EnergyNet and the Future of Local Energy Systems

A Viable Cities Outlook on a New Energy Society | Mar 2026

VIABLE CITIES OUTLOOK 2026:1 *Prepared by Viable Cities with input from Jonas Birgersson and partners working on local energy systems within the Viable Cities ecosystem.*

Executive Summary

This Outlook presents EnergyNet as a possible foundation for a new energy society. The core proposition is simple: electricity can become greener, more secure and more affordable when local generation, storage, demand flexibility and digital coordination are designed as one system rather than as isolated assets.

Two shifts are now reinforcing each other. The first is the rapid rise of electrotech: solar and wind, batteries, electric vehicles, heat pumps and digital controls that make clean electricity cheaper and smarter to use. The second is a change in grid logic, from a centralized and one-directional model to a local-first, modular and digitally coordinated model.

Together, these shifts change what energy means for cities. Electricity moves from being a constraint to becoming a local strategic resource. For municipalities, this can mean stronger resilience, more predictable costs and faster electrification of housing, mobility and local industry.

In this perspective, affordability and a just transition are not side effects. They are design objectives. Local energy systems can reduce exposure to volatile wholesale prices, lower peak-related costs and create ways for residents, housing associations and communities to participate directly in the energy transition.

The report is written for local government leaders shaping climate-neutral cities, and for funders and national decision-makers designing regulatory and financial frameworks.

1. Global Trends Shaping Local Energy Systems

The character of the energy system is changing. For decades, cities managed energy primarily as a question of supply, scarcity and infrastructure provision. Today, electrification is accelerating across transport, heating and parts of industry, while renewable generation is becoming more abundant, distributed and cost-competitive.

This creates a historic opportunity. Electricity can move from being a bottleneck to becoming a strategic local strength. For cities, that means the possibility of safer supply, more predictable costs and faster climate action.

Two development paths explain this shift. The first is electrotech: a family of technologies that electrify society while reducing emissions and improving flexibility. Solar and wind, batteries and thermal storage, electric vehicles, heat pumps and digital control systems increasingly work best as an integrated whole.

The second path concerns the logic of the grid itself. Existing grids were built for centralised generation, one-way power flows and limited flexibility. As electrification accelerates, that legacy design contributes to capacity shortages, long connection queues and rising system costs.

EnergyNet is presented as a response to this mismatch: a system architecture inspired by the internet, where local systems are coordinated first, and then connected to the wider grid through open interfaces and digital control.

Three global trends are especially important:

- Electrotech at scale. Solar, wind, batteries, electric vehicles and heat pumps are scaling rapidly, reducing costs and increasing system flexibility.
- Grid congestion as a bottleneck. In many regions, grid capacity is now a primary constraint on electrification and renewable deployment.
- Digitalisation of energy systems by smart microgrids through open standards such as the Energy Protocol. Coordination, data and control are becoming as important as physical assets.

2. The European Policy Landscape

European policy has created a more enabling environment for local energy systems. Through the Clean Energy Package, the EU established Citizen Energy Communities and Renewable Energy Communities as recognised actors in the energy system. These frameworks make it easier to organise collective self-consumption, local renewable generation, energy sharing and participation in flexibility markets.

This marks a structural shift from passive consumers to active local system participants. It also gives social and political meaning to local energy systems: they are not only climate instruments, but potentially affordability instruments as well.

Europe's broader competitiveness agenda has also highlighted grid bottlenecks, high electricity prices and slow connection processes as risks to economic growth and industrial transition. In response, policy increasingly emphasises:

- Digitalisation of grids
- Flexibility and storage
- Faster integration of renewables
- New market designs for local system services

Strategic implications for Europe

Within this trajectory, EnergyNet can be understood as a proposed operating architecture that seeks to make local flexibility and energy communities functional at scale.

Europe has three strategic strengths in this field: a good regulatory basis for energy communities, large urban markets facing acute grid constraints, and a strong industrial base in power electronics, automation and digital infrastructure.

At the same time, Europe faces important geopolitical challenges. Open and interoperable system design is therefore not only a technical issue. It is also part of Europe's technological sovereignty and industrial competitiveness.

3. Sweden's Special Role

Sweden enters this transition with several advantages. It has a long tradition of reliable infrastructure, early digitalisation and practical cooperation between the public sector, utilities, housing actors and industry.

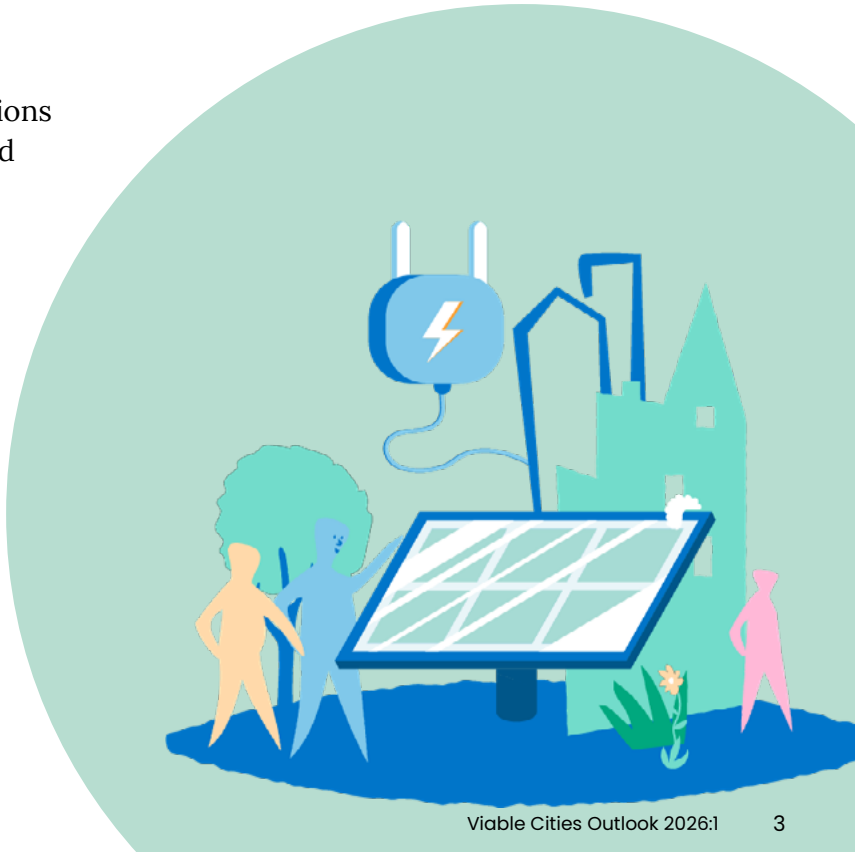
Sweden's position is shaped by three strengths:

- A strong ICT and power-electronics base
- Advanced public-sector digitalisation
- A tradition of open standards and public-private collaboration

Why Sweden is a useful testbed

Sweden, like the rest of Europe, faces questions around peak power, connection capacity and the pace of electrification. These pressures have made local energy systems more relevant in practice, not only in theory.

Recent regulatory change has widened the space for energy sharing and for parallel local system concepts. Combined with strong municipal planning capacity and active innovation ecosystems, this gives Sweden unusually good conditions for testing how local energy systems can support both urban development and national power adequacy.



4. What Is EnergyNet?

EnergyNet is a decentralised local electricity network architecture inspired by the design logic of the internet. It is intended to address a growing challenge: how to electrify more buildings, vehicles and local activities without relying only on expensive and slow conventional grid reinforcement.

The approach focuses especially on winter peak demand and local capacity constraints. It aims to do this by enabling local flexibility and demand response, reducing coincident peaks and using storage and local generation during critical hours.

EnergyNet rests on three core ideas:

- Local-first coordination. Energy is used and balanced locally before interacting with the wider grid.
- Modular digital control. Energy routers and power electronics coordinate flows in near real-time.
- Open and interoperable standards. An open Energy Protocol is intended to allow multiple vendors and communities to connect.

From technical solution to system architecture

In this sense, EnergyNet is not only a technical solution, it is a system architecture. It treats neighbourhoods, buildings and mobility nodes as active components of a coordinated local energy system rather than as passive end users.

The architecture will reduce long-term system costs, lower peak-driven tariffs and distribute the benefits of flexibility more evenly across users. The report's policy relevance lies less in any single device and more in the organisational logic: local coordination first, interoperability by design and public governance strong enough to keep the system open.

5. Local Energy Systems in Practice

Local energy systems are no longer abstract models. They are being tested in real districts, with real buildings, real residents and real grid constraints. Three Swedish examples are especially relevant to the Outlook.

CoAction Lund, Brunnshög

In Brunnshög, Lund, EnergyNet is demonstrated through CoAction Lund. In the system pilot, a residential building, connected with the world's first independent and locally owned parallel power cables, shares surplus solar electricity with a neighbouring mobility hub. Each building is equipped with an energy router and connected through an open Energy Protocol.

The case illustrates how local production, storage and consumption can be coordinated across buildings; how peak loads on the traditional grid can be reduced; how new loads may be connected without immediate reinforcement; and how residents may benefit from more predictable electricity costs.

The broader significance of CoAction Lund is that it shows how a new parallel local grid infrastructure can complement existing infrastructure.

Tamarinden, Örebro

In Örebro, the Tamarinden district is being developed as a highly integrated local energy system in which buildings are planned to produce, store and share energy locally. The project became possible through regulatory changes that opened new practical possibilities for energy sharing across property boundaries.

In Tamarinden EnergyNet combines solar generation, battery storage and coordinated energy management to create a neighbourhood-scale system that can reduce peaks, improve resilience and lower costs for residents and property owners. The project is significant not only as a technical pilot, but as a model of how municipal planning, utilities, housing actors and research institutes can align around a common system design.

Hammarby Sjöstad, Stockholm

In Hammarby Sjöstad, energy-community initiatives are being developed in both existing and planned neighbourhoods to combine local renewable generation, storage, demand flexibility and shared energy services. ElectriCITY Innovation and its partners are working with housing associations and other local actors to coordinate energy use, increase renewable uptake and link buildings with mobility infrastructure.

This case matters because it shows that local energy systems can also be introduced incrementally in existing urban areas, even where ownership is fragmented, resident participation matters and the practical challenge is coordination.

Why these cases matter

Across the three examples, some common lessons emerge. Municipal planning matters. Property owners and housing cooperatives matter. Open technical standards matter. And governance matters at least as much as hardware.

Beyond Sweden, similar dynamics are visible across Europe and elsewhere. Campuses, industrial parks and urban districts are exploring local energy communities and coordinated smart microgrids wherever regulation allows local generation, sharing and flexibility services. In that sense, the Swedish cases are not isolated exceptions. They are early indicators of a broader shift.

6. Resilient Energy Grids: What EnergyNet Could Mean for Ukraine

Recent years have shown that energy systems are exposed not only to market volatility, but also to climate extremes, cyber threats and geopolitical disruption including military attacks. Under these conditions, resilience becomes a design principle rather than a technical add-on.

Local energy systems strengthen resilience by reducing single points of failure, enabling island operation in emergencies and allowing faster recovery after disturbance. Resilience is also tied to affordability and social protection. Systems that can avoid extreme price spikes and maintain basic services during crises are central to a just transition, especially for low-income households and critical public services.

Ukraine demonstrates this with brutal clarity. Repeated attacks on generation assets, substations and transmission infrastructure have shown how vulnerable highly centralised systems can be in wartime. In such a context, energy is not only an economic issue. It is a matter of public safety, healthcare and continuity of essential services.

From centralised vulnerability to distributed resilience

The logic of local energy systems is therefore highly relevant to reconstruction. Smaller and distributed generation units are harder to disable simultaneously. Local balancing reduces dependence on long transmission corridors. Critical facilities such as hospitals, water utilities, schools and shelters can be supported by smart microgrids and islandable systems.

The report's relevance to Ukraine is not that EnergyNet offers a single finished answer. It is that the underlying architecture - modular, local-first, digitally coordinated and repairable in parts - aligns with the needs of a system that must be resilient under extreme stress.

Seen this way, reconstruction is not only about replacing damaged assets. It is also an opportunity to rebuild system architecture: from centralised vulnerability to distributed resilience, from emergency stopgaps to permanent renewable microgrids, and from dependency to a greater degree of municipal and community energy sovereignty.

7. Financial Dimensions and Industrial Opportunities

Whether local energy systems scale will depend heavily on finance. The energy transition requires major investment not only in generation, but also in transmission and distribution grids, digital control systems, storage and flexible demand.

Grids and flexibility are becoming one of the largest infrastructure investment classes of the transition. That matters for cities because local system design affects when and where grid investment is needed, and whether some investment can be avoided, deferred or better targeted.

Swedish and European firms already hold strong capabilities in power electronics, control systems, automation and grid equipment. EnergyNet creates demand for exactly those capabilities. For that reason, local energy systems should not be seen only as a municipal climate issue. They are also part of industrial policy, export potential and technological positioning.

For Viable Cities and similar initiatives, the question is whether early public co-financing can de-risk system innovation, attract private co-investment and build a pipeline of strategic urban infrastructure projects. If so, local energy systems can become a bridge between urban climate policy and industrial development. EnergyNet is an investment opportunity within the newly launched Viability Fund for Cities - through which these dimensions are explored.

8. Challenges and the Way Forward

The transition to local, digital and resilient energy systems is not without potential friction. Technical, financial and regulatory barriers remain substantial. So do questions of distributional fairness, affordability and legitimacy. Without explicit attention to those issues, local energy systems could reinforce existing inequalities instead of supporting a just transition.

One structural challenge is the conflict between centralized, capital-intensive investment logics and distributed, modular system building. Large projects such as nuclear power, major transmission expansion and centralised generation often dominate political attention, financing models and regulatory design. The shift is not only technological. It is also about who pays, who benefits and who carries risk.

Three investment trends deserve particular attention:

INVESTMENT OUTLOOK 1: Grid investment and future electricity costs
Sweden is entering a period of major grid investment. Industry estimates often place future needs in the hundreds of billions of kronor (500 – 1000 BSEK). Because grid tariffs are regulated and largely unavoidable for consumers, the scale and timing of these investments will have a strong influence on future electricity costs for households and businesses (500 BSEK in investment could lead to a 2x cost for grid access).

INVESTMENT OUTLOOK 2: Rising costs and longer lead times
The cost of key grid components such as substations and transformers has risen markedly, while supply-chain pressure and global demand have lengthened delivery times. Grid expansion is therefore both capital-intensive and time-intensive, which can slow electrification and increase planning uncertainty. A conservative estimate looking at the price performance development over the last 10 years indicate a 2x increase on price for the same transformer capacity. The traditional central grid is already expensive and it's getting worse.

INVESTMENT OUTLOOK 3: Nuclear financing and system bias
Large-scale generation projects may form part of national energy strategies, but they can also lock in capital, policy focus and market design for decades. If regulatory and financial frameworks tilt too heavily toward centralised assets, investment in flexibility, storage and local system services may be crowded out. Conservative estimations of the impact for end users indicate that a large scale build out of nuclear generation in Sweden could end up with a 2x increase in cost for decades.

Governance barriers

Additional barriers are institutional as much as technical. Local energy systems cut across planning law, grid regulation, market design, procurement and data governance. Fragmented rules raise transaction costs and slow deployment. Many municipalities also lack the internal competence needed to design, procure and govern complex local energy systems over time. Finally, incumbent actors may be tempted to resist changes that threaten established business models.

The next phase therefore requires system governance, not only technology deployment.

Priorities for the European Commission

First, bring energy communities and local energy systems more clearly into industrial policy discussions. These models matter not only for mitigation, but also for resilience, affordability and future competitiveness.

Second, use procurement as a scaling instrument. Joint procurement, pre-commercial procurement and European framework approaches can help cities buy interoperable and modular components at scale.

Third, align funding with system architecture. European instruments should reward open standards, interoperability and local-first designs that can reduce long-term grid costs and avoid lock-in.

Priorities for national governments and regulators

National policy should avoid structural bias in favor of only centralised assets. It should create clear frameworks for energy communities and local flexibility markets, and it should support municipal competence-building in system planning, procurement and governance.

Cities as long-term system stewards

Cities are not merely hosts for energy infrastructure. They could act as long-term system stewards. That means integrating energy into urban development strategies, using municipal ownership and procurement strategically, building internal institutional capacity and working collectively across cities to influence national and European frameworks.

The transition to a new energy society is therefore not only a technological shift. It is also a governance transformation.

9. Conclusion: Cities as Builders of a New Energy Society

EnergyNet illustrates how cities could move from scarcity to local strength, from passive consumption to active system participation and from fragmented pilots to integrated infrastructure.

The larger lesson of the report is not that one architecture will solve every challenge. It is that cities need frameworks capable of linking housing, mobility, buildings, flexibility, data and power-system planning into one transition strategy.

For policymakers and funders, the challenge is to create open and inclusive frameworks that allow such system innovations to scale. For cities, the task is to become capable stewards of systems that are more digital, more decentralised and more participatory than the ones they inherited.

This Outlook invites cities, funders and decision-makers to treat local energy systems not as a niche experiment, but as a serious pillar of climate-neutral urban development. Their success should be measured not only in megawatts, but in resilience, affordability, participation and shared benefit.

References

Birgersson, J., Weiss, M. A., Chen, J., Kammen, D., Kåberger, T., Carrero-Martinez, F., Wernberg, J., Menser, M., & Ajami, N. K. (2025). EnergyNet Explained: Internetification of Energy Distribution. arXiv.

European Commission. (2019). Clean Energy for All Europeans Package. Brussels: European Commission.

European Commission. (2023). EU Action Plan for Grids. Brussels: European Commission.

European Commission. (2024). The Future of European Competitiveness. Brussels: European Commission.

RISE. (2024). How energy sharing became possible for the futuristic Tamarinden neighbourhood.

RISE. (2024). System change with locally shared energy.

ElectriCITY Innovation. (2024). An overview of the Hammarby Sjostad energy community.

ElectriCITY Innovation. (2024). Microgrid in Hammarby Sjöstad.

UN-Habitat. (2025). Briefing on Renewable Energy in Ukraine. Nairobi: United Nations Human Settlements Programme.

World Economic Forum. (2025). Grid Flexibility for a Resilient, Equitable and Digital Energy Future. Geneva: WEF.

World Economic Forum. (2025). Solar Power to Surpass Nuclear and Other Top Energy Trends. Geneva: WEF.

Energiföretagen Sverige. (2023). Investeringsbehov i elnäten i Sverige. Stockholm: Energiföretagen.

Energimarknadsinspektionen. (2023). Regulation and Valuation of Swedish Electricity Networks. Eskilstuna: Ei.

Svenska kraftnät. (2024). Langsiktig marknadsanalys och nätutvecklingsplan. Sundbyberg: Svenska kraftnät.

International Energy Agency. (2023). Electricity Grids and Secure Energy Transitions. Paris: IEA.

Eurelectric. (2022). Power Distribution in Europe: Facts and Figures. Brussels: Eurelectric.

Government Offices of Sweden. (2024). Budget Bill and Policy Proposals on Nuclear Financing. Stockholm: Government Offices of Sweden.

OLLE DIERKS
Viable Cities

JONAS BIRGERSSON
Via Europa

VIABLE CITIES OUTLOOK provides analyses of areas that are of great importance for a faster climate transition in cities.

VIABLE CITIES – a Swedish strategic innovation programme for climate neutral and sustainable cities, jointly funded by the Swedish Energy Agency, Vinnova and Formas.