the heat island effect can reduce overall cooling demand, enhance air quality, and create a more comfortable environment for residents and workers. To reduce the heat island effect within the economic zones, planners can integrate several practical strategies:

- → **Incorporate Green Roofs and Walls**: Adding vegetation to rooftops and building walls provides natural insulation, reduces heat absorption, and cools the surrounding air. Green roofs also help manage stormwater and improve air quality.
- → **Use Cool or Reflective Roofing Materials**: Opt for “cool” roofing materials that reflect more sunlight and absorb less heat than standard options. Light-colored or reflective materials reduce the amount of heat buildings retain, lowering cooling costs and ambient temperatures.
- → **Increase Urban Green Spaces**: Planting trees, creating parks, and installing landscaped areas help cool the air through shade and evapotranspiration. These spaces offer natural cooling, reduce energy demand, and improve the quality of life for residents and workers.

- → **Use Permeable Pavements**: Permeable pavements, such as porous asphalt, permeable concrete, or grass pavers, reduce heat absorption and allow rainwater to infiltrate the soil, helping to cool the surface and prevent excessive runoff.
- → **Install Shade Structures**: Constructing shade structures over walkways, bike lanes, and parking areas, or using canopies with reflective or green materials, reduces sun exposure on paved surfaces and keeps areas cooler.
- → **Promote Tree-Lined Streets**: Planting trees along roads and pathways provides natural shade, lowers surface temperatures, and helps counteract the heat generated by roads and vehicles. Trees also improve air quality and create a more pleasant environment for pedestrians.

3.1.3. Sustainable Mobility

Efficient, low-carbon transportation options are essential for reducing emissions and supporting a sustainable zone. Plans should prioritise low-emission public transit, car-pooling and electric vehicles (EV).

- → **Electric Buses or Shuttles:** Establishing a small fleet of electric shuttle buses that connect residential areas and the EZ would provide a reliable, low-emission transit option. These could operate on a loop or as on-demand services.
- → **Electric Vehicle (EV) Infrastructure:** Installing EV charging stations at key points within the EZ will encourage the use of electric vehicles. Chargers could be located at a few central points within the zones and could incorporate roofs to allow solar panel-powered charging, thus further reducing the zone's carbon footprint.
- → **Car-Pooling** among workers should also be encouraged by companies established within the EZs.

3.1.4. Collaboration Among Economic Zone Stakeholders

Two other key elements for a successful integrated planning include raising community awareness and fostering a strong culture of collaboration among businesses, government bodies, residents, and organisations within and around the EZ. Improving awareness and engagement can contribute to achieving a community-wide commitment to sustainability goals, while collaboration can be useful in addressing challenges like resource allocation, regulation, and public awareness.

Community Awareness

Adequate community education and awareness are essential for the success of the net-zero economic zones in Tkon and Pašman. A well-informed community can actively participate in sustainability initiatives, adopt energy-saving behaviours, and support municipal policies aimed at reducing emissions.

Key strategies include public workshops and educational campaigns to teach residents and businesses about energy efficiency, waste reduction, and renewable energy. Schools can incorporate sustainability topics into curricula, while digital platforms and social media can be used to share best practices and interactive tools like carbon footprint calculators.

Municipalities can also launch "Sustainability Ambassadors" programs, where local leaders, business owners or members of the public, showcase successful sustainability efforts. Fostering a culture of awareness and engagement in Tkon and Pasman can ensure long-term commitment to their net-zero goals.

Engaging the Community

Engaging local communities early in the planning process ensures that the economic zones reflect the needs, values, and priorities of Tkon and Pašman's residents and stakeholders. By involving community members in decision-making and gathering input on design, services, and amenities, municipalities can build trust, encourage buy-in, and create spaces that align with local aspirations. Several strategies can be leveraged to engage the community from the start of the planning:

→ **Public Workshops and Fora**: Host interactive workshops and fora to gather input from the community, share project updates, and discuss concerns. These events can be held both in-person and online to reach a wider audience, allowing residents to voice their priorities and offer feedback on design elements, sustainability initiatives, and services.

→ **Surveys and Polls:** Conduct surveys or polls, either online or distributed through local organisations, to gather residents' opinions on specific aspects of the zone's development. Surveys can capture preferences on transit options, green space, energy solutions, and other community needs, helping planners tailor their approach.

→ **Participatory Budgeting:** Invite community members to take part in budget allocation decisions for aspects of the project, such as green spaces, renewable energy installations, or public amenities. This empowers residents to directly influence how funds are spent, enhancing transparency and building trust.

→ **Online Platforms and Social Media:** Use dedicated online platforms, websites, and social media to provide continuous updates, facilitate dialogue, and invite feedback. Platforms like community forums, social media groups, or project-specific apps can engage people who may not attend in-person events but still want to contribute.

→ **Collaborative Design Sessions (Charrettes):** Organise design charrettes where community members work alongside architects, urban planners, and developers to co-create design elements. These sessions give residents direct input on details such as building layouts, green space locations, and transportation routes.

Collaboration Among Businesses within the Entrepreneurial Zone

Collaboration among businesses within the EZs is essential for maximising resource efficiency and reducing collective emissions, and can help significantly reduce costs for everyone. This collaboration also reduces risk for businesses and improves the economic sustainability of the project. Some collaborative strategies that companies can use include:

→ **Share Energy Resources:** The portion of solar energy that comes from rooftop panels can be shared among buildings when excess energy is produced, and waste heat energy produced by a building can be used as input by others (for space heating, water heating, or other process needs).

→ **Share Facilities:** Companies can choose to have shared data centres to host their computer servers, and shared showers to encourage cycling transit. They can also combine efforts to offer workers break rooms, cafes and lunch areas, gyms and sports facilities, children's daycare centres, etc.

→ **Collaborate on transportation and logistics to minimise environmental impact**: Companies can combine shipping and coordinate shuttles for workers.

3.1.5. Well-being of Workers

The planning of the EZs should not only consider the environmental aspect of sustainability principles but also include the human well-being aspect. Prioritising the health and well-being of people working within the EZs fosters a productive and resilient economy. Key considerations include:

- → Elements of building design, such as good indoor air quality, access to natural light, and ergonomic design.
- → Zone-level elements such as green spaces, wellness spaces, walking paths, and access to sustainable transit options also support physical and mental health.

3.1.6. Procurement Best Practices

To ensure the initial intentions and goals for the net-zero EZ are carried over throughout the project phases and ultimately implemented properly, it is crucial to establish strict procurement criteria when selecting designers, contractors and suppliers. Key criteria for selecting builders and projects in net-zero EZs should include certifications such as EDGE Advanced, LEED, or BREEAM, which ensure high standards in energy efficiency, water conservation, and materials use. Procurement should also emphasise builders with a strong track record in green construction, use of low-carbon materials, and experience with renewable energy integration. Additionally, contracting practices that require lifecycle analysis (LCA) of materials and carbon footprint assessments for projects can help ensure that selected projects align with net-zero goals.

3.2. Energy Component

Minimising energy consumption and maximising on-site production of renewable energy are essential in developing a net-zero EZ. Key strategies to consider are detailed in the following subsections.

3.2.1. Energy Efficiency and Behaviour

- → **Energy Efficiency is Crucial:** Energy efficiency, also called energy conservation, is often considered a "first fuel" in sustainable planning, as it is the most effective way to reduce overall energy demand. Energy efficiency is a very cost-effective way to reduce energy needs and should be kept in mind at all stages of planning and design of the EZ, as well as its buildings and infrastructure. By lowering energy requirements across buildings (envelope, heating and cooling, etc.) and infrastructure (street lighting), and systems, the EZ can achieve its net-zero goals more effectively, and businesses within the zone can reduce operational costs over time.
- → **High-efficiency Street Lighting**: Selecting high-efficiency LED and smart street lighting systems that adjust based on occupancy (e.g. dimming during off-peak hours) and ambient light levels can help reduce the energy needs of the EZ.
- → **Decarbonised heating and cooling systems: Heating and cooling represent the most significant share of buildings' energy demand, making decarbonising** these systems a priority in achieving net-zero goals. Adopting energy-efficient solutions like heat pumps, district heating and cooling networks, or waste heat recovery can significantly reduce greenhouse gas emissions associated with heating and cooling systems. Heat pumps, for instance, use ambient air or ground heat to efficiently provide heating in the winter and cooling in the summer, dramatically cutting down on fossil fuel consumption. Additionally, systems that recover and redistribute waste heat from industrial processes or

commercial buildings can further enhance efficiency, creating a low carbon, integrated thermal network.

→ **Promoting a Culture of Energy Conservation:** By promoting energy-efficient practices as a core principle, the EZ can foster a culture of energy conservation which can play a critical role in reducing energy consumption. This can be achieved with several strategies:

  - Education and awareness activities such as workshops or informational campaigns can play a critical role, as the lack of knowledge on energy issues is typically among the most significant barriers to energy conservation. Digital tools could also be developed to educate businesses and building users on simple actions to reduce consumption—such as turning off lights and electronics when not in use, optimising thermostat settings, and using energy-efficient modes on appliances. Increased awareness builds long-term habits that contribute to overall energy savings.

  - Smart meters and energy management apps that show real-time energy usage data can empower users to make informed decisions and see the immediate impact of their behaviours. For example, businesses can track daily or weekly usage patterns and adjust their consumption habits to lower costs.

  - Incentive Programs: Offering rewards for conservation efforts, such as discounts on utility bills or rebates for energy-efficient upgrades, encourages ongoing engagement in energy-saving practices. Businesses and individuals are more likely to participate in conservation efforts when they see direct benefits.

  - Gamification can also be a good tool for encouraging behavioural change by making energy conservation engaging, competitive, and rewarding. Through gamification, individuals and businesses in an economic zone can be motivated to reduce their energy consumption by turning conservation into a series of “challenges” or “competitions”, making the process fun and socially engaging.

3.2.2. On-site Renewable Energy

Below are the key strategies to include to maximise on-site renewable energy resources and thereby reduce the island’s reliance on electricity imported from mainland Croatia via submarine cables.

→ **Maximising on-site solar photovoltaic (PV) systems**: Installing solar PV systems on various locations such as building rooftops, parking lot carports (which also provide shading), or open spaces can optimise generation and supply a significant portion of the zone's primary electricity needs (for buildings, street lighting, EV charging, etc.). Solar PV systems should be integrated with the main electricity grid and energy storage systems. Placement of solar panels should be considered carefully, prioritising areas with optimal sunlight exposure (minimal shading) and selecting appropriate orientation and tilt angles for the island of Pašman. In addition, solar tracking systems could be included to follow the sun’s position throughout the day and increase generation capacity by up to 25%.

→ **Energy Storage Systems (ESS):** Given the intermittent nature of solar PV generation, energy storage should be included in the planning of the economic zones. Energy storage systems like batteries, which store surplus energy for later use, maximise the benefits of on-site solar PV generation by making the system more reliable. Batteries can also help balance supply and demand and provide backup power during low production. Another advantage of batteries is their ability to reduce electricity demand from the main grid during peak periods, which are times when the grid is under the most stress. Reducing peak demand can help the government to avoid or defer significant investments for additional electricity generation. Examples of battery systems include lithium-ion battery systems for short-term storage, and options like flow batteries or large-scale community battery banks for longer duration storage for the entire zone.

3.2.3. Optimisation of Energy Demand at the Zone Level

Balancing energy supply and demand is critical in a net-zero zone. By aligning demand patterns with solar PV generation, such as using more energy-intensive systems or equipment when solar energy is abundant, the zone can make better use of intermittent solar power and reduce the share of primary energy needs supplied by the main electrical grid. This involves managing when and how much energy is used to take advantage of peak renewable production times. Some key strategies to consider include:

→ **Building Automation:** Building automation systems (BAS) enable centralised and automated control of heating, cooling, lighting, and other energy-intensive systems in buildings. These systems use sensors, real-time data, and programmed settings to automatically adjust energy use based on occupancy, weather, and time of day. For instance, automated lighting and HVAC systems can dim lights or lower heating in unoccupied rooms, and smart thermostats can reduce energy use during off-peak hours. Occupancy sensors, daylight sensors, and predictive maintenance tools all help to cut down unnecessary energy usage.

→ **Demand Response Technologies**: Demand response (DR) technologies manage and shift energy usage patterns in response to grid needs, usually by incentivising reduced demand during peak periods or times of high electricity prices. These systems respond to real-time signals from the grid or utility provider. For instance, buildings or businesses can receive notifications to temporarily lower their energy use during peak times (e.g., adjusting thermostat settings using their building automation systems, or reducing non-essential power loads). Automated DR systems can also adjust loads without human intervention, such as cycling down HVAC systems or delaying appliance operation until off-peak times. Demand response also improves the integration of renewable energy sources by acting as a complementary optimisation system.

→ **Energy Monitoring and Management Systems:** Smart energy management systems monitor and control energy consumption across the EZ. Dedicated smart meters could be installed in each building, and for other infrastructure like street lighting, car charging stations, as well as solar PV production (measured at the building level and aggregated at the zone level), enabling real-time adjustments and data-driven decisions to optimise electricity usage and identify opportunities to improve energy efficiency. A centralised energy management platform could optimise building temperatures, control lighting schedules, and manage battery storage based on real-time demand and weather forecasts.

3.2.4. Solar PV Potential

To provide guidance on the planning of on-site solar PV generation for the EZs, sample calculations were carried out for a solar PV system that would generate 30% of the primary electricity needs for an office building (single stories, 1,200 m^2 building footprint and roof area). The system specified consists of a 52 kWp[5] solar array (that would generate an estimated 67 000 kWh per year[6]). The table below provides the estimated incremental cost of the system, as well as the estimated simple payback period (calculated using an electricity cost of 0.30 EUR/kWh).

Table 1: Incremental Cost and Payback Period for a Sample Roof-top Solar PV System

Possible Measure	Estimated Energy Production for a 260 kWp Solar PV System	Estimated Cost (EUR)[7]	Typical Simple Payback period (yrs)
Solar PV Panels **(52 kWp)**	67 000 kWh	87,000	4.3
Solar PV Panels **(52 kWp)** + Batteries **(30 kW$_{dc}$/110 kWh)**		146,000	7.3

3.3. Zero-Energy Buildings Component

3.3.1. Legislative Context

The European Union's Energy Performance of Buildings Directive ("EPBD") aims to promote the improvement of the energy performance of buildings within the European Union (EU). The Directive introduces the concept of a nearly zero-energy building (nZEB). nZEB are generally defined as buildings having very low energy demand, with most of it met by onsite or nearby renewable energy sources.

According to the EPBD, EU Member States are required to ensure that as of 2021, all new buildings are nearly zero-energy buildings (2019 for new buildings used by or owned by public authorities). The directive also applies to existing buildings undergoing major renovation, to progressively upgrade the existing building stock, which is old and energy inefficient. The Directive does not determine the minimum requirements for nZEBs and leaves it to the Member States to define these requirements themselves.

The Republic of Croatia ("Croatia") enforced this directive one year earlier than required by the EU, requiring all new buildings to be nZEB as of 2020 (2018 for new buildings used by or owned by public authorities).

In the coming years, the nZEB requirement established by the EPBD will be replaced by a further enhanced 'zero-emission buildings' requirement, starting from 2028 for new buildings owned by public bodies and 2030 for all other new buildings.[8]

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[5] kWp: kilowatts-peak, which is the maximum amount of power a solar PV system can generate under ideal conditions.
[6] Estimated using the PV Watts online calculator published by the National Renewable Energy Laboratory (NREL) which is part of the US Department of Energy (DOE). Online calculator available at: https://pvwatts.nrel.gov/pvwatts.php.
[7] Costs for community solar systems (with and without energy storage) taken from: National Renewable Energy Laboratory (NREL). U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2023. https://www.nrel.gov/docs/fy23osti/87303.pdf
[8] European Commission. "Nearly-zero energy and zero-emission buildings". https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/nearly-zero-energy-and-zero-emission-buildings_en (last accessed 24.10.2024)

3.3.2. Requirements for Nearly Zero-Energy Buildings (nZEB)

In compliance with the EPBD, the Ministry of Physical Planning, Construction and State Assets of the Republic of Croatia developed "Guidelines for Nearly Zero-Energy Buildings"[9] (the "Guidelines"), which provides clear requirements for achieving this building standard. Requirements are determined based on the building type (purpose), on location (continental or coastal), and shape factor. In the context of the development of the EZs within the Tkon and Pašman municipalities, this report addresses new commercial buildings in a coastal region, with a focus on two building archetypes: office buildings and small manufacturing buildings (which fall under the "other non-residential building" archetype defined in the Guidelines).

As detailed in the Guidelines, the requirements for achieving the nZEB standard are determined based on the following factors:

- → The annual required heat energy for heating per unit area of the usable area of the heated part of the building, $Q''_{H,nd}$ [kWh/(m^2·a)],
- → The annual primary energy per unit area of the usable area of the heated part of the building, E_{prim} [kWh/(m^2·a)], which, depending on the purpose, includes energy for heating, cooling, ventilation, domestic hot water and lighting,
- → The minimum share of delivered energy supplied from renewable energy resources,
- → The air tightness requirement, which shall be demonstrated by a test on the building prior to the technical inspection of the building.

The Guidelines contain details on maximum permissible values for the annual required heating energy and primary energy, as well as minimum values for the share of energy supplied by renewable energy sources. The Guidelines also establish which building systems must be included in the calculation of the total primary energy needs of the building. Table 2 contains a summary of key nZEB requirements for the office building and small manufacturing building archetypes.

Table 2. Key nZEB Requirements for Office Buildings and Small Manufacturing Buildings

Parameter	Office Building Archetype	Small Manufacturing Archetype
Maximum permissible heating energy needs, $Q''_{H,nd}$ [kWh/(m^2·a)]	• For $f_0 \leq 0.20$* → 16.19 • For $0.20 < f_0 < 1.05$ → $11.21 + 24.89 \cdot f_0$ • $f_0 \geq 1.05$ → 37.34	• For $f_0 \leq 0.20$* → 24.84 • For $0.20 < f_0 < 1.05$ → $19.86 + 24.89 \cdot f_0$ • $f_0 \geq 1.05$ → 45.99
Maximum permissible primary energy needs, E_{prim} [kWh/(m^2·a)]	25	-
Building systems included primary energy needs	• heating and cooling systems • mechanical HVAC systems • lighting system	• heating system • mechanical HVAC systems • lighting system

[9] Ministry of Physical Planning, Construction and State Assets of the Republic of Croatia. "Guidelines or Nearly Zero-Energy Buildings - Part 1 and Part 2". 2019. https://mpgi.gov.hr/about-the-ministry-139/scope-of-the-ministry/energy-efficiency-in-the-buildings-sector/nearly-zero-energy-buildings-guidelines-nzeb/7535

Share of primary energy to be supplied by renewable energy sources	Minimum 30%
*The shape factor f_0 is defined as the ratio of the envelope area to the volume of the heated space. The more compact the building, the lower the value will be.	

3.3.3. Design Approach for Achieving the Nearly Zero-Energy Building Standard

In general, to achieve these objectives when designing nZEBs, it is necessary to coordinate all design professionals (architects, building envelope, heating, cooling and ventilation engineers, etc.) to ensure an integrated design. The key building characteristics and components that need to be considered to achieve high energy efficiency include:

- → Building characteristics:
  - Building orientation to optimise shading and passive solar gains.
  - Building shape (compactness) to limit the surface area of exterior walls exposed to the outside environment, which can heavily impact the heating and cooling needs of the building. The building shape factor is the ratio of the envelope area to the volume of the heated space. The more compact the building, the lower the value will be.
  - Optimal glazing ratio (portion of exterior walls covered with doors and windows relative to the total area of exterior walls).
- → Building components
  - Building envelope:
    - High levels of thermal insulation (U-values) of exterior walls, roofs and foundations
    - Minimal thermal bridges in exterior walls
    - Type of glazing (e.g. triple-pane windows and doors with low-emission glass)
    - Airtightness of exterior walls and roofs to minimise air leaks
  - Heating, cooling and ventilation (HVAC)
    - High efficiency heating and cooling systems (e.g. heat pumps)
    - Heat recovery ventilation (HRV)
  - High efficiency lighting (LEDs)
  - Domestic hot water supplied by efficient systems
- → On-site renewable energy generation
  - Solar energy is used to heat water
  - Electricity produced by photovoltaic (or other) systems

3.3.4. Possible EE Measures Towards Net-Zero Buildings

To identify which EE and RE measures would allow the Pašman and Tkon EZs to achieve net-zero levels of performance, two commercial building archetypes were modelled: an office building and a small manufacturing building. These energy models were built with the Edge Buildings online modelling tool, created by the International Finance Corporation. This tool allows defining key characteristics of a building (size, location, purpose, types of systems and appliances, etc.) and estimating the approximate energy consumption for that building. For each building archetype, a base case scenario was modelled first to estimate the baseline energy consumption of the building. Then, a proposed (improved) case was modelled to estimate the impact (energy savings) that would be generated by improving the energy efficiency of the building. Several energy efficiency measures were included in the proposed model to assess which ones would allow the building to reach requirements for heating energy and primary energy consumption established by the nZEB standard. The building characteristics of the two building archetypes modelled are defined in Table 3.

Table 3. Building Archetype Characteristics

Building Characteristic	**Office Building – Single Floor**	**Small Manufacturing Building**
Length	40 m	80 m
Width	30 m	40 m
Floor-to-floor height	3,5 m	6 m
Number of floors above grade	1	1
Number of floors below grade	0	0
Total height above ground	3,5 m	6 m
Floor area	1 200 m^2	3 200 m^2
Total conditioned area	1 200 m^2	3 200 m^2
Thermal envelope area	2 890 m^2	7 840 m^2
Conditioned volume	4 200 m^3	19 200 m^3
Shape factor, f_0*	0,69	0,41
*The shape factor f_0 is defined as the ratio of the envelope area to the volume of the heated space. The more compact the building, the lower the value will be.		

For both building archetypes defined above, Table 4 describes the building components for the base case and proposed case.

Table 4. Building Model Description, Base Case and Proposed Case

Building Characteristic	**Base Case**	**Proposed Case**
Window-to-wall ratio (glazing ratio)	40%	32%
Roof solar reflectance index	45 SRI	85 SRI
Exterior wall solar reflectance index	45 SRI	85 SRI
External Shading Device	-	Yes – Annual Average Shading Factor of 0.14
Roof insulation (U-value)	0.25 W/m^2·K	0.18 W/m^2·K
Ground insulation (U-value)	0.49 W/m^2·K	0.15 W/m^2·K
Exterior wall insulation (U-value)	0.30 W/m^2·K	0.20 W/m^2·K
Door/window glass insulation (U-value)	1.6 W/m^2·K	1.12 W/m^2·K
Airtightness of envelope	0.21 L/s-m^2	0.11 L/s-m^2
Cooling system	Air Cooled DX Split System	Heat pump with COP=2.78
Heating system	Gas-Fired Hot-Water Boiler (75% efficiency)	Heat pump with COP=3.7

Heat recovery ventilation	-	Heat recovery with 65% efficiency
Heating system controls	-	Yes
Domestic hot water (DHW) system	Electric water heater (100% efficiency, 80% of usage) with solar water heater (20% of usage)	Heat pump water heater (50% usage) and solar water heater (50% of usage)
Demand control ventilation	-	Yes (CO_2 sensors)
Interior lighting	Standard – 65 Lumen/Watt	High efficiency – 100 Lumen/Watt
Exterior lighting	Standard – 65 Lumen/Watt	High efficiency – 100 Lumen/Watt
Lighting controls	-	Yes

Table 5 below shows the estimated heating and primary energy needs for the base case and proposed case for each modeled archetype, along with estimated savings and NZEB requirements.

Table 5. Estimated Heating and Primary Energy Needs for the Office Building and Small Manufacturing Building Archetypes

Parameter	**Office building Single floor; Total area: 1 200 m²; Shape factor f_0=0,69**		**Small manufacturing building single floor; Total Area: 3 200 m²; Shape factor f_0=0,41**	
	Specific Heating Energy [kWh/(m2·a)]	Specific Primary Energy [kWh/(m2·a)]	Specific Heating Energy [kWh/(m2·a)]	Specific Primary Energy [kWh/(m2·a)]
Base Case	97.1	137.2	78.2	115.4
Improved Case	15.2	43.3	14.5	41.4
Savings	81.9	93.9	63.7	73.9
NZEB requirement	28.3	25	30.0	-

4. Investment Requirement for Typical Net-Zero Buildings and Renewable Energy Infrastructure

Using the Edge Buildings application, an estimation of the construction costs for a typical office building and a small manufacturing building (see Table 3 in Subsection 3.3.4 for building characteristics) was carried out. These cost estimates take into account the energy efficiency measures listed in Table 4 above, but do not consider the costs associated with rooftop solar PV systems. Solar PV system cost estimates, along with estimates of EV charging station installation costs, are provided separately in Table 8. Economic Zone Barriers and Potential Mitigation Measures.

Table 6. Estimated Construction Costs for Modelled Archetypes

Building Archetype	**Estimated Total Cost (EUR)**	**Estimated Incremental Cost Compared to no Energy Efficiency Measures (EUR and %)**
Office Building (1 200 m² footprint, single floor)	1 938 000	584 000 (40%)

Small Manufacturing Building (3,200 m^2 footprint, single floor)	8,110,000	560,000 (7%)

Table 7. Estimated Costs for Solar PV Systems and EV Charging Stations

System	Estimated Total Cost (EUR)
Roof-top Solar PV System (260 kWp)	87,000
Roof-top Solar PV System (260 kWp) + Batteries (140 kW_{dc}/550 kWh)	146,000
EV Charging Stations (AC terminal 22 kW)	2,500 – 5,000

5. Barriers and Mitigation Measures

Table 8 below details the typical barriers to the implementation of net-zero buildings and entrepreneurial zones, as well as potential mitigation measures to be considered.

Table 8. Economic Zone Barriers and Potential Mitigation Measures

Barriers	Potential Mitigation Measures	Municipality
Financial Barriers		
Higher upfront capital investment is required to implement energy efficiency measures and renewable energy generation	→ Project-level subsidies: ▪ Access to land at a reduced price relative to the standard market value ▪ Reduced permit fees and land value taxes → Measure-level subsidies ▪ Financial incentives to reduce the incremental capital cost of EE and RE measures, and reduce the payback period for developers and contractors	→ Pašman → Tkon and Pašman
Low cost of fossil fuels relative to electricity costs, which may hinder the choice of electrical heating systems like heat pumps	→ Provide specific incentives for efficient electrification measures, as well as information for designers and developers on the cost-effectiveness of such measures (payback periods, etc.)	Tkon and Pašman
Education Barriers		
Lack of knowledge of developers, design professionals and contractors on EE and RE	→ Education and training for developers, designers and contractors, including on: ▪ Energy efficiency upsides for clients/occupants (comfort/quality of buildings) ▪ Financial upsides of implementing these measures (payback period)	Tkon and Pašman

	▪ Design and sizing of heat pumps, solar PV systems, etc. → Professional training and certification for contractors and trade workers on: ▪ Installation, commissioning and maintenance of energy-efficient technologies such as heat pumps, and renewable energy systems such as solar panels, inverters, batteries, or other key equipment like EV chargers.	
Lack of understanding and buy-in from developers, businesses and potential occupants of the economic zones	→ Provide information campaigns to educate the general public and potential economic zone occupants to increase buy-in. These campaigns can include: ▪ Public fora or meetings, ▪ Ads in social media or local print media, television talk shows, etc. → Encourage collaboration and facilitate dialogue among government agencies, utilities, businesses, and developers to ensure alignment.	Tkon and Pašman
Supply Chain Barrier		
Difficulty with the procurement of energy-efficient materials and equipment or solar system components (for installation and maintenance)	→ Provide procurement support to help contractors source key materials and equipment from reliable vendors, such as heat pumps, solar PV components (panels, inverters, batteries).	Tkon and Pašman
Regulatory Barriers		
Fragmented governance or inconsistent regulations between levels of government (local, regional, national) can create confusion and inefficiencies	→ Provide support and guidance for developers to navigate the regulations in place at the various levels of government. These regulations may be related to the permitting process, the building code, renewable energy implementation, etc.	Tkon and Pašman
Restrictions on third-party ownership and operation of solar panels and battery storage might deter businesses from installing them, even with financial incentives	→ Ensure that local utilities will support third-party ownership of solar panels and batteries by presenting the grid-benefits of distributed energy generation, such as reducing reliance on electricity provided from the mainland (and imported from outside of Croatia).	Tkon and Pašman

Lengthy or complex permitting processes for approving developments of renewable energy infrastructure	→ Streamline the permitting process by ensuring that municipal governments have sufficient skilled staff members to oversee the permit applications submitted by the developers, with respect to energy-efficient or net-zero buildings, as well as solar systems and EV charging infrastructure.	Tkon and Pašman
Technical Barriers		
Grid infrastructure limitations: many electrical grids are designed for centralised energy generation and may struggle to accommodate decentralised, intermittent renewable energy sources like solar	→ Coordinate with the local utilities to ensure the electricity grid infrastructure (distribution network, feeders, etc.) has enough capacity to allow interconnection of solar PV generation in the EZs. → Ensure that utilities provide sufficient technical support for interconnections.	Tkon and Pašman
Land Use Barriers		
Given that Tkon has less control over land-use decisions until land is purchased, which may slow the implementation of net-zero development goals, private landowners can dictate terms to developers, potentially prioritising profit over sustainability	→ The municipality can proactively update zoning laws to align with net-zero development goals. For example, rezoning areas for mixed-use, renewable energy infrastructure, or green spaces ensures private developers adhere to sustainability principles. → Involve private landowners and developers in creating a comprehensive master plan for the EZ, aligning their goals with municipal priorities. → Consider establishing private-public partnerships (PPPs) where the municipality provides support, such as co-funding infrastructure or renewable energy projects, in exchange for developers' commitment to net-zero standards.	Tkon

6. Final Recommendations

Based on the analysis carried out in this report, the following recommendations can be drawn for the successful realisation of net-zero entrepreneurial zones in the municipalities of Tkon and Pašman.

1. **Adopt an integrated planning approach:**
   Ensure urban planning incorporates sustainability across energy, buildings, transportation, and space management. Along with key net-zero strategies, such as energy-efficient buildings, sustainable mobility and on-site renewable energy generation, consider issues related to soil permeability, heat island effect, the well-being of workers and occupants, etc.
2. **Use procurement requirements aligned with objectives:**

Consider procurement policies that prioritise energy efficiency, sustainable materials, and certified building practices (e.g., EDGE Advanced certification). For instance, include provisions within requests for proposals for developers and contractors to commit to net-zero energy goals, specifically regarding zero-energy buildings and renewable energy.

3. **Require nearly-zero energy buildings (nZEB):**
Require that all buildings included in the economic zones be designed according to Croatia's "Guidelines for Nearly Zero-Energy Buildings" to maximise energy efficiency of buildings, minimise primary energy needs and reduce reliance on the main electricity grid.
4. **Maximise the use of renewable energy and optimise electricity demand:**
Optimise the use of rooftop and parking lot carport solar PV systems, incorporate energy storage, and collaborate with local utilities for grid integration. Optimise electricity demand within the EZs to maximise the use of on-site renewable generation by promoting the implementation of building automation systems (BAS), demand response technologies and strategies, as well as energy monitoring and management systems
5. **Find all available funding sources, both at the national and EU levels:**
Assign dedicated resources, either within municipalities or local consultants, to identify and monitor funding opportunities like EU Green Deal grants, Horizon Europe, or national recovery plans to support the development of net-zero EZs.
6. **Offer financial and non-financial incentives:**
Offer financial incentives like tax breaks, reduced permit fees, subsidies or access to low-interest capital for energy efficiency measures that go above and beyond existing requirements, as well as for on-site renewable energy generation and demand optimisation strategies. Include non-financial incentives such as expedited permits or technical support.
7. **Promote community engagement and awareness:**
Actively involve residents and businesses through public forums, awareness campaigns, workshops, and digital platforms to ensure the zones align with local needs. Educate stakeholders on the benefits of net-zero initiatives to foster buy-in.
8. **Integrated mobility solutions:**
Prioritise public transit, cycling, and pedestrian-friendly infrastructure to reduce vehicle emissions. Include provisions for electric vehicle (EV) charging stations and shared mobility hubs.
9. **Workforce training and capacity building:**
Invest in training programs for building designers, developers, contractors and workers focused on energy-efficient building practices, renewable energy technologies, and optimal building operation to help support a skilled local workforce.

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