

The Trunk and the Mesh

Europe's Probable Technology Future, and What the Vacuum.Net Reads in It

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Summary

Europe now has many technology visions. Large companies, member states and the European Union each publish their own. Read together, they describe one direction. Europe will build more central computing capacity, in larger units, on a longer supply chain. It will call this sovereignty.

The money behind the visions is smaller than the words. Private firms announced about €136 billion for AI, data-centre and cloud capacity in Europe in 2025 and 2026. Sixty-three per cent of that comes from American firms. The EU's own €200 billion AI plan contains €150 billion of private intent. Of the €20 billion earmarked for AI gigafactories, €1 billion is firm. No gigafactory has yet been chosen.

The physical world sets the pace. Grid connections in Europe's data-centre hubs take seven to thirteen years. Europe makes about 9 per cent of the world's chips and has no leading-edge production. Seventy-one per cent of its gallium imports come from China. Electricity costs European firms roughly twice what American industry pays.

A probable picture for 2030 follows. Ten to twenty large computing sites, near cheap power. Data centres using 4 to 5 per cent of EU electricity, and far more in some regions. A sovereign cloud that is largely American technology under European control. Chips still from Taiwan. Alternatives such as open software, small ternary models and photonics, working where tried, but receiving 1 to 4 per cent of the money.

This essay then reads that picture a second time, through the Vacuum.Net theory. The theory describes the world as one strand forming a net. Only what closes on itself persists. Every state has a computed address. Capacity at a given depth is fixed. Exceeding it forces the next depth, not a larger copy of the same one.

Read that way, the visions scale the term that does not close. They grow capacity at one depth, on a trunk, held open by outside money. The theory points to the mesh: computation by address, short chains, local closure, and a register of three values. Some of this is proven. Some of it is reading. The essay keeps the two apart.

1. The Occasion

On 21 October 2026, Jensen Huang addressed four thousand people in Berlin. Nvidia's chief executive offered Europe a way to catch up in artificial intelligence. Europe should produce AI, he said, not merely consume it.

His central product was the DSX POD. It is a complete AI data centre in a shipping container. According to Nvidia's briefing, one POD holds seven Vera Rubin NVL72 racks with 504 graphics processors. It is assembled and tested in the factory. On a prepared site it can run within fourteen days instead of six

months. First deliveries are planned for early 2027.

Two Greenpeace activists unrolled a banner during the speech. They pointed to water, land and electricity bills. The contrast frames this essay. One side sees speed and sovereignty. The other side sees load and dependency.

The question here is broader than one product. What do all the large technology visions for Europe add up to? Which future is probable, given money, power, chips and people? And what does a theory of closure say about that future?

2. Four Voices

2.1 The companies

Large firms announced their European plans mostly in 2025 and 2026. Deduplicated, the AI, data-centre and cloud commitments come to about €136 billion. That figure counts twenty-one announcements. It converts dollars at 0.864 euro and pounds at 1.15 euro. It excludes equity rounds and partner totals that would count the same racks twice. Depending on inclusion rules, the honest range is €120 to €150 billion.

The largest items are these:

- SAP: €20 billion over ten years for sovereign cloud.
- Amazon: €18 billion of new money in Spain, part of €33.7 billion; €4.8 billion for its Frankfurt cloud region in 2027; €7.8 billion through 2040 for the AWS European Sovereign Cloud, live since January 2026.
- Microsoft: about \$15 billion of capital spending in the United Kingdom; \$10 billion in Sines, Portugal; a \$6.2 billion purchase of capacity in Narvik, Norway.
- Google: at least €13 billion in Finland; €5.5 billion in Germany; €5 billion in Belgium; £5 billion in the United Kingdom.
- Schwarz Group, owner of Lidl: €11 billion for a 200-megawatt site at Lübbenau and up to €5.6 billion near Rostock.
- Mistral: a 44-megawatt site near Paris, €1.2 billion in Sweden, and a planned 1.4-gigawatt campus with MGX and Nvidia.

American firms provide 63 per cent of the core total. European firms provide 35 per cent. ByteDance provides the rest, through €1 billion data centres in two Finnish towns.

Almost every firm uses one word: sovereignty. Microsoft promises “a European cloud for Europe.” Amazon promises no operational control outside EU borders. Google says a sovereign future must be built in Europe, for Europe. Even TikTok calls its European data programme a sovereignty effort.

Three things are mostly absent. Only Nvidia gives an efficiency figure for its own systems: up to 30 per cent less power for the same output. No investment announcement quantifies jobs lost. Every announcement quantifies jobs created or supported. And no firm places less computation, or local computation, at the centre of its vision. Nvidia’s picture of telecom networks as distributed AI comes closest.

2.2 The European Union

The EU’s plan is the AI Continent Action Plan of April 2025. Its financing arm, InvestAI, aims to mobilise €200 billion. Of that, €150 billion is private intent from an industry initiative. The €50 billion public part comes from existing programmes, mostly in the next budget period.

The flagship is a set of AI gigafactories. These are sites with three to four times the processors of today’s largest European AI facility. Each needs 100 to 250 megawatts and costs €4 to €5 billion. A

formal call opened on 30 July 2026. It closes on 12 November 2026. Up to seven sites will be chosen in early 2027.

The arithmetic of that call is instructive. Four smaller sites may receive up to €100 million plus €400 million of EU money each. Three larger sites may receive up to €200 million plus €800 million each. The EU maximum is therefore $4 \times 0.5 + 3 \times 1.0 = €5.0$ billion. Only the first phase, €1 billion, is firm. The remaining €4 billion depends on the 2028–2034 budget, which is still a proposal. The €20 billion headline thus becomes at most €5 billion in the actual call.

Below the gigafactories sit nineteen smaller AI Factories in sixteen countries, plus thirteen satellite “antennas.” Together they mobilised about €2.6 billion of EU and national money.

In June 2026 the Commission proposed a Cloud and AI Development Act. It aims to triple EU data-centre capacity within five to seven years. The proposal records how far Europe has fallen behind. European providers held 29 per cent of their home cloud market in 2017. By 2022 they held 15 per cent. Three non-European providers hold more than 70 per cent.

The Commission’s own scoreboard, the State of the Digital Decade 2026, shows the gap to its 2030 targets:

Indicator, 2025	Value	2030 target
Firms using AI	20.0%	75%
Firms using cloud	46.7%	75%
Adults with basic digital skills	60.4%	80%
ICT specialists	10.5 million	20 million
EU share of world chip production	8.8%	20%

The European Court of Auditors expects the chip share to reach 11.7 per cent in 2030. It calls the 20 per cent target very unlikely. On current trends, basic digital skills reach 80 per cent only in 2037.

Committed EU money is modest. The two dedicated programmes of the current budget, Digital Europe and the digital part of the Connecting Europe Facility, total €10.17 billion over seven years. The proposed digital window for 2028–2034 is €51.5 billion. That is $51.5 / 10.17 = 5.06$ times as much. It is a proposal.

2.3 The member states

Twenty-one national strategies were examined, including the United Kingdom, Norway and Switzerland. All twenty-one place artificial intelligence and computing capacity at their core. Roughly six to eight also name semiconductors and quantum technology as core priorities.

Public money committed per country is small. It ranges from tens to hundreds of millions of euros. Germany has set aside about €1 billion for a gigafactory. The Netherlands is building an AI factory in Groningen for about €200 million. Announced private money is large but mostly not binding. France announced €109 billion of AI investment in February 2025. Its Choose France summit of 2026 announced €93 billion, of which €45 billion is firm.

Data-centre policy divides Europe in two. France, Germany, Italy, the United Kingdom and Norway attract data centres. Germany adopted a national strategy in March 2026 to double total capacity and quadruple AI capacity by 2030. The Netherlands and Ireland restrict them. The Netherlands allows hyperscale sites only in two locations, and Amsterdam will admit no new data centres from 2035. Ireland now requires new data centres to bring their own generation and source at least 80 per cent from additional Irish renewables.

Several countries bid together: Spain with Portugal, Poland with the three Baltic states, Czechia with Poland. A few national strategies address people directly. Denmark aims to free about 30,000 public-sector posts through automation. Italy set up a labour-market observatory for AI. Sweden requires AI-

assisted public decisions to remain open to appeal.

2.4 The counter-voices

A smaller set of actors proposes another path.

The EuroStack initiative, from Bertelsmann Stiftung and CEPS, calls for a European technology stack from chips to applications. It estimates the need at €300 billion to 2035. That money does not exist. More than ninety firms, including Airbus, Dassault Systèmes and OVHcloud, asked in March 2025 for European preference in public procurement.

Some public bodies have already moved. The German state of Schleswig-Holstein moved more than 40,000 mailboxes to open-source software. About 80 per cent of its workplaces run LibreOffice. It expects more than €15 million of licence savings in 2026 against a one-time €9 million. The Austrian armed forces use LibreOffice on about 16,000 workstations. The International Criminal Court replaced Microsoft Office with the German openDesk suite after American sanctions. The Dutch parliament adopted a motion in March 2025 for a state cloud under Dutch control.

Efficient computing has working examples. BitNet b1.58 is a language model whose weights take only three values: -1 , 0 and $+1$. It needs 0.4 GB of memory, against 2.6 GB for a comparable model. Its estimated energy per token is 0.028 joule against 0.347, which is $0.347 / 0.028 = 12.4$ times less. Its benchmark score is one point lower. In Delft, Innatera produces a neuromorphic chip that draws 0.5 milliwatt. The Netherlands funds integrated photonics through PhotonDelta, a €1.1 billion programme.

The money gap is wide. Committed money for these alternatives totals about €4.2 billion. Against the €136 billion of company commitments, that is 3.1 per cent. Without the €2.6 billion edge-cloud state-aid project IPCEI-CIS, it is 1.2 per cent.

Local resistance has measurable effects. In Talavera, Spain, Meta redesigned a planned data centre. Its water use fell from 2.2–4.8 million cubic metres a year to about 40,600. In Zeewolde, Netherlands, Meta withdrew. In Aragón, citizens took Amazon's expansion to court.

3. What the Physical World Allows

3.1 Electricity

EU data centres used 68 terawatt-hours in 2024. The Commission projects 114 terawatt-hours in 2030 and calls that 3.2 per cent of EU demand. Eurostat's figure for EU final electricity consumption in 2024 is 2,378 terawatt-hours. Then $114 / 2,378 = 4.8$ per cent. The Commission's 3.2 per cent requires a denominator of about 3,560 terawatt-hours. The realistic share for 2030 is 4 to 5 per cent.

The growth is easier to grasp as continuous load. From 2024 to 2030 consumption rises by 46 terawatt-hours. A year has 8,760 hours. So $46,000 \text{ GWh} / 8,760 \text{ h} = 5.25$ gigawatts, running day and night. Tripling capacity, as the Commission proposes, would add about 136 terawatt-hours. That is 15.5 gigawatts, or 5.7 per cent of today's EU final consumption.

At EU level this is significant but not decisive. Locally it is decisive. Irish data centres used 22 per cent of national electricity in 2024 and 23 per cent in 2025. Ireland's grid operator expects 31 per cent in 2034. In 2023 data centres used about 80 per cent of Dublin's electricity and a third or more of Amsterdam's and Frankfurt's. In the Netherlands the national share was 4.6 per cent in 2024.

3.2 One POD, counted

A single DSX POD makes the scale tangible. Each Vera Rubin NVL72 rack draws about 190 to 240 kilowatts. Take the midpoint, 227 kilowatts. Seven racks draw $7 \times 227 = 1,589$ kilowatts. Cooling and conversion add overhead, expressed as power usage effectiveness. Take 1.2. The site then draws 1,589

$\times 1.2 = 1,907$ kilowatts.

Over a year: $1,907 \text{ kW} \times 8,760 \text{ h} = 16.7$ gigawatt-hours. An average Dutch household uses about 2,430 kilowatt-hours. So one POD equals $16,700,000 / 2,430 \approx 6,900$ households. Across the plausible range of rack power and overhead, one POD uses 12.8 to 19.1 gigawatt-hours a year: 5,300 to 7,900 Dutch households. A one-gigawatt AI factory equals about 524 such PODs.

3.3 The grid

The binding limit is the connection, not the generation. In Europe's established hubs a grid connection takes seven to ten years, up to thirteen. Dublin has had a de facto stop on new connections until 2028. In the province of Noord-Holland about 4.6 gigawatts of connection requests are waiting. In April 2026 a Dutch court ruled the Haarlemmermeer grid genuinely full, possibly until about 2035. In Italy more than 300 data-centre projects requested more than 50 gigawatts.

The Commission estimates Europe needs €584 billion of grid investment this decade. Forty per cent of distribution grids are more than forty years old. A container that installs in fourteen days does not shorten a queue of ten years.

Price adds weight. In the second half of 2025, European firms in a middle consumption band paid on average €0.18 per kilowatt-hour. American industry paid about 9 to 10 dollar cents in 2025-2026. Corrected for the exchange rate, Europe pays roughly 2.2 times as much.

3.4 Water and heat

The 770 European data centres that reported in 2024 used on average 0.58 cubic metres of water per megawatt-hour. Their average power usage effectiveness was 1.36. About 1.8 per cent of their waste heat was reused. Germany now requires new data centres to reach a power usage effectiveness of 1.2 and to reuse 10 per cent of their energy, rising to 20 per cent for those opening from 2028. In the Netherlands, 44 of 186 commercial data centres publish their electricity use, and 47 their water use.

3.5 Chips and raw materials

Europe produced about 9 per cent of the world's chips in 2025. It has no production at the most advanced nodes. Intel cancelled its €30 billion plant in Magdeburg and its plant in Poland in July 2025. The TSMC-led plant in Dresden, with €5 billion of state aid, will make 28- to 12-nanometre chips from late 2027. Those serve cars and industry, not AI accelerators. The graphics processors in every gigafactory and POD will come from outside Europe.

China produces about 98 per cent of the world's gallium. The EU takes 71 per cent of its gallium imports and 45 per cent of its germanium imports from China. Its dependence on China for rare-earth magnets is about 98 per cent. China suspended parts of its export controls in late 2025. Those suspensions expire on 10 and 27 November 2026.

3.6 Capital

Huang puts the cost of a one-gigawatt AI factory at about \$50 billion. He also says about \$40 billion of that goes to Nvidia. These are a supplier's own figures. On that basis, seven gigafactories with 0.93 gigawatts of IT load would cost about \$46 billion. The EU call offers about €30 billion, public and private together.

4. The Probable Version

Combining the four voices and the physical limits gives one probable version of Europe's technology future. Each statement carries a status: probable, uncertain or open.

2027-2028: the run-up. Up to seven gigafactories are selected in early 2027. Candidates cluster

where power is cheap or guaranteed: northern Germany, France with its nuclear sites, Iberia, Poland with the Baltic states, Czechia and Finland. First racks run late 2028 at the earliest. Private campuses move faster than public ones: Google in Finland, Schwarz in Lübbenau, Mistral near Paris and in Sweden, Amazon in Spain, Microsoft in Sines and Narvik. Factory-built containers shift the pace from the building site to the grid connection. *Probable*.

2030: the picture.

- Computing concentrates in roughly ten to twenty large sites, increasingly outside the old hubs of Frankfurt, London, Amsterdam, Paris and Dublin. Those hubs' share of European capacity falls from 62 to 55 per cent. *Probable*.
- Data centres use 4 to 5 per cent of EU electricity. Ireland passes 25 per cent. Several Nordic regions see steep local growth. *Probable*.
- The sovereign cloud is largely American technology under European operation: AWS European Sovereign Cloud, Microsoft's sovereign offerings, Google's German regions, and the joint ventures Delos in Germany and Bleu in France. European stacks such as STACKIT, OVHcloud, Scaleway and SAP with Mistral grow from a 15 per cent base. *Probable*.
- Leading-edge chips still come from Taiwan; accelerators still come mostly from Nvidia. Europe's chip share sits near 11 per cent. *Probable*.
- AI use by firms rises but stays far below 75 per cent. Europe still lacks about ten million ICT specialists. *Probable*.
- Open-source migration grows steadily in a handful of public administrations, with 1 to 4 per cent of the money. *Probable*.

The binding limits, in order: grid connection; chips and raw materials; public money after 2027; local acceptance of water, land and electricity bills. The EU's total electricity volume comes after these. *Probable*.

2035: uncertain. The outcome depends on four open variables. These are the 2028-2034 budget, the fate of the Cloud and AI Development Act, China's export controls, and the real demand for AI output. Huang expects token demand to keep rising through AI agents. That expectation is a supplier's. *Uncertain*.

5. The Human Layer

A technology future happens to people in places.

The places that gain are those that host the sites. They receive land income, construction work and a few hundred permanent jobs. Schwarz expects about 120 direct jobs at its Rostock site. Grid companies and builders gain. So do the few universities and firms that use the capacity for science and industry.

The places that carry the load are often nearby. In Amsterdam about 30,000 homes are delayed by grid shortage. In Aragón and around Talavera, people in dry regions defend their water. In Ireland every household shares a grid that data centres increasingly fill. Electricity prices pass load to every bill.

Work shifts. Routine office tasks move to AI services. New work appears in construction, maintenance and operation. No vision calculates this shift in numbers, except Denmark's plan for its own public sector. The investment announcements count jobs created. They do not count tasks removed.

Some citizens are already choosing differently. Civil servants in Schleswig-Holstein work in open software they can inspect. Local communities in Spain changed a cooling design. In the Netherlands, 696 energy cooperatives with 143,000 members organise power locally. These are small. They show that people act when the load becomes visible.

6. A Second Reading: the Vacuum.Net

6.1 The theory in brief

The Vacuum.Net theory pictures the world as a fishing net under tension. There is one strand. Where it crosses itself, a knot forms. Between knots lie meshes. Five axioms govern the net:

- **N1 Strand.** There is one strand. At each self-crossing it passes over (+1), under (−1) or not at all (0).
- **N2 Closure.** Only what returns onto itself in phase persists. There is no outside selector.
- **N3 Memory.** A closed configuration shapes the next. The net carries its history as its form.
- **N4 Context.** The response of the medium is a function of its state, not a universal constant.
- **N5 Scale.** Each step deeper multiplies the distinguishable states by three.

The theory makes no causal stories. It describes by selection (what closes stays), by identity over scale (the same winding at another depth), and by constitutive relations (quantities that move together without an arrow). Its results carry a status. *Proved* means conditionally proved from the axioms in the foundational paper. *Computed* means checked by arithmetic. *Reading* means an application of the theory to a domain. *Open* means unsettled.

Four results matter here.

T6, loss has an address. Every irreversible loss occurs at a definite mesh. Loss is bookkeeping on the net, not a leak out of it. *Proved*.

T7, the unique address. Every state at depth n corresponds to exactly one string of n balanced-ternary digits, using -1 , 0 and $+1$. Every integer has exactly one such representation. *Proved*.

T7.3, capacity per depth. The largest value expressible at depth n is $(3^n - 1)/2$. For depths 1 to 6 this gives 1, 4, 13, 40, 121 and 364. Exceeding a depth's capacity forces the next depth. *Proved*.

Radix economy. Representing a number N in base r costs about $(r / \ln r) \cdot \ln N$. For base 2 the factor is $2 / \ln 2 = 2.885$. For base 3 it is $3 / \ln 3 = 2.731$. Three is the cheapest integer base, 5.4 per cent cheaper than two. *Computed*.

6.2 How large an address must be

Address length grows with the logarithm of what is addressed. With N items, the needed depth is $\log_3 N$.

- One billion items: $\log_3 10^9 = 18.9$, so 19 ternary digits.
- One trillion items: $\log_3 10^{12} = 25.2$, so 26 digits.
- 10^{20} items, enough for every moment of every human life: $\log_3 10^{20} = 41.9$, so 42 digits, or 66.6 bits.

Doubling the archive adds $\log_3 2 = 0.63$ digit. *Computed*.

This does not by itself prove that address-based computing uses less energy than today's models. Indexed search also grows with the logarithm of the archive. The difference lies elsewhere. A computed address is the same for anyone who applies the rule. An assigned address, such as a vocabulary entry or a domain name, depends on whoever assigns it. The energy per address query has not yet been measured. *Open*.

6.3 The chain, counted

T6 says where loss occurs. It does not say how much per link. An earlier analysis, "Where Waste Comes From," assumed that each link in a supply chain optimistically keeps 85 per cent of what it receives. That figure is an illustrative input, not a theorem.

Under that assumption, delivered value falls as 0.85^n . After seven links: $0.85^7 = 0.32$. After ten: $0.85^{10} =$

0.197. Value halves after $\ln 2 / -\ln 0.85 = 4.27$ links. The structure of the result is general. Shortening a chain changes the exponent. Polishing a link changes only the base. *Computed on an assumed input.*

The AI value chain has at least seven links: mine, refinery, chip fabrication, accelerator, data centre, grid, and cloud service. Several of these lie outside Europe. Its loss is real, whatever the exact factor. Its address is mostly at the far end, with those who pay last.

7. The Mirror

Each feature of the probable future can now be set beside the net.

More capacity at one depth. The visions grow computation by building more and larger units of the same kind. A gigawatt costs \$50 billion and the next costs the same. T7.3 states that capacity at a depth is fixed and that exceeding it forces the next depth. Read on the net, the visions scale a copy at the same depth instead of moving deeper. *T7.3 proved; the application is reading.*

Sovereignty as ownership. The visions define sovereignty as European control of facilities, contracts and data. On the net, an address computed from inside is the same for everyone who applies the rule; one assigned from outside depends on the assigner. T7 proves that the address is unique. That a computed address cannot be withdrawn is reading. The point is practical. Europe can own a building that runs on a foreign stack, foreign chips and a foreign vocabulary. One earlier analysis put it sharply: tripling the capacity of the wrong architecture is not sovereignty. *Reading.*

The converging points. The probable future rests on a few points without a second path. Five hubs held 62 per cent of capacity. One island makes the leading-edge chips. One country supplies 71 per cent of the gallium. Three firms hold more than 70 per cent of the cloud. On the net, a converging point without a second path is an open mesh. Tension passes there first. The order of binding limits in Section 4, grid, chips, raw materials, money, is the list of those meshes. *Reading; the concentrations are measured.*

Held open by money. Most gigafactory money waits for the next budget. Most private money is not binding. N2 states that only what closes persists. A configuration that exists only through outside supply does not close by itself. The plain reading is that what is held open disappears when the money stops. *N2 is an axiom; the application is reading.*

The trunk. Large campuses draw on single connection points. Grids built as trees fail first at the trunk. On the net, a tree is an open mesh by construction; a mesh that closes locally and shares its surplus is not. The Irish rule that data centres bring their own generation is a first step toward local closure, forced by a full grid. *Reading; the rule is measured.*

The register. Today's models compute in 16-bit numbers on binary chips. The ternary register is the cheapest integer base, by 5.4 per cent. BitNet's three-valued weights reach 12 times lower estimated energy per token at one point less on benchmarks. One earlier analysis set register depth beside energy ratio: $16 / \log_2 3 = 10.09$ against $0.347 / 0.028 = 12.4$ for BitNet, or 9.21 in another comparison. They lie 9 to 23 per cent apart. Calling them the same number is a correspondence, not a computation. The ternary register is in any case already engineering practice. *Radix computed; energy figures modelled; identity corresponded.*

Carrier and state. The visions separate hardware from software, memory from processor, and the data centre from the grid. N1 allows one strand only: carrier and state are one winding. The so-called memory wall, the cost of moving data between memory and processor, is the price of that separation. Photonic chips, neuromorphic chips and in-memory computing each remove part of it. Europe has strength in all three: PhotonDelta and New Origin in the Netherlands, Innatera in Delft, SpiNNaker2 in Dresden. *Reading; the optical three-valued lock is open.*

Institutions of the chain. The probable future needs hyperscalers, grid operators, funds and tenders.

Each maintains part of the chain. On the net, a long chain makes its own institutions. Where closure becomes local, their reason weakens. Coordination then closes in circles of consent and couples upward only when local closure fails. This reading depends on local energy closure, which is open. *Reading, conditional.*

People. In the visions, work is a place in a process, and the data centre is that process without people. The net places supply in the house and the circle. The measured signs point that way on a small scale: Schleswig-Holstein, Talavera, Dutch energy cooperatives. *Reading; the examples are measured.*

8. Where the Visions and the Net Meet

The mirror is not only contrast. Several current moves already lie along the net's lines.

Containerisation. A factory-built POD is a smaller, complete unit. It moves toward the mesh. It does not yet close: it still hangs on grid, water, cooling and fibre.

Distributed networks. Nvidia describes telecom networks as distributed AI, with about 100,000 sites. The EU counts 7,451 edge nodes against a target of 10,000. Both point to meshes rather than trunks.

Local obligation. Ireland's rule and Germany's heat-reuse rule force data centres to close part of their own loop. They arose from limits, not from theory. They match it.

Small registers. Ternary models run on machines that already exist. They need no gigafactory.

From this follow directions that an influential reader can test against any plan:

1. **Count the chain, not only the capacity.** For every euro of compute, state the number of links and where each lies. A plan that shortens the chain gains on the exponent.
2. **Fund depth, not copies.** Research and procurement can favour designs that change the register, the carrier or the address: ternary models, photonics, neuromorphic chips, in-memory computing. These are now 1 to 4 per cent of the money.
3. **Give every converging point a second path.** A second chip source, a second gallium route, a second cloud stack, a second connection. The cheapest resilience is a second path, not a larger first one.
4. **Close locally where the grid is full.** Make own generation, storage and heat reuse the condition of connection, as Ireland and Germany began to do.
5. **Measure what matters in public.** Publish energy, water and heat per site. The current EU rules keep per-site data confidential. A ledger that prices only the endpoints does not see where the loss sits.
6. **Count work removed as well as work created.** Every public plan can state both.

These directions do not depend on accepting the whole theory. They follow from the measured limits. The theory explains why they belong together.

9. What Remains Open

Five questions decide how far this reading reaches.

1. **Energy per address query.** Address-based computation has been built and tested on small scale. Its energy per query against today's models has not been measured.
2. **Local energy closure at small scale.** One unreplicated device reports 70 watts per square metre. Whether such layers add up is unknown. The gap to the target is a factor of about 25 million.
3. **The rewrite rule.** The rule by which the net rewrites itself is solved for the register but not yet for the whole net.
4. **The optical three-valued lock.** Three-phase locking is exact for ideal elements and shown in

microwave devices. It has not yet been shown in an optical loop.

5. **Europe's political will after 2027.** The budget, the Cloud and AI Development Act and the chip strategy are proposals.

Until the first two are measured, "the long chain disappears" is a direction, not a derivation.

Method

The evidence came from six independent research lines: companies, the EU, member states, physical limits, alternatives, and the theory itself. The theory line derived its expectations without seeing the visions. Fifteen predictions were written and fixed before any counting. Three independent reviewers checked 184 claims against their own sources. They confirmed 130, confirmed 29 with corrections, rejected one interpretation, and left 22 non-numerical claims unchecked. Every number in this essay was recomputed with separate code. Nine of fourteen countable predictions held.

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