

How AI Depends on Energy Sector Development and How Energy Sector Development Is Influenced by AI

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These are the lecture notes accompanying the slides: each section corresponds to one slide and sets out the evidence, figures and context behind it, with references listed per section. The deck was produced with AI assistance for image generation and research verification; the argument and the text are the author's own.

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1. How AI Depends on Energy Sector Development and How Energy Sector Development Is Influenced by AI



The talk reads the relationship between AI and energy in both directions at once, then runs a thought experiment to find out which parts of it are durable.

The argument in three sentences

- Energy is a low-interest commodity until it becomes scarce; then its value surfaces abruptly and reorders economies, alliances and trust.
- AI acts on energy as a *footprint* (a fast-growing, inelastic electricity consumer) and as a *tool* (forecasting, grid management, materials research).
- Energy constrains AI: since 2024, for the largest projects in the United States, power has become as binding a limit as chips; the IEA now describes bottlenecks in energy supply chains and in advanced chip manufacturing tightening at the same time ([IEA, Key Questions on Energy and AI, 2026](#)).

Three anchoring numbers

- Data centres used about 415 TWh in 2024, roughly 1.5 % of global electricity; the IEA projects more than a doubling to around 945 TWh by 2030 ([IEA, Energy and AI, 2025](#)); its 2026 update ([IEA 2026](#)) puts 2025 at about 485 TWh and keeps 950 TWh for 2030.

- Published estimates of one AI query differ by an order of magnitude: about 3 Wh (de Vries 2023, older hardware and assumptions) against about 0.3 Wh (Epoch AI 2025, which revises the older figure); the spread is mostly a difference in assumptions, which is itself the point. Google's own median for a Gemini text prompt is 0.24 Wh and 0.26 ml of on-site cooling water, not the full water footprint ([Google 2025](#)).
- The US queue of generation and storage projects waiting for a grid connection peaked near 2,600 GW at the end of 2023 and still held 2,060 GW at the end of 2025; projects completed in 2025 had waited a median of 61 months ([LBNL, Queued Up 2026](#)).

Method

- Instead of walking through the numbers, the talk lets the current build-out finish, removes humanity and every written record around 2030, waits a thousand years, and asks what an expedition could still learn about energy in the AI decade.
- The purpose is to separate what is *durably* true about AI and energy from what is merely reported.

REFERENCES

1. [IEA: Energy and AI \(2025\)](#) – 415 TWh in 2024; more than doubling to around 945 TWh by 2030
2. [Epoch AI: How much energy does ChatGPT use? \(Feb 2025\)](#) – about 0.3 Wh per typical query
3. [de Vries, A.: The growing energy footprint of artificial intelligence. Joule 7 \(2023\)](#) – at most 2.9 Wh per request
4. [Google: Measuring the environmental impact of delivering AI at Google scale \(Gemini, 2025\)](#) – 0.24 Wh and 0.26 ml of water per median text prompt
5. [Rand et al. \(LBNL\): Queued Up – 2026 Edition](#)

2. Thought experiments



- Einstein at sixteen, chasing a beam of light (1895)
- Galileo's falling bodies · Maxwell's demon (1867) · Schrödinger's cat (1935)
- Physics runs experiments it cannot yet build
- Why not history? Weber (1906), Fogel (1964), Ferguson (1997) did

Thought experiments are a respectable method in physics; history has the same tool under the name counterfactual history, so the talk borrows a method rather than inventing one.

Physics

- Einstein at sixteen (Aarau, 1895–96) imagined riding alongside a light beam; recalled in his 1946 *Autobiographical Notes*; John Norton's reconstruction: *Chasing the light*.
- The falling lift of 1907, "the happiest thought of my life", seeded general relativity; the train-and-lightning picture of simultaneity is in his 1916 popular book.
- Galileo's tied falling bodies, *Two New Sciences* (1638); Maxwell's sorting "finite being" (letter to Tait, 11 December 1867), named a demon by Kelvin in 1874; Schrödinger's cat (1935).
- The [Stanford Encyclopedia entry](#) surveys the epistemology and links thought experiments to counterfactual reasoning (Williamson 2007).

History: prior art

- Max Weber (1906), "objective possibility and adequate causation": every causal claim about the past implies a counterfactual.
- Robert Fogel, *Railroads and American Economic Growth* (1964): the US economy without railways; Nobel prize 1993.
- Geoffrey Hawthorn, *Plausible Worlds* (1991); Niall Ferguson (ed.), *Virtual History* (1997): disciplined counterfactuals.
- Richard Evans, *Altered Pasts* (2014): the standard critique, most counterfactuals are wishful or political.
- Ferguson's rule of thumb: consider only alternatives that contemporaries themselves regarded as possible.

How our experiment differs

- It does not change the past; it removes the *witnesses* and asks what the physical record alone still says.
- That is closer to Zalasiewicz's "future geologist" than to Ferguson; the next two slides borrow one licence from the theatre and one from geology.

REFERENCES

1. [Stanford Encyclopedia of Philosophy: Thought Experiments](#)
2. [Norton, J. D.: Chasing the light – Einstein's most famous thought experiment](#)
3. *Virtual History: Alternatives and Counterfactuals* (1997), Niall Ferguson (ed.)
4. *Altered Pasts: Counterfactuals in History* (2014), Richard J. Evans

3. AI looks weightless. Its energy is not: concrete, copper, turbines, water, the objects that outlast the words.



The power of objects

This conference runs under the Academy's AV21 programme *The Power of Objects: Materiality between Past and Future*; the talk takes both of its directions, past and future, literally.

The frame

- The programme (2025–2029) is coordinated by the Institute of Contemporary History of the CAS, one of the two organisers of this conference ([Strategy AV21](#)).
- Its own description: "materiality can be seen as an important trace that materials and objects leave behind"; and "for the humanities and social sciences, the material turn is a major challenge".
- This talk takes the first sentence as a method: read our decade from the traces its energy leaves behind.

Where the day has been

- The programme reads energy crises largely from archives: coal supply in the Slovenian lands 1918–1941; coal, firewood, tanbark and leather in Třebíč during the First World War; the collapse of Prague's water supply in the cold spells of 1929 and 1939; and, in the talk just before this one, high-temperature alloys for energy infrastructure ([programme](#)).

- In the archive, objects are what the documents talk about.

The turn

- AI is discussed as software, "in the cloud". Its energy is material: concrete halls, copper, transformers, gas turbines, cooling water; the following slides count them.
- Prior art: Kate Crawford's *Atlas of AI* (2021) describes AI as "a technology of extraction: from the minerals drawn from the earth to the labor pulled from low-wage information workers to the data taken from every action and expression" ([Yale University Press](#)). This talk narrows her atlas to one layer, energy, and asks what of it survives.
- The thought experiment keeps the objects and deletes the documents, the reverse of the archive: materiality between past and future, read from the future.

Why geology next

- Geology already dates the past from objects alone, without a single witness; its golden spikes are the procedure the visitors will need.

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1. [Energy in Times of Crisis – conference programme \(FLÚ AV ČR & ÚSD AV ČR, 2026\)](#).
2. [Strategy AV21: The power of objects – Materiality between past and future \(ÚSD AV ČR, 2025–2029\)](#).
3. [Crawford, K.: Atlas of AI. Yale University Press \(2021\)](#).

4. How geologists cut time



- Eons, eras, periods, epochs – a hierarchy of boundaries
- A boundary is one point in one section of rock or ice: a golden spike
- Proposed by the stratigraphers, ratified by the IUGS – about eighty so far
- The Holocene begins 11,700 years ago, in a Greenland ice core (2008)

Geological ages are measured; the boundaries between them are agreed. Since the 1970s most boundaries have been defined by one physical point, and the procedure was built for deciding such things without any witness.

The procedure

- Units of the International Chronostratigraphic Chart (eons, eras, periods, epochs, ages) are separated by boundaries that, for most of the record, are defined at a physical reference point ([ICS chart](#)).
- A boundary is fixed by a Global Boundary Stratotype Section and Point (GSSP), the "golden spike": one horizon in one named section, usually rock, sometimes ice, marked physically.
- Proposals are voted by the subcommissions and the International Commission on Stratigraphy and ratified by the IUGS; the concept goes back to Hedberg (1965), formal registration to 1977; around eighty boundaries have a spike ([ICS GSSP table](#)).
- Older Precambrian boundaries are still defined by numerical age, not by a spike.

Even our own epoch has one

- The base of the Holocene is defined in the NGRIP2 ice core, central Greenland, ratified 2008, dated by annual layer counting to 11,700 years before AD 2000 (± 99 years), at a sharp change in deuterium excess ending the Younger Dryas ([Walker et al. 2009](#)).
- Two separate acts: the boundary is *defined* at a point and *dated* by measurement; the definition is a decision, the date has an error bar.

Why an energy conference needs this

- The thought experiment asks the visitors to recognise a boundary: the moment one species' energy system changed character.
- Geologists have an explicit, contested, documented way of deciding that without asking anyone who was there.
- The next slide: the procedure was born a few kilometres from this room. The one after: how it can fail.

REFERENCES

1. [Cohen et al.: The ICS International Chronostratigraphic Chart](#)
2. [International Commission on Stratigraphy: GSSPs](#)
3. [Walker et al.: Formal definition and dating of the GSSP for the base of the Holocene \(2009\)](#)

5. Three golden spikes within an hour of this room



- Klonk 1972 · Silurian–Devonian, the first ever
- Požáry 1984 · base of the Přídolí, Silurian
- Velká Chuchle 1989 · base of the Pragian

Three of the world's golden spikes, including the very first, sit within an hour of this conference centre; they show that ordinary places can carry global boundaries decided entirely from physical evidence.

The three spikes

- Klonk near Suchomasty: Silurian–Devonian boundary (base of the Lochkovian), defined by the first appearance of the graptolite *Uncinatograptus (Monograptus) uniformis*; approved by the boundary committee 1971, accepted at the 24th International Geological Congress, Montreal, 1972, the first GSSP ever; physical marker set 1974 ([IUGS Geoheritage](#)).
- Požáry quarry, Řeporyje, Prague: base of the Přídolí Series, the last series of the Silurian, ratified 1984.
- Velká Chuchle quarry, Prague: base of the Pragian stage (Lower Devonian), ratified 1989, defined by the conodont *Eognathodus sulcatus*.
- Not Czech: the base of the Emsian is at Zinzilban Gorge, Uzbekistan (1995). All three Czech spikes are on the [ICS table](#).

Why it matters for the argument

- They are ordinary places: a hillside and two disused quarries. The world agreed where the Devonian begins by pointing at a Bohemian outcrop.
- The decision was made by people who never saw the Devonian, from physical evidence and correlation alone, which is exactly the situation of our visitors.
- If a boundary 419 million years back can be fixed at Klonk, a boundary a thousand years back can be fixed at a lake bed near Memphis.

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1. [IUGS Geoheritage: GSSP for the Silurian–Devonian boundary at Klonk](#)
2. [International Commission on Stratigraphy: GSSP table](#)
3. [OpenStreetMap: Vltava, Berounka and the Prague boundary for the map](#) ([© OpenStreetMap contributors, ODbL](#)).
4. [Natural Earth: 1:50m admin-0 countries \(public domain\)](#), [outline of Czechia for the map](#)

6. Clear in the strata, rejected in the vote



- Anthropocene: coined in 2000 by Crutzen and Stoermer
- Proposed start around 1952; candidate spike in Crawford Lake, Canada (2023)
- Rejected 12 to 4 in March 2024: an unfolding event, not an epoch
- A sharp signal is not enough; the unit has to fit the phenomenon

The most famous recent attempt to add an epoch failed in 2024, and the committee's reason, an unfolding event is not an epoch, is the lesson for anyone naming the AI-energy decade from inside it.

Timeline

- Paul Crutzen and Eugene Stoermer proposed "Anthropocene" in the IGBP newsletter, May 2000, after Crutzen blurted it out at a meeting in Cuernavaca; Crutzen, *Geology of mankind*, *Nature* 2002.
- The Anthropocene Working Group (from 2009) chose its candidate spike in July 2023: the annually laminated sediments of Crawford Lake, Ontario, start about 1952, marked by plutonium fallout from bomb tests.
- March 2024: the Subcommittee on Quaternary Stratigraphy voted the proposal down, 4 for, 12 against, 3 abstentions; ICS and IUGS confirmed the rejection on 20 March 2024 ([IUGS/ICS statement](#)).

- Jan Zalasiewicz, the working group's founding chair, disputed the procedure; treat it as a live controversy, not a closed case.

The stated reason

- The marker was not the problem: the plutonium spike of the early 1950s is sharp and correlatable worldwide.
- What failed was the fit between one sharp boundary and a diachronous, still-unfolding process: human impact began at different times in different places and is better described, the majority judged, as an ongoing *event*, like the Great Oxidation Event, than as a formal epoch with one start date.

Lesson for the talk

- A sharp signal is necessary but not sufficient; the unit has to fit the phenomenon. The Holocene has a spike *and* a shape.
- We are trying to name an energy boundary from inside the decade, while the phenomenon is still changing shape. That is why the experiment waits for the build-out to finish before the god intervenes: not so that a marker appears, but so that the thing being marked has a shape.

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1. Crutzen, P. J.: Geology of mankind. Nature 415, 23 (2002).
2. IUGS/ICS: statement on the Anthropocene decision (20 March 2024) – 4 for, 12 against, 3 abstentions
3. Nature news: Anthropocene rejected as a new geological epoch (March 2024)

7. Deus ex machina: let the crane lower a god, and skip the knots that do not change the story.



Our licence

The god from the machine is our declared licence to skip every detail that does not change the conclusion; Horace's condition tells us when the licence is legitimate.

Origin

- Euripides, *Medea* (431 BC): the heroine escapes in the sun god's chariot, lowered onto the stage by the *mechane*, the theatre crane; the Latin phrase translates the Greek "god from the machine".
- Aristotle, *Poetics* ch. 15: "the unravelling of the plot ... must arise out of the plot itself; it must not be brought about by the *deus ex machina*, as in the *Medea*".
- Horace, *Ars Poetica* 191–192: *nec deus intersit, nisi dignus vindice nodus*, let no god intervene unless a knot worthy of such a deliverer appears.

How the talk uses it

- The god comes down once: every human and every written record, on paper or on silicon, is gone; nothing else changes; a thousand years pass.
- Knots it settles so that we need not: whether the removal is instantaneous, what unattended reactors do, whether the visitors read our alphabet.
- What remains is the physical world and an expedition with physics, chemistry and patience.

The cost, stated

- Counterfactual historians insist on the "minimal rewrite": change one thing, hold everything else fixed.
- Our rewrite is enormous but *uniform*: it removes exactly the evidence we normally rely on (testimony) and keeps exactly the evidence we normally neglect (physical traces).
- That asymmetry is the point of the exercise, so the god is worthy of the knot.

REFERENCES

1. Aristotle, Poetics, ch. 15 (S. H. Butcher translation)
2. Horace, Ars Poetica, 191–192: nec deus intersit

Part 2: The experiment



Year 3030. No humans, no texts. Visitors with good instruments.

The crane comes down: the god lets the build-out finish, then removes humanity and every record; a thousand years later an expedition arrives with good instruments and no dictionary.

The set-up

- Around 2030, when the campuses now under construction are complete, the god removes every human being and every written record: books, newspapers, hard drives, tapes, the caches of every data centre. Nothing else changes; the lights go out as fuel and maintenance stop.
- A thousand years pass. An expedition lands with physics, chemistry, geology and patience, and no language of ours; there is nothing left to learn it from.
- Their one question: what happened to energy on this planet in the decade before the lights went out? They do not know that thinking machines existed; that is our question, not theirs.

Rules of the game

- Anything that needs a dictionary is gone: labels, manuals, permits, the internet.
- Anything that needs no reader remains: the shape of the land, the chemistry of lake mud and ice, metals in the ground, bones in graves.
- A thousand years is chosen with care: long enough that paper, magnetic and flash media are unreadable and forest covers most of the built landscape; short enough that concrete, ceramics,

glass, gold and large earthworks survive (timescales in Weisman, *The World Without Us*, 2007).

- It is also the horizon on which real geologists have tried to talk to strangers: the Waste Isolation Pilot Plant markers were designed for ten thousand years.

What the visitors can and cannot do

- They can date: annual lake layers, radiocarbon, and the plutonium horizon of the 1950s bomb tests, which persists for tens of thousands of years; lead-210, the usual tool for recent mud, is useless beyond about 150 years.
- They cannot read intent: from the hardware they may infer *that* the halls computed, even what kind of computation, but not *what* was computed or why it mattered. That limit returns in the verdict.
- They will be tempted, like Macaulay's future archaeologist, to mistake a motel for a tomb; the next slide is about how not to.

9. Reading a world without a single text



- Macaulay, *Motel of the Mysteries* (1979): the tomb that was a motel room
- Zalasiewicz: technofossils, our artefacts as future strata (2014)
- Sandia, WIPP markers (1993): we already tried to write to such visitors
- Rock, mud, ice and metal keep records that need no reader

The exercise has a serious literature, including one paper that asks the reverse question, and its shared method is the one the visitors will use: proxies that need no reader.

Prior art

- David Macaulay, *Motel of the Mysteries* (1979): an archaeologist in 4022 reads a motel room as a tomb; a warning about interpretation, not evidence.
- Alan Weisman, *The World Without Us* (2007): how quickly cities and infrastructure decay once maintenance stops.
- Jan Zalasiewicz, *The Earth After Us* (2008); Zalasiewicz et al., *The technofossil record of humans* (2014): our artefacts as future strata, with a diversity and rate of change unprecedented in the fossil record.
- David Farrier, *Footprints* (2020): individual traces, roads to plastics, followed into deep time.
- Gavin Schmidt and Adam Frank, *The Silurian hypothesis* (2018): could an industrial civilisation be detected in the geological record at all? Their answer for deep time is sobering: carbon

isotopes, metals and plastics leave a signal, but not proof of *who* made it. Our horizon is a thousand years, not millions, which is why the buildings themselves still count.

We have already tried to write to such visitors

- Sandia National Laboratories, 1993: expert panel on markers to deter intrusion into the Waste Isolation Pilot Plant over ten thousand years ([Trauth, Hora & Guzowski, SAND92-1382](#)).
- Their principles, read backwards, are our checklist: messages must survive without a shared language, so rely on redundancy, on materials with no salvage value, and on the landscape itself.
- The Long Now Foundation's ten-thousand-year clock is the optimistic cousin of the same idea ([longnow.org](#)).

The method

- Rock, mud, ice and metal keep records that need no reader.
- The rest of the talk is a tour of those proxies, from orbit down to a single trench.

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1. [Zalasiewicz et al.: The technofossil record of humans. The Anthropocene Review 1 \(2014\)](#)
2. [Schmidt, G. A. & Frank, A.: The Silurian hypothesis. International Journal of Astrobiology 18 \(2018\)](#)
3. [Trauth, Hora, Guzowski: Expert Judgment on Markers to Deter Inadvertent Human Intrusion into the WIPP. Sandia SAND92-1382 \(1993\)](#)
4. [Long Now Foundation: The 10,000 Year Clock](#)
5. Motel of the Mysteries (1979), David Macaulay
6. The World Without Us (2007), Alan Weisman
7. The Earth After Us (2008), Jan Zalasiewicz
8. Footprints: In Search of Future Fossils (2020), David Farrier

Part 3: From orbit



Lidar and the shape of the grid

Any sensible expedition starts from above; two instruments with real scientific pedigrees do the first survey, and each has a defined job.

The instruments

- Airborne laser scanning (lidar): measures the ground surface through vegetation; it has rewritten the archaeology of tropical civilisations in fifteen years. It *locates and maps*; it does not date or identify.
- The map of every wire, pipe and pylon, reconstructed from corroded steel, ceramic insulators and the straight scars of cleared corridors: how power moved across a continent.

Why macro first

- Large things are hard to misread. A single motel is easy to mistake for a tomb.
- A rectangle of concrete the size of a small town, with turbine foundations beside it, in a landscape where other large consumers are fed by wires, narrows the possibilities; the trench then settles what it was.

The next two slides

- The footprint of the campuses; the campuses that made their own power.

11. Lidar through the forest



- Maya lowlands: 60,000 structures under 2,144 km² of canopy (2018)
- Angkor's city grid, Casarabe's causeways: legible after a thousand years
- AI campuses: Hyperion 910 ha, Abilene 445 ha, cement by the hundred kilotonnes
- Power 1.2–5 GW each, one or two Temelíns; all that cement $\approx$ 1–3 weeks of the load
- Lidar finds the rectangles; the trench dates them and says what they were

A millennium of forest hides earthworks from the eye but not from a laser; abandoned cities remain legible after six to thirteen centuries, and a single AI campus covers about a quarter of Angkor's urban core with a regularity none of them has.

Evidence: what lidar found under forest

- Caracol, Belize: 200 km² scanned, causeways, terraces and dense settlement invisible to decades of ground survey ([Chase et al. 2011](#)).
- Guatemalan lowlands: 2,144 km², more than 60,000 structures including fortifications and irrigation, implying a far larger Maya population ([Canuto et al., *Science* 2018](#)).
- Angkor: a planned urban grid of streets, canals and ponds over at least 35 km² ([Evans et al., *PNAS* 2013](#)).
- Casarabe culture, Bolivian Amazon (AD 500–1400): platform mounds and causeways, about 570,000 m³ of earth moved at Cotoca ([Prümers et al., *Nature* 2022](#)).

Evidence: the size of AI campuses

- Meta Hyperion, Richland Parish, Louisiana: about 910 hectares (9 km²), up to nine buildings, about 370,000 m² of floor space, more than 2 GW targeted by 2030 in the first phase ([Meta](#)); in July 2026 Meta announced an expansion to nearly 930,000 m² and 5 GW of IT capacity ([Louisiana Economic Development](#); [Meta](#)). The expedition finds whichever phase was built by 2030.
- Stargate Abilene, Texas: eight buildings on 445 hectares, about 370,000 m² in total, by the operator's description ([Oracle](#)); Microsoft Fairwater, Wisconsin: 127 hectares ([Microsoft](#)).
- Industry estimates: 150,000–300,000 tonnes of cement per 500 MW campus; data-hall slabs with 60–120 kg of rebar per cubic metre, two to three times an ordinary commercial floor ([Rock Products 2026](#)); orders of magnitude, not audited figures.

Evidence: power draw, and what the cement costs in energy

- Announced capacities, not metered draw: Hyperion about 2 GW by 2030 in the first phase and 5 GW of compute after the July 2026 expansion ([Meta](#)); Stargate Abilene 1.2 GW ([Crusoe](#)); Fairwater's power is not published for the site itself.
- Cement takes about 3.6 GJ of kiln fuel per tonne of clinker at a clinker ratio of 0.71, plus roughly 100 kWh of electricity per tonne of cement ([IEA, Cement](#)): about 2.9 GJ per tonne in all, 88 % of it fuel. The CO₂ released by calcination is a process emission, not energy.
- 150,000–300,000 t of cement therefore hold 120–240 GWh (15–30 GWh of it electricity): 1.5–3 weeks of a 500 MW campus at full load. Spread over a two-year build, the cement's electricity is 1–2 MW and its kiln fuel the equivalent of 6–12 MW; the plant that feeds the halls needs the same 0.5 GW with or without the concrete.
- Czech scale: Temelín's two units give 2.06 GW net and Dukovany's four 1.92 GW ([WNA](#)); Hyperion at 5 GW would draw 44 TWh a year, about three quarters of the 59 TWh Czechia consumed in 2025 ([ERÚ](#)), before cooling and losses.

What the visitors read, and what they still need

- Rectangles of that size and regularity on former farmland, each paired with a substation, cooling plant and often its own generators, are unlike temples, fields or ordinary factories.
- Lidar only finds them. Dating the concrete and identifying the halls is the trench's job (the slides on the ground); the lidar map shows a continent dotted with the Maya platforms of the 2030s.

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1. [Chase et al.: Airborne LiDAR, archaeology, and the ancient Maya landscape at Caracol, Belize. J. Archaeol. Sci. \(2011\)](#)
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3. Canuto et al.: Ancient lowland Maya complexity as revealed by airborne laser scanning. Science 361 (2018).
4. Evans et al.: Uncovering archaeological landscapes at Angkor using lidar. PNAS 110 (2013).
5. Prümers et al.: Lidar reveals pre-Hispanic low-density urbanism in the Bolivian Amazon. Nature 606 (2022).
6. Meta: Richland Parish Data Center (Hyperion).
7. Rock Products: Report on data centers (cement demand, 2026) – 150–300 kt of cement per 500 MW campus: an industry order-of-magnitude estimate, not an audited figure
8. Crusoe: 1.2 GW AI factory campus in Abilene, Texas
9. IEA: Cement (energy intensity of clinker and cement, 2022 data) – 3.6 GJ/t clinker, clinker ratio 0.71; ~100 kWh/t electricity → ~2.9 GJ/t cement, 88 % fuel
10. World Nuclear Association: Czech Republic (net capacities of Temelín and Dukovany).
11. ERÚ: Spotřeba energií v roce 2025 vzrostla (čistá spotřeba elektřiny ≈ 59 TWh).

12. Islands with their own fires



- 2,600 GW waited for a US grid connection in 2023; 2,060 GW in 2025, median wait 61 months
- Loads queue too: Texas from 63 to over 400 GW in eighteen months, mostly data centres
- So they bring their own power: ~100 GW of on-site gas planned, a fifth of the US fleet
- True islands are being built: a 2 GW campus in West Virginia on its own gas engines
- The alien maps every pylon and finds the largest halls making their own power

The map of wires shows the clearest energy signature of the decade: the queues broke, so the largest new consumers made their own power, and some cut the wire altogether.

Evidence: the two queues

- Generation queue: about 2,600 GW of generation and storage waited for a US grid connection at the end of 2023; after reforms about 2,060 GW (1,312 GW generation, 749 GW storage) at the end of 2025; median time from request to operation 61 months for the 2025 cohort, against 22 months in 2008; only about 13 % of the capacity that applied in 2000–2020 had reached operation by the end of 2025 ([LBNL, *Queued Up* 2026](#)).
- Load queue: large consumers wait as well; in Texas the large-load queue grew from 63 GW at the end of 2024 to over 400 GW by mid-2026, nine tenths of it data centres ([Data Center Frontier](#)). This second queue, not the first, is the direct reason to bring your own power.

Evidence: bring your own power

- BloombergNEF counts about 100 GW of on-site gas generation planned for US data centres, equivalent to 18 % of the existing US gas fleet ([Utility Dive](#)).
- Cleanview's *Bypassing the Grid* (February 2026) found 46 behind-the-meter data centres totalling 56 GW, about 30 % of all planned US capacity; of the generation equipment it could identify (23 GW), three quarters was gas ([Cleanview, Feb 2026](#)); by September 2026 its tracker lists 59 projects and about 90 GW ([Cleanview tracker](#)).
- Most such sites keep a grid line: Stargate Abilene is tied to ERCOT, the Texas grid operator; the operator describes its on-site gas turbines as backup ([Oracle](#)), while permit filings reported in the press put them at about 360 MW with year-round operating hours allowed; how much they actually run is not public.
- Some are designed as true islands, and they are plans, not yet plants: the Monarch campus in Mason County, West Virginia, has applied for an air permit for 864 reciprocating gas engines, 2.16 GW, described as an off-grid facility ([Herald-Dispatch via WV Press, May 2026](#)), with power delivery slated to begin in 2026 and 2 GW online in 2027 ([Caterpillar/AIP release](#)); in Ohio 412 MW of Wärtsilä engines are to run as primary power so the site can operate off-grid, commercial operation early 2028 ([Wärtsilä](#)). The experiment assumes they were finished by 2030.
- Regulators pushed back on the nuclear variant: the Federal Energy Regulatory Commission (FERC) rejected Amazon's behind-the-meter deal at Susquehanna in November 2024, and the 1,920 MW contract was restructured in 2025 as grid-connected supply ([Utility Dive](#)); Ireland's regulator now requires large new data centres to bring dispatchable generation or storage, on site or nearby, *in addition to* a grid connection ([CRU decision, Dec 2025](#)).

What the visitors read

- Beside the largest halls they find the foundations of the halls' own power plants; for some campuses no corroded pylon line leads in at all.
- Power was made where it was used. That reversal of a century of grid architecture is the clearest thing the AI decade did to energy, readable without a word of text.

Caveat

- "Planned" is not "built": the 100 GW and 56 GW are announcements; the visitors will see only what was finished by 2030.

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(BloombergNEF: 100 GW $\approx$ 18 % of US gas fleet)
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5. Oracle: Abilene data centers (campus description) – grid-tied to ERCOT; on-site gas turbines described as backup
6. Herald-Dispatch / WV Press: Point Pleasant data center – 3 buildings, nearly 1,000 natural gas and diesel engines (WV DEP permit application, May 2026) – 864 engines, 2.16 GW, off-grid facility (permit application, not yet operating)
7. AIP / Caterpillar / Boyd CAT: alliance to deploy 2 GW of dedicated power (press release, 31 March 2026) – power delivery from 2026, 2 GW online in 2027 (planned)
8. Wärtsilä: 34SG engine makes its data center debut with new 412 MW U.S. project (Ohio, April 2026) – primary power, site can operate off-grid; commercial operation planned early 2028
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– dispatchable on-site or proximate generation and/or storage required for large connections
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Part 4: On the ground



What a lake, a well, a street and a trench say

Orbit gives the shape; the story needs boots on the ground. The visitors land, drill one core and dig three small holes, and archaeology learns its most human lessons from small holes.

The core and the three holes

- A lake core: what burned, and when, year by year; the same kind of archive the Anthropocene Working Group used.
- A well: what happened to the water.
- A street: who became rich.
- A trench through one of the halls: what a thinking machine leaves behind when it stops.

Why it works

- Each has a real method behind it, developed for Roman towns and Neolithic villages.
- Each yields a different kind of evidence about the same decade.

14. The lakes remember the turbines



- Memphis: 35 unpermitted turbines, 15 permitted (2025); 41 next door, 1.2 GW (2026)
- Colossus 1 $\approx$ 0.4 GW; Colossus 2 $\approx$ 1.3 GW today, 2 GW planned: the largest of 2026
- Not for long: by 2028 Fairwater WI $\approx$ 3 GW, Rainier IN and Jupiter NM 2.2 GW pass it
- Coal and oil left fly-ash spheres in lake beds worldwide, rising from 1950 (Rose 2015)
- Gas leaves only soot, PAHs and a nitrogen spike; a core dates it, the fuel is inferred

Lake mud records combustion without a reader; the Memphis turbines are the test case, and the honest point is that gas leaves a fainter fingerprint than coal, and that reading the fuel from it is an inference.

Evidence: the sediment archive

- Spheroidal carbonaceous particles, fly-ash spheres from high-temperature coal and fuel-oil burning, are solely anthropogenic and rise sharply from about 1950 in lake records worldwide (Rose, *Environ. Sci. Technol.* 2015).
- They are chemically inert and survive in mud, peat and ice; they were a candidate Anthropocene marker precisely because they need no reader.

Evidence: Memphis

- xAI's Colossus went live in summer 2024 in a former appliance factory in South Memphis with 100,000 GPUs.

- Aerial imagery of 9 April 2025 showed 35 gas turbines running without air permits, 422 MW combined ([SELC press release](#)).
- July 2025: Shelby County permitted 15 permanent turbines, about 247 MW ([CNBC](#)).
- March 2026: Mississippi permitted 41 permanent turbines for the second campus in Southaven, over a gigawatt; reporters counted dozens more declared "mobile"; NAACP, Earthjustice and SELC sued under the Clean Air Act in April 2026 ([NAACP](#)).
- Community groups estimate 1,200–2,000 t of NO_x a year; an air-toxics study of south-west Memphis, where Boxtown lies, had already put the modelled cumulative cancer risk at four times the national average ([Jia & Foran 2013](#)).

Evidence: how much power, and who is bigger

- Colossus 1: Epoch AI estimates about 340 MW of IT load and 425 MW of total capacity for its 200,000+ GPUs ([Epoch AI](#)). TVA approved 150 MW of grid supply in November 2024 and another 150 MW on 11 February 2026 ([TVA board minutes](#)); the rest comes from the permitted turbines (the operator now lists 12 permanent units, about 200 MW) and more than 200 Megapack batteries ([xAI](#)).
- Colossus 2 (Tulane Road, Memphis; power plant across the state line in Southaven): Musk called it the first gigawatt training cluster in January 2026, with an upgrade to 1.5 GW in April ([X](#)); Epoch AI estimates 946 MW of IT load and 1.28 GW of total capacity in mid-2026, 1.53 and 2.07 GW in 2027 ([Epoch AI](#)). The 41 permitted turbines add up to about 1.2 GW ([DCD](#)) and the plant was still under construction in summer 2026.
- All of these are capacities, not metered draw; GPU counts and the 2 GW figure are the operator's own.
- Largest? Epoch ranks Colossus 2 as the largest AI data centre it tracks in 2026 and projects that by 2028 Microsoft Fairwater (Mount Pleasant, Wisconsin; about 3.3 GW total by late 2027), the Amazon–Anthropic campus at New Carlisle, Indiana (2.2 GW), Stargate Jupiter (Doña Ana County, New Mexico; 2.2 GW) and the first phase of Meta Hyperion overtake it ([Epoch AI comparison](#); [Epoch AI on Fairwater](#); [Data Center Frontier on Jupiter](#); [CNBC on Rainier](#)).
- Outside the United States the figures are thinner: Envision opened a campus in Ulanqab, Inner Mongolia, in August 2026 at a claimed 2 GW ([Global Times](#), state media) and ByteDance reportedly plans 5–6 GW there by early 2028 ([SCMP](#), one anonymous source); Fermi America's 11 GW Matador campus in Amarillo has an air permit and turbines on site but no buildings.

What the mud will show

- Natural gas is essentially ash-free, so the classic fly-ash spheres of the coal age will be largely *missing*.
- Instead: black carbon and polycyclic aromatic hydrocarbons from incomplete combustion, and a spike in nitrogen deposition from NO_x; the vanadium-nickel signature of oil burning absent.

- Dating: annual layers where the lake has them, radiocarbon, and the plutonium horizon of the 1950s as an anchor; lead-210 does not reach a thousand years ([Aquino-López et al. 2018](#)).

Caveats

- Turbine counts in press reports range from 27 to 59 by month; the permit figures are the stable ones.
- The gas-specific signature is an inference from combustion chemistry, not a published core from Memphis; the visitors would know intense combustion without the coal fingerprint, and would *infer* the fuel.

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17. SCMP: ByteDance to expand AI data centre cluster in Inner Mongolia to 5–6 GW by early 2028 (source says) – single anonymous source
18. Global Times: Envision Galaxy campus in Ulaanbaatar opens at 2 GW (Aug 2026) – state media; claim of the largest single AI computing facility

15. Old fires kept burning



- 15 US coal plants kept from retiring since 2025: over 68 million tons of CO₂ in 2024
- Three Mile Island Unit 1 being restarted for one customer: 835 MW for twenty years
- Turbine prices forecast up 195 % by 2027; heavy turbines five to seven years away
- In the strata: the coal fly-ash layer thins later here than elsewhere

The lake core's second story, and the second lesson of the map of wires: old plants had their retirements postponed, one old reactor is being woken, and the fast answer, gas, became a bottleneck itself.

Evidence: coal kept running

- Since early 2025 US utilities postponed the retirement of at least fifteen coal plants, partly under federal emergency orders, partly citing data-centre demand; nearly three quarters had been due to close within two years; their two dozen generators emitted more than 68 million tons of CO₂ in 2024 ([DeSmog](#), [Dec 2025](#)).
- The Department of Energy issued more than forty section 202(c) emergency orders between May 2025 and mid-2026 ([POWER](#)); on 11 September 2026 the D.C. Circuit vacated the order keeping the 1,420 MW J. H. Campbell plant open ([opinion](#)).
- Across all fuels, operators planned to retire 12.3 GW in 2025 and retired 4.6 GW, the least since 2008 ([EIA](#), [Feb 2026](#)).

Evidence: the reactor being woken

- Three Mile Island Unit 1, shut in 2019 as unprofitable, is being restarted by Constellation as the Crane Clean Energy Center under a twenty-year contract for its entire 835 MW with Microsoft; announced 20 September 2024, DOE loan of one billion dollars in November 2025 ([Constellation](#)).
- Status in September 2026: the NRC found no significant environmental impact in June 2026 and expects its final decision in 2027; Constellation targets first electricity late in 2027 ([NRC 26-061](#)). The plant is grid-connected; Microsoft buys the output, it does not receive it by a private wire.
- The four largest hyperscalers' announced nuclear agreements "could provide up to 13 gigawatts (GW) in total", split roughly between power purchase agreements and direct partnerships, mostly for reactors that do not yet exist (Carnegie Endowment, *Beyond the Hype: Assessing Hyperscaler Nuclear Commitments Against U.S. Energy Realities*, June 2026).

Evidence: gas as its own bottleneck

- Wood Mackenzie expects turbine prices to reach 600 dollars per kilowatt by the end of 2027, a 195 % increase since 2019, a forecast rather than a realised rise; orders of about 110 GW in 2025 against manufacturing capacity of 60–70 GW a year; five to seven years for heavy turbines ([Wood Mackenzie](#)); GE Vernova effectively sold out to 2030.
- Where turbines are unavailable, reciprocating engines fill in. Meta's Louisiana campus is instead paired with ten new combined-cycle gas plants of about 7.4 GW: three approved in 2024–25 and seven more, "totaling more than 5,200 megawatts", agreed in March 2026 ([Entergy Louisiana, 27 March 2026](#)).

What the strata show, and what they do not

- If the postponed retirements hold into the 2030s, which is an assumption of the scenario, a coal fly-ash layer that thins later in North America than in Europe is an observation the visitors could make; the height of that peak varies with distance from the sources ([Rose 2015](#)), so it needs comparable lakes on both continents.
- Why it thinned later, the planned retirement dates and the orders that postponed them, is exactly the kind of record the god removed; the visitors see the burning, not the decision.

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5. Constellation: Constellation to Launch Crane Clean Energy Center (20 Sept 2024) – 835 MW for 20 years; restart of Three Mile Island Unit 1
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7. Wood Mackenzie: Gas turbine prices soar 195 % as market faces supply-demand crisis (April 2026) – forecast: US\$600/kW by end-2027, a 195 % increase since 2019

16. Wells and rivers



- Memphis drinks from a deep aquifer; Colossus drew 0.8 million gallons a day from it (2026)
- The Dalles, Oregon: one company, nearly 40 % of the town's water (2025)
- Santiago: a court struck a permit to draw 7.6 million litres a day
- Aragón, Spain: a campaign called „your cloud dries my river“
- A compacted aquifer stays compacted; a river's bad years read as climate, not one building

Water is the local conflict of the AI build-out; where drawdown compacts a deep aquifer the loss is permanent, while a river's bad decade reads as climate rather than as one building.

Evidence: totals

- US data centres: about 17.4 billion gallons of direct on-site water in 2023, plus about 211 billion gallons consumed indirectly at the power plants supplying them ([LBNL 2024](#)).
- Google alone: about 8.1 billion gallons consumed in 2024, up 28 % in a year ([Google 2025 Environmental Report](#)).

Evidence: local cases

- The Dalles, Oregon (16,000 people): Google's use rose fivefold since 2012 to roughly 550 million gallons in 2025, close to 40 % of the city's supply; figures released only after a two-year public-records lawsuit ([Latitude Media](#)).

- Memphis: drinking water comes from the deep, slowly recharged Memphis Sand aquifer; in spring 2026 Colossus was pumping 812,502 gallons a day from it, with more expected in summer, while the wastewater-recycling plant meant to replace the draw was paused and its estimate rose from 80 to about 200 million dollars ([Memphis Flyer](#), 22 May 2026).
- Santiago de Chile: Google's approved design would have drawn 7.6 million litres of groundwater a day in a fifteen-year megadrought; in 2022 the company itself proposed replacing the cooling towers with air cooling, in February 2024 the environmental court partly annulled the original approval and ordered a new assessment of water and climate impacts, and the project Google resubmitted in 2026 has air cooling and 44 backup generator sets of 120 MW ([OhMyGeek](#), Sept 2026) ([Tribunal Ambiental](#), ruling; [DF](#)).
- Aragón, Spain: three Amazon sites licensed for about 756,000 m³ a year in a region that asked the EU for drought aid; the campaign is called *your cloud dries my river* ([SourceMaterial](#)). Montevideo marched in the 2023 drought under *no es sequía, es saqueo*.

What survives a thousand years

- Rivers: a decade of low flow is written in narrow tree rings and thin lake layers, and those records persist, but as climate; they cannot separate one town's withdrawal from a regional drought, and wood rarely survives a millennium.
- Aquifers: where sustained drawdown compacts clay layers, the lost storage is permanent and can show as subsidence ([USGS](#)); whether the Memphis Sand behaves that way is not established. The deepened wells themselves survive.
- If the pumping ran on to 2030, as the scenario assumes, the visitors would find deepened wells around Memphis and Phoenix; that they exist is a scenario assumption, and whether the visitors could name the cause is open.

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17. The rich electricians



- Electrical work is 45–70 % of a data centre's construction cost
- IBEW Local 26, Northern Virginia: membership doubled since 2018 to 14,700
- Median US electrician \$63,000; Texas data-centre electricians reported at \$260,000
- Houses and bones show who got richer; which trade it was, the visitors cannot tell

Archaeologists measure wealth from houses and bones; the AI build-out made a handful of trades rich; and the honest limit is that a grave shows who got richer, not what they did for a living.

Evidence: the archaeological method

- House-floor areas as a wealth proxy across ten thousand years: Gini about 0.17 for hunter-gatherers, 0.35 for early farmers, near 0.48 in Old World societies by AD 1 ([Kohler et al., *Nature* 2017](#)).
- A health index from thousands of skeletons across the Americas: stature, enamel defects, iron-deficiency lesions, healed fractures ([Steckel, Rose, Larsen & Walker 2002](#)).
- Houses and bones are exactly the evidence that survives our god.

Evidence: the trades

- Electrical work is put at 45–70 % of a data centre's construction cost in industry and union statements: "It's estimated that 45% to 70% of the construction costs of the typical data center go to the electrical subcontractor" ([IBEW, *The Data Center Surge*](#)); it is a union estimate, not a study.

- Local 26 of the International Brotherhood of Electrical Workers (IBEW; Washington and Northern Virginia, "Data Center Alley") has roughly doubled its membership since 2018 to about 14,700, its members logging 28 million hours a year against 14 million a decade earlier (Ellis & Ramkumar, *Wall Street Journal*, 28 August 2026, paywalled; figures as quoted in a [public summary](#)); a September 2025 report gave 12,500, so the count moves with the date.
- National median electrician \$63,190 (May 2025), 9 % growth projected over the decade, three times the average occupation ([US Bureau of Labor Statistics](#)).
- The report of data-centre electricians under thirty in Plano, Texas, "each earning about \$260,000 a year with no student debt" is Mike Rowe's anecdote relayed by Fox Business, not a survey; the slide marks it as "reported" ([Yahoo Finance / Fox Business, April 2026](#)).
- The industry projects a shortfall of hundreds of thousands of construction workers in 2026.

What the visitors read

- A cluster of large new houses on old streets near the halls; a cohort with better teeth and healed rather than untreated fractures; if isotopes can be read, a richer diet, all dated to the years of the rectangles.

The limit, stated on the slide

- Houses and bones show *that* someone got richer near the halls. They do not say who wired them: the visitors cannot tell an electrician's grave from a landowner's. The method measures inequality, not occupation.
- That is why this slide is an example of the method's edge rather than another proof: wealth from wiring leaves bones, but unsigned.

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4. [Ellis & Ramkumar: Blue-Collar Jobs Are the New Flashpoint in Data-Center Fight. Wall Street Journal, 28 Aug 2026 \(summary with the Local 26 figures\)](#) – Local 26 roughly doubled since 2018 to about 14,700; WSJ original behind paywall; a Sept 2025 report gave 12,500
5. [Yahoo Finance / Fox Business: Mike Rowe on data-center electricians in Plano earning about \\$260,000 \(2 April 2026\)](#) – anecdote relayed by television, not a survey; marked as reported

18. Richer than the electricians



- Meta hired one Apple researcher with a package of over \$200 million (2025)
- OpenAI staff sold \$6.6 billion of shares in one round; 75 reached the \$30 million cap
- Nvidia's Jensen Huang: about \$3 billion in 2022, about \$200 billion in 2026
- Virginia: a 9-hectare family farm assessed at \$2 million, listed at \$50 million
- For the trench: estates, walls and concrete shelters, built to last

The electricians are the modest winners; the AI decade minted fortunes on a scale no trade can match, and some of that wealth is already being poured into concrete.

Evidence: salaries and shares

- Meta hired Ruoming Pang, head of Apple's foundation-model team, with a package "over \$200 million", most of it tied to retention and performance ([Bloomberg, 9 July 2025](#)). Sam Altman's claim of "\$100 million signing bonuses" was disputed by Meta and is left out.
- Meta paid about \$14.3 billion for 49 % of Scale AI, a data-labelling company, and hired its founder Alexandr Wang ([CNBC, 12 June 2025](#)).
- In October 2025 more than 600 current and former OpenAI employees sold about \$6.6 billion of shares at a \$500 billion valuation; about 75 reached the \$30 million cap per person ([Bloomberg, 2 October 2025](#)).
- Jensen Huang, co-founder of Nvidia: about \$3 billion in 2022, about \$200 billion by September 2026 ([NBC News; Forbes, 4 September 2026](#)); an internal survey reported in the press puts 76–78

% of Nvidia employees above a million dollars (a survey, not a disclosure).

Evidence: land

- Loudoun County, Virginia: farmland sells for a fraction of what data-centre parcels fetch, \$2–6 million per acre (about \$5–15 million per hectare); one 39 ha parcel went for \$615 million ([Loudoun Now](#); [CNBC](#), 6 September 2026).
- Woodbridge, Virginia: a 22-acre (8.9 ha) family farm assessed at about \$2 million was listed at \$50 million, "aimed at data center developers" ([Fox 5 DC](#), 6 August 2026).

What the visitors read

- Wealth that ends up in concrete survives. The best-known tech-elite example predates the AI boom and comes from a social-media fortune: Mark Zuckerberg's Koolau Ranch on Kauai, about 566 ha, with an underground shelter of about 465 m², reported by *Wired* in December 2023 and widely repeated. It stands here for the type, not for AI money.
- Estates, walls, private shelters and sudden large houses near the halls: the house-size spread that Kohler's method measures (previous slide) widens sharply at the top.

The limit

- As with the electricians, the ground shows *that* someone became very rich, not how. A farmer who sold 9 ha and a researcher with a \$200 million package leave the same kind of house.

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7. [CNBC: AI data centers are transforming rural land markets, fueling backlash \(6 Sept 2026\)](#)
8. [Fox 5 DC: Virginia farm worth \\$2M listed for \\$50M as AI data centers drive up land prices \(6 Aug 2026\)](#)
9. [The Hollywood Reporter: Zuckerberg on his Hawaii compound shelter \(after Wired, Dec 2023\)](#) – Koolau Ranch about 566 ha, shelter about 465 m²; predates the AI boom, cited as a type

19. And those left aside



- Kenya 2022: labelling violent texts for ChatGPT at \$1.32–2 an hour
- Ages 22–25 in AI-exposed jobs: employment 19 % below trend (2026)
- UK 2024: 36 % of translators, 26 % of illustrators already lost work to AI
- Boxtown, Memphis: turbines next door; US power bills up 6–29 % by 2030
- In the ground: small houses beside large ones, soot on the poor side

Every boom has its bill, and in the AI decade it lands on people far from the halls and right next to them; the trench will show some of it soon, the bones only much later.

Evidence: the hidden workforce

- In 2021–2022 workers in Nairobi, employed by the outsourcing firm Sama, labelled graphic texts for ChatGPT's safety filter for a take-home pay of about \$1.32–2 an hour ([TIME](#), [18 January 2023](#)); in May 2023 content moderators in Nairobi founded the African Content Moderators Union ([TIME](#), [1 May 2023](#)).

Evidence: the young and the creative trades

- Employment of 22–25-year-olds in the most AI-exposed occupations stands about 19 % below where it would be had it kept pace with less-exposed occupations; the gap comes from fewer hires, not layoffs ([Brynjolfsson, Chandar & Chen, Stanford Digital Economy Lab](#), [update of August 2026](#)).

- After ChatGPT, writing freelancers on Upwork saw monthly jobs fall 2 % and earnings 5.2 % (Hui, Reshef & Zhou, *Organization Science* 2024, [summary](#)).
- UK Society of Authors survey (2024, 787 respondents): 36 % of translators and 26 % of illustrators had already lost work to generative AI ([European Writers' Council](#)).
- Salesforce cut customer support from about 9,000 to about 5,000 people: "I need less heads" (Marc Benioff, [CNBC, 2 September 2025](#)). Klarna's similar move was partly reversed in 2025, so the picture is mixed.

Evidence: the neighbours and the ratepayers

- Boxtown, a majority-Black neighbourhood of South Memphis beside xAI's turbines: in April 2026 the NAACP, with SELC and Earthjustice, sued over unpermitted turbines ([NAACP](#); [SELC](#)).
- A 2026 study projects data-centre and crypto demand raising average US electricity bills by 6–29 % by 2030, more in some regions ([NC State, May 2026](#)).

What the visitors read

- House sizes first: Kohler's Gini from house floors (previous slides) will show small, crowded houses beside the large new ones, and soot in the soil on the side nearest the turbines.
- Bones later: enamel defects form in early childhood, mostly between two and four years ([King et al. 2005](#)); in industrial-era London, children from a poor burial ground grew visibly worse than middle-class ones ([Newman & Gowland 2017](#)).
- Garbage too: Rathje's Garbage Project in Tucson (from 1973) read income from household rubbish ([Rathje & Murphy, Rubbish!, 1992](#)).

The limit

- Skeletal studies pool burials over decades; no study resolves a single decade from bones alone. A decade of inequality shows first in houses and soil, and in bones only as a generation.

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20. What the trench turns up



- Concrete pads and cooling-tower rings, the Maya platforms of the 2030s
- Backup fuel tanks and their hydrocarbon halo in the soil
- Gold that never corrodes, in flakes around the boards; racks rusted to a red stain
- And not one byte of what the machines computed

The trench is taphonomy: working out what our artefacts decayed into. Concrete, gold and hydrocarbons survive; steel, batteries and every byte do not; and each of those statements is a materials claim, not a guarantee.

Evidence: technofossils

- Our artefacts will form a stratum of unprecedented diversity ([Zalasiewicz et al. 2014](#)); the paper gives the frame, not a decay schedule for each object.
- Concrete pads and the ring foundations of cooling towers are the best candidates to keep the footprint of the halls after the steel superstructure collapses; Roman concrete is the analogy, not a proof that modern mixes behave the same.
- Backup generators, mostly diesel, are near-universal in data centres (Abilene's backup is gas), and leaking fuel tanks are a documented contamination pathway; a hydrocarbon halo in the soil around the pads would be a characteristic local signature ([Inside Climate News](#)).
- Santiago shows how the water story and the fuel story intertwine: the project Google resubmitted in 2026, without water cooling, carries 44 backup generator sets of 120 MW

([OhMyGeek](#), Sept 2026), and every generator needs a tank.

Evidence: what the metals do

- Gold does not corrode: the plating on connectors and the bonding wires on tens of millions of boards survive as metal, but plating is only microns thick over copper and nickel, and field studies show it failing once the substrate corrodes ([Yi et al. 2017](#)); what the trench yields is gold as a material, flakes and wires on and around the boards, not bright contacts.
- Copper busbars corrode slowly and predictably; steel racks rust to red stains whose pattern preserves the grid of the rows; lithium battery banks degrade into salts; ceramics and glass fibre survive.
- The visitors can reconstruct the room: rows of identical frames, dense wiring, a floor built for extraordinary loads and cooling, cables from foundations that once held turbines or engines.

What they will not find

- A single byte. Magnetic and flash storage is unreadable within decades even with readers, and there are no readers.
- The machines that read everything ever written will have left nothing to read.
- From a board they infer scale, fuel, water and wealth, and not the answer to a single question we asked.

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21. They will know that the machines computed, and what it cost. What they computed, the rocks will not say.



What they will know

One sentence carries the whole experiment: once the records are gone, the cost of the machines can be read, and probably even what kind of machines they were; what they computed cannot.

What the proxies recorded

- Lidar, lake mud, the geometry of the grid, the depth of wells, house floors, bones, gold and rust: each records a piece of the material side, the halls, the fuel, the water, the wealth nearby.
- None of them records what was computed.

What the hardware may still say

- Reading function from structure is routine: reverse-engineering firms delayer undocumented chips and recover functional blocks and circuit architecture from electron micrographs ([TechInsights](#)).
- At board level the difference is plain. An AI accelerator is one large die with stacks of high-bandwidth memory beside it on a silicon interposer ([Wevolver](#), [HBM explainer](#)); a Bitcoin miner is a hashboard of many small identical hashing chips with almost no memory ([D-Central](#)). So the visitors could probably tell a training hall from a mining farm, and conclude that this civilisation computed on an enormous scale.

- Caveat: whether the fine metal lines inside a die stay readable for a thousand years is untested; moisture corrodes copper and aluminium interconnects, and only dry or sealed conditions favour survival ([Nature Communications 2024](#)). Board and package layout are the safer evidence.
- They would also read a priority: a civilisation burned fuel beside its computing halls on a scale no other building type matched. That is what it valued, not what it asked.

What the experiment does and does not show

- It does not prove that intelligence is naturally less durable than energy; it removed the records by decree.
- It shows something narrower and more useful: after the meaning-bearing records are lost, the material side of the AI decade can still be read, the size of the halls, the fuel burned beside them, the water drawn, the wealth that gathered nearby, even the kind of machine; the content of the computation, the money and whether it was worth it cannot.

How the decade will look from a thousand years away

- An energy event: sudden, concentrated, largely inelastic new demand that reorganised where and how power was made, kept old fires burning, drew down aquifers and made someone rich.

The lesson for a time of crisis

- In a crisis we decide what to protect and what to count; the experiment says which part of AI is durable in the plainest sense.
- The watt is the part of AI that stays. It is also the part that policy can see, permit, price and refuse.
- The epoch we cannot yet name from inside will be named, if at all, by its energy.

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Part 5: The second experiment



Same god, same visitors. One change: China's bet on electricity pays off, and the god waits until 2080.

The second run of the experiment changes one assumption and one date: China's bet on electricity pays off, and the god waits until the century has shown it.

The set-up

- Same god, same removal of every human and every text, same expedition with good instruments and no language of ours.
- The god now waits until about 2080 rather than 2030, long enough for a bet on energy to decide something; the visitors land in 3080.
- The changed assumption is stated, not argued: China's build-out of electricity, wires and reactors turns into a durable advantage in the machine economy, and over the century the largest halls move east.

Why this is worth a second run

- The first run asked what of the AI decade is durable; the second asks whether a *shift of the centre between states* is legible at all once the texts are gone, what it would look like, and what part of it, power itself, is not.

- The question has a literature: historians have argued since 2021 that clean energy "will transform geopolitics – just not necessarily in the ways many of its champions expect" ([Bordoff & O'Sullivan, *Foreign Affairs* 2022](#)); Ember's analysts call China "the world's first electrostate" ([Bond et al. 2025](#)), and Adam Tooze has spent 2026 clarifying the term ([Chartbook 439](#)).
- The visitors have heard none of it. That is the point.

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3. [Tooze, A.: Chartbook 439 – Electrostates v. petrostates \(2 Apr 2026\)](#)

23. The bet: the first electrostate



- Electricity 2025: China 10,600 TWh, the US 4,400 TWh; in 2000 China had a third of the US
- 2025: 58 % of the world's new solar and 72 % of its new wind were installed in China
- 36 of the world's 73 reactors under construction; State Grid: 42 UHV projects, 370 GW
- Energy-transition investment 2025: China \$800 billion, the United States \$378 billion
- Caveats: coal still 54 % of generation; 15–30 % of western wind and solar curtailed

The bet is real and can be counted: China already generates far more electricity than the United States, installs most of the world's new solar and wind, builds half of the world's reactors and the wires to move it all; the caveats are coal and curtailment.

Evidence: the scale

- Electricity in 2025: China's demand 10,573 TWh, nearly double the 5,802 TWh of 2015; the United States generated 4,430 TWh, up 2.8 % (Ember reports demand, EIA net generation; the two measures differ by a few per cent, not by a factor) ([Ember, *Global Electricity Review 2026*](#); [EIA, *March 2026*](#)). China's single-year increment (+503 TWh) was almost four times the US increment (+131 TWh).
- Carnegie's framing: China's generation "has soared from one-third of U.S. levels in 2000 to nearly two-and-a-half times U.S. levels in 2024" ([Carnegie, *The Compute Coalition*, June 2026](#)).

Evidence: the build-out

- 2025 additions: 315 GW of solar (AC) and 119 GW of wind, more than 430 GW together, up 22 % ([NEA via gov.cn, Feb 2026](#)); wind and solar reached 1.84 TW, 47 % of all capacity, passing thermal for the first time.
- Share of the world: 58 % of global solar and 72 % of global wind installed in 2025 ([Ember GER 2026](#)).
- Nuclear: 36 reactors under construction, more than 49 % of the world total, beside 60 in operation ([EIA, June 2026, from IAEA PRIS](#)).
- Wires: State Grid, the larger of the two grid companies, had completed 42 ultra-high-voltage projects by the end of 2025 and put its cross-regional and cross-provincial transmission capacity at 370 GW ([Xinhua, 16 Jan 2026](#)); the Hami–Chongqing line alone runs 2,290 km.
- Money: energy-transition investment in 2025 of about \$800 billion in China against \$378 billion in the United States ([BloombergNEF, Jan 2026](#)).
- The comparison US officials use: in 2024 China "added 429 GW of new power capacity", "the U.S. contributed just 51 GW" ([OpenAI letter, Oct 2025](#)).

Caveats, stated on the slide

- Coal still supplied 54 % of China's electricity in 2025, down from 70 % in 2015, and 78 GW of coal plants were commissioned in 2025, a decade high ([CREA/GEM, Feb 2026](#)).
- Abundance is uneven: CREA and GEM estimate reported and unreported wind and solar curtailment at 360 TWh in the first half of 2026, a rate of 26 %, and twelve-month rates of 15–30 % in Inner Mongolia, Xinjiang, Qinghai, Gansu and Ningxia against under 3 % on the coast; the causes they list are dispatch rules, contracted coal and market design as much as wires ([CREA/GEM, Aug 2026](#)); solar additions fell 66 % year on year in that half after the switch to market pricing ([pv magazine](#)).
- Oxford's energy institute titles its comment *The China data centre advantage: hype versus reality* ([OIES, Feb 2026](#)).

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24. Assume it pays off



- Compute follows electrons: halls go where a gigawatt is a permit, not a five-year queue
- America puts gas turbines beside its halls; China moves the halls west to the solar seas
- Assumption, not forecast: by mid-century the largest halls stand by the western solar seas
- Against it today: chips, not watts, are China's limit; some western halls sit near empty
- „China is well ahead of us on energy. We are way ahead on chips.“ – Jensen Huang, 2025

The assumption is that compute follows electrons; the slide says what that would mean on the ground by mid-century, and lists the evidence that today points the other way.

The assumption, spelled out

- Training halls are built where a gigawatt is a permit rather than a decade. In the United States a new power plant connected in 2025 had waited a median of more than five years in the interconnection queue ([LBNL, *Queued Up* 2026](#)); that is a queue of generators, not of data centres, and it is why the American answer so far is gas beside the hall, with turbine backlogs stretching to 2031.
- China's answer is the opposite geometry: "East Data, West Computing", launched in 2022, moves the computing to the western solar and wind bases and moves the data instead ([Carbon Brief explainer, Apr 2025](#)).
- If the bet pays off, by mid-century the largest halls stand beside the western solar and wind bases, while 2,000 km lines carry the surplus to the coast; both leave traces, halls in the west

and corridors running east. The machine economy's centre of gravity is then in East Asia. That is the assumption of this run, not a forecast.

What today's evidence says against it

- Chips, not watts, are the binding constraint on the Chinese side: the most advanced Nvidia parts are barred and the H200 class is licensed case by case, and in May 2026 Washington extended licensing to Chinese-owned firms abroad ([CNBC](#)); the Council on Foreign Relations argues Huawei cannot catch Nvidia ([CFR](#)).
- Abundant electricity is not enough: some western Chinese data centres sit nearly empty, with reported utilisation "as low as 20 to 30 percent", the obstacles being data transfer, demand and interoperability as much as chips; data centres take only 1.68 % of China's electricity ([ASPI, May 2026](#)).
- The United States and China host about 45 % and 25 % of the world's data-centre capacity ([CSIS, May 2025](#)).
- Nvidia's Jensen Huang put the asymmetry as bluntly as anyone: "China is well ahead of us on energy. We are way ahead on chips." ([CNBC, Oct 2025](#)); the US energy secretary framed it as a race: "The implications on national defense make it simply critical that America leads the AI race" ([DOE, CERAWEEK 2025](#)).

What the experiment needs

- Only that the bet *could* pay off. The visitors will not adjudicate the chip war; they will read what a century of it left in the ground.

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8. CFR: China's AI chip deficit – why Huawei can't catch Nvidia
9. CSIS: Great Power Competition – Surveying Global Electricity Strategies for AI (8 May 2025)
 - US 45 %, China 25 % of world data-centre capacity

25. Can they read a shift of power?



- Greenland copper peaks twice, a millennium apart: Rome, then Song China
- One Antarctic core reads three centres in turn: the Andes, Potosí, Broken Hill
- The shift is in the ice now: Greenland soot peaked in 1908, Everest's tripled after 1975
- Ours would read as a change of material: fuel and soot on one shore, glass on the other
- Kubuqi: a solar wall planned at 400 km; Landsat already sees it growing

Shifts of the centre are already legible in the ground: ice has recorded the centre moving from Rome to China once, then from Andean smelters to colonial Potosí to Australian mines, and it is recording the industrial centre moving to Asia now. Empires write themselves into ice as chemistry, without a word; ours would be written as a change of material.

The centre has moved east before

- Greenland copper: concentrations above natural levels from about 2,500 years ago, attributed to "crude, highly polluting smelting technologies used for copper production during Roman and medieval times, especially in Europe and China" ([Hong, Candelone, Patterson & Boutron, *Science* 1996](#)). The companion reconstruction puts Roman copper production at about 7,000 t a year on average with a peak near 15,000 t two millennia ago, and a second peak of about 14,000 t a year in the 1080s under the Song ([Hong et al., *Sci. Total Environ.* 1996](#)); Song coin output rose from about 800 million coins a year in 997 to 6 billion in 1085 ([Asia for Educators, Columbia University](#); other summaries give 8 billion for 1085, so read it as an order of magnitude). Same core, same element, the centre a continent away.

- Lead tells the same story in the west: Iberian lead peaks in the 1st century and falls with the Antonine plague ([McConnell et al., PNAS 2018](#)); the Black Death halves it across the Arctic ([McConnell et al., PNAS 2019](#)); at annual resolution the Alpine core at Colle Gnifetti shows the Melle mines behind the switch to silver coinage around 640–670 and lead troughs at the deaths of Angevin kings in 1189 and 1199 ([Loveluck et al., Antiquity 2018; 2020](#)), though the names come from texts.

One core, three centres

- East Antarctic ice: lead rises around 1200 with Andean (Chimú) smelting, becomes lasting soon after the Spanish arrival in 1532 as Potosí supplies the empire's silver (compare the Quelccaya record, [Uglietti et al., PNAS 2015](#)), then spikes with Australian lead mining in the late 19th century ([McConnell et al., Sci. Total Environ. 2024](#)); sixteen cores show Broken Hill's isotopic signature across the whole continent by 1889 ([McConnell et al., Sci. Rep. 2014](#)).

The shift under way now

- Greenland black carbon peaked in 1908 at more than 12.5 ng/g, mostly from North American coal, and averaged 2.3 ng/g in 1952–2002, about a fifth of the peak ([McConnell et al., Science 2007](#)). Alpine sulphate peaked in the 1970s and was back at first-half-of-the-century levels by the 2010s ([Eichler et al., The Cryosphere 2023](#)).
- Meanwhile Everest black carbon in 1975–2000 is about three times the 1860–1975 level, consistent with South Asian emissions ([Kaspari et al., GRL 2011](#)); cores in the Eurasian Arctic peak in the 1980s and Elbrus in the 1970s, from Russian and Asian emissions ([Eckhardt et al., Nat. Commun. 2023](#)); nitrate and ammonium deposition on southern Tibetan glaciers accelerated after 2000 ([Yang et al., Commun. Earth Environ. 2026](#)). The Everest signal is largely South Asian, mostly Indian, not Chinese.

What our shift would look like

- The first run's signature was fire: combustion traces and the hydrocarbon halo of fuel tanks.
- China's bet leaves glass, silicon, aluminium and steel. Kubuqi "solar great wall", Inner Mongolia: planned 400 km long and 5 km wide, 100 GW by 2030, about 5.4 GW built when Landsat photographed it in December 2024 ([NASA Earth Observatory](#)). Talatan, Qinghai: a site of about 420 km² inside a 609 km² planned park, 21 GW by March 2026 as reported on Wikipedia, not yet confirmed from an official release ([Talatan; Hainan prefecture](#)). China's ground-mounted PV mapped from satellites: 2,468 km² in 2020 ([Feng et al., Sci. Data 2024](#)), 4,520 km² in 2024 ([CPVPD-2024, Sci. Data 2025](#)); 1,286 GW installed by the end of July 2026 ([NEA via pv magazine](#)).
- Wires: State Grid's 42 ultra-high-voltage projects; UHV direct-current lines passed 40,000 km and alternating-current lines 20,000 km by 2025 ([China Energy News, Dec 2025](#)); at design spans of 400–600 m that is roughly 170–250 steel towers per 100 km, each on a concrete footing, on the order of a hundred thousand footings pointing from the deserts to the coast.

- Glass and silicon do not rot; whether the rows stay legible in lidar after a millennium of sand is a licence of the experiment, not a measured fact. Certain are the material and the concrete.
- The scenario adds two trajectories that the bet alone does not imply: the American gas islands of the 2030s fade, and China's coal signal peaks and fades too. Chemistry alone cannot tell decline from cleaner production, so the decisive evidence for a moved centre is the map: dated halls, glass and lines appearing in one region while another stops building.

Caveats

- Hong 1996 tonnages are from the companion paper's abstract, not from a 2020s re-measurement; site areas are not square kilometres of glass; the tower count is arithmetic from typical spans, not a published inventory.

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26. They will date the shift to the decade and trace the goods to their workshops. Who owned them, the rocks will not say.



What they will read

The second run ends where the first did, one level up: the shift of the *material* centre is legible after a thousand years, dated to the decade and traced to its workshops; ownership, command and the names of states, and so whose century it was, are not in the record.

What the visitors can say

- *When*, far better than to the century: the plutonium horizon of the bomb tests, the bomb radiocarbon peak and annual lake layers (see the lake-bed slide) pin a shift around mid-century to within a decade.
- *Where things were made*: lead isotopes and trace elements point to the ore and the smelter. That is how Rosman and colleagues traced about 70 % of the lead in Greenland ice from roughly 150 BC to AD 50 to ores of the Rio Tinto type in southern Spain ([Rosman et al. 1997](#)).
- *Where the goods went*: panels, transformers and conductors from one set of workshops lying on several continents, the way archaeologists read the reach of amphorae or porcelain without a line of text. The fires of one continent flaring in the 2030s and fading, a sea of glass on another, lines from it to the coast: all of that is in mud, on the surface and in the geometry of the grid.

What they cannot say

- Who owned the workshop, who commanded it, who took the profit. Provenance reads the workshop, not the owner: the back of many an iPhone says *Designed by Apple in California. Assembled in China* ([Engadget 2012](#)), and that is exactly the line the god has erased; materially the phone is from China.
- Rome is the proof. The ice gives the mines, their isotopic signature and their dates; the word Carthaginian or Roman in Rosman's title comes from what historians know about who worked those mines. McConnell and colleagues read the Greenland lead as a proxy of the Roman economy, tracking wars, the Pax Romana and the Antonine plague ([McConnell et al. 2018](#)), but they match it against a chronology written in books. Without the books the ice says: Spanish mines boomed and collapsed. The visitors will see that the workshop of the world moved; they will not know what a state was, or which one this had been.

Why this matters for a talk about energy in a crisis

- Both runs point the same way: the durable part of the AI century is its energy, the fuel burned, the glass laid, the wires strung, the water drawn. A bet on electricity, if it pays off, is the kind of thing that stays legible for a thousand years. The chips reach the ground too, as boards that show what kind of machines they were; what they computed, the race and the question of who won do not reach it at all.

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27. Where this comes from



- Essays on AI — Czech essays for the curious lay reader – mila.guide/psani
- Od mýtů k megawattům — A book on wind and wind power – vitr.mila.guide
- Energetika a AI — A book in preparation – the source of these figures
- Free books — Earlier books, free to download – vydavatelstvi.mila.guide

Where the figures and the framing in this talk come from, and where to read more.

Essays on AI

- Czech essays on artificial intelligence for the curious lay reader, collected at mila.guide/psani: in full on the Substack *AI srozumitelně*, some also read aloud as podcast episodes; the essay *AI a elektrina* (working title, in preparation) is the companion piece to this talk (415 TWh; 0.3 versus 3 Wh; the interconnection queue). Shorter versions appear on Seznam Médium and LinkedIn.

Od mýtů k megawattům

- A book on wind, in progress and readable online at vitr.mila.guide: from the physics of the atmosphere through sails and windmills to wind power in Czechia and the world; an encyclopaedic companion grew beside it.

Energetika a AI

- A book in preparation on the two-way relationship between energy and artificial intelligence; its chapters on the interconnection queue, behind-the-meter generation, gas for AI, the return of nuclear power and the water footprint are the sources of most figures quoted here. Not yet public.

Free books

- Earlier titles (on artificial intelligence, on pensions, on public-service media) are free to download as PDF, ePub and HTML, each with an ISBN, at vydavatelstvi.mila.guide.

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28. Thank you



- Essay „AI a elektřina“ – AI srozumitelně (in Czech)

aisrozumitelne.mila.guide

Where to read more, and how these slides were made.

Sources by the author

- Czech essay *AI a elektřina*, Substack *AI srozumitelně* (aisrozumitelne.mila.guide): scale (415 TWh), uncertainty (0.3 vs 3 Wh per query), limit (the interconnection queue).
- Book in preparation, *Energetika a AI* (Czech): chapters on the interconnection queue, behind-the-meter generation, the return of nuclear power, gas for AI and the water footprint are the sources for the figures quoted here.
- Both under a Creative Commons licence; each section of these notes points to the primary documents (IEA, LBNL, regulatory filings, court records, peer-reviewed papers).

How the deck was made

- Slides and notes were produced in a conversation with an AI writing assistant; images were generated with an image model from prompts written for each slide.
- Every number was checked against the primary source cited; where sources disagree (turbine counts in Memphis, water withdrawals) the notes say so.

- The argument, the choices and the mistakes are the author's.

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