Solar: 644 GWh (4.7%)Wind: 5 GWh (0%)

• Bioenergy: 239 GWh (1.8%)

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• Waste: 8 GWh (0.1%)18

## Climate protection targets

Overall Emissions: Reduce overall emissions by 15% compared to 2005 levels by 2030.

Non-ETS Emissions: Reduce non-ETS emissions by 27% compared to 2005 levels by 2030.<sup>19</sup>

Net-Zero Emissions by 2050: Plan targets, policies, and measures for 2030 to achieve net-zero GHG emissions at the EU level by 2050.

GHG Emissions Reduction: Reduce total GHG emissions by at least 55% by 2033 compared to 2005.

Slovenia's Burden Sharing Targets by 2030: Reduce GHG emissions by 28-31% compared to 2005, with sectoral targets:

Wide use: -74%Agriculture: -1%

• Waste Management: -67%

• Industry (non-ETS): -55%

Energy (non-ETS): -48%

Buildings Sector: Reduce GHG emissions in buildings by at least 70% by 2030 compared to 2005.<sup>20</sup> Reduce emissions in the buildings sector by 85-95% by 2040 and aim for minimal possible emissions by 2050, compared to 2005 levels.

Transport Sector: Reduce emissions from the transport sector by 55-65% by 2040 and by 90-99% by 2050, compared to 2005 levels.<sup>21</sup>

LULUCF Sector: Ensure LULUCF emissions do not exceed sinks from 2021 to 2025 and achieve a sink of at least -146 kt CO<sub>2</sub> eq by 2030.<sup>22</sup>

Coal Consumption: Reduce coal consumption by 30% by 2030 and phase out coal entirely by  $2033^{23}$ .

Climate Adaptation: Reduce Slovenia's vulnerability to climate change impacts and increase resilience and adaptive capacity.

Climate Justice: Ensure climate justice.

Low-Carbon Circular Economy: Promote sustainable consumption and production to transition to a low-carbon circular economy.

Decarbonization of Industries: Provide financial incentives for green technologies, green gases (including hydrogen), green fuels, and CO2 capture and storage.

Human Resources: Increase investment in training and skills needed for the transition to a climate-neutral society and to reduce implementation gaps.<sup>24</sup>

## Renewable energy targets

Renewable Energy Sources (RES): Achieve at least a 30-35% share of RES in final energy use by 2030.

- Buildings: At least 66% of energy use in buildings from RES (excluding electricity and district heat); prohibit sale and installation of new fuel oil boilers after 2022.
- Industry: At least 30% share of RES (including waste heat) in industrial energy use.
- District Heating/Cooling: Annual increase of 2-3% in the share of RES and waste heat/cold, achieving 25-40% by 2030.
- Electricity Generation: At least 52% share of RES.
- Heating and Cooling: At least 41% share of RES.
- Transport: At least 26% share of RES.

Energy Activities: Rapid expansion to install electricity-generating installations from solar or wind in multi-use spaces (agricultural, road, water, etc.).

Natura 2000 Sites: Allow renewable energy installations in these protected areas.

Public Sector: Accelerate solar panel installation on public sector roofs.<sup>25</sup>

## Renewable energy potential

Solar Resource Potential: Over 80% of the country's land area has low solar energy potential, falling into the lowest class (class 1 out of 7 on a global scale), with an annual generation of less than 1.2 MWh per kWp of installed PV capacity.

Onshore Wind Potential: Nearly 80% of the country's land area has low wind energy potential, classified in the lowest category (class 1 out of 7 on a global scale), with a wind power density below 260 W/m² at a height of 100 meters.

Biomass Potential: The country has high biomass potential, with an average net primary production (NPP) of 5.5 tC/ha/yr, higher than the global average of 3-4 tC/ha/yr.<sup>26</sup>

Technical Potential for Installed Renewable Electricity Capacity in MW: Biomass(700), Solar PV (19,200), Wind (600), Small Hydro(300)<sup>27</sup>

# Renewable energy support regime

#### European Commission Aid Scheme:

- The European Commission approved a €150 million state aid scheme for renewable energy and energy storage.
- Grants can reach up to €25 million per beneficiary under the State Aid Temporary Crisis and Transition Framework.
- Aimed at accelerating investments in renewable energy production and energy storage to achieve a net-zero economy transition, including heat.
- Funds must be allocated by December 31, 2025.

#### Current Projects in Slovenia:

- Several grid-scale battery storage projects are underway, including 60MW units with a hydroelectric plant and a new pumped hydro energy storage system.
- Slovenia is conducting a cross-border grid synchronization project with Croatia, incorporating 50MWh of battery storage, partly funded by the EU.<sup>28</sup>

#### Based on the European Commission Aid Scheme (EUR 150 million):

- The Slovenian government has adopted a decree on investment aid to promote the deployment of energy from renewable sources. This scheme provides direct grants of up to EUR 25 million per beneficiary, targeting legal entities, cooperatives, individuals engaged in business activities, and local authorities.
- Eligible projects include the installation of photovoltaic, solar, geothermal, and hydropower plants, as well as wind energy installations and cogeneration facilities using biomass, biogas, landfill gas, and sewage gas.
- Aid can cover up to 45% of the total project cost, with additional increases (up to 20% for small enterprises and 10% for medium-sized enterprises).<sup>29</sup>

#### Relevant laws, policies, and plans

- National Strategic Framework for Adaptation to Climate Change (SOPPS) a vision for Slovenia to become an adapted and resilient society with high quality and safety of life by 2050.
- Slovenia's renewable energy regulations:
- Slovenia adopted a bylaw on self-supply with electricity from renewable energy sources in May 2019.
- The regulation allows for two forms of collective self-consumption (CSC):
  - In multi-apartment buildings
  - In "RES communities" formed by customers in various types of dwellings
- Key provisions for collective schemes include:
  - Single metering points can't belong to multiple schemes
  - Multiple schemes can exist in the same LV grid
  - Third-party owners can't market excess energy
  - Contracts must specify relationships and energy division among members
  - Capacity limits are set for RES production units
  - No balancing requirements for individual self-supply
  - Annual capacity limitations were abolished
- Net-metering systems continue with a one-year accounting interval.
- The government plans to introduce new support schemes (2021-2023) for RES communities and is considering local flexibility markets.
- A draft electricity law in November 2020 introduced Citizen Energy Communities, to be established as cooperatives.

This framework aims to stimulate private investments in renewable energy generation and is a step towards transposing the EU's Clean Energy Package.<sup>30</sup>

## Regulatory framework for citizen energy EU Directive Implementation for Energy Communities

Slovenia implemented EU directives on renewables and electricity markets in July and October 2021 through Acts No. 2570 (ZSROVE) and No. 3349 (ZOEE). These Acts include provisions for energy communities of citizens (ECCs), allowing participation in most markets and activities, except ownership or management of distribution networks. Implementing rules for collective self-consumption within ECCs was defined in March 2022. However, detailed national measures for ECCs in the renewable energy support scheme are yet to be introduced, and further elaboration is needed on certain criteria derived from EU directives.<sup>31</sup>

#### **Evaluation of the legal framework**

Slovenia has set up basic rules for citizen energy projects in line with EU Directives. However, these rules need improvement with more specific support and fewer obstacles to help energy communities grow. The current legal framework doesn't clearly mention important aspects like citizen participation or a designated authority to oversee these projects.<sup>32</sup>

The NECP process for public consultation was inadequate, as it did not allow enough time for civil society and other stakeholders to offer meaningful comments and feedback.<sup>33</sup>

Regarding self-supplying with electricity from renewable sources, the existing rules are just a starting point. The roles and operations of the Distribution System Operator (DSO) within energy communities need to be standardized and officially regulated, rather than relying on temporary solutions. Additionally, regulatory sandboxes in Slovenia should be more flexible to meet all the needs of implementing energy communities.<sup>34</sup>

## Citizen energy projects

## Empowering Renewable and Citizen Energy Communities (POWER-E-COM)

State: July 2024

- Funding: European Commission, LIFE

- Timeframe: 2023 - 2026

- Budget: 21.4 M€

- Coordinator: WIP, Germany

Partners: ESCAN (Spain), EWO (Germany), ESV (Austria), ENER-GAP (Slovenia), BSERC (Bulgaria), Ayto Rivas (Spain), Obcina Selnica (Slovenia), TUS (Ireland), TEA (Ireland), Community Power (Ireland), Municipality of Gabrovo (Bulgaria)

#### Description:

- Aims to establish energy communities across six European countries including Slovenia, fostering cooperation between local authorities and citizens in the energy transition.

#### Objectives:

- Develop adaptable models for energy community creation.
- Provide training and capacity building for citizens and officials.
- Facilitate knowledge exchange to enhance community energy development.

#### **Target Groups:**

- Existing renewable energy communities, active citizens, and municipal decision-makers.<sup>35</sup>

## COMPILE (Integrating Community Power in Energy Islands)( <a href="https://www.compile-project.eu/">https://www.compile-project.eu/</a>)

- Overview:
  - Demonstrates energy self-sufficiency in Luče, Slovenia, using renewable sources despite weak grid connections.(<a href="https://main.compile-project.eu/sites/pilot-site-luce/">https://main.compile-project.eu/sites/pilot-site-luce/</a>)
  - Innovates large-scale PV installation and community energy management in rural areas.
- Objectives:

- Empower rural communities globally to adopt sustainable local energy systems.
- Develop toolsets for energy community establishment and management.

#### - Impact:

- Shortlisted for the EU Sustainable Energy Awards 2021, showcasing its role in the EU's 2030 climate goals.
- Piloted in Portugal, Spain, Greece, and Croatia, proving scalability and replicability.

#### - Partnership:

- Led by the University of Ljubljana, with 12 European partners.
- Funded by EU Horizon 2020 with a budget of €6.42 million.<sup>36</sup>

#### **ENERGISE Project**

- Issue:
  - Energy policy often prioritizes short-term efficiency without considering long-term sustainability in existing energy cultures, potentially leading to increased consumption over time.
- Research Strategy Living Labs Approach:
  - Approach: Uses Living Labs to observe real-world energy cultures and test household and community-level energy reduction initiatives.
  - Scope: Reviews energy initiatives from 30 European countries to establish prototype ENERGISE Living Labs.
     Data from 16 labs across eight countries informs future energy strategies.

#### - Objectives:

- Innovation: Develop a new framework merging social practice and energy cultures for sustainable consumption research.
- Impact Assessment: Evaluates European energy consumption reduction efforts.
- Community Focus: Advances Living Lab approaches to transform community energy cultures and understand routine impacts on sustainability.
- Insights: Generates insights on societal norms and disruptions in promoting sustainable energy use.
- Engagement: Promotes stakeholder involvement and shares ENERGISE findings to support the European Energy Union.<sup>37</sup>

#### **Other Projects:**

#### Zadruga Sončnih Elektrarn Slovenije (ZSES):

 Established in Ptuj in 2014, ZSES supplies and installs solar power plants across Slovenia. Members collectively operate solar capacity exceeding 6.3 MW and have successfully raised capital for solar projects.<sup>38</sup>

State: July 2024

#### Lesna Zadruga Loški Potok:

Founded in 2016, operates a local biomass district heating system in Loški Potok, serving 13 customers. Completed a 33 kW solar PV installation in 2020 and is developing a community wind turbine project.<sup>39</sup>

#### Zeleni Hrastnik:

 Developing Slovenia's largest cooperative solar power plant, a 300 kW array on a local primary school roof in Hrastnik.<sup>40</sup>

#### Sočna Zadruga:

- Implemented five biomass-based microheat network projects using cooperative principles.<sup>41</sup>

#### Ajdovščina Municipality:

- Implemented a pilot community solar PV project using a public facility roof to supply electricity to seven households.

#### **Solar Energy Cooperative in Sv. Anton:**

- Established through the ENES-CE Interreg Central Europe project near Koper.

#### **Krajcarca Hydro Power Plant:**

Established in 1992 as a small cooperative hydropower plant.<sup>42</sup>

# Research and capacity building activities

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#### **NGOs**

- Focus (https://focus.si/): ENERGISE project partner 46
- Thriving Communities (https://thriving-communities.org/)

### Governmental bodies

The Ministry of the Economy (www.mgrt.gov.si/en/):

- Shapes the overall national policy and strategy in the energy sector

Energy Agency Slovenia (www.agen-rs.si/en/):

- Energy market regulator, responsible for licensing in the energy sector
- Responsible for granting feed-in tariff and premium

#### BORZEN (<u>www.borzen.si/</u>):

- Power Market Operator provides and facilitates coordinated operation of the Slovenian electricity system
- Via the internal centre for RES/CHP it operates the support scheme for the generation of energy from RES

#### ELES (www.investslovenia.org/):

- State-owned Transmission System Operator responsible for electricity transmission and management of the national grid

Invest Slovenia (www.investslovenia.org/):

- As part of the Slovenian Public Agency for Entrepreneurship, Innovation, Development, Investment and Tourism Investment Agency, responsible to attract, consult and facilitate potential investors<sup>47</sup>

# Relevant actors and stakeholders

Local govern-	Municipality of Selnica ob Dravi
ments	Municipality of Luče
Private actors	<ul> <li>WIP(https://www.wip-munich.de/welcome/home/)</li> </ul>
International/	- European Commission
supra-national	- LIFE
actors	
Academia	University of Ljubljana
	Prof. Andrej Gubina, PhD
	Mr. Tomi Medved <sup>48</sup>
Others	Eko sklad ( <u>www.ekosklad.si/</u> ):
	The Environmental Fund of the Republic of Slovenia
	awards low-interest loans to renewable energy projects through a ten-
	dering process. <sup>49</sup>

#### **Summarizing evaluation**

#### **Fields of Action**

- Expanded collective self-consumption (CSC) system currently limited to low voltage (LV) transformer level in Slovenia.
- LV communities combined with reduced grid fees could incentivize setup
- Need for multiple LV communities to cover villages like Luče
- Public buildings are ideal for new photovoltaic (PV) installations but are not always connected to the same transformer
- Expansion of localization criterion for energy communities proposed for broader implementation
- Standardization needed for DSO (Distribution System Operator) activities in sharing and metering
- Legal/regulatory clarification required for DSO's role in local microgrid operations<sup>50</sup>
- Decarbonizing districts and cities will require a significant share of decentralized renewable energies, posing challenges for local electric grids.
- Local Energy Communities (LECs) can significantly contribute to decarbonization efforts and address technical and societal challenges.
- Need for high flexibility in future smart energy systems to manage uncertain renewable energy production.
- Flexibility can be achieved through sector integration, citizen involvement in flexibility programs, and aggregation.
- Empowering citizens to participate in these programs is crucial, requiring a focus on social aspects alongside technical solutions.
- Future energy systems must be designed with planning tools that incorporate emerging technologies like energy storage and electric vehicles.
- New architectures and control mechanisms may be necessary to achieve decarbonization goals effectively.<sup>51</sup>

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