

Batteries and the Net

The Dutch Lines of Battery Research, the Vacuum Net, and What the Net Adds

J. Konstapel, Leiden

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Abstract

On 16 October 2026 *Het Financieele Dagblad* described Europe's attempt to make batteries without China. The difficulty it named is the machines. They come from China, and so does the knowledge that runs them.

This essay does four things:

- It sets out who in the Netherlands works on which part of the battery.
- It reads the battery through the vacuum net theory, beside the research already under way.
- It names what the net adds to Dutch innovation, and why there.
- It sketches the battery's future if the net's readings hold.

The central finding is simple. Every line of cell research meets the same limit: the seam between two structures that close differently. The Netherlands is strongest exactly at seams, thin layers and measurement. The net turns that seam into a design object. It ranks crystal orientations before they are grown. It treats the coupling at a wall as a quantity of that wall. And it points to a route of making that avoids the machines China has placed under licence.

1. The occasion: the article

1.1 Three threads

The FD article, by Jan Fred van Wijnen, follows three threads.

LeydenJar. The Leiden company grows an anode of pure silicon by plasma deposition on copper foil. Its silicon stands as porous columns, and the gaps absorb the swelling. The claim is 50 to 70 percent more energy than graphite. LeydenJar is building PlantOne in a former Philips hall in Eindhoven. Anode production starts in 2027. A second hall will make complete cells for drones and defence. Its cell line comes from

Germany, South Korea and China. LeydenJar tunes the machines itself, because defence customers accept no Chinese technicians on the floor.

The European gigafactories. ACC, Verkor, PowerCo and Northvolt all bought most of their machines in China. All struggled to run them.

- **Northvolt** bought about 1,200 machines from Wuxi Lead. Hundreds of Chinese technicians stayed longer than planned. The company went bankrupt in March 2025.
- **ACC** still fights scrap. In September 2026 Stellantis halted two French car plants for lack of ACC cells. ACC brought in a team of experts from China.
- **PowerCo** runs Salzgitter almost entirely on Chinese machines, with about 200 specialists of the suppliers on site.
- **Verkor** lost its anchor customer's trust after 18 months of delay.

The Dutch plan. Mustafa Amhaouch, director of the Battery Competence Cluster Netherlands (BCC-NL), wants a European production line built from machines the Netherlands already makes: coaters (the “paint robot” of the headline), foil laminators, packaging lines. ACC takes part in a feasibility study.

1.2 The fact behind the article

On 9 October 2025 China placed several items under export licence (MOFCOM Decision No. 58):

- cells of 300 Wh/kg and above;
- cathode material and artificial graphite;
- the machines for winding, stacking, filling, hot pressing and formation.

The licence was suspended until 10 November 2026. A wider US-China arrangement was extended on 28 September 2026 to 10 January 2027. Whether Decision No. 58 falls under that extension has not been stated.

1.3 The numbers that frame it

- China made more than 80 percent of the world's cells in 2025 (IEA).
- In Europe, 98 percent of cell capacity is owned by Asian companies (Deloitte, 2025).
- Battery packs in China were about 35 percent cheaper than in Europe in 2025 (IEA).
- A quarter of the European capacity announced since 2022 has been cancelled or halted (T&E).

1.4 The question here

The article asks how Europe can copy the battery and the line that makes it. This essay asks a different question. What is a battery in the vacuum net, and what follows for how it is made, measured and used?

2. The network

2.1 The skeleton

BCC-NL in Helmond is the hub. It was founded in 2021 by DAF, VDL, Damen, ELEO, TNO, TU/e, Brainport Development, RAI and NMT. Its director since March 2025 is Mustafa Amhaouch, former member of parliament and twenty years at ASML.

The growth-fund programme “Material Independence & Circular Batteries” (MICB) runs from 2024 to 2031. It has three lines:

1. raw materials, refining and recycling;
2. materials, components and **equipment**;
3. systems for transport and grid.

The budget is at most €296 million. Phase 1 has €157.9 million. Twenty-two projects have run since 3 March 2026.

The national research consortia:

Consortium	Funding	Lead	Core
BatteryNL	€9.3 m	Marnix Wagemaker, TU Delft	the electrode–electrolyte interface
ANION	€23.6 m	Marc Koper, Leiden	electrochemical interfaces at the nanoscale
NANEXBAT	€8 m	Mark Huijben, Twente	sodium-ion
SMART-CBAT	€22.3 m	TU Delft	materials, processes and equipment
SLDBatt	> €30 m	Guido Mul, Twente	storage of 8 to 100 hours from salt, water, local materials
CIMBATT	€30 m	VDL	heavy transport
CRM-Lion	€23 m	TNO	recovery of critical materials
10X-Factor(y)	€30 m	Beatriz Noheda, Groningen	domain walls and memristors

The new National Action Agenda (23 September 2026) names five themes: heavy transport and defence, stationary storage, components and materials, **production equipment**, and the circular chain. One of its moonshots is modular, AI-steered production with more than 50 percent energy saving.

2.2 The eight lines

Line	Who	Where
1. Silicon and carbon anodes	LeydenJar; E-magy; CarbonX; LionVolt	Leiden and Eindhoven; Broek op Langedijk; Delft; Eindhoven
2. Solid state and electrolyte	Thionics; Huijben; de Jongh and Ngene; Wagemaker; Creatore and Kessels	Twente; Utrecht; Delft; Eindhoven
3. Sodium-ion	NANEXBAT; Alfen with CATL (5 GWh)	national; Almere
4. Long duration: iron, salt, flow	Ore Energy; Elestor; AquaBattery; SLDBatt; REDOX BLEND	Delft; Arnhem; Alphen aan den Rijn; national
5. Production and equipment	SALD; SparkNano; Kalpana; Powall; D&M with TNO; TNO Holst Centre; OBIC	Eindhoven; Rotterdam; Delft; Helmond
6. Recycling and second life	SK tes; Back to Battery; CRM-Lion; ADAPT-BATT	Rotterdam; Geleen; national
7. The interface inside the cell	BatteryNL; ANION; Bannenberg; Tromp; Olsson	Delft; Leiden; Groningen; Amsterdam
8. Storage in a wall	Nguyen, Koster, Rijnders; Noheda; Banerjee	Twente; Groningen

Two further groups matter for what follows. **George Palasantzas** in Groningen measures Casimir forces across gaps of tens of nanometres, including on films that switch phase. **Peter Schall** in Amsterdam measures critical Casimir forces in liquids near their tipping point.

2.3 The people who join the lines

A few people sit in more than one consortium and hold the network together:

- **Marnix Wagemaker** (TU Delft): leads BatteryNL, technical manager of NANEXBAT.
- **Mark Huijben** (Twente): leads NANEXBAT, runs the Energy01 thin-film pilot line.
- **André Schilt** (TNO Holst / BCC-NL): pillar lead at BCC-NL; Holst spun off LionVolt, LeydenJar and SALD.

- **Moniek Tromp** (Groningen): initiator of BatteryNL; ANION; NANEXBAT.
- **Petra de Jongh** (Utrecht): BatteryNL, ANION, NANEXBAT.

2.4 Where the network is thin

- **Inline measurement on foil and coating at production scale.** The skill exists in Dutch chip metrology. Nearfield raised €330 million in June 2026 for inline metrology of chips. No battery application was found.
- **The coupling of a cavity's open side.** No Dutch group measures current without applied voltage in an asymmetric cavity.
- **Logic and storage on three values (+1, 0, -1).** Not found.
- **Lithium-sulfur and quantum batteries.** No Dutch party found.

2.5 The choice already made

The Action Agenda of 2022 set a goal: by 2030, Dutch machine builders supply the European gigafactories. The cabinet chose components, machines and niches, not a cell gigafactory. A letter to parliament of February 2026 repeats that choice. The FD article describes the execution of a decision taken four years ago.

3. The model and the current research

3.1 The net in five rules

Picture a fishnet under tension. Strands run through it and cross. Where windings hold each other, there is a knot. Between strands there are meshes: openings with a size and a direction.

The vacuum net theory reads the vacuum as such a net. Five axioms carry it:

1. **Strand.** There is one strand. Every distinction is the strand touching itself.
2. **Closure.** A configuration persists only if it closes on itself in phase.
3. **Memory.** The net keeps the orientation of what was laid down first.
4. **Context.** Constants are state functions of the local net.
5. **Scale.** The same winding appears at every depth.

Three objects follow:

- A **winding** is a strand that returns on itself in phase. It is energy, with dimension T/S .
- A **knot** is windings holding each other in three directions. It is mass, T^3/S^3 .
- A **mesh** is an opening between strands, with size S .

Power. Power is energy per unit of time: $(T/S)/T = 1/S$. Passage through a mesh therefore scales with one over its open size.

The window rule. Each crossing carries a trit: +1, 0 or −1. Three neighbouring crossings form a window. A window closes when the sum of its values is divisible by three. Of the 27 possible windows, 9 close. The other 18 stand under tension. What closes, stays.

The mesh energy. The energy of one mesh of size L is $\pi^2 \hbar c / (720 L)$. At the natural mesh size $S_0 = 45.588 \text{ nm}$:

- $\hbar c = 1.0546 \times 10^{-34} \times 2.9979 \times 10^8 = 3.1615 \times 10^{-26} \text{ J}\cdot\text{m}$;
- times $\pi^2 = 9.8696$ gives $3.1203 \times 10^{-25} \text{ J}\cdot\text{m}$;
- divided by 720 gives $4.3337 \times 10^{-28} \text{ J}\cdot\text{m}$;
- divided by $4.5588 \times 10^{-8} \text{ m}$ gives **$E_{\text{mesh}} = 9.51 \times 10^{-21} \text{ J}$** .

3.2 What a battery is in the net

In everyday speech a battery “contains” energy. In the net it does not. Energy is a closed motion, not a substance in a jar. A battery is a state that is held for a time.

That gives a battery four phases: load, hold, discharge, rest. The public grid fuses them into one. What is generated is used at the same instant. Its hold time τ is zero.

Hold times form a ladder. Each rung has its own carrier:

Hold time	Carrier	Dutch work
seconds	flywheel, supercapacitor, polar wall	Twente (dielectric films); Wang, Delft (MXenes)
hours	lithium-ion, sodium-ion	LeydenJar; NANEXBAT; Alfen
days	iron-air, salt, flow	Ore Energy; Elestor; AquaBattery; SLDBatt
months	molecules	hydrogen pilots

No rung replaces another. A cell asked to cover days does the work of another rung. That is why it grows heavy, dear and dependent on scarce material.

3.3 The seam: one limit for every line

The lines of cell research differ in chemistry. They share one limit. Every gain in energy density comes from an electrode that changes shape. The boundary layer must follow that change without breaking.

Line	What happens at the boundary
silicon anode	volume grows by more than 300%; the interphase cracks and re-forms every cycle
lithium metal	lithium plates unevenly and grows along cracks
solid state	

Line	What happens at the boundary
	solid-solid contact is lost; filaments grow along grain boundaries
lithium-sulfur	intermediate products dissolve and leave the cathode
magnesium, calcium	the boundary layer seals and no longer passes the ion

Each boundary joins two structures that close differently: crystal and liquid, metal and ceramic, lattice and film. By the window rule such a boundary is an open window. It stands under tension. It does not stay unless something keeps closing it.

The rule does not say why a seam breaks. It says which configurations persist. That is enough to turn the seam into three design questions:

1. Where is the seam?
2. Can it be laid so that fewer windows stay open?
3. Can the motion take place in a mesh, an open space, rather than in the seam?

3.4 The rules against the Dutch measurements

The rules were set against numbers that Dutch groups have published. The arithmetic is given in full.

Closure orders the orientations of a crystal. A crystal direction is written with three Miller indices. For the low-index directions these are three values of -1 , 0 or $+1$: trit triples. The window rule applies to them directly.

Family	Members	Closing	Open fraction
$\langle 100 \rangle$	6	0	100%
$\langle 111 \rangle$	8	2	75%
$\langle 110 \rangle$	12	6	50%

An open direction carries passage. A closed direction holds. The rule predicts the order $\langle 100 \rangle > \langle 111 \rangle > \langle 110 \rangle$ for transport through a film.

- **Li₄Ti₅O₁₂** (Cunha and colleagues, 2019), at 3C: $\langle 100 \rangle$ about 313 mAh/g, $\langle 111 \rangle$ about 283, $\langle 110 \rangle$ about 277. Exactly the order of the open fraction.
- **LiMn₂O₄** (Huijben and colleagues, Twente, 2022): after 1,000 cycles at about 5C, $\langle 100 \rangle$ keeps 55 percent and $\langle 110 \rangle$ keeps 33 percent. The surface-held share is larger in $\langle 110 \rangle$. An earlier Twente study of all three orientations (Hendriks and colleagues, 2018) also found $\langle 100 \rangle$ best.

In both spinels the most open family moves charge best. The most closed family holds most at its surface. That is the split between passage and hold that the rule describes.

The coupling at a wall. The theory’s coupling law reads $g_{\text{eff}} = \bar{g}(1 + \gamma\delta)$. Here $\delta = (n - \bar{n})/\bar{n}$ is the relative change in density. The relative change of the coupling is $\Delta g/g = \gamma\delta$.

Palasantzas’s group in Groningen measures the Casimir force between a gold sphere and a phase-change film. When the film crystallises, the force changes, and so does the density.

- **GST** ($\text{Ge}_2\text{Sb}_2\text{Te}_5$): the force rises by about 40 percent below 100 nm (*Physical Review B*, 2025). The density goes from 5.87 to 6.27 g/cm³, so $\delta = 0.40/5.87 = 0.068$. The measured γ is $0.40/0.068 = \mathbf{5.9}$.
- **AIST** (AgInSbTe): the contrast is 17 to 25 percent. The film densifies by 5.2 percent, so $\delta = 0.052$. The measured γ is $0.17/0.052$ to $0.25/0.052 = \mathbf{3.3 \text{ to } 4.8}$.

The theory’s own derivation of γ shows that γ is not one universal number. It depends on what the wall counts as its density: it is a state function, as axiom 4 says (“What the Path Gives”, 2026). The two films confirm that. Each wall has its own γ , between 3 and 6.

Passage scales with one over the gap. Garret Moddel’s group in Colorado placed an optical cavity on one side of a metal-insulator-metal junction (*Symmetry*, 2021). They measured current without applied voltage for cavities from 33 to 1,100 nm. The current rose as the cavity grew thinner. Maclay (*Physics*, 2024) fitted the conductance against one over the thickness. The fit passes through the origin: conductance goes as $1/L$. That is the exponent of the passage rule.

Energy per cell in a polar wall. Thin perovskite films store energy in their polarisation. The Twente multilayer of Nguyen, Koster and Rijnders stores 128.4 J/cm³ at 81 percent efficiency (*Advanced Energy Materials*, 2022). With a lattice parameter $a = 4.15 \text{ \AA}$:

- $a^3 = (4.15 \times 10^{-10} \text{ m})^3 = 7.147 \times 10^{-29} \text{ m}^3$;
- energy per cell $= 128.4 \times 10^6 \text{ J/m}^3 \times 7.147 \times 10^{-29} \text{ m}^3 = 9.18 \times 10^{-21} \text{ J}$;
- per mesh energy: $9.18 / 9.51 = \mathbf{0.97}$.

The best films reported up to October 2026 hold between one and 1.65 mesh energies per cell. A polar wall holds energy at the scale of one mesh per lattice cell.

Room instead of grip. LeydenJar’s columns, E-magy’s pores and LionVolt’s three-dimensional pillars all leave room for the swelling. In the fishnet image, the motion goes into the mesh, not into the knot. Single-crystal cathodes, which have no internal seams, outlast polycrystalline ones by a wide margin (Dalhousie-Tesla, 2022). That is the homogeneous, crystal-like closure of the window rule.

3.5 Where the readings stand

Reading	Status
	counted, exact

Reading	Status
9 of 27 windows close; 0/6, 2/8, 6/12 per family	
Orientation order $\langle 100 \rangle > \langle 111 \rangle > \langle 110 \rangle$	agrees in two spinels
γ at a wall is a quantity of that wall	GST 5.9; AIST 3.3-4.8
Conductance $\propto 1/L$	agrees with Moddel's series (Maclay's fit)
Polar walls hold about one mesh energy per cell	Twente 0.97; best films up to 1.65
A battery boundary is an open window	reading
Life follows the count of open windows	hypothesis, not yet measured

4. What the net adds to Dutch innovation, and why

4.1 Why the Netherlands

The net places the limit of the battery at the seam. The Netherlands is strongest exactly there:

- **BatteryNL**, its largest academic battery consortium, is devoted entirely to the electrode-electrolyte interface.
- **Twente** grows crystal films one atomic layer at a time and measures them while they grow.
- **Delft** watches lithium move through the interface with neutrons.
- **Eindhoven** has the densest cluster of thin-layer equipment builders in Europe: spatial atomic layer deposition, plasma, coatings on powders.
- **The chip supply chain** has made the country a world leader in measuring and controlling thin layers.

That is a different strength from the paint robot in the headline. It is also the strength the net speaks to.

4.2 Contribution 1: ranking the seam before it is grown

The window rule ranks crystal orientations by their open fraction before a single film is grown. It got the order right in two spinels.

The step that would turn this into a design tool is one series. Grow all three orientations of one electrode at equal surface area, and measure life and rate. Huijben's group in Twente has the films, the pilot line and the prior series. Wagemaker and Bannenbergh in Delft have the instruments to watch the seam while the cell runs.

The same count extends to any interface whose two sides can be written as trits. For every new coating, interlayer or epitaxial stack, the count of open windows gives a ranking at no cost. Laboratories then grow the best-ranked candidates first.

4.3 Contribution 2: the coupling of a wall as a design quantity

The coupling law gives $\Delta g/g = \gamma \delta$, with γ a quantity of the wall. Two Groningen films give $\gamma = 5.9$ and $3.3\text{--}4.8$.

That makes γ measurable for any wall that changes density: a phase-change film, an interphase that densifies during formation, a coating that compacts. With γ known per wall, the change in coupling follows from a density measurement alone. Palasantzas has the force set-up. Wagemaker's neutron depth profiles give the density of a plated layer during operation. Together they would give γ for the interphases that decide a cell's life.

4.4 Contribution 3: making without the heat step, outside the list

A conventional electrode is a slurry coated on foil and dried in long ovens. Schütte, Degen and Walter (*Batteries*, 2024) give 11.02 kWh of drying energy per kWh of cell capacity. Drying is 27 to 48 percent of all factory energy in different studies.

- Total factory energy per kWh of cell: $11.02 / 0.48 = 23$ kWh to $11.02 / 0.27 = 41$ kWh.
- At 70 percent yield, each good kWh carries $40.8 / 0.70 = 58$ kWh.

A cell of 1 kWh must therefore be fully discharged 23 to 58 times before it has returned the energy of its own factory.

The net describes making as a three-step cycle:

1. **Soften:** bring the local state close to its tipping point.
2. **Write:** impose a mesh, a layering, an asymmetry.
3. **Harden:** return the state, so that only closing windings remain.

Hardening selects; it does not place. The cycle sets the state so that the target is the only thing that stays. Processes that work layer by layer, at low temperature, follow this cycle directly.

The machines China has licensed belong to one process order: mix, coat, dry, press, wind or stack, fill, form. Four process families do not appear on the list:

- plasma deposition (LeydenJar);
- spatial atomic layer deposition (SALD, SparkNano, Kalpana, TNO Holst Centre);
- thin-film cells (Huijben, Energy01);
- electrodeposition.

Each of these is already Dutch. The FD plan rebuilds the existing order from Dutch coaters and laminators. That order still contains the steps under licence. A second route chooses the processes that do not need them. It is less mature. It touches the Chinese list less. And it plays to the strength of 4.1.

4.5 Contribution 4: the loop instead of the hand

The FD article names the real difficulty: a machine does not run by itself. The knowledge sits in the people who tune it.

Fraunhofer FFB gives 15 to 30 percent scrap in the first years of a gigafactory and about 10 percent after five. Each percentage point costs about €30,000 per day.

- Per point per year: $30,000 \times 365 = \text{€}10.95$ million.
- At 20 percent scrap: $20 \times 10.95 = \text{€}219$ million per year.

In the net, a state that holds itself is a closed loop. A loop that moves one setting until the output is at its maximum, then holds it there, needs no operator. Where the state of each layer is measured inline and the setting follows, the knowledge sits in the loop. It no longer sits in the hands of technicians flown in with the machine.

This is the thin spot of the Dutch network (2.4). The skill is in chip metrology. The battery application is missing. Joining the two would address the cause of Northvolt's and ACC's troubles directly.

4.6 Contribution 5: the wall that holds in three states

A ferroelectric wall has three polarisation states, P^+ , P^0 and P^- : a trit. The Twente films already store about one mesh energy per lattice cell (3.4). No ion moves house, so there is no seam that changes with every cycle.

Twente and Groningen (10X-Factor(y), €30 million) hold the materials. What the net adds is the register. A wall with three states can hold and pass on +1, 0 and -1 directly. Storage and logic on three values are not yet worked on in the Netherlands.

4.7 Contribution 6: passage instead of stock

One mesh at S_0 holds 9.51×10^{-21} J. One passage per natural time unit $T_0 = 1.5207 \times 10^{-16}$ s gives $9.51 \times 10^{-21} / 1.5207 \times 10^{-16} = 6.25 \times 10^{-5}$ W per mesh.

Moddel's patent (US 12,166,434) gives 1.4 pW from an active junction of $0.02 \mu\text{m}^2$:

- power per area: $1.4 \times 10^{-12} \text{ W} / 0.02 \times 10^{-12} \text{ m}^2 = \mathbf{70 \text{ W/m}^2}$;
- meshes in the junction: $0.02 \times 10^{-12} / (4.5588 \times 10^{-8})^2 = 0.02 \times 10^{-12} / 2.078 \times 10^{-15} = 9.6$;
- power per mesh: $1.4 \times 10^{-12} / 9.6 = 1.45 \times 10^{-13} \text{ W}$;
- share of the full rate: $1.45 \times 10^{-13} / 6.25 \times 10^{-5} = \mathbf{\eta = 2.3 \times 10^{-9}}$.

η is the coupling of the cavity's open side: the share of what the mesh closes that leaves as current. It is the one parameter that decides how far this route goes. No Dutch group works on it. Palasantzas in Groningen and AMOLF in Amsterdam have the cavities and the walls. Schall in Amsterdam has the tipping point as a knob.

4.8 The contributions side by side

Contribution	Dutch partner	What is there	What the net adds
Ranking the seam	Huijben; Wagemaker; Bannenberg	films in three orientations; operando neutrons	a count that ranks before growing
Coupling of a wall	Palasantzas; Wagemaker	force across switchable films; density in operation	γ as a measured quantity per wall
Making without heat	LeydenJar; SALD; SparkNano; Kalpana; Powall; TNO Holst	the process families outside the list	soften–write–harden; a route outside Decision No. 58
Loop instead of hand	chip metrology; INNER; Thiede	the skill, not the application	the self-holding state as design goal
Wall with three states	Nguyen, Koster, Rijnders; Noheda	films at one mesh energy per cell	the trit as register
Passage instead of stock	Palasantzas; AMOLF; Schall	cavities, walls, tipping point	the mesh energy and η as target

5. The future of batteries if the net is right

Two conditions carry the strongest of what follows: Moddel's 70 W/m² must be reproduced, and stacked layers must add. The other directions need no such condition. They rest on what is already measured.

5.1 Less is asked of the cell

When storage follows the ladder of hold times, each rung does its own work. Seconds go to polar walls and flywheels. Hours go to cells. Days go to iron, salt and flow. Months go to molecules.

The cell is then no longer asked to bridge days. It becomes smaller, lighter and less dependent on cobalt, nickel and graphite. A good part of the demand that drives gigafactories falls away. Storage moves from a remote park to the street, the house and the district.

5.2 The seam is designed, not suffered

A cell is built from the seam outward. Orientations, interlayers and coatings are ranked by their open windows before they are grown. The coupling of each wall is known from its density. Life becomes a design target instead of a test outcome after years.

Single crystals, epitaxial films and columns with room for motion are no longer special cases. They are the rule.

5.3 Factories without fire, near the user

Making by soften-write-harden needs no ovens tens of metres long and no dry rooms. A line that deposits layer by layer at low temperature is small. It fits in a city rather than on the edge of the country. It uses a fraction of the energy of a slurry line.

The gigafactory of today is built around the oven and the formation hall. In this future it is no longer the natural form of making a cell. The scale of production follows the scale of use.

5.4 The knowledge sits in the loop

Where every layer is measured as it forms and the setting follows, the line holds itself. The knowledge no longer travels with foreign technicians. Scrap falls, and with it the €10.95 million per percentage point per year. A licence decision in Beijing then reaches the spare parts of a machine, not the know-how of the line.

5.5 The wall holds and computes

A wall with three states holds energy without moving ions. The same wall holds a trit. Storage and the register become one structure. The fastest rung of the ladder, seconds, is served by walls that do not wear.

5.6 Passage instead of stock

If the passage holds, the change is largest. At 70 W/m² per layer:

- **A house** needing 1,450 W continuously needs $1,450 / 70 = 20.7$ m² of one layer. With 100 layers: $1,450 / 7,000 = 0.21$ m², a plate of about 45 by 45 cm.
- **Compared with a battery:** such a plate gives $1.45 \text{ kW} \times 24 \text{ h} = 34.8 \text{ kWh}$ per day. A battery of 250 Wh/kg holding one such day weighs $34,800 / 250 = 139$ kg.
- **A drone** needing 1 kW needs 0.14 m² with 100 layers.

The battery then stops bridging energy. It only catches peaks: a small buffer in the meter cupboard, in the drone, in the tool.

5.7 What it means for people

A battery is made and used by people.

In Eindhoven laboratory staff at LeydenJar assemble test cells by hand, all day long. About 95 percent pass. Their skill is what the new machines must carry. In a line that holds itself, their work moves from tuning by feel to reading a state.

In Skellefteå a town of about 75,000 built its future on Northvolt. In one round of cuts alone, 1,600 people lost their jobs in Sweden, 1,000 of them there. Beside them worked technicians from Wuxi who lived in their own camp. A factory without fire, near the user, is less likely to tie a whole town to one plant.

In Debrecen residents raised concerns about CATL's plant. Early in 2026 the authorities closed parts of it after nine employees were exposed to nickel. A cell asked to do less carries less nickel.

In Ukraine the drones soldiers carry still run mostly on Chinese cells. A licence decision reaches their front line. A plate that delivers continuously would end that dependence.

In the household the base load would no longer depend on a cable, a substation or a battery park. What disappears is the long chain: mine, refinery, gigafactory, ship, grid. What remains is the house and its plate.

6. Annotated references

The occasion

Van Wijnen, J. F. (2026). "Europa maakt batterijen desnoods met een verfrombot om los te komen van China." *Het Financieele Dagblad*, 16 October. <https://specials.fd.nl/europa-maakt-batterijen-desnoods-met-een-verfrombot-om-los-te-komen-van-china> *Why read?* LeydenJar, the gigafactories and the Dutch machine plan in one story. The occasion of this essay.

Bits&Chips (2 October 2025). "Leydenjar partners with Chinese firm to scale silicon-anode batteries." <https://bits-chips.com/article/leydenjar-partners-with-chinese-firm-to-scale-silicon-anode-batteries/> *Why read?* LeydenJar's partnership with Highpower, which the FD does not mention.

The Local Sweden (2 February 2026). "Northvolt lost ten months due to gamble with untested Chinese machines." <https://www.thelocal.se/20260202/northvolt-lost-ten-months-due-to-gamble-with-untested-chinese-machines> *Why read?* What it costs when the knowledge sits in someone else's machines. Read with the next item.

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