

Electricity without Geography

Energy abundance, economic power and the allocation problem

White paper on consequences of FUSA Quantum Solar Core Energy Extraction technology.
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The basic premise of this gedankenexperiment is as follows:

If usable electricity can be deployed in large quantities, independently of conventional generation, physical footprint, fuel supply and transmission geography? Then energy ceases to be merely a commodity and infrastructure problem and becomes a question of economic geography, industrial allocation, who controls the allotments - and therefore growth - and ultimately, poses the question of governance and the core prerogatives of the state.

The world as we know it

Energy is the fundamental currency of physical work and economic throughput. It is the ultimate physical reality economies need to generate, distribute and manage to enable growth, stability and social cohesion. However in our modern digital, data driven, economies the reality is more nuanced than merely the availability of “raw power” alone.

Human cognitive and physical labour currently cap the velocity of value creation and economic growth. But human cognitive capital is limited and geographically constrained. Training new minds takes years, sometimes decades. Meanwhile existing know-how retires, dies and capability gaps are created. Sometimes the cognitive capacity under training will no longer be relevant by the time said training ends. Economies are therefore stuck in a permanent game of “Whack a Mole” between the needs of the market, the current brain capital and the time it takes to train a new generation, compounded by the “forward looking” guesswork as to which capabilities will actually be needed. And this became a more urgent practice as the time of progress compressed; one decade of time no longer equals one decade of progress. The training pipeline however hardly changed at all over the past century.

The most likely instantaneous cognitive multiplier available to us therefore is to start complementing (and ultimately replacing) biological bottlenecks, with digital minds. This is the unspoken reality and drive behind the AI race.

The next logical step would be to use said digital capability to achieve faster scientific breakthroughs in automated molecular manufacturing. The current physical scarcity of materials limits immediate manufacturing scaling. Nanotechnology, ER/EPR boundary chemistry and molecular printing could, in principle, remove risk of disruption, delays in logistics and bring down materials value to their utility cost.

In turn this will require a universal global compute infrastructure: Economic coordination and physical - intellectual automation require high-bandwidth data processing in real time. Global infrastructure must be able to handle exponential optimisation tasks simultaneously and be hardened against malevolent interference.

Such an evolution has already started to see the light with advances in a global quantum internet backbone, zero-latency logistics synchronisation and better resource allocation equations across every industrial node.

Finally, this fast-paced growth engine would require an entirely new ecosystem of protocol-level value routing. Taking the human intermediaries out of global supply chain allocations and financial asset transactions, legal verification, as well as the trust architectures that allow near real-time, instantaneous exchange of value and arbitrage.

But at the very foundation of all of this, sits energy. Electricity remains geographically constrained: Widely available and affordable in developed regions, scarce or subsidised in others, where growth became a fiscal burden for the state. Even in advanced economies, grid interconnection has become a bottleneck. A 2024 Joule study led by Lawrence Berkeley National Laboratory analysed more than 38,000 U.S. projects and found 2,600 GW in active interconnection queues at the end of 2023, connection times up 70% over the preceding decade and withdrawal rates around 80% (Gorman et al., 2024). The issue is increasingly not only securing investment, but how long it takes to obtain a connection and allow industrial tooling to start generating value and return on investment.

This is mainly because new capacity is needed and, inevitably, large new loads require some combination of generation, fuel, transmission and logistics, substations, permits and... time. Solar and wind have proven to not be the panacea they promised to be seen their footprint and ecological damage. Nuclear is a valid solution but the regulatory processes are long and return on investment too slow to be predictable. The planned grid investments required will take trillions and tend to get stuck in land permits, litigation, etc.

Consequently, energy availability ultimately influences where industries, data centres, mines, factories and logistics hubs can expand, but also the workforce manning the latter. And this is yet another contradiction: People want nearby economic opportunity, yet refuse the infrastructure choices that that entails.

Governments therefore treat energy infrastructure as strategically important, and actively leverage, regulate, control it to assert power, relevance, manage reliability, affordability, security and geopolitical independence.

The Hidden Assumption

Almost every energy-policy model contains the same implicit assumption at its basis:

Additional electricity requires additional conventional energy infrastructure somewhere.

Now this can take on various, sometimes seemingly unrelated forms:

- licenses for “behind the meter” large-scale generation (ex.: gas turbines);
- new generation sites such as renewables or nuclear;
- additional fuel, mining, licensing rights to exploit;
- transmission and distribution as well as the ownership thereof;
- storage;
- interconnects, long term rights and distribution regulations;
- grid reinforcements and authorisations for the materials used therein;
- some combination of the above.

And this brings us to the central theme of this paper:

What changes if that assumption is no longer necessarily true?

Modern civilisation has been organised around the assumption that useful electricity is geographically constrained and tied to physical generation and transmission infrastructure. FUSA, building on its Quantum Solar Core Extraction technology has collected enough evidence to ask a legitimate question; what happens if that assumption is no longer absolute?

FUSA; the Technical Proposal

FUSA is a quantum technology company currently developing a deployable electrical architecture, based on quantum energy teleportation-related work. Its technical programme asks whether useful energy can be extracted locally, without the conventional local fuel-generation-transmission logistics chain.

Quantum Energy Teleportation (or QET) is a protocol first described in 2008 and is itself based on the earlier Quantum State Teleportation (QST) and Quantum Information Teleportation (QIT) protocols, both of which have been around since 1993 and are a cornerstone of modern quantum computing, as well as the upcoming quantum internet technology.

In layman's terms, the protocol is based on well known quantum behaviours where a party (often called Alice) makes a quantum measurement of an observable quantum energy signature. This "collapsed" quantum state (collapsed because it has been "observed" and is therefore no longer a superposition of states) is then transferred classically to the locally distant implementation site (often called Bob or Dave in quantum lore), in what is known as a "Local Operations Classical Communication" link, or LOCC.

The "Dave" unit receives this message and implements the inverted Hamiltonian on his own quantum system (which is usually a shared resource with Alice). It is this operation that allows "Dave" to extract the energy that "Alice" observed in the first place. This is the essence of QET.

Important to note here is that Alice's message is transmitted classically and therefore; even if Dave has instantaneous access to Alice's observed energy (Dave does not have to wait until Alice's energy-wave-beam-packet or whatever arrives to his locality traditionally), the speed of the message itself is always below the speed of light, therefore causality is strictly maintained. The second important concept to grasp is that the energy observed at Alice is not unique. In other words, if Alice observes 10 and were to send her message to ten different Dave's at equally different locations, each Dave would receive an energy packet of 1, the system can therefore - by its very nature, be meshed and networked. What matters is the total ledger, ie.: No one can debit more than the ledger measured in the first place.

Finally, and maybe most importantly; there is no intrinsic limitation of distance between Alice and Dave. Nothing in quantum physics limits the QET domain of application. It is this profoundly quantum concept of being insensitive to physical distance that Einstein famously called "spooky action at a distance". In our case this translates to a situation where, Alice being in Dubai and Dave being in Houston, or Singapore, or Mars for that matter, doesn't make the slightest difference to the protocol or the effectiveness thereof.

In today's world, the QET protocol is actively used and further investigated for various real-life applications such as quantum batteries, powering remote quantum computers into decentralised clusters, the new quantum internet and, the application retained by FUSA; the transfer of meaningful energy without the need for any capital intensive, geographically and politically restrictive, "classical" infrastructures.

The idea was simple: What if we can use Solar Core Fusion as the energy generator that "Alice" observes, then distribute that signature to worldwide (or space-based) users under a hyperbolic meshed network to procure reliable, meaningful energy, directly from the Sun's Core to the final point of use.

FUSA has built a substantial stack of internal theoretical, experimental and engineering evidence over the past years. The programme has now reached the point where detailed design is largely complete and physical manufacture is the next planned step.

The evolution of the aforementioned evidence can briefly be described as follows:

- 2018-2020: First theoretical work on a new type of fusion process using quantum technologies, nuclear compression and the ER/EPR conjecture as a working basis. As opposed to a merely inertial or magnetic confinement system. Initially this was intended to power a new type of SSTO aircraft design to deliver payloads into space.
- 2022: The genesis of the “Star Law” or “Entanglement Relativity” framework. It was built around two (then) conjectures:
 - The ER/EPR holographic duality: Ergo; whatever is present or happens in our 3+1D “bulk” reality, has a lower dimensional 2D mathematical description on remote boundary. This duality being real and scale invariant.
 - Entanglement as a conserved quantity, like energy. Ergo; entanglement is a universal total quantity which cannot be destroyed but is rather “redistributed” by things like time dilation (cosmological constant) or measurement (the observation problem).
- 2024: Successful test of the “Magnetar” fusion reactor, the first real world engineered ER/EPR holographic duality fusion application, using both holographic principles and concepts which were (at that stage) theories of the Star Law framework under development.
- January 2026: Completed Star Law framework and appendixes were completed and proved mathematically from first principles, within 1% of precision (To our knowledge this is the first time any “First Principles” approach managed to obtain such results, without fitting parameters):
 - The Cosmological constant;
 - Dark Energy / Dark Matter / DME split;
 - Correlation with the Bullet Cluster behaviour;
 - Explains the Yukawa hierarchy and logic;
 - Limit of application of both General Relativity and Quantum Mechanics (note: We do NOT claim reconciliation);
 - Energy and weight of a Proton and the results of the Standard Model up to the Higgs Boson;
 - Reality and domain of application of ER/EPR duality and the physical existence of Einstein-Rosen bridges (often vulgarised as “wormholes”);
 - Emergence of the Born rule, the Lorentz Symmetry and a universal speed constant “c”.
- April 2026: Theoretical validation and physical demonstration of the “Alice” Solar Core extraction system. The essential backbone to the proposed QET Solar Core Extraction Energy ecosystem. In essence a system that detects and exploits the telltale quantum state signatures of Solar Core Fusion like High Frequency Gravity Waves and Neutrinos, to obtain a reliable signature of the latter.
- April 2026: A security engineering limit of 40 TW (40,000 GW) is implemented on the “Alice” system under an inviolable quantum protocol.
- May 2026: Filed for UK patent protection, and pursued international protection under PCT, protection was date granted for the FUSA Solar Core Extraction QET system and its further applications.
- August 2026: FUSA completed a series of IBM Quantum hardware campaigns comprising more than 400,000 measurements (on 150 qubits which is a record by our knowledge) to test its Solar Core Extraction QET protocol. Under FUSA’s system-level normalisation, the measured work map corresponds to a greater-than-5-TW equivalent; the QPU itself did not physically transmit terawatts of electrical energy.
- August 2026: External independent valuation of the IP, technology and patent obtained;
- September 2026: Final engineering design validation of the “Dave” transducer required to transform “Alice’s” Solar Core Extraction energy into useful power on a local grid “behind the meter”. Two systems validated; 10-100 kW and 1-30MW.

Most of the above is detailed on FUSA websites, or available under NDA after verified serious interest. The resulting transducer is intended to extract meaningful and scalable power for earthly (or space) use. The remaining challenge is not a theoretical one or engineering one, those proofs

have been delivered to over 80% certainty. The remaining challenge is to find a way to mass produce said transducers and lower their cost under the ensuing “economies of scale”.

Gedankenexperiment

The corpus of theoretical and experimental evidence is now developed enough to permit a thought experiment: Assume, for purposes of economic analysis, that the technical proposition is validated, repeatable and scalable?

What follows?

First Consequence: Geographical limitations

Conventional electricity has a spatially bound architecture. FUSA's proposed architecture is designed to weaken that dependence. The classical chain has changed in technology and market structure, but its basic physical sequence remains familiar:

resource → generation → transmission → distribution → consumer

FUSA's Solar Core Extraction QET is not bound by distance or geography and operates totally behind the meter without any on-site generation whatsoever, nor the footprint or capital burden thereof:

Solar Core → Alice Energy System → Dave transducer / Consumer

This in turn potentially reduces the dependence on:

- transmission corridors;
- interconnectors;
- proximity to generation;
- local fuel availability;
- weather;
- grid congestion or state thereof;
- lengthy generation system build-outs.

That is not to say that these systems would disappear overnight, they would not. What might however happen in the very near term is that they will become less determinative.

Second consequence: Industrial Geography changes

Once electricity is less geographically constrained, one could ask what happens to the very industries that are currently highly reliant on those geographic constraints? For example:

- Desalination / water purification;
- AI compute;
- data centres;
- semiconductor manufacturing;
- aluminium and steel smelters and roller mills;
- raw and primary chemicals production;
- hydrogen and green hydrogen production, noble gas treatment and conditioning;
- synthetic fuel production;
- mining and refining;
- electrified transport;
- advanced manufacturing.

When energy ceases to be a geographically limiting, and often debilitating factor, the optimal locations for these industries may shift towards geographies that are closer to their clients, resources or talent. In other words, electricity availability is no longer one of the dominant siting constraints. And that is fundamental game-changer for industries in any financial-fiscal and exploitation planning.

When factories or industries are no longer forced into corridors where they are promised electrical power, they are free to choose the geographical, industrial, political and fiscal setting that matches their business model best. This will bring about changes in investments, long term expansion planning and local economical growth in regions that, to date, may have been used below their full potential.

Third consequence: Eliminating scarcity

It would be tempting to conclude quickly that this solves the energy puzzle and that abundance removes the ultimate constraint: scarcity.

This however is both premature and wrong. What will most likely happen is that scarcity will move from one layer to another. There is an important distinction to be made between source scarcity; how much energy does ultimately exist? And development scarcity; how rapidly can hardware capable of accessing said energy be manufactured and installed?

These are fundamentally different questions. Even if the first becomes effectively abundant (40,000 GW engineering cap in the FUSA case, not a claimed physical limit), the second remains scarce initially. Therefore the transition is the bottleneck moving from electricity pure towards an early, and guaranteed, access thereto.

This would be further accelerated when one takes into account economical cost. Solar Core Extraction QET does not require large infrastructure investments, it does not depend upon cost of capital or ROI. If widely adopted, the logic would be for a global electricity benchmark to emerge, like Brent crude. And this cost will be very much lower than any current technology if we assume current projections to be correct.

Although this may sound *prima facie* like a simple movement from point A to point B, human institutions matter. A potentially important benefit could still be reduced to “more of the same” if the new access layer inherits the same frictions, rent-seeking and political constraints as the classical architecture.

Fourth Consequence: The Value-Layer Shift

The proposition is not that physical wires will disappear, it is that, if the FUSA technical premise scales, ownership of the wire, power station, fuel supply and transmission corridor may cease to determine who captures the highest value layer of the energy system.

Historical precedents are plentiful; Pony Express and the telegraph, recorded media vs. streaming, Bell-era telecommunications vs. the internet, runners in the City against electronic SWIFT wires, etc.

An equivalent shift hypothesis happens here:

The “old” world of:

Generation → transmission → distribution → meter

would become increasingly subordinate to:

Entitlement → information → allocation → local transducer → settlement

If the physical architecture works as proposed. And this is not the only genuine disruptive idea. There is the question of proven reserves. Typically, these do not apply to electricity. But that rule shifts dramatically when considering Solar Core Extraction technology. Looking at the emerging setup;

- FUSA has protected, privileged and unique strategic access to a high infinite energy resource;
- no one can claim ownership to a stellar body but exploitation thereof is protected under the IST and ensuing Artemis Agreements;
- This then becomes a valid and defensible “proven reserve” under IFRS.

This may sound like a technical detail but it gives rise to possibly an entire new class of financial instruments, forwards, futures, QET as informational currency that can be arbitrated, etc.

Under these hypothesis, not only would the grid and its ownership becomes less economically privileged, but the important question would shift from “**who owns the energy infrastructure**” to “**who controls access to the energy service**”?

And then follows the next step:

Who authenticates, allocates, measures and settles that access?

In such a scenario, much of the system intelligence and potentially the system value, move to reside above the hardware stack itself. This creates another interesting possibility: Energy becomes informationised, and that could change everything.

The stranded value question

We do not mean physically stranded, more like economically subordinated. But in light of the above?

Why spend a decade constructing generation at location X to service a future data centre cluster at location Y if the electrical constraint can instead be removed directly at Y before that investment is even licensed, completed, or its capital cost recovered?

Other potential examples would be:

- transmission expansion;
- generation projects with 30-60 year capital recovery assumptions;
- gas pipeline capacity;
- LNG import infrastructure;
- interconnection projects;
- peaking generation;
- long duration electricity procurement agreements;
- land or land-right acquisition motivated principally by the local availability of power.

The Allocation Problem

Continuing the thought experiment, assume that the physical hardware lives up to expectations, the economics work out, and reliability and scalability are demonstrated. An obvious question then arises: Suppose demand for deployment vastly exceeds manufacturing capacity?

Casual readers might be inclined to call this a typical “luxury problem”: Great, works for capital raising, books look great with such a backlog, credit rating etc. And they would be right, under a traditional architecture.

But, if we stick with the thought experiment, this is not a traditional setup as much as it would be a paradigm shift in how the world sees, uses, grows, and experiences “energy” as a whole.

And this brings about an uncomfortable question:

Someone must decide who gets what...

And this should be taken at face value, in the literal sense. “Someone” will have to decide:

- which customer receives capacity units first;
- which countries receive capacity first;
- whether strategic industries receive priority, or what such “strategic” industries might be;
- how allocations are priced;
- whether allocation is purely commercial;
- whether geographic balance matters;
- whether governments can reserve capacity? And, if so... for what purpose?;
- whether poorer economies receive access, and whether the criterion is humanitarian, economic, strategic or performance-based;
- whether capacity can be withheld? more importantly, by whom? and on what grounds?

The cold reality is that finite deployment capacity for a paradigm-shift technology, offered at lower projected cost and without the same geographic restrictions, produces an almost unavoidable consequence:

Finite deployment capacity creates allocation power

With all of the challenges, responsibilities, harsh economic realities, tough decisions and temptations that this short phrase implies.

The allocation problem therefore creates a governance problem: criteria that appear economically efficient may still carry distributional, geopolitical and legitimacy costs. The harder question is whether allocation should maximise output, preserve geographic balance, protect strategic sectors or follow some blended rule.

From Allocation to Economic Power

The last point raises another important issue: the concept of “creating economic growth”. If we accept, within the thought experiment, that additional electricity can enable growth - much as falling memory costs expanded computing capacity and software possibilities - then distributing large quantities of new power can enable additional:

- compute;
- manufacturing;
- transport;
- industrial output;
- water and food production;
- metals;
- base chemicals.

A simple causal framework then arises; if allocation of electricity-producing capability influences allocation of productive capacity? It then follows that;

deployment allocation → energy availability → productive capacity → economic growth

This then becomes the central causal chain, and it influences the question of allocation in a very deterministic manner as a logical outcome presents itself:

During a capacity-constrained transition, deployment decisions could materially influence the rate at which different economies can add energy-intensive productive capacity. Therefore, the weighting of allocation could favour those economies who would add the most global GDP value per MW of power used.

This might solve several issues and avoid moral “red herrings”. The allocation would not depend on a subjective judgement but rather on where this allocation could benefit humanity the most, as a whole. And global GDP output is the ultimate barometer of that parameter. Even if not the most popular solution initially, it could be the right long-term solution to ensure that everyone benefits from the “trickle down” economical effects.

This is where it becomes important to differentiate 3 economic terms which are often conflated, yet mean entirely different things: GDP, Adjusted GDP or PPP (Purchase Power Parity) and Institutional Inefficiency or “lack of productivity”.

GDP is straightforward and familiar to everyone; the pure metric measuring raw local output, using local currency converted at notional market exchange rates. It does not take into account differences in local prices but only the total financial activity, excluding any notion of standard of living.

Then there is PPP or “Power Purchase Parity”, one could consider this as a GDP+, calculating not only gross throughput but adjusting the GDP for purchasing power in different currencies. As such, it reveals what people can actually buy for their money locally.

Then, finally, there is the concept of “Direct Unproductive Profit Seeking” (DUPS) or Institutional inefficiency. In other words; when corruption, grafts, conflict, regulatory capture or excessive taxation become rampant. It results in talent, capital and productivity shifting way from wealth creation, moving towards wealth extraction. Such a country may still have a certain GDP transaction rate but it is stifled by systemic grafts and loss of aggregate productivity.

This then also means that, in our globalised system, the measure of investment is no longer considered as a “what will it bring to their growth and GDP”, but rather a more conservative “what loss of productivity can developed nations avoid for each dollar invested”

In this context, allocation could be weighted towards all 3, by taking into account which allocations will produce the largest net benefit to the global productivity as a whole. Not a geopolitical constraint, not a moral one, nor a purely financial metric, but put more effectively; which allocation would benefit humanity most on the whole, per MW allocated?

And, if electricity allocation has a direct linkage to economic growth? This then poses another fundamental consideration; what is currency? Is it a local monetary value? Or, as some advanced nations like China have already started implying; a true and universal measure of productivity? Like the Joule?

At this point, things could become interesting. If we take the above results from our thought experiment to their logical conclusion, there is a final unspoken question, a “final problem” if you will: The question of sovereignty....

Sovereignty

In the traditional scheme of things, from East to West and everything in between, North or South, governments exert considerable control over electricity through various long standing mechanisms. Some of these came about by mere happenstance, others were purposefully designed to manage reliability, pricing, security and strategic dependence:

- generating licensing;
- fuel policy;
- land and reserves licensing;
- grid ownership and regulation;
- transmission planning;
- interconnection;
- electricity markets, arbitrage, weather premiums;
- strategic reserves;
- tariffs.

Despite efforts by various nations to legislate “behind the meter” generation and consumption, the Solar Core Extraction QET technology could potentially bypass portions of that architecture. This would reframe an important question;

When a critical economic input can be deployed without corresponding expansion of sovereign infrastructure? Then where does infrastructure sovereignty reside?

Governments are considered to have 5 core functions: Issue and maintain laws, issue currency, collect taxes, provide internal and external security and providing economic management. The above thought experiment does not abolish those functions; it asks whether one important infrastructure lever becomes less territorially bound.

Corporate quasi-sovereignty

Once largely the territory of science fiction, corporate quasi-sovereignty is now an explicit subject of political-science research. Chung and Dietrich (2026) describe circumstances in which private firms combine command of critical infrastructure, executive autonomy and geopolitical or normative assertion, allowing them to bypass, substitute for or pre-empt elements of state authority. Universally deployable energy at scale provides a useful test case for that emerging concept.

Should a production “Dave” transducer perform as advertised, the resulting system could be assessed against several related criteria:

- Infrastructure command: Does the technology control something fundamental to economic activity or the sustenance thereof?
- Operational autonomy: Can it be deployed internationally without ordinary state energy infrastructure or interference?
- Cross-border consequences: Could such a private deployment decision materially affect national economic options or planning?
- Taxation: How to impose tariffs on energy that did never cross a physical measuring point or border? Since no one can claim ownership to a stellar body, yet the right to exploitation is universal; under which framework would any individual nation impose taxation or tariffs on it in the first place?

If such conditions eventually arise, the existing frameworks for multinational corporations may be incomplete.

The Abundance Paradox

Conceptually speaking, energy abundance sounds inherently and irreversibly decentralising. Yet, during the production ramp-up phase described above, it could produce the exact opposite phenomenon:

The more valuable the capability to eliminate scarcity becomes, the more consequential temporary control over access to that capability becomes.

Ultimately, this produces a paradox; underlying abundance, combined with temporary deployment scarcity equals an outcome of concentrated transitional power. This transitional phase could, in and of itself, create economic advantages that others struggle to catch up with after later, potentially creating new tensions rather than automatically delivering the peaceful effects associated with abundance.

The State does not therefore disappear

Under any plausible outcome, states would still control most of the socio-economic fabric:

- law;
- property;
- taxation;
- safety, national security, diplomacy;
- borders;
- trade;
- manufacturing (through licensing);
- competition policy;
- physical territory.

Nothing will change those fields directly under any given possible scenario of outcomes. What might change is one source of state leverage. Because the context has evolved, it hasn't changed the basic forms of government, but it might reshape the precise interpretation thereof:

How do states adapt when energy infrastructure becomes less territorially dependent?

Interconnectors and grids would not vanish overnight. On the contrary, they retain enormous value, especially during a transition in which the number of transducers could not meet demand. They could provide:

- balancing;
- distribution;
- legacy supply;
- redundancy;
- market integration;
- existing capital stock.

But their role might eventually be changed. Like the telegraph replaced the Pony Express, the DVD got replaced by streaming and the internet showed telecom companies it became irrelevant who "owned" the wires. This evolution will happen here also: The value layer will shift.

Eventually, once the scarcity period has passed, utilities will morph into informational node managers to survive and find new relevance. QET bandwidth will become a new value, arbitrage, the management of distribution and hyperbolic networks the new profit centres. Eventually, utilities could evolve from the indispensable source delivery architecture toward being one of several methods of moving and balancing the information that now represents energy.

And this would be the final consequence: **Informationised energy**

One possible extension is what this paper calls causal sovereignty: a state's capacity to secure access to the informational, quantum and industrial capabilities that underpin critical infrastructure. In that framing, sovereignty migrates partly from ownership of fuel and wires towards control of protocols, access rights, trusted hardware and settlement.

The most obvious sphere in which this might be noticed is globalisation, one of the traditional foundations of sovereign economic power. The reasons are familiar:

Today, nations control exchanges and the transfer of goods, as well as the conflicts that come from this “controlled value of scarcity”. Such flows of goods are well known to all;

- hydrocarbons;
- electricity;
- uranium;
- LNG;
- noble gases and rare-earth minerals;
- coal;
- refined fuels;
- potable water, food production;
- manufactured electronics, semiconductors, military and energy equipment.

A wider Star Law programme also contemplates applications beyond energy, including boundary chemistry and remote quantum tomography. Those proposals are not required for the argument in this paper and remain outside its scope unless independently validated.

If such adjacent applications were later demonstrated, the sovereignty implications would extend beyond energy and could affect:

- trade balances;
- strategic chokepoints;
- commodity diplomacy;
- sanctions;
- energy security;
- industrial policy.

AI as immediate case study

The most immediate case study is probably AI and the evolution of data centres (be it on earth or in space). Current AI expansion is increasingly limited by combinations of the following;

- microprocessors
- capital
- possible deployment sites
- cooling
- electricity
- data backbones for communication and token exchanges, meshed computer networks

As argued above, if the electricity and geographic constraints were to be diminished, AI scaling economics would change and one could then legitimately ask;

- does compute move closer to demand?
- do tokens become a real-time, tradable commodity?
- does access broaden?
- do countries that lack large grids become viable compute locations?
- does the hyperscaler geography change? Does space become a more viable option?
- does energy cease being the principal limiting infrastructure?
- what then are the new bottlenecks?

Economic Growth

Energy is a fundamental enabling input to virtually every productive sector, including now; the cognitive one. Removing a binding energy constraint should therefore increase the feasible production frontier, although the magnitude of that wave would depend on available capital, skilled labour, materials regulation and... demand.

Lowering one bottleneck does not guarantee proportional demand. Adoption still depends on complementary capital, regulation, supply chains, customer demand and alternative technologies. The paper therefore uses three adoption scenarios rather than assuming that cheaper or more available energy automatically produces unlimited uptake.

Therefore, one has to assume three possible development scenarios;

Scenario A - Limited adoption:

Deployment, especially initially, will be geared towards very specific high-value bottlenecks. It is quite possible that a situation emerges where FUSA's Solar Core Extraction QET is used for the "crown jewel" industries and has less success to penetrate there where existing generators are "good enough". This is plausible especially since in most cases, industries are not particularly worried about the mere cost per MW but rather the cost of early access and their industrial tooling. Outright replacing their existing solutions may well not be financially viable. There are however notable exceptions, to name but one example: Space.

The cost per MW on earth or in space differs by orders of magnitude and Solar Core Extraction QET is uncannily well suited for such missions. Not just the cost per MW, but the implementation of power in space becomes much easier, and lighter to place into orbit. It might be that the new technology creates a "gold rush" of sorts in a new industry such as space, rather than upgrading the existing industrial tooling and generators, which have been depreciated and written off to minimal value for several decades whilst being able to meet expectations for years to come.

Scenario B - Industrial Adoption:

This scenario would be one where large electricity users increasingly deploy independent capacity. This is already an evolution that can be observed, especially in countries where the grid investments are weak. Or, in countries like Bangladesh where some industry capacity is down by as much as 50% simply because of the lack of availability of fuel (Iran crisis). Governments try to limit and regulate such "behind the meter" installations but eventually, economical and market pressures may well deny such restrictions.

Typical advanced economies see less of this evolution as large users hedge price shocks with long term utility contracts, limiting them in the amount of useful power they could generate "on-site". Typically the utility has a "use it or lose it" clause, reducing economical appetite for large scale "behind the meter" solutions to replace their base load obligations, which they will pay for either way.

Scenario C - Widespread adoption:

If production tooling can be scaled sufficiently and mass production of transducers becomes a possibility, then electricity availability ceases to be a major constraint on global productive capacity. Solar Core Extraction QET would gradually find its way into every aspect of life, from new frontiers like space, to large industry, commercial, healthcare, residential, EV charging, micro grids, defence etc.

This scenario would have the largest potential consequences for global growth. The world already faces very large grid-investment requirements. MIT's 2024 fusion study estimated an undiscounted GDP value of \$68 trillion to \$175 trillion through 2100 in its deep-decarbonisation scenarios, equivalent to a 2024 net present value of \$3.6 trillion to \$8.7 trillion, with cumulative global GDP about 0.4% to 0.9% higher than comparable scenarios without fusion. Traditional fusion in that study still requires large plants and grid integration. A Solar Core Extraction technology that also reduces siting and transmission constraints could have a different value profile; this paper does not attempt to quantify that additional uplift.

Chokeholds that will not change

Potentially having access to all the fusion energy of the Solar Core sounds like an ideal solution. A Type II civilisational shift kind of move. That is as laudable in inspiration as it would be shortsighted in our current and near term reality.

No matter how much energy one could pump into the industrial global tissue, taking into account the shift in scarcity this thought experiment discussed earlier, some things will take a lot longer to follow:

- labour scarcity (including skilled trained labour to unlock AI cognitive potential);
- land;
- water;
- minerals (at least until nuclear printing comes of age);
- semiconductor supply;
- logistics (again, depending on how fast boundary printing becomes scalable);
- political instability;
- capital scarcity;
- environmental externalities;
- Inequality *.

Having access to an (almost) eternal source of unlimited, efficient and wireless power removes one foundational constraint, and it is a big one. It will however only have limited effect on removing the aforementioned other natural "speed bumps".

* Note:

Energy abundance would not automatically eliminate institutional, skills, health or infrastructure inequalities. A useful cultural illustration appears in *The West Wing*: a fictional discussion of expanding access to AIDS medication turns on the fact that supplying the medicine is moot as the people locally do not have watches, so how can they tell time or plan the medicine intake? The example is fictional; the underlying systems point is not. Complementary capabilities determine whether households, firms and states can convert cheaper or more abundant energy into productive outcomes.

Those inequalities and institutional frictions can persist for decades even where technology is feasible and profitable, and should be treated separately from the energy constraint itself.

Governance before crisis

The main question that remains open at the end of the thought experiment is simple to state yet much harder to solve, a Gordian knot of sorts:

If deployment capacity temporarily confers allocation power, what rules should govern that power?

Although possible principles to meet this conundrum are relatively standard, their true implementation would remain an open, and probably hotly debated question:

- transparent allocation criteria;
- published pricing principles;
- non-discrimination, geopolitical or otherwise;
- independent technical verification;
- competition safeguards;
- emergency access provisions;
- sovereign participation;
- auditability;
- geographical diversification of production;
- limits on unilateral political conditioning.

The ultimate solution would probably be a mixture of all of the above. Its practical implementation would very likely follow some sort of construction like the one developed by Schmidt and Bohacek in their astropolitical work.

The F1 allotment concept

In the 2020 “Concorde Agreement” (put in place decades earlier between Ecclestone and the FIA “Place de la Concorde” - hence the name). New entrants to F1 have to pay a “non-dilution” fee, to protect the current competing teams from losing prize money. The F1 organisers then redistribute part of the total profit of the F1 operations to the teams, protecting the license and its profitability.

This could be one possible solution to transitional capability deployment scarcity. It would effectively protect the allotments of the existing members, create a fair market where all users benefit from the wider adoption of the technology and its future benefits.

Manufacturing capacity could also be reserved for jurisdictions on a pro-rata basis using current and projected demand. Different economies have very different energy intensity and growth paths; the formula could therefore use transparent forward-looking metrics rather than political preference. The same logic could later be applied to emerging sectors such as the space economy.

Other possible solutions could be;

- pure market allocation;
- national reservation;
- strategic industry priority;
- auction;
- blended systems.

Closing questions

All of the above is hypothetical, for now. One interesting factual proposition however remains:

Technological transitions often destroy less physical infrastructure than they do economic privilege.

The telegraph did not make horses disappear.

Streaming did not abolish cinema screens.

The internet did not eliminate telecommunications infrastructure.

And therefore;

If electricity becomes increasingly deployable as an information-mediated service, the decisive asset may cease to be ownership of generation and transmission infrastructure and become control of authorisation, deployment, measurement and settlement.

At the end of this “gedankenexperiment”, and, once the FUSA architecture passes physical validation and begins deployment?

Something will have happened. We don’t know yet exactly how large it is. But if the premise survives scrutiny, existing assumptions no longer close:

Five serious questions then remain, and someone will have to answer them:

1. **What happens to economic geography when electricity becomes locally deployable?**
2. **What happens to energy sovereignty when supply no longer necessarily depends upon national generation and transmission systems or services?**
3. **How should temporary deployment scarcity be allocated if the underlying energy scarcity falls dramatically?**
4. **Can a private infrastructure provider acquire economically meaningful quasi-sovereign power without intending to do so?**
5. **What institutions should exist before such capability reaches scale?**

These questions are premature if the technical premise fails. They however become urgent if it does not...

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