Interreg Danube Region

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ESINERGY

Transnational Master plan for peak load reduction and energy policy alignment

Towards smart, flexible and resilient energy systems in the Danube region.

Political call to action – integrating ESINERGY into national policy

> ***Developed by 12 partner countries of the Danube Region, the ESINERGY Transnational Master Plan provides a unified framework for implementing the EU Green Deal through practical, tested measures for energy flexibility, renewable integration, and consumer participation.***
> ***The transnational approach ensures coordinated progress across borders, avoiding national fragmentation and maximizing shared grid benefits.***

The ESINERGY Transnational Master Plan provides a ready-to-adopt roadmap for aligning national energy policies with the EU Renewable Energy Directive (RED II/III) and the Electricity Market Directive (EMD). It offers concrete models for renewable integration, grid flexibility and citizen participation - core enablers of the EU Green Deal and 2030 climate goals.

Political leaders across the Danube Region are encouraged to integrate ESINERGY recommendations into their National Energy and Climate Plans (NECPs) and other strategy documents (LEP, SECAP, etc.) to accelerate directive implementation, unlock EU funding and strengthen national energy sovereignty.

By adopting ESINERGY measures, governments can ensure:

- Compliance with EU transposition deadlines.
- Faster access to financial mechanisms such as Horizon Europe, Interreg and the Recovery and Resilience Facility (RRF).
- Lower national dependence on imported energy.
- Enhanced credibility and influence in regional energy cooperation frameworks.

Vision and context

The **ESINERGY Transnational Master Plan** is a joint strategic framework developed by **12 partner countries** across the **Danube Region** to support the **implementation of the EU Renewable Energy Directive (RED II/III)** and the **Electricity Market Directive (EMD)**.

Its goal is to **reduce electricity peak loads**, **integrate renewable energy sources (RES)** and **promote flexible, decentralized and citizen-driven energy systems**.

The plan translates real pilot experience and stakeholder dialogue into actionable guidance for **policy makers, regulators and municipalities** showing how **smart storage, renewable generation and consumer participation** can make Europe's energy transition more secure, affordable and sustainable.

Why peak-load reduction matters

Reducing peaks helps postpone costly grid upgrades, lowers electricity prices and facilitates more RES integration.

Across the Danube region, energy systems face common challenges:

- **Aging grids** not designed for decentralized renewables and EV charging.
- **Lack of regulatory clarity** for storage and flexibility markets.
- **Slow permitting and high investment risks.**

Yet, ESINERGY pilots have proven that combining **PV generation**, **batteries** and **digital control** can achieve measurable technical and economic results while improving grid stability.

Directive alignment and political benefits

The Master Plan supports implementation of key EU legislation:

Directive	ESINERGY contribution
RED II/III (2018/2001; 2024/1711)	Promotes decentralized renewables, prosumer empowerment and energy storage integration
EMD (2019/944; 2024/1711)	Enables flexible connection agreements, consumer rights and dynamic tariffs
Governance Regulation (2018/1999)	Contributes to NECP targets and 2050 climate neutrality

What ESINERGY adds:

- Practical **models for flexibility** (AI control, storage, EV integration).
- Tested **energy community structures** (e.g., Lenti–HU, Weiz–AT).
- **Evidence for policy reform**, showing how directive principles work in real systems.

Integrating ESINERGY into national strategies enables:

- Full compliance with RED III and EMD implementation timelines.
- Strengthened energy independence and emission reductions.
- Higher public trust through citizen and community participation.
- New market opportunities and local job creation.

> ***Embedding ESINERGY measures in policy transforms EU directives into measurable progress at the national level.***

Development process

The Master Plan was co-created through:

- **8 pilot projects** in AT, BA, BG, HR, DE, HU, SI, UA.
- **36 stakeholder workshops** (focus groups, SWOT, measure identification).
- **Joint transnational sessions** aligning strategies and measures.

Stakeholders included: **ministries, DSOs, energy agencies, municipalities, prosumers and NGOs.**

Key pilot insights and policy impact

The Master Plan builds on eight pilot actions implemented in Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Germany, Hungary, Slovenia and Ukraine. These pilots demonstrate how renewable generation, battery storage and smart control can improve grid performance, cut emissions and reduce costs.

Country	Core solution	Peak-load reduction	CO_2 reduction	What it enables
Austria (Weiz)	PV + 50 kWh battery in energy community	15–30 %	36 t/year	Storage for local RES balancing
Bosnia & Herzegovina (Goražde)	10 kW PV + 10 kWh battery	12.5 kW	7.4 t/year	Replicable hybrid PV-storage for public buildings
Bulgaria (Varna)	Battery + energy management system	14.93 %	8–10 t/year	RES share +10 %, local grid flexibility
Croatia (Čakovec)	PV + 25 kWh battery + smart metering	46 %	1.6 t/year	Legal precedent for battery integration
Germany (Bad Hindelang)	AI-controlled hydropower + EV charging	20 %	319 t/year	Smart grid management & digital twin concept
Hungary (Lenti)	Energy community with PV + storage + DSM	10.7 %	5 t/year	Model for legal & technical community setup
Slovenia (Martjanci)	Vehicle-to-Building (V2B) charging	30.7 %	n/a	Flexible EV-battery integration
Ukraine (Khotyn hospital)	Heat pump + PV for heating	28 % (9.4 kW)	53 t/year	100 % gas substitution, energy resilience

Transnational results:

- **Peak-load reduction:** up to 46 %
- **Average CO_2 savings:** ≈ 75 t/year per pilot
- **Deferred grid investment:** estimated > € 10 million regionally
- **Self-consumption increase:** 10–35 %
- **Financial savings:** € 1,300 – 16,000 / year per pilot site

These results provide real-world evidence that national governments can use to shape flexible grid management, support renewable integration and meet EU commitments.
Political impact:

- Demonstrates feasibility of large-scale flexibility measures.
- Provides replicable models for municipalities and ministries.
- Contributes to energy independence and EU directive alignment.

What policy gains from pilots

Policy dimension	Pilot contribution
Regulatory alignment	Real-world evidence for transposing RED & EMD: clear benefits of storage, flexibility and prosumers.
Economic efficiency	Demonstrated payback periods < 8 years for small-scale storage; avoided network costs.
Energy security	Reduced dependence on imported electricity or gas (UA pilot → –53 t CO_2 and full gas phase-out).
Grid stability	Data from DE, SI and AT show up to 20–30 % load smoothing and new grid capacity unlocked for renewables.
Social acceptance	Local ownership, citizen engagement and new job creation via energy communities.

> ***ESINERGY pilots turn EU directives into tangible benefits showing that flexibility is both a policy goal and an investment opportunity.***

Policy frameworks and transposition status

Well advanced: DE Germany | AT Austria | SI Slovenia
Partially completed: HU Hungary | SK Slovakia | HR Croatia | BG Bulgaria
Emerging (Energy community members): BA BiH | ME Montenegro | RS Serbia | UA Ukraine
Common needs:

- Simplify rules for **storage & prosumers**.
- Introduce **dynamic tariffs** rewarding peak-shaving.
- Adopt **flexible grid connection agreements**.
- Strengthen **one-stop-shops** for local investors.

Strategic priorities

1. Modernize the grid

Upgrade distribution networks, install smart meters and digitalize monitoring to handle bi-directional flows.

➞ Enables: faster PV/EV integration, reduced redispatch costs and improved resilience.

2. Empower consumers & energy communities

Simplify administrative procedures, promote collective self-consumption and fund pilot replications.

➞ Enables: citizen participation, local ownership and higher social acceptance.

3. Advance digitalization

Support AI-based optimization, smart-meter interoperability and real-time data management.

➞ Enables: efficient balancing, transparency and lower operational costs.

4. Mobilize investment

Align EU and national funds (Interreg, Horizon, RRF) to de-risk storage and grid modernization.

➞ Enables: long-term scalability and investor confidence.

5. Strengthen regional cooperation

Coordinate policy reforms, harmonize standards and expand cross-border balancing.

➞ Enables: stable regional energy markets and collective resilience.

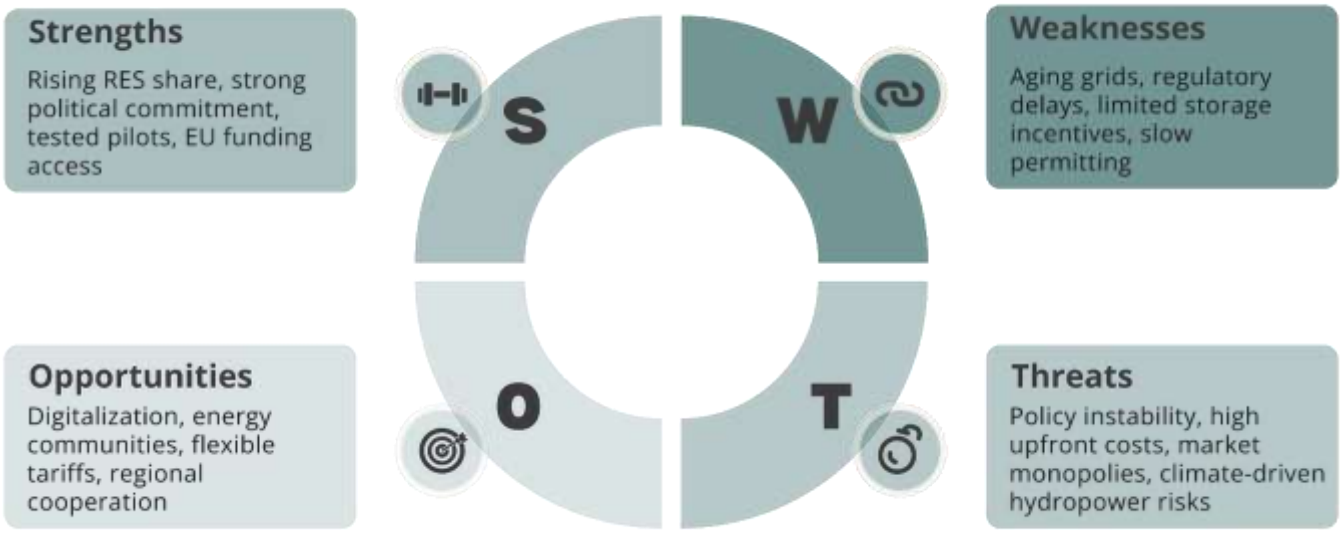
Vision for 2030+:

> ***A decentralized, smart and resilient Danube energy system where renewable generation, storage and digital control ensure security, affordability and citizen empowerment.***

Expected outcomes by 2030:

- 30% average peak-load reduction.
- Over 45% renewable share in electricity mix.
- Energy communities active in all partner countries.
- 25% reduction in CO_2 emissions from electricity generation.

Brief transnational SWOT



What the Master Plan enables

Impact Area	Enabled By	Policy Benefit
Grid Flexibility	AI, smart meters, storage	Postponed infrastructure investments
Decarbonization	PV, heat pumps, prosumers	Lower CO_2 emissions and cleaner heating
Economic Return	Battery storage, flexibility markets	Shorter payback periods and lower bills
Resilience	Local RES + digital control	Energy security during crises
Replication Potential	Pilots & twinning actions	Policy harmonization and regional scaling

Path to adoption

To ensure lasting impact, the Master Plan will be **endorsed and implemented** through:

- **Policy Forums** at national and regional levels.
- **Letters of Intent** by ministries, municipalities and DSOs.
- Integration into **National Energy and Climate Plans (NECPs)**.
- **Twinning actions** for replication beyond pilot sites.

Call to action for policy makers

The ESINERGY Master Plan calls for joint political commitment to:

1. **Accelerate directive transposition** by aligning national laws with RED III & EMD 2024.
2. **Fund flexibility measures** (storage, digitalization, demand-response).
3. **Empower municipalities and citizens** to lead energy communities.
4. **Foster regional cooperation** for stable and integrated energy markets.

To accelerate implementation and ensure policy coherence, national authorities are invited to:

1. Complete RED III and EMD transposition without delay.
2. Introduce and fund flexibility and energy storage measures.
3. Empower municipalities and energy communities to lead local transitions.
4. Strengthen regional cooperation for smart, flexible grids.

Integrating the ESINERGY Master Plan into national policy is not only about compliance it is about leadership, innovation and energy sovereignty.

Added value for decision-makers

For governments: A ready roadmap linking pilot evidence with EU compliance.
For municipalities: Practical frameworks for renewable, storage and e-mobility integration.
For investors: Clear, stable regulatory environments that reduce risk.
For citizens: Opportunities for participation, cost savings and greater energy security.

What ESINERGY pilots enable

The ESINERGY pilot actions across the Danube Region demonstrate how small-scale technological interventions can deliver measurable, scalable impacts. Each pilot not only optimizes local energy use but also **enables broader system benefits** - from grid flexibility and emission reduction to national-level energy independence.

Country / Pilot	What it enables
Austria (Weiz)	Integration of **3.7 kWp PV solar parks**, powering ~500 households per year; equivalent to avoiding emissions from ~900 cars annually.
Hungary (Lenti)	Integration of **5 new 0.5 kWp PV solar parks**, powering ~530 households/year; scalable community model replicable nationwide; avoids emissions from ~900 cars annually.
Bosnia & Herzegovina (Goražde)	Equivalent to installing **~15 new 5 kW PV systems**, powering ~20 households; comparable to planting ~340 trees per year.
Croatia (Čakovec)	Integration of **980 new 5 kW PV systems nationally** (~5 GWh/year); avoids ~1,580 tons of CO_2 over a decade; 4.9 MW reduction if 10% of PV systems are upgraded.
Germany (Bad Hindelang)	Unlocks **4.84 GW of flexible grid potential** if scaled nationally; avoids emissions equal to ~145 petrol cars/year; integrates ~1,000 PV plants (~500 kW each).
Slovenia (Martjanci)	Enables **50 MW peak-load reduction** through V2B and V2G charging; equivalent to 10,000 new 5 kW PV systems powering ~14,000 households/year; adds capacity for ~420 commercial PV units.
Ukraine (Khotyn)	Enables **heating independence** for critical infrastructure; saves 30,000 m³ gas/year (heating 20 homes); avoids 53 tons CO_2/year; if scaled to all 562 hospitals, saves **16.8 million m³ gas annually**.

Transnationally:

Integration of over 5 GW flexible renewable capacity, supporting grid stability and renewable balancing.

- **Avoidance of more than 500 tons CO_2 annually** across all pilot sites.
- **Energy independence and resilience** for public buildings and communities.
- **Scalable community models** for prosumer networks and local RES development.
- **Support for policy goals** under RED III and EMD through practical, tested flexibility measures.

> ***Each ESINERGY pilot acts as a local enabler of the European Green Deal—demonstrating that small, intelligent, and interconnected energy solutions can collectively transform regional and national energy systems.***

Key data snapshot (Danube region, 2025)

📈 **8 pilot actions** tested in 12 countries
⚡ **Up to 46 %** average peak-load reduction
🌍 **≈ 500 t CO_2 /year** avoided across pilots
🏘️ **Energy communities** emerging in > 6 countries
💶 **€ 1,300–16,000/year** average cost savings per site

Conclusion

The **ESINERGY Transnational Master Plan** transforms pilot evidence into **policy intelligence**. It shows that the clean energy transition can be both **technically feasible** and **socially inclusive** if supported by modernized grids, stable legislation and empowered citizens.

> ***"From pilots to policy – from directives to action – ESINERGY enables a resilient, smart and cooperative energy future for the Danube Region."***
> ***"By integrating ESINERGY into national and regional strategies, governments can not only meet EU obligations but also strengthen their political visibility as frontrunners of the Green Deal."***

Website: https://interreg-danube.eu/projects/esinergy
From Directive to Action: ESINERGY enables political will to power Europe's energy future.