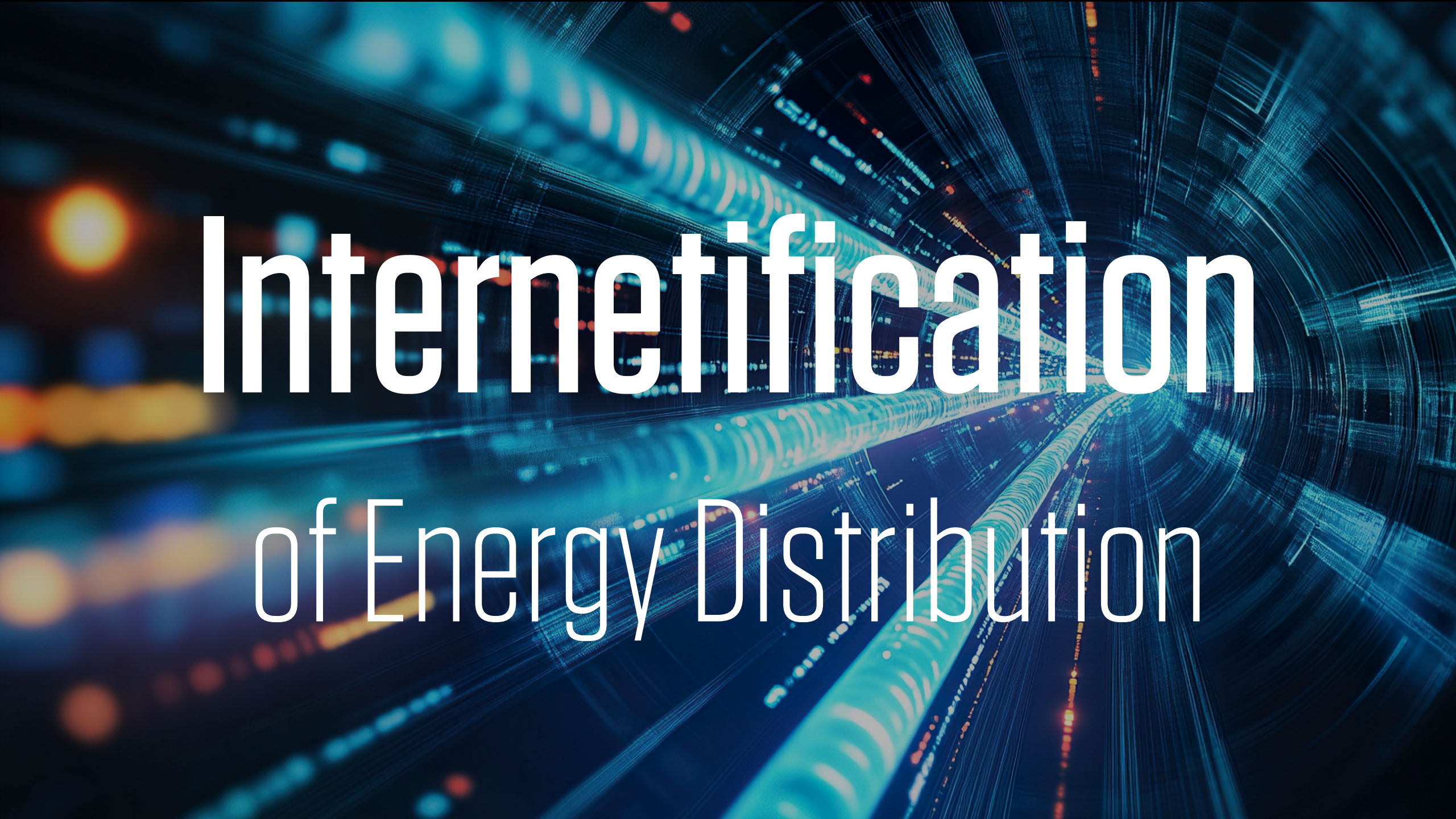

Internetification
of Energy Distribution

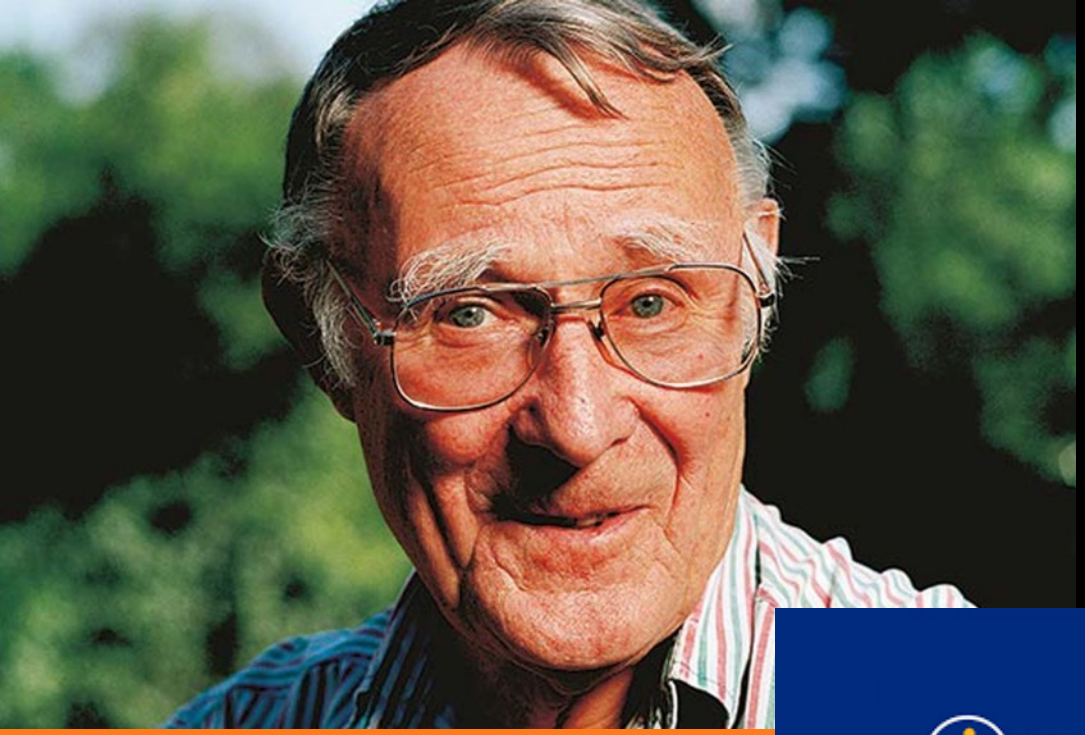


Energy is Becoming a Network Business

ViaEuropa is the world's first EnergyNet Operator, turning buildings into connected local energy markets that we call **short grids**.

Starting in Lund. Built on 25 years of open-network operating experience.







investor

FRAMFAB







Våra bilar Köpa Äga Elbilar Om oss VOLVO Logga in

The new and electric Volvo EX60 is changing the game: join us for the global reveal

Watch later Share

EX60

Watch on YouTube


U.S. Robotics
56K Faxmodem
RD
SD
PWR
CD

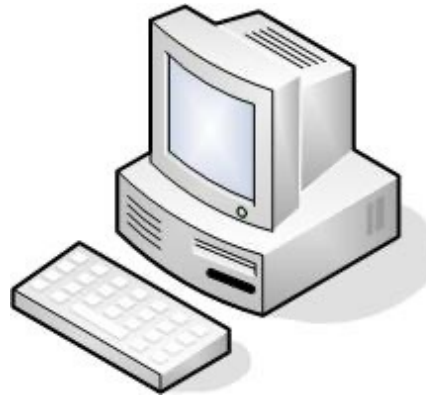







doro
1234567
M1
M2
R
C
1
2 ABC
3 DEF
4 GHI
5 JKL
6 MNO
7 PQRS
8 TUV
9 WXYZ
*
0
#
doro







Networked Readiness Index 2012, 1-7 (best)

Description Networked Readiness Index (Framework as of 2012)

Source World Economic Forum, [i]The Global Information Technology Report 2012[i] Dataset Networked Rea

R...	Entity	Value	.	Period	Series (tree)
1	Sweden	5.94			Networked R
2	Singapore	5.86			Networked R
3	Finland	5.81			Networked R
4	Denmark	5.70			Networked R
5	Switzerland	5.61			Networked R
6	Netherlands	5.60			Networked R
7	Norway	5.59			Networked R
8	United States	5.56			Networked R
9	Canada	5.51			Networked R
10	United Kingdom				Networked R
11	Taiwan, China				Networked R
12	Korea, Rep.				Networked R
13	Hong Kong S...				Networked R
14	New Zealand				Networked R
15	Iceland				Networked R
16	Germany				Networked R
17	Australia				Networked R
18	Japan				Networked R
19	Austria				Ne Networked R
20	Israel				Networked R

We worked with **seven of the eight first countries** on the NRI (not Singapore)

Bredbandsbolaget: Pioneered national-scale broadband; designed, built, and operated infrastructure that set the **new price / performance standard.**

10/10 Mpbs for **200 SEK / month** in **1998**

Telia Company



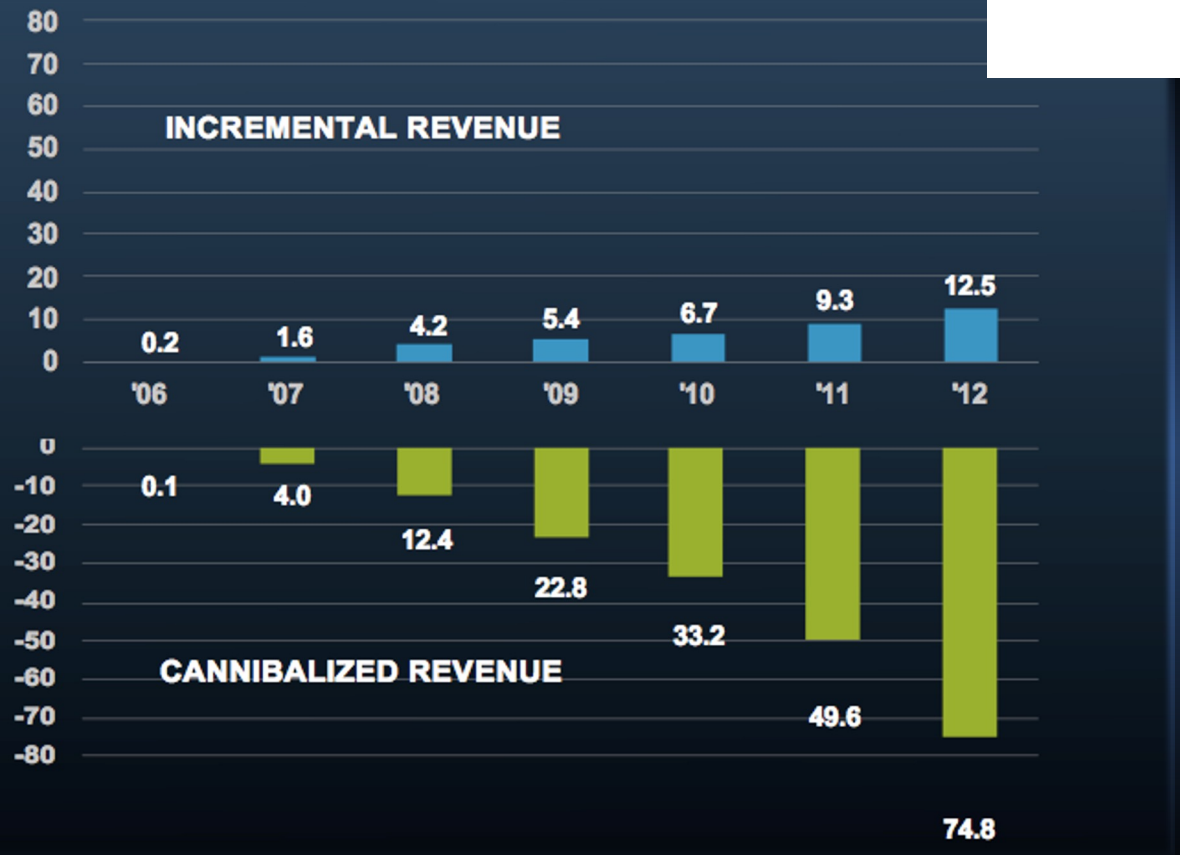
Telia: after ISDN & ADSL made a quick pivot to the **new price / performance standard.**

2014 1 million homes on fiber
2026 closing POTS **only on Mobile / Fiber**

Challenges for traditional Telecom Operators

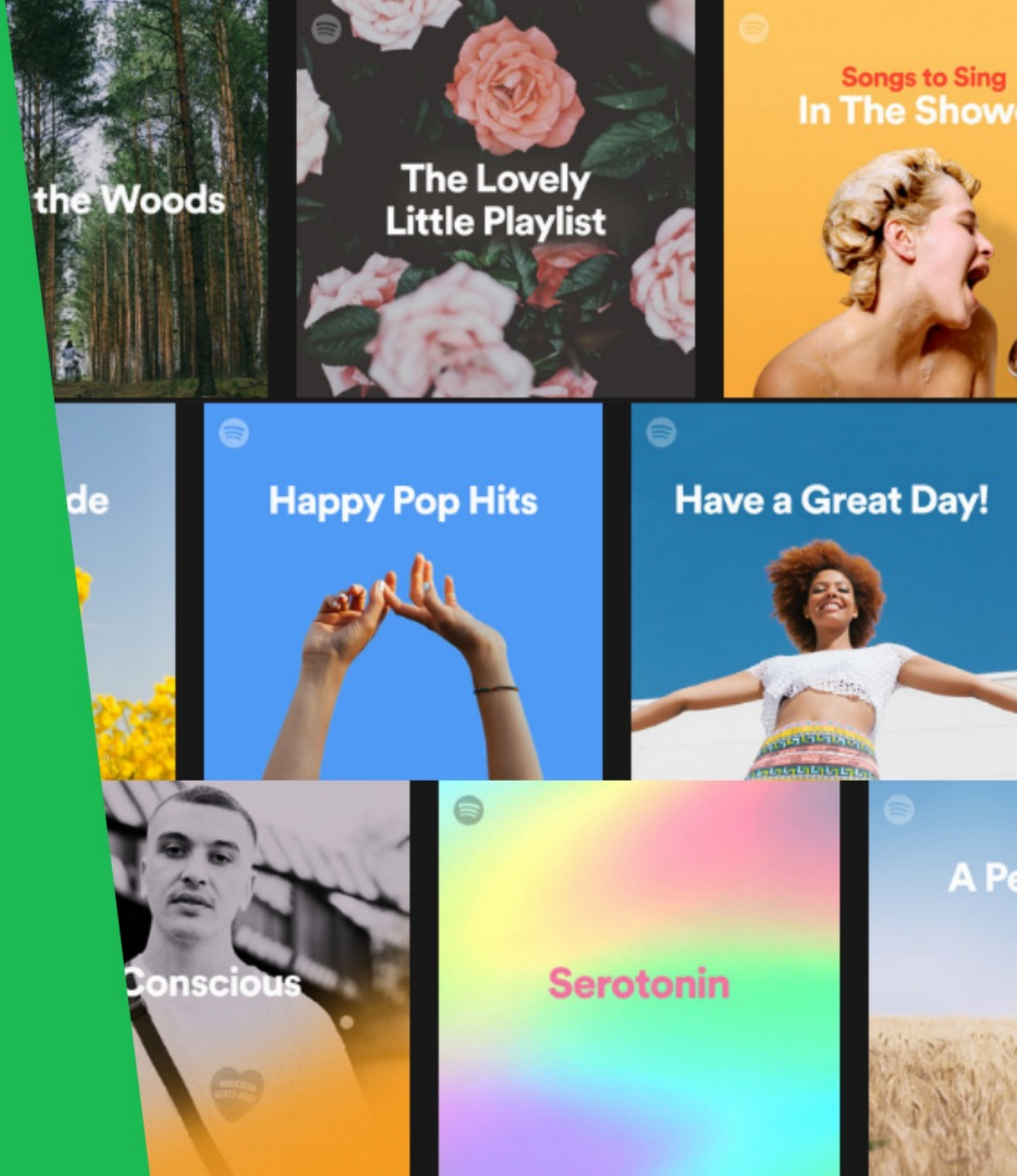
Constant pressure on revenues





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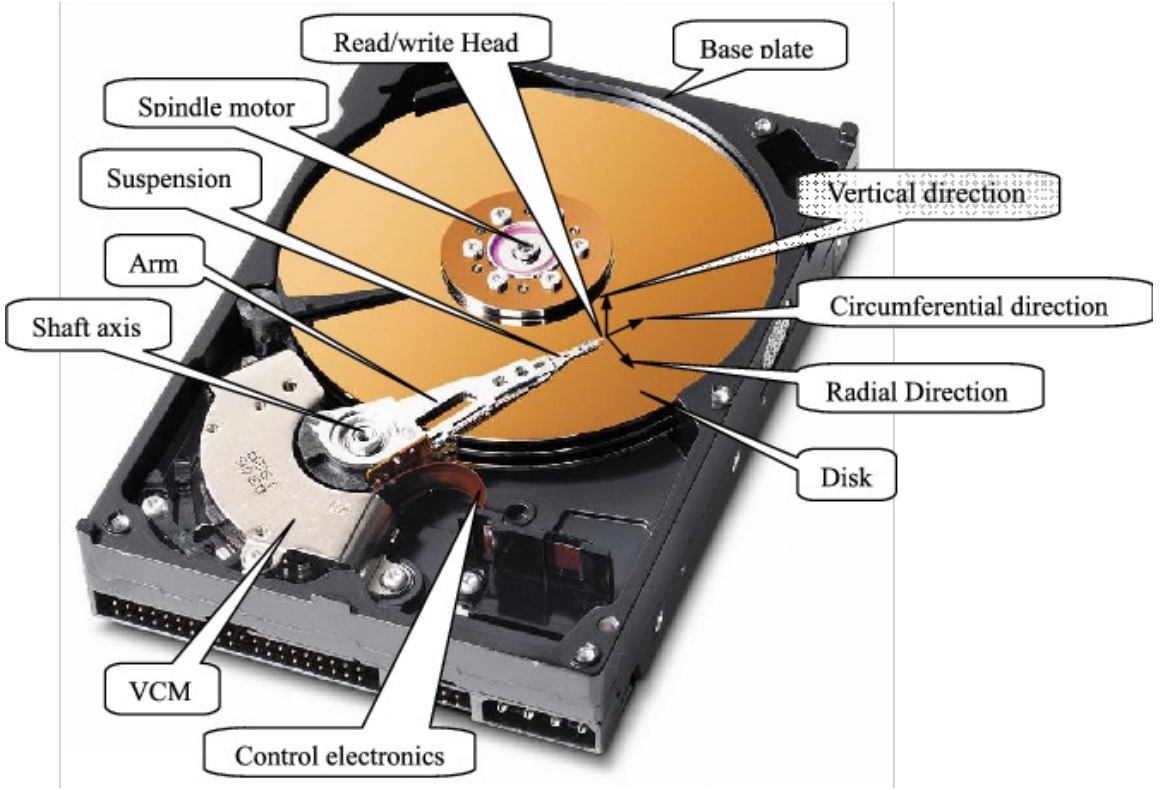
Spotify®


the Woods
The Lovely
Little Playlist
Songs to Sing
In The Show
de
Happy Pop Hits
Have a Great Day!
Conscious
Serotonin
A Pe

Price Performance drivers [Architecture]

Better drive solution (adding complexity & cost)

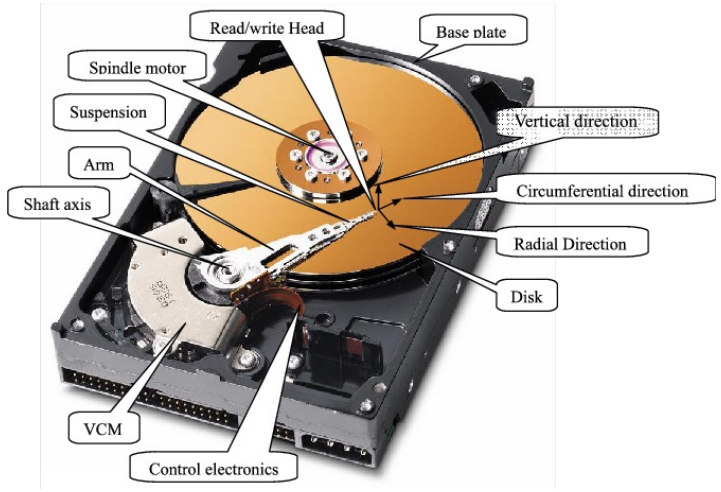
99%	100 USD
99,9%	1000 USD
99.99%	10 000 USD
99.999%	100 000 USD
99.9999%	1 000 000 USD



Better drive vs RAID

1000 000 USD 99.9999% 300 USD

~~NA~~ 99.99999999999% 600 USD





Better drive vs RAID

99.9999999999 %

600 USD

1 second of down time

in 31 700 years

Age of human civilization : ~5000 years



Better drive vs RAID

99.999999999999999%

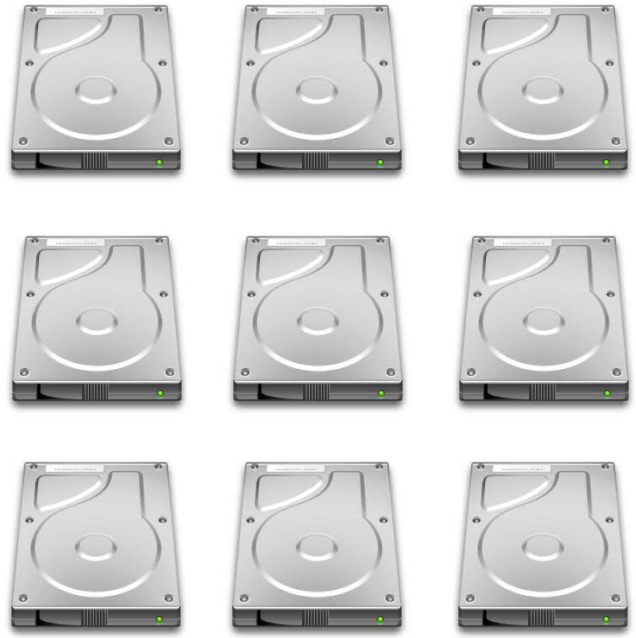
900

USD

1 second of down time

in 31,7 billion years

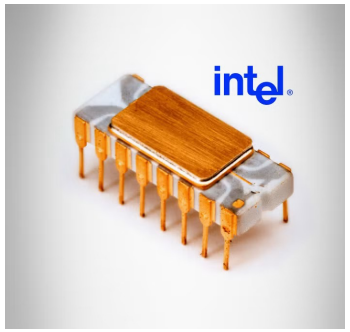
Age of the universe: ~13.8 billion years



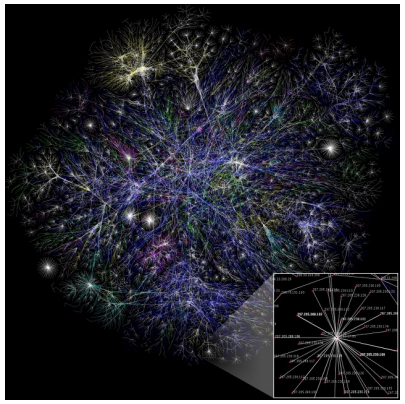
Few / Large / Expensive

Many / Small / Cheap

Electrotech

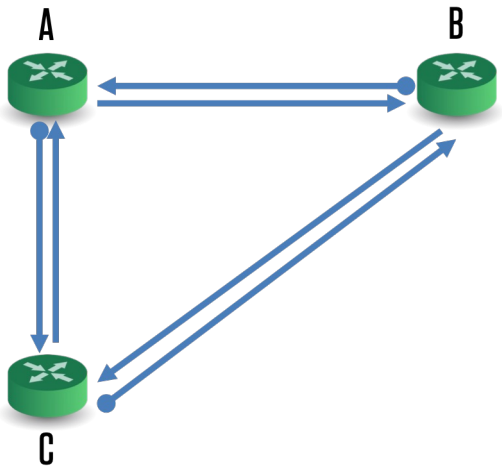

intel


IBM






DEFA
READY
RFID


A
B
C

Digitalisation

Electrification

First gridlock transmission blocking green energy

The old grid upgrade is a trillions of dollars problem. And even if funded it would take decades.

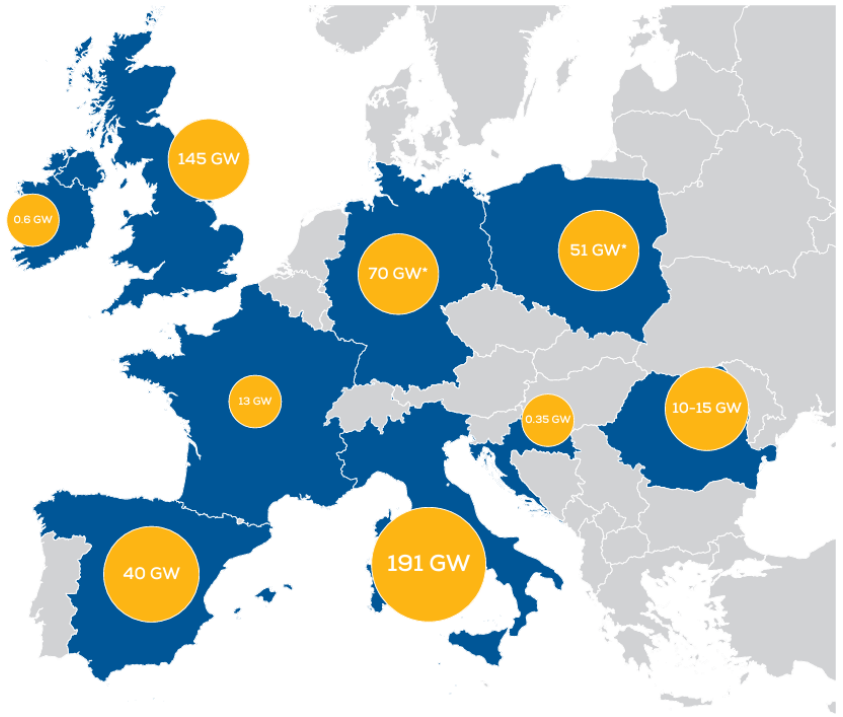


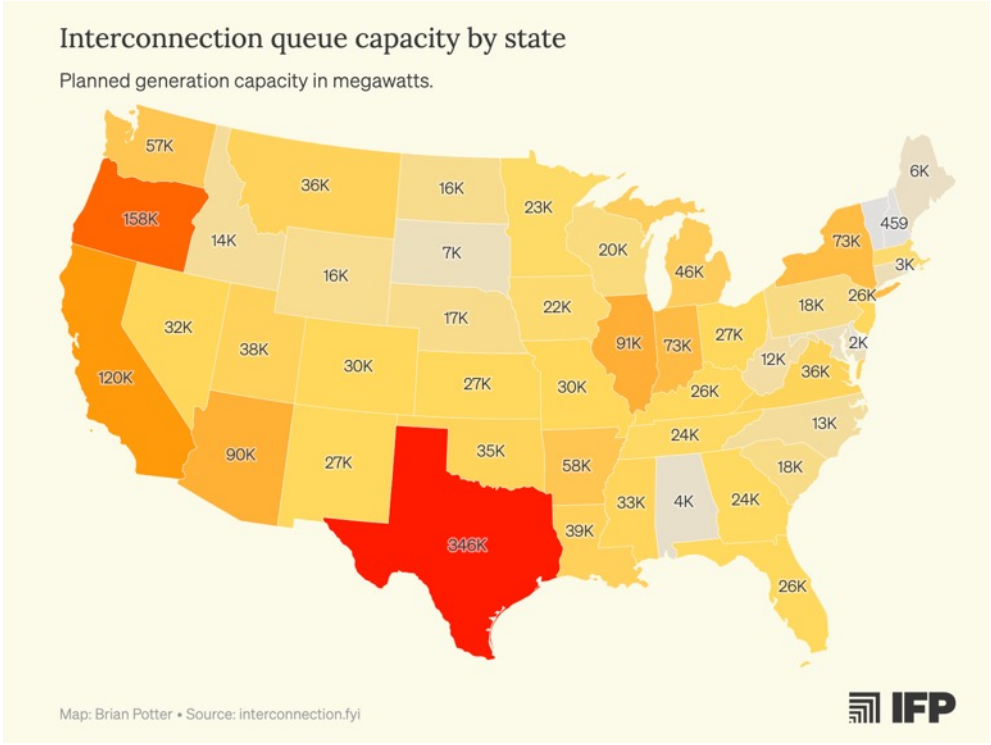


Technology Quarterly | The ultimate supply chains

The electric grid is about to be transforme

The technological and regulatory requirements will be immense, writes Hal Hodson





First gridlock transmission blocking green energy

The old grid upgrade is a trillions of dollars problem. And even if funded it would take decades.





Is there a risk for the old grid (POGS) to become a dead end?

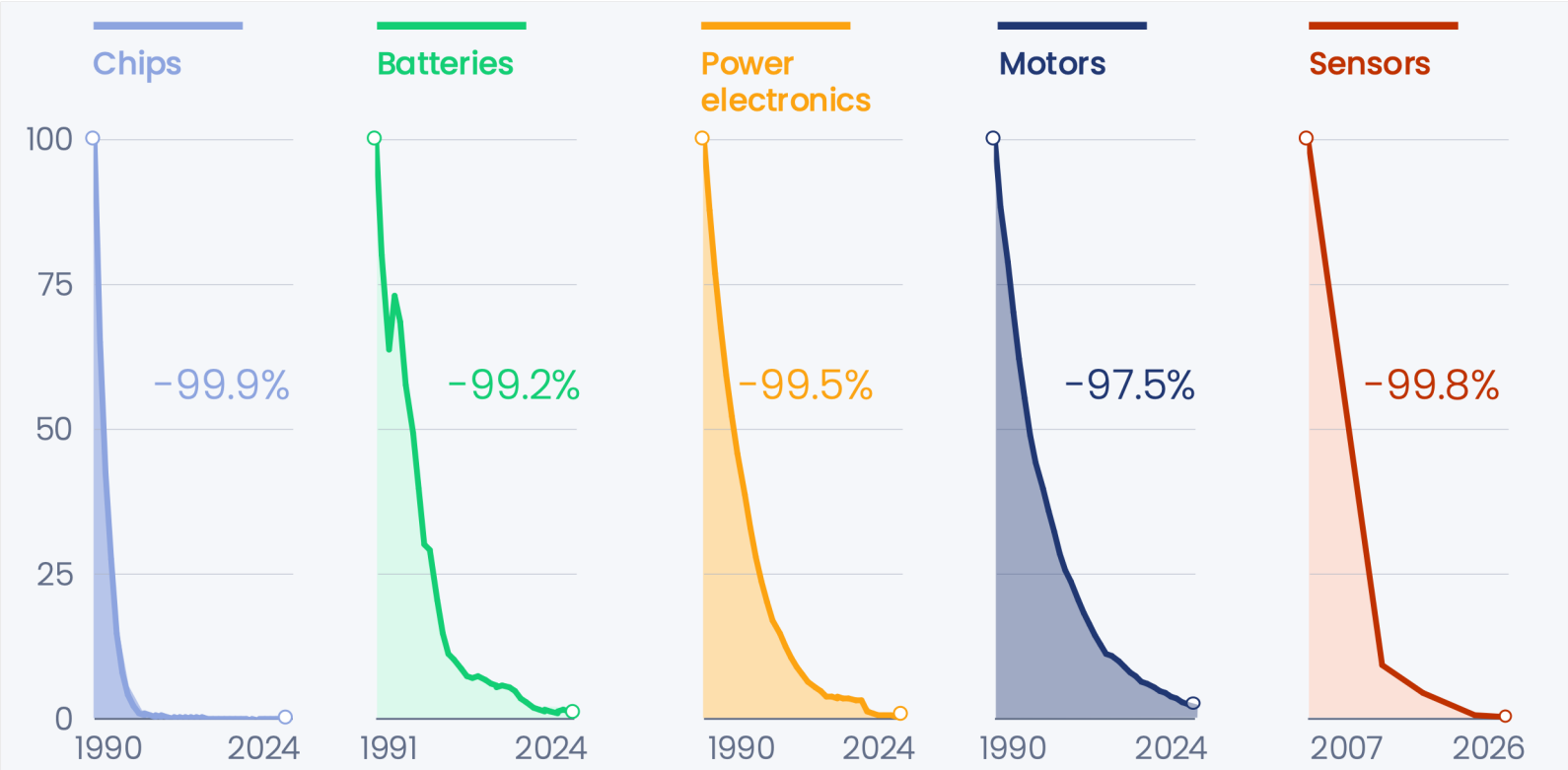
- Increasing cost
- Reduced reliability
- Connection queues

One tech stack, one flywheel, two revolutions

Infotech and electrotech push each other's costs down and capabilities up

The electric component stack

Price, first year = 100



Lower prices for each

Lower prices reduce final cost of infotech and electrotech, boosting sales

More collective volume

Both infotech and electrotech drive up demand and therefore scale up supply, lowering production cost

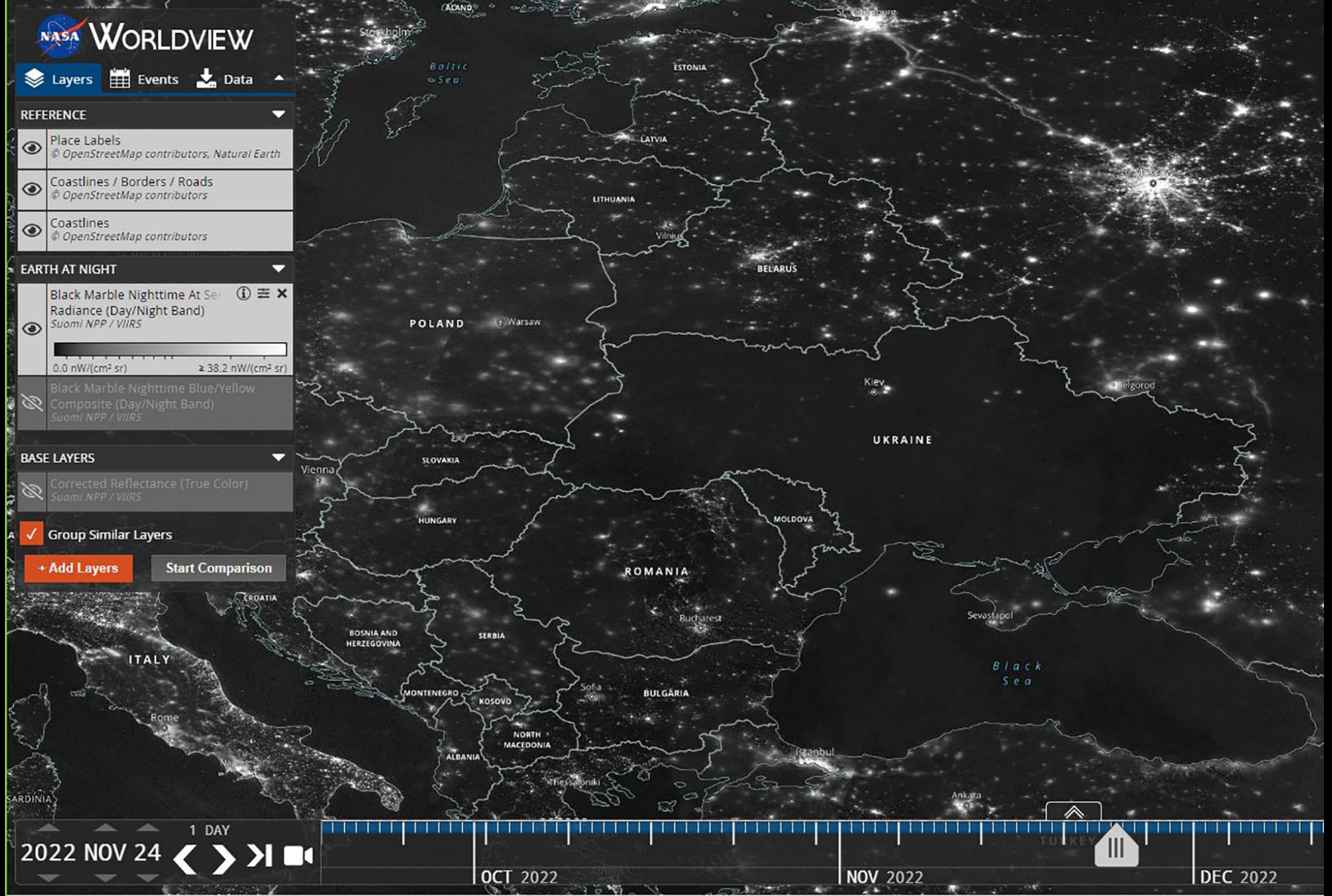
Example electrotech and infotech using the five components

- Laptop & PC
- Smartphone
- AI server
- Solar system
- Electric car
- Grid battery

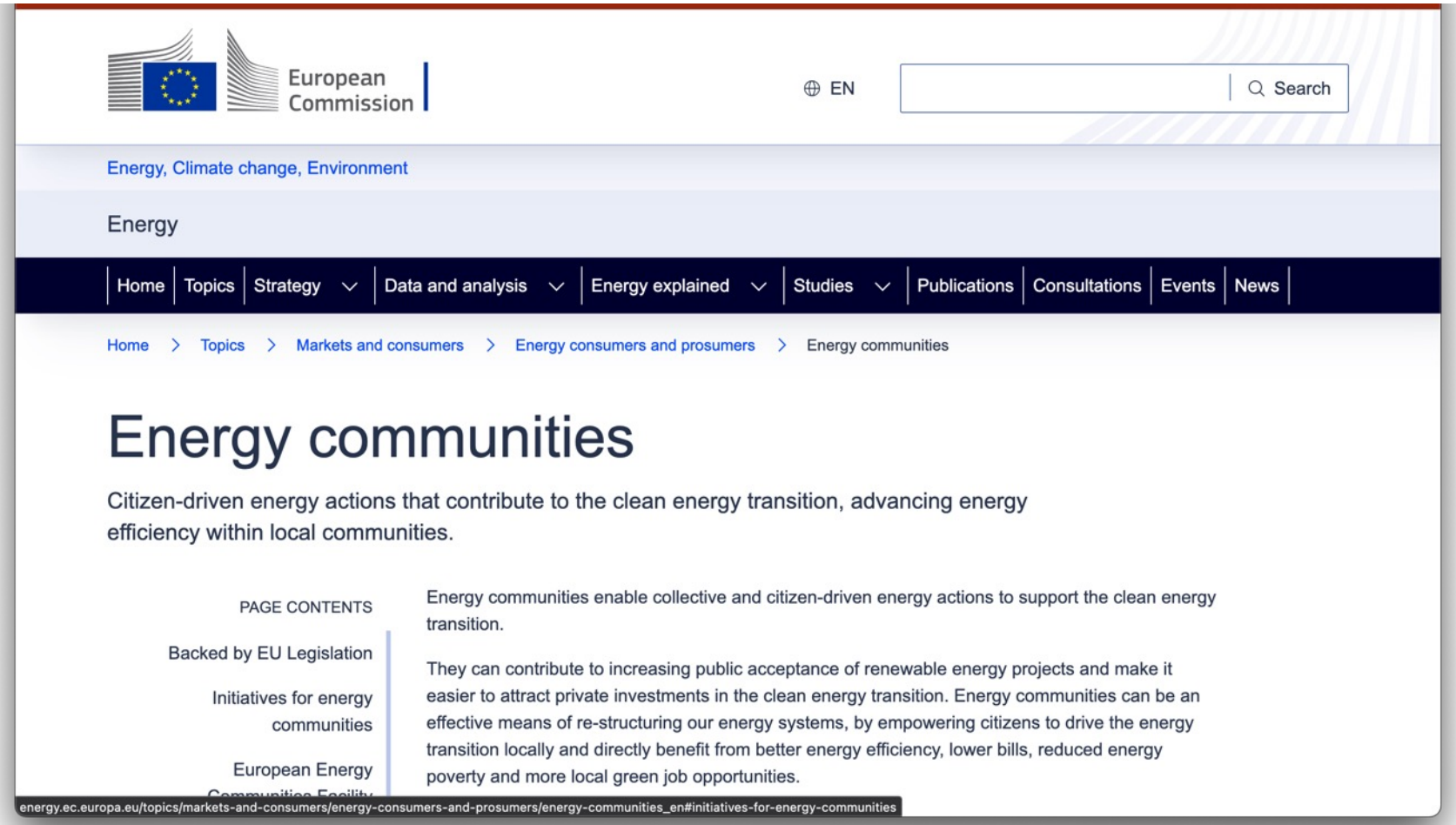
Sources: Not Boring (The Electric Slide); Our World in Data; Velodyne; Hesai; Thunder Said Energy; Ember analysis • Note: based on the following units: chips $/DMIPS, batteries $/kWh, power electronics $/kW, motors $/kW, sensors $/LIDAR unit.

EMBER




NASA WORLDVIEW
Layers
Events
Data
REFERENCE
Place Labels
© OpenStreetMap contributors, Natural Earth
Coastlines / Borders / Roads
© OpenStreetMap contributors
Coastlines
© OpenStreetMap contributors
EARTH AT NIGHT
Black Marble Nighttime At Se
Radiance (Day/Night Band)
Suomi NPP / VIIRS
0.0 nW/(cm² sr)
≥ 38.2 nW/(cm² sr)
Black Marble Nighttime Blue/Yellow Composite (Day/Night Band)
Suomi NPP / VIIRS
BASE LAYERS
Corrected Reflectance (True Color)
Suomi NPP / VIIRS
Group Similar Layers
+ Add Layers
Start Comparison
1 DAY
2022 NOV 24
OCT 2022
NOV 2022
DEC 2022
Baltic Sea
ESTONIA
LATVIA
LITHUANIA
Vilnius
BELARUS
POLAND
Warsaw
Kiev
UKRAINE
SLOVAKIA
Vienna
HUNGARY
MOLDOVA
ROMANIA
Bucharest
Sevastopol
Black Sea
CROATIA
BOSNIA AND HERZEGOVINA
SERBIA
ITALY
Rome
MONTENEGRO
KOSOVO
Sofia
BULGARIA
NORTH MACEDONIA
ALBANIA
Istanbul
Ankara
SARDINIA

For the first time in a 100 years, it now legal to build parallel electrical grids in all EU countries



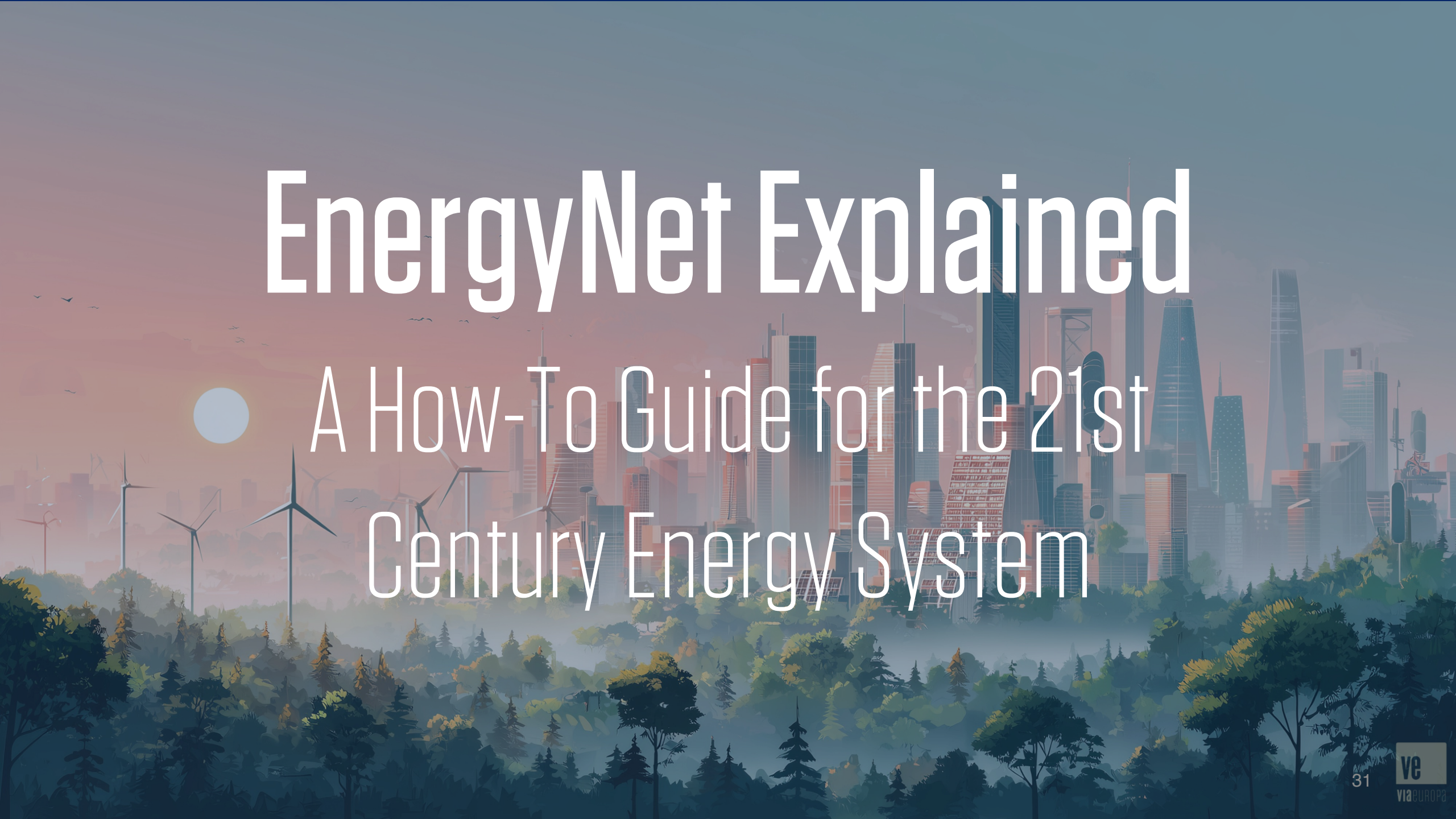
"Freedom Cables"

- ✓ Distribution Tech (AC/DC)
- ✓ Set price for transport
- ✓ Set your price for power

Because of this deregulation EU could become a leader in **new and disruptive energy distribution systems**.

EnergyNet Explained

A How-To Guide for the 21st Century Energy System



EnergyNet Explained: Internetification of Energy Distribution
A How-To Guide for a 21st-century Energy System

Abstract

Building on lessons from telecom's shift from a centralized, circuit-switched phone system to decentralized, packet-switched data networks. EnergyNet utilizes:

(i) an Energy Router that enforces galvanic separation and software-defined energy flows over a DC backplane;

(ii) Energy Local/Wide Area Networks (ELAN/EWAN), DC microgrids that interconnect by policy via an open Energy Protocol (EP); and

(iii) a control plane comprising the Energy Router Operating System (EROS) and EP Server, managed at operator scale through an Energy Network Management System (ENMS).



EnergyNet Explained: Internetification of Energy Distribution
The podcast version



Quantifying EnergyNet performance: a simulation-based framework for decentralized energy networks

Max Collins, Jonas Birgersson, Marc A. Weiss, Jimmy Chen, Marc Z. Jacobson, Newsha K. Ajami, Daniel Kammen, Tomas Kåberger, Franklin Carrero-Martínez, Joakim Wernberg, Michael Menser, Henrik Ny, Lou Riordan, Jill G. Ferguson



Abstract

Modern power systems are increasingly exposed to severe disturbances caused by extreme weather, infrastructure failures, and geopolitical conflicts. Conventional power systems rely on interconnected transmission and distribution infrastructure to connect generation and consumers, and failures of this infrastructure can disconnect large groups of consumers from their energy supply until service is restored. At the same time, increasing amounts of local generation, storage, and controllable loads are being deployed throughout the power system, creating new possibilities for how electrical energy systems can be organized and operated.

EnergyNet has been proposed as a decentralized, software-defined energy architecture based on interconnected power electronic Energy Routers. Each router coordinates local loads, generation, storage, and grid connections, while bidirectional Energy Links enable energy exchange between routers. Energy exchange is coordinated through the Energy Protocol, allowing routers to communicate energy needs and availability and establish energy transfer across the network. EnergyNet can operate together with the conventional grid, independently from it, or across combinations of grid-connected and isolated regions.


EnergyNet is not
a product, a brand
or a company.



Outcome 01

Resilience Without Single Points of Failure

Low fixed cost for clean energy





Unlocking the **EV Promise**

Unlimited Mobility



The 500 kg battery is visible. The 28 tonnes of CO_2 are not.

Illustrative petrol car: 6.0 L/100 km over 200,000 km. Tailpipe CO_2 only.

THE OBJECT WE SEE



0.5 t

durable battery asset

Materials remain in the system and can be reused or recycled.

THE OUTPUT WE DO NOT SEE

28.2 t CO_2

≈ 14 two-tonne cars



Each car silhouette = 2 tonnes of CO_2

≈ 56 battery masses

6.0 L/100 km	×	**200,000 km**	=	**12,000 L petrol**	×	**2.35 kg CO_2/L**	=	**28.2 t CO_2**

Most of the added mass is oxygen from the air.

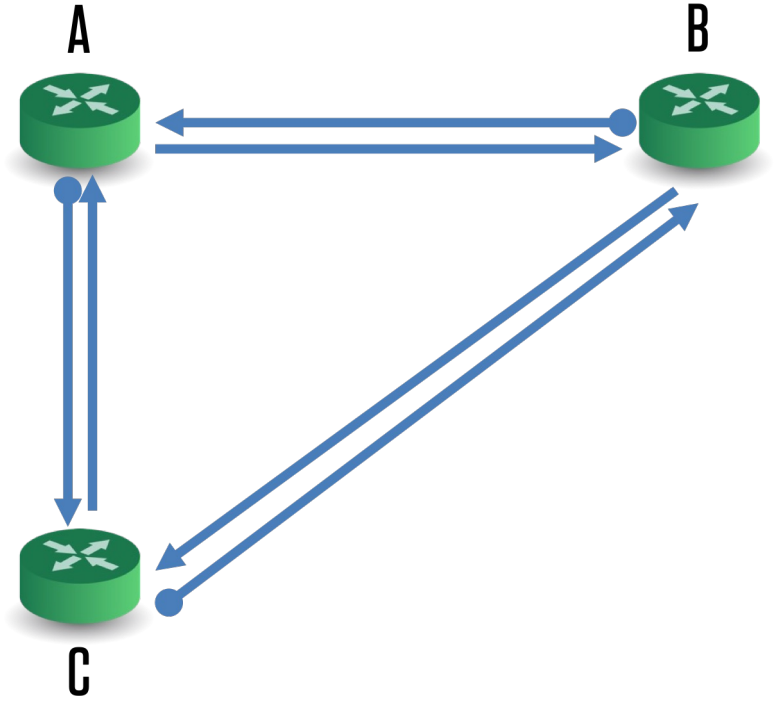
Lifecycle check: IEA finds a medium BEV sold in 2023 produces about half the lifecycle emissions of an equivalent ICEV globally.

Sources: US EPA combustion factor; IEA Global EV Outlook 2024, p. 157.

Innovation the energy protocol

The Energy Protocol (EP)

Inspired by the Internet architecture distributed and independent networks that can function as standalone but will benefit greatly from being interconnected with as many compatible networks as possible. EP will include similar concept to routing but for Energy Sharing. It also simplify EnergyNet operation concepts such as Software Defined Energy Networks.



ENERGYNET TASK FORCE

A Protocol for Packet Network Intercommunication

VINTON G. CERF AND ROBERT E. KAHN,
MEMBER, IEEE

Abstract — A protocol that supports the sharing of resources that exist in different packet switching networks is presented. The protocol provides for variation in individual network packet sizes, transmission failures, sequencing, flow control, end-to-end error checking, and the creation and destruction of logical process-to-process connections. Some implementation issues are considered, and problems such as internetwork routing, accounting, and timeouts are exposed.

INTRODUCTION

IN THE LAST few years considerable effort has been expended on the design and implementation of packet switching networks [1]-[7],[14],[17]. A principle reason for developing such networks has been to facilitate the sharing of computer resources. A packet communication network includes a transportation mechanism for delivering data between computers or between computers and terminals. To make the data meaningful, computer and terminals share a common protocol (i.e, a set of agreed upon

of one or more *packet switches*, and a collection of communication media that interconnect the packet switches. Within each HOST, we assume that there exist *processes* which must communicate with processes in their own or other HOSTS. Any current definition of a process will be adequate for our purposes [13]. These processes are generally the ultimate source and destination of data in the network. Typically, within an individual network, there exists a protocol for communication between any source and destination process. Only the source and destination processes require knowledge of this convention for communication to take place. Processes in two distinct networks would ordinarily use different protocols for this purpose. The ensemble of packet switches and communication media is called the *packet switching subnet*. Fig. 1 illustrates these ideas.

Network the energy router

03 **The Independent Energy Router (IER)**

Core component the E-LAN energy network. Enable low level decentralized routing of energy to where it is needed based on active routing following command and principals from the energy protocol (EP).

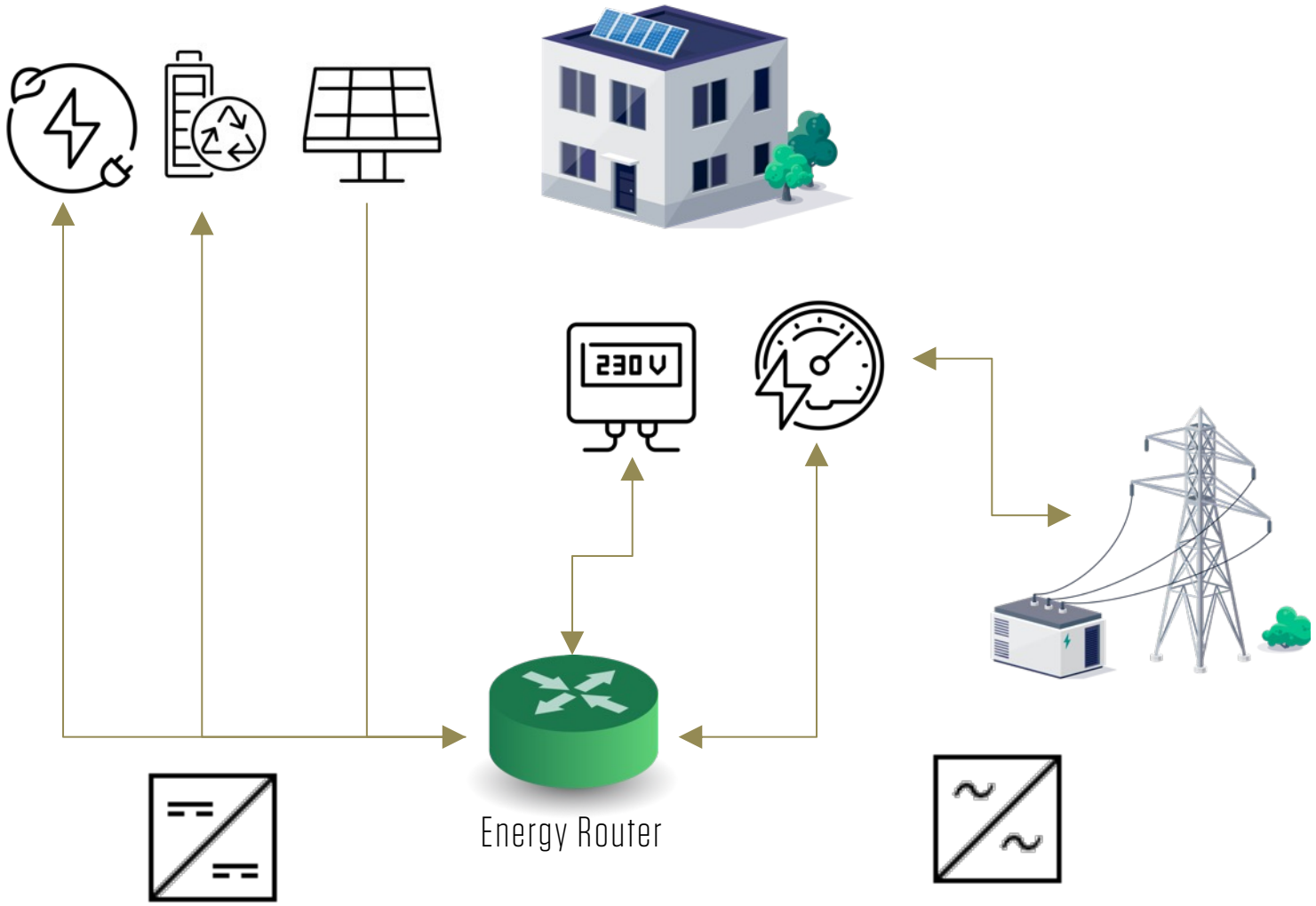
The central network element in each node

Each node, usually a building will, have at least one IER, its interfaces can be connected to the traditional grid (taking on the role of a Boarder Router), other energy communities (EC) and other nodes inside the E-LAN (typically with the organizational boundaries of an EC. Nodes can be in-building AC or DC grids but also energy storages and electrical vehicles (EV) with both charging and vehicles to X energy sharing.





EnergyNet enable independent local investments



the firewall effect

- ✓ **Unlimited local production**
- ✓ **Galvanic insolation** (DC/AC)
- ✓ **Power electronics** (EV)

The **Energy Router** plus the EnergyNet tech stack works as a "**firewall**" that with the EnergyNet operator as a Service create a local marketplace and sharing capabilities

Build locally. Build in parallel.

Repeatable local infrastructure removes unnecessary dependence on upstream reinforcement.

Upstream-dependent expansion

- Existing connection constraint
- Upstream design and approvals
- Network reinforcement
- Additional local resources commissioned

Shared upstream dependency

Parallel Short Grid deployment

Building	Block	Campus
Design locally	Design locally	Design locally
Build + connect	Build + connect	Build + connect
Operate + expand	Operate + expand	Operate + expand

Standard interfaces let many sites develop at once.

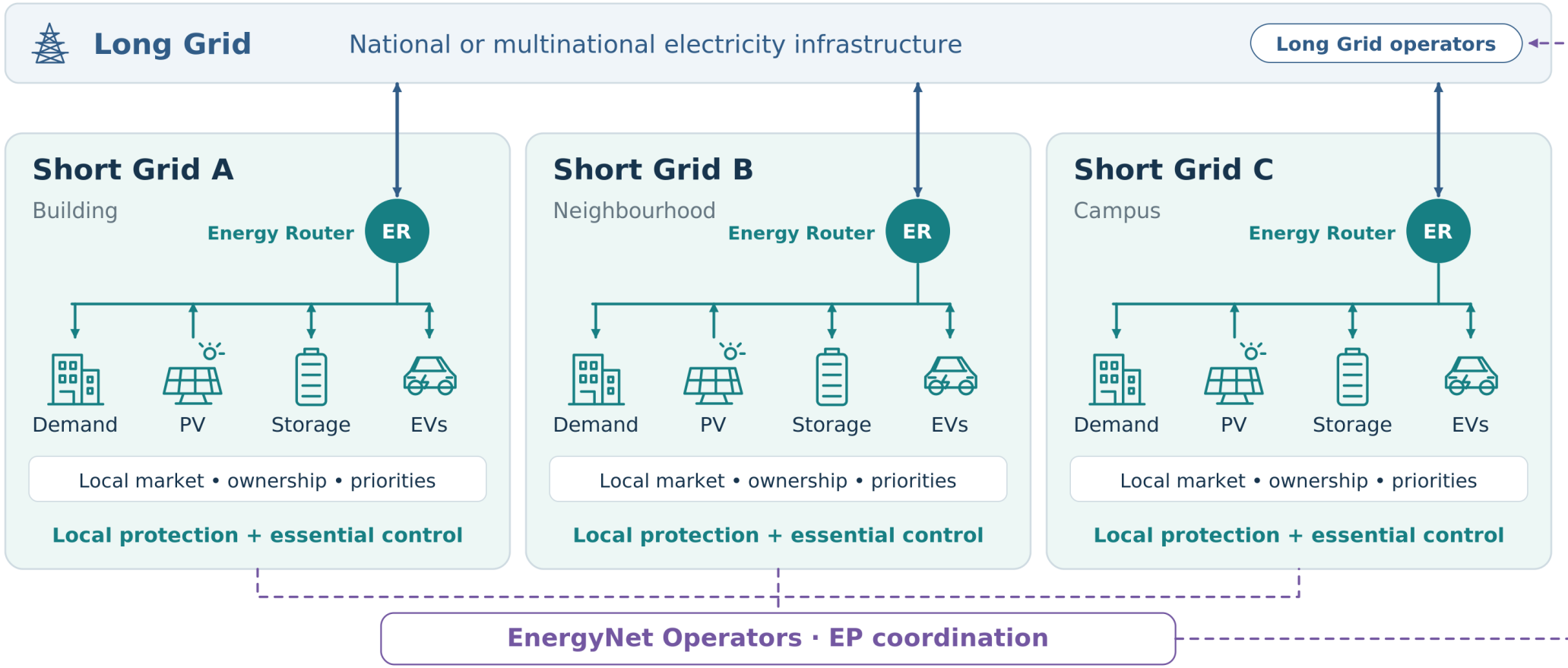
Each site still respects its approved connection envelope and local engineering requirements.

Source: Review Draft 0.4, §§1–2. Qualitative deployment sequence; no construction durations are implied.

CONCEPTUAL SCHEMATIC

Long Grid, many Short Grids

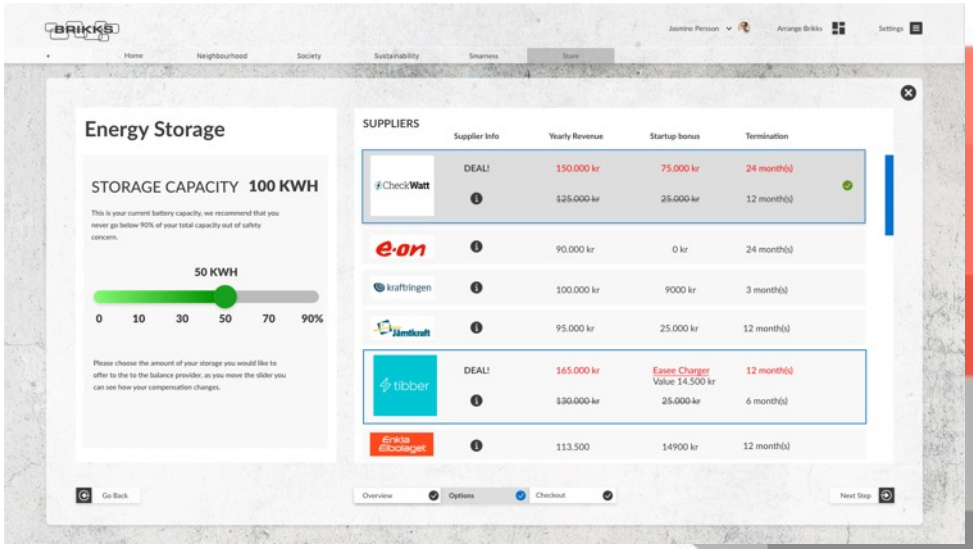
One shared infrastructure layer. Many autonomous local domains.

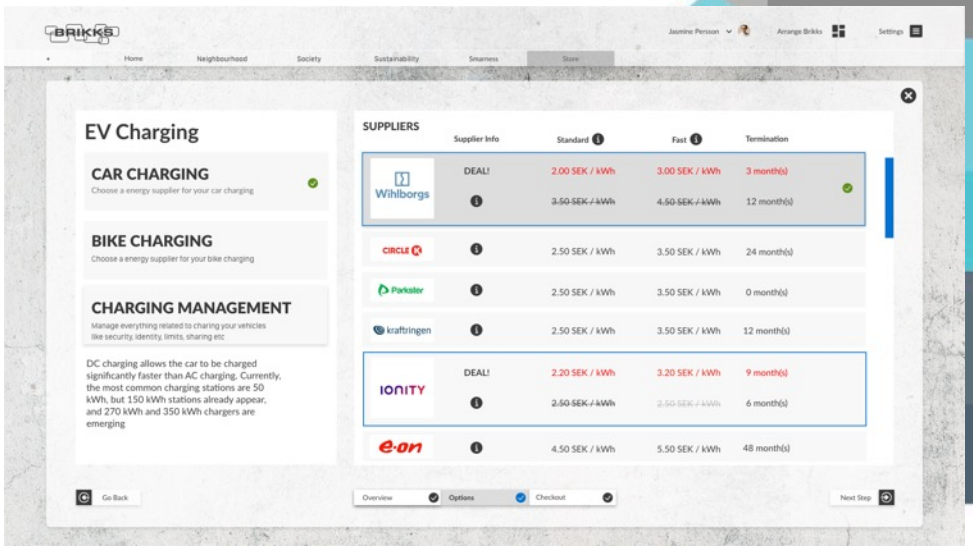


Local autonomy + network-scale coordination

Source: Review Draft 0.4, §2.3. Solid lines: electrical links. Dashed purple: coordination, not power flow.

Business model EnergyNet Operator as a Service





Services
independent service providers

ENO (ViaEuropa)
marketplace & operations

Network
energy resources

Infrastructure
energy distribution cables

Revenue share for ENO

- ✓ **Marketplaces** (sell locally)
- ✓ **Billing** (BSS/OSS)
- ✓ **Operations** (24/7/365)

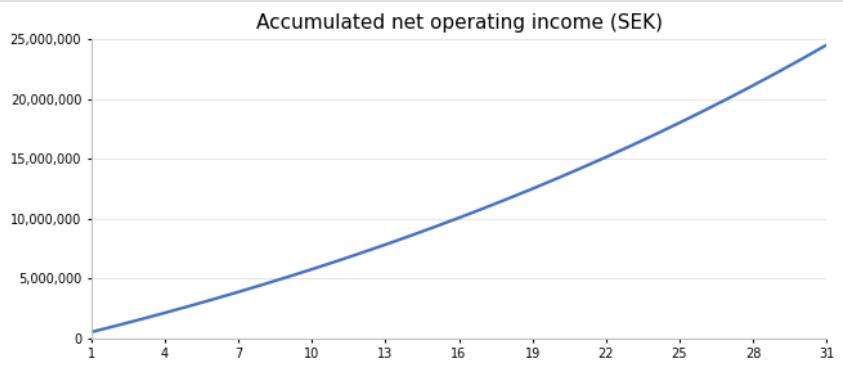
ViaEuropa is a Software driven Operator **with a revenue share on all electricity sold over the new marketplace.**

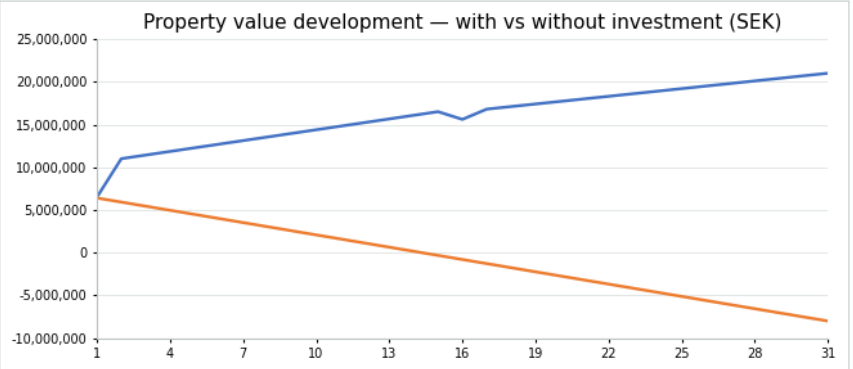
ENO also represents the Local EnergyNet vs the traditional grid operator (LSO / DSO) that create new value-added services.

EnergyNet investment case — multifamily property

Total return (ROI, 30 yrs)	Annual return (IRR)	Payback period
2.49x	6.28%	14.7 years

NOI increase, year 1 (SEK)	Net present value (NPV, SEK)	Property value increase, at exit (SEK)
+506,784	+5,613,093	+20,407,445





Energy class (EPC) — potential (PRELIMINARY)	Cost per apartment per year	Potential — NOI uplift from neighbourhood energy sharing
F → D	308 SEK	+83,596 SEK

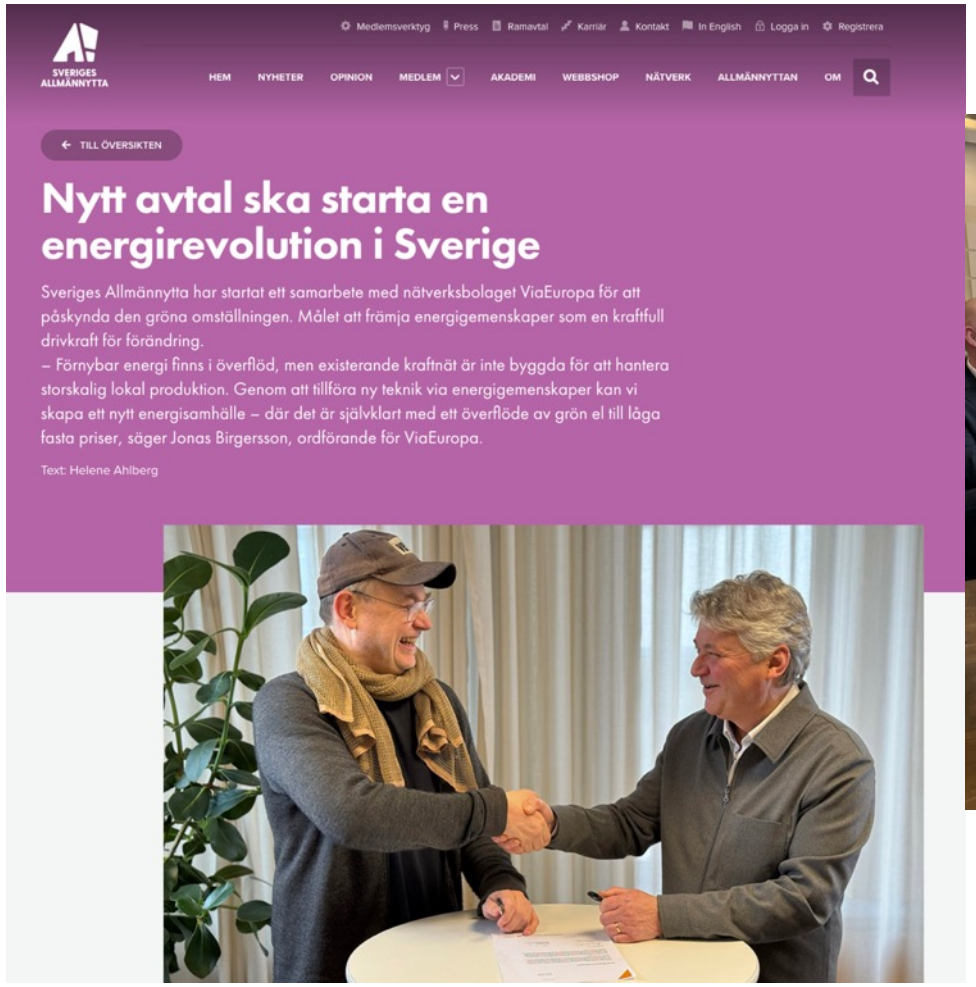
Resilience — island-mode capability	NOI contribution per apartment per year	Expense reduction per household per year
10h	9,665 SEK	−3,105 SEK

Rebalanced by 25%

Self-sufficiency	Households' annual expense reduction
5.4 months	−276,345 SEK

Rebalanced by 25%

Anonymised case output from the EnergyNet investment tool. Chart curves illustrative; headline figures per the underlying case.





Key Customers in Sweden

- ✓ **National public housing** (20% HH)
- ❑ **HSB** (7% HH)
- ❑ **Riksbyggen** (5% HH)

ViaEuropa reaches 32% of the Swedish housing market through just three contracts. VESE has active broadband contracts with all three, plus a signed EnergyNet contract with the public-housing organization (Sverige Allmännytta).

Real-estate companies and cities have strong reasons to invest in local clean energy. Infrastructure funds are now engaging too.

Read more: EU Energy Performance of Buildings Directive (EPBD)
https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

Key Partners in Sweden

Polhem Infra AB, Swedish national infrastructure fund.
Viable Cities, a national network of 48 climate neutral cities.
Skanska AB, a Swedish global construction company.

Different systems, same answer: the built environment is #1

Comparable definition: households plus commercial, public, service or tertiary electricity. This is a physical grid-interface view, not a narrow “real-estate-company” accounting category.

SWEDEN

2024

BUILT ENVIRONMENT

75.9 TWh

60.5% of sector electricity

TOTAL SECTOR ELECTRICITY

125.3 TWh

NEXT-LARGEST USER

Manufacturing, 45.3 TWh

built environment still ranks #1

DENMARK

2023

BUILT ENVIRONMENT

19.2 TWh

63.1% of sector electricity

TOTAL SECTOR ELECTRICITY

30.4 TWh

NEXT-LARGEST USER

Agri. + industry, 10.3 TWh

built environment still ranks #1

NORWAY

2024

BUILT ENVIRONMENT

66.5 TWh

51.4% of sector electricity

TOTAL SECTOR ELECTRICITY

129.3 TWh

NEXT-LARGEST USER

Secondary industry, 60.3 TWh

built environment still ranks #1

Implication

Even in very different national systems, the largest controllable electricity interface is the building estate: homes, offices, shops, public buildings, parking, chargers, heat pumps, batteries and local generation.

Sources: SCB Sweden 2024 electricity use; Danish Energy Agency Energy Statistics 2023; SSB Norway 2024 electricity by consumer group. Denmark converted from PJ to TWh.

California vs Scandinavia: same electricity scale, different depth

The corrected comparison counts California behind-the-meter solar. The result is simple and useful: the two systems are both roughly 0.3 PWh/year, but Scandinavia gets there with far fewer people.

CALIFORNIA

ELECTRICITY FOOTPRINT

305 TWh/yr

≈49% of combined

POPULATION

39.4m

about 77% larger

ELECTRICITY / PERSON

7.7 MWh/yr

large system, lower electrification

COMBINED

TOTAL SCALE

618 TWh/yr

CA + SE + DK + NO

POPULATION

61.6m

lead-market platform

POLITICAL MESSAGE

scale + reference

one transatlantic engine

SCANDINAVIA

ELECTRICITY FOOTPRINT

313 TWh/yr

≈51% of combined

POPULATION

22.2m

about 56% of CA

ELECTRICITY / PERSON

14.1 MWh/yr

high-electrification benchmark

Takeaway: Scandinavia demonstrates the highly electrified system. California demonstrates the scale of the transition still to come.

Sources: California Energy Commission 2024 TSEG, gross consumption and BTM solar; SCB Sweden 2024; SSB Norway 2024; Danish Energy Agency 2023/2024. Rounded values; Scandinavia = Sweden, Denmark, Norway.

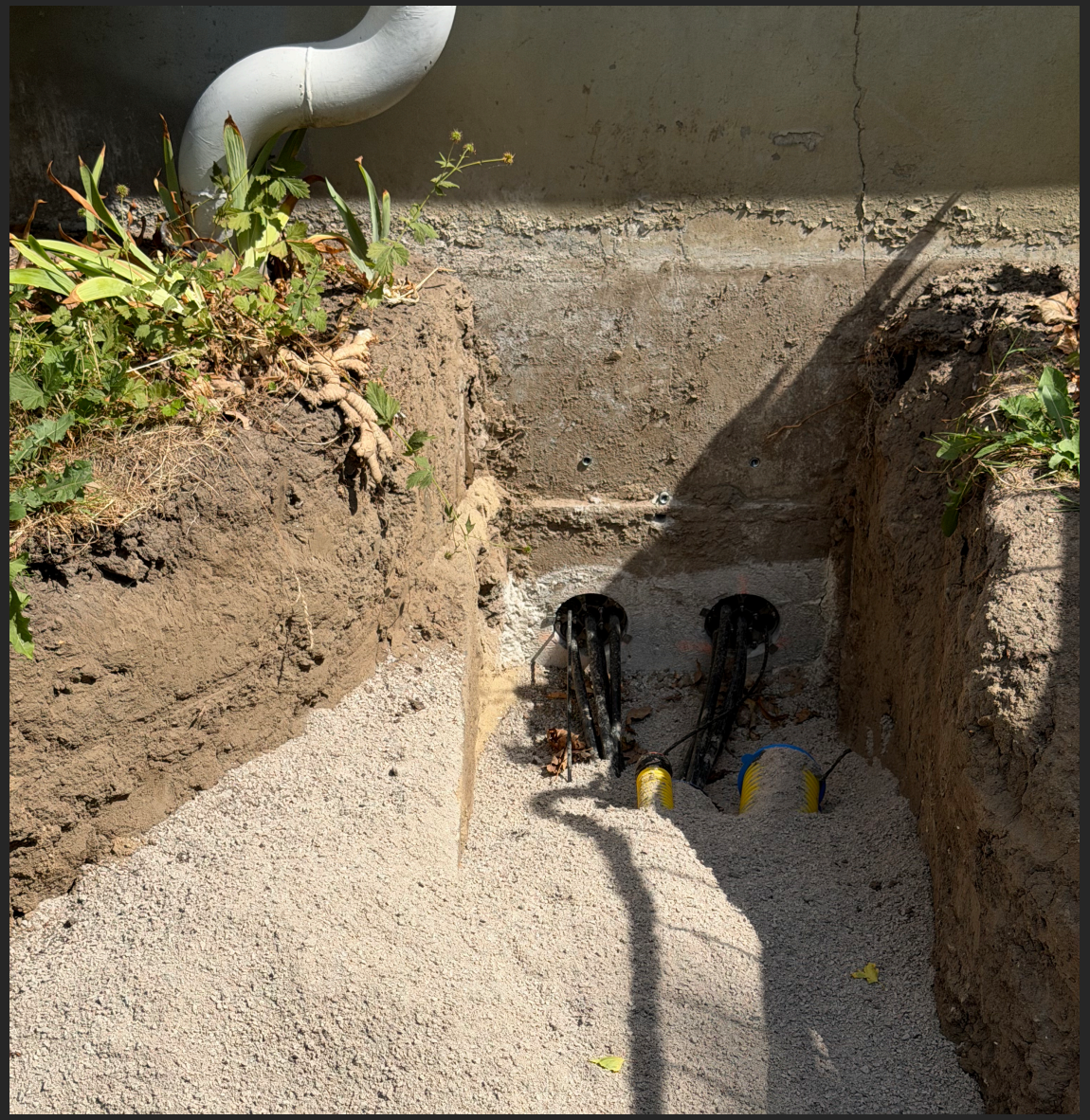
Energy cost is the key for **real estate value**

Energy cost is (together with cost of capital) the **key** recurring cost for real-estate and because of this fundamentally important for **valuation**.

With the **Energy Performance of Buildings Directive** (EPBD) energy performance of buildings will become even more important. A **building with energy class A or B will become significantly more valuable** but the opposite is also true (F or G grade) will reduce value.


A
B
C
D
E
F
G
EPBD


B e r l a y m o n t
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