Business & Economic Theory | Jan 19, 2026 | 7 min read | By Bryan White

Why Sweden is Betting Against the Traditional Grid with EnergyNet's Router System

Energy * Economics

Introduction: The Architecture of Scarcity and the POGS Grid

As global electrification accelerates, the centralized power infrastructure of the 20th century faces a structural capacity crisis. Known to critics as the "Plain Old Grid System" (POGS), the conventional grid operates on a synchronous, circuit-switched alternating current (AC) architecture established over a century ago. Bound by the first law of thermodynamics and lacking intrinsic storage, generation must match consumption millisecond by millisecond across a continental 50/60 Hz frequency lock.[1] Any sudden drop in wind generation or spike in demand threatens frequency deviations that can cascade into systemic blackouts.

Facing a projected doubling of electricity demand by 2045 from industrial and transport electrification, Sweden exemplifies this bottleneck.[1] Rather than waiting decades for capital-intensive high-voltage transmission expansions, Swedish broadband pioneer Jonas Birgersson and his "Project Energy Society" (Energisamh llet) argue that the bottleneck stems from an obsolete switching paradigm. Applying the logic of packet-switched data networks to electricity, the initiative seeks to replace synchronous AC scarcity with asynchronous, software-defined Direct Current (DC) microgrids, solid-state "Energy Routers," and flat-fee capacity subscriptions.[3][4]

From Fiber Optics to Electrons: De-Constructing the Value Chain

Project Energy Society draws directly from Sweden's 1990s telecommunications revolution. As founder of Framfab and Bredbandsbolaget, Birgersson bypassed state telecom monopolies and incremental copper upgrades (ISDN/ADSL) by deploying Fiber-to-the-Home (FTTH) networks built on a de-constructed value chain that separated physical infrastructure from service provision.[3][5] That architectural leap replaced per-minute metered scarcity with flat-rate data abundance.

Through ViaEuropa, Birgersson now applies the same critique to incumbent grid operators, who manage congestion via volatile spot-price billing (per kWh) and peak-load tariffs. Project Energy Society contends that by pairing local generation with distributed storage buffers, buildings and neighborhoods can achieve local energy abundance -- shifting electricity from a volume-metered commodity to a flat-rate monthly capacity subscription.[6]

The Physics of the Switch: Asynchronous DC Networking and the Energy Router

In a traditional synchronous AC grid, every generator and load is electromagnetically coupled: the rotational inertia of a northern hydro or nuclear turbine is physically locked to appliances hundreds of kilometers south. As

intermittent renewables replace thermal inertia, maintaining this continuous circuit-switched lock becomes increasingly costly and fragile.[2]

The EnergyNet architecture decouples this lock by packetizing electricity into buffered, software-routed transfers across three core layers: the building-level Energy Local Area Network (ELAN), the Energy Router, and the peer-to-peer Energy Protocol (EP).[4][2]

| Architectural Feature | | Plain Old Grid System (POGS) | | Project Energy Society (EnergyNet) |

| Switching Paradigm | | Circuit-Switched (Continuous unbuffered flow) | | Packet-Switched (Buffered, routed delivery) |

| Distribution Current | | Alternating Current (AC) | | Direct Current (DC) Microgrids (380V / 760V) |

| Grid Coupling | | Synchronous (50/60 Hz frequency lock) | | Asynchronous (Galvanic isolation via router) |

| Buffer Mechanism | | Centralized spinning reserves | | Distributed local lithium battery buffers |

| Control Topology | | Top-down centralized dispatch | | Autonomous peer-to-peer software routing |

| Economic Model | | Variable volumetric billing (per kWh + spot) | | Fixed monthly capacity subscription |

Unlike a passive transformer that transmits grid frequency disturbances directly into a property, the Energy Router uses power electronics to establish galvanic separation.[4] Incoming AC power is rectified into DC and buffered in local batteries before serving internal loads.[4] Because the building is galvanically isolated from the national grid's 50 Hz lock, it draws power at a steady, optimal baseline rate while its internal battery absorbs chaotic local spikes from EV fast chargers or induction stoves -- flattening peak demand curves and shielding the external transmission network.[2]

Engineering the DC Microgrid and the CoAction Lund Pilot

Inside each property, EnergyNet replaces internal AC wiring with an ELAN DC microgrid. Because modern loads -- LED lighting, computing hardware, variable-speed heat pumps, EV chargers, rooftop photovoltaics harvesting solar radiation, and batteries -- operate natively on DC, conventional AC distribution forces multiple AC-to-DC and DC-to-AC conversions. Governed by thermodynamics and the second law of thermodynamics, each conversion stage dissipates 5-10% of electrical energy as waste heat.[7] Consolidating onto a 380V or 760V DC backbone eliminates redundant conversions, boosting end-to-end efficiency by up to 20%.[7][8] To overcome the absence of an AC zero-crossing point -- which otherwise allows DC faults to sustain hazardous plasma arcs -- the Energy Router monitors current at microsecond intervals and trips solid-state semiconductor breakers long before thermal fuses could react.[7]

This architecture is currently operating in the Brunnsh g district of Lund under the

Vinnova-funded CoAction Lund pilot, uniting ViaEuropa, municipal housing provider LKF, and commercial developer Wihlborgs.[9][10] A dedicated underground DC link connects an office building and a student dormitory into an Energy Wide Area Network (EWAN), pairing rooftop solar arrays with basement battery banks housed in repurposed telecom exchange rooms.[9] On weekends, surplus solar power from the dormant office building routes directly behind the meter to the high-demand student dormitory; on weekday mornings, dormitory battery reserves buffer the office's peak load, avoiding public grid transmission fees and losses.[9][10]

Frequency Containment Reserves and Swedish Regulatory Friction

Project Energy Society finances its hardware capital expenditure through a "double-dip" revenue model centered on the Frequency Containment Reserve (FCR) market operated by Sweden's transmission system operator, Svenska kraftn t.[11][12] Because the national grid must remain locked at 50 Hz, Svenska kraftn t pays premium standby rates for sub-second battery reserves that inject or absorb power during grid deviations.[13][14] By aggregating spare capacity across distributed building batteries into the FCR market while simultaneously shaving local peak-demand tariffs, the EnergyNet amortizes its solar and battery hardware -- enabling flat monthly fees for tenants.[2][6]

Deploying EWAN cables across property lines, however, collides with Sweden's Network Concession (N tkoncession) laws, which grant regional grid operators legal monopolies over cross-property electricity distribution.[15] The Lund pilot leverages emerging IKN (Icke Koncessionspliktiga N t, or non-concession network) exemptions and the EU's Citizen Energy Communities (CEC) directive, which prohibits member states from discriminating against local peer-to-peer energy sharing.[15][16] Rulings by the Swedish Energy Market Inspectorate (Energimarknadsinspektionen) on how broadly internal microgrid exemptions apply will determine how rapidly EWAN clusters can scale nationwide.[17][15]

Conclusion: Distributed Resilience as Civil Defense

Beyond efficiency and pricing reform, Project Energy Society frames asynchronous DC networking as critical civil defense infrastructure. Whereas a centralized, synchronous AC grid presents a single point of failure vulnerable to cyber or physical disruption, a packet-switched network of galvanically isolated microgrids can instantaneously island itself and sustain local communities on stored solar and battery reserves.[3][18] By fusing DC power electronics, internet routing protocols, and ancillary frequency markets, Sweden's Lund experiment offers a compelling blueprint for a resilient, post-scarcity electrical grid.

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