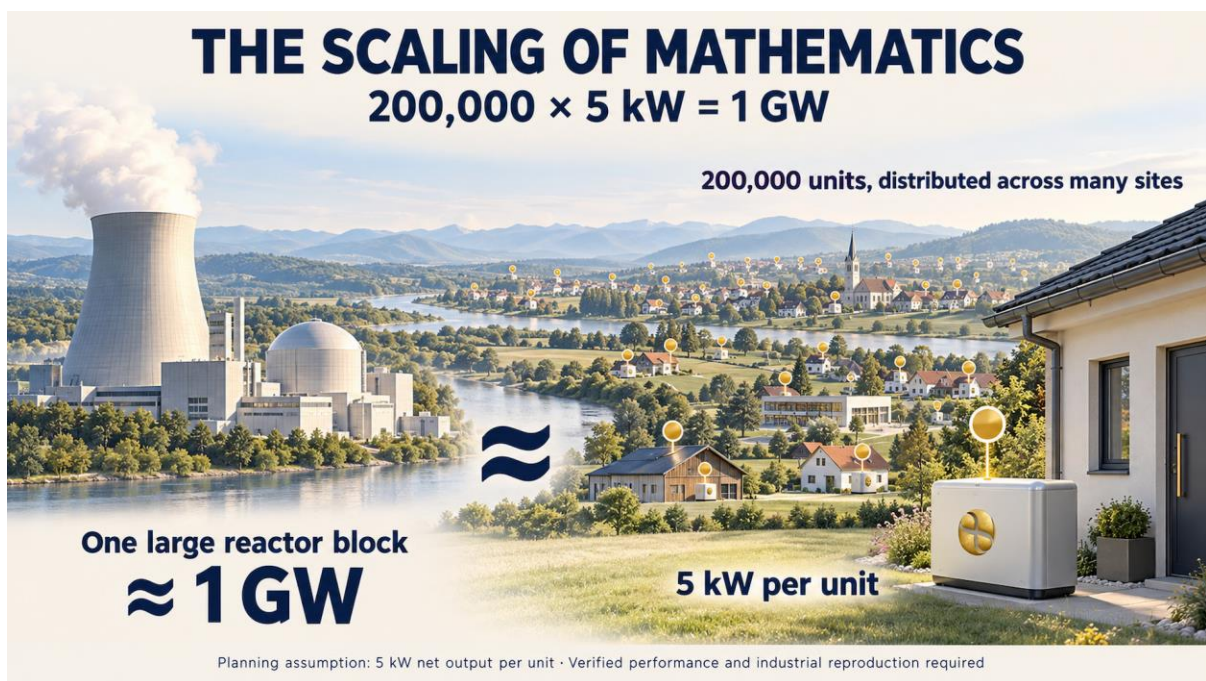


The Scaling of Mathematics

Neutrino® Energy Group | October 2026



Even a nuclear power plant begins with processes that cannot be seen. Its output comes from their enormous number. Anyone who judges a technology by how small its single process is overlooks the decisive question: what does the measurable sum add up to?

Understanding the Comparison

The comparison with a nuclear power plant serves one purpose: to illustrate power and scale. Environmental impacts, radiation risks, safety considerations and the merits of nuclear energy are outside the scope of this discussion.

We deliberately chose a powerful benchmark: a nuclear power plant. Its enormous output originates in countless microscopic processes. The physical mechanisms differ fundamentally; the shared focus is how individual contributions combine into measurable total power.

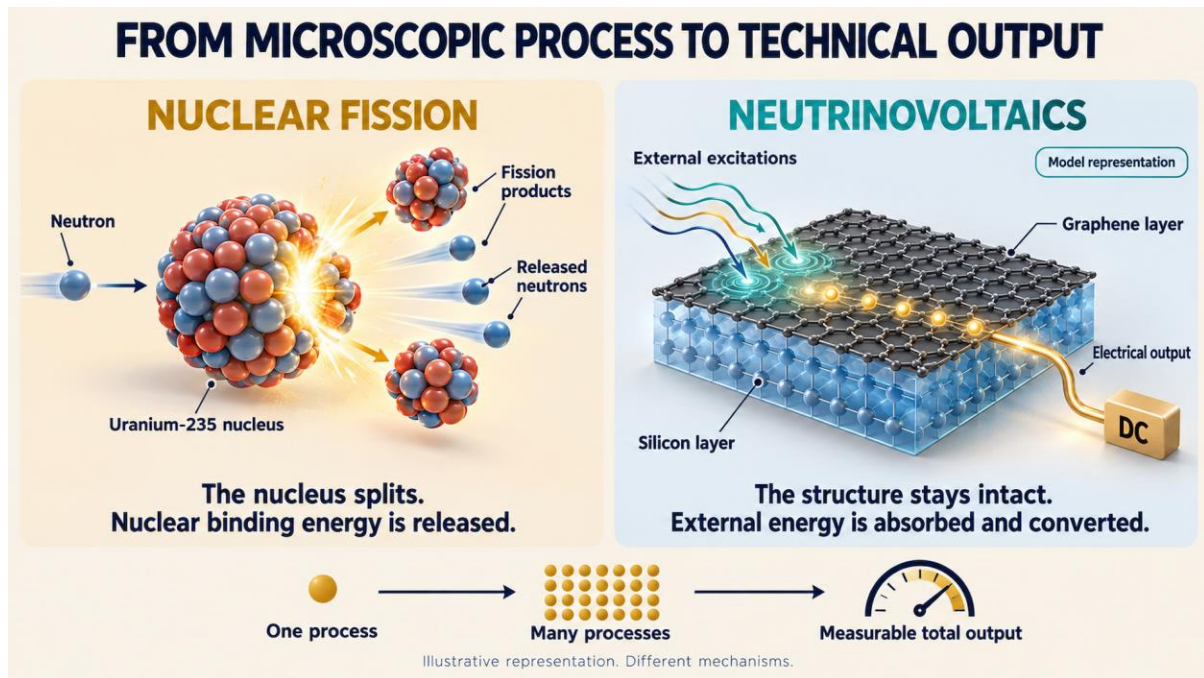
A frequent objection is that neutrinos are "too weak" to make a meaningful contribution. Yet the small energy transfer of a single interaction does not, by itself, establish the total power of many interactions. That requires considering how many interactions actually occur, how much energy they transfer and what fraction can be converted into usable electricity.

This is where mathematical reasoning becomes decisive: the individual contribution, the number of effective interactions and the usable fraction together determine the total. A vast number of particles alone does not demonstrate high power. Equally, a tiny individual contribution alone does not demonstrate negligible total power. The answer requires a measured energy balance for the complete system.

The scaling question therefore has two levels: how microscopic processes combine into the net output of one functioning unit, and how many such units combine into the output of a distributed generation fleet. Each level requires its own verified inputs.

Small does not automatically mean weak. To assess power, we must calculate the effective sum and verify its inputs through measurement.

Anyone who underestimates the small should remember the history of nuclear power. An atomic nucleus is tiny. Yet the output of a nuclear power plant is measured in gigawatts. Between these orders of magnitude lies something that is surprisingly easy to overlook in the energy debate: the number of effective processes. Nature has no minimum diameter for significance. What matters is how much energy a process transfers, how often it occurs and what share of it can be used technically. Anyone who says "too small" has therefore not yet presented an energy balance. So far, they have only offered a description of size.



Different mechanisms, one shared perspective: many microscopic processes can add up to a large total output. The right-hand side is a model representation.

Setting nuclear fission side by side with neutrinovoltaics leads us to exactly this question. The mechanisms differ fundamentally. In one, nuclear binding energy is released. In the other, we are investigating the absorption and electrical conversion of external energy in nanostructured materials. The shared perspective is scaling, from the microscopic process to measurable total output.

That scaling happens on two levels, and the connection between them is the core of our argument. First, many effective microscopic processes combine into the output of one unit. Then, many functioning units combine into the output of a fleet. The first level is decided inside the material. The second is decided in manufacturing and operation.

At system level, the calculation is remarkably simple. With our planning assumption of five kilowatts net output per Power Cube:

$$200,000 \times 5 \text{ kW} = 1 \text{ GW}$$

Provided every unit delivers a demonstrated, continuous net output of 5 kW.

This is the order of magnitude of a large nuclear reactor block, distributed across many sites. Around 1 GW is a common reference figure for a conventional reactor; a power plant site can comprise several blocks.

What Stands Behind Every Figure

Four conditions stand behind every calculation in this article. The net output of a single unit must be established through measurement, with a complete energy balance. That output must be reproducible in every unit produced. Manufacturing must be qualified to deliver large numbers at that quality. And the installed units must demonstrate their availability in long-term operation. The multiplication itself is unambiguous. These four inputs decide whether it describes reality. Where a later section adds a further condition, we name it there.

Our proposal to governments is therefore: continue operating your existing power plants responsibly. But before you plan the next large block, also examine what output a large number of small units could provide.

Sometimes the size of the possibilities only becomes visible once we stop smiling at the small and start calculating its sum.

"Those who think the small are powerless have yet to calculate their combined strength."

Holger Thorsten Schubart, Mathematician

Every Country Has Different Needs

Every country starts from a different energy situation. Some have high-performing power grids and a large fleet of power plants. Others need to expand their supply, overcome regional bottlenecks or create reliable access to electricity for the first time. A scalable approach must therefore adapt to each country's needs. This is exactly where mathematics becomes the key: it translates a supply requirement into output, unit numbers, production capacity and time.

Our approach begins with a question every government can answer for itself: what additional electrical output should be available, where, and at what times? From this, an architecture can be developed that complements existing infrastructure or builds new local supply. The

scaling logic stays the same. What differs is the order of magnitude, the locations and the operational requirements.

For a fleet of identical units, the mathematical relationship is immediate:

$$\mathbf{P(total) = N \cdot p(net)}$$

Here, N is the number of units in operation and p(net) is the electrical output of a single unit after deducting its own consumption and its conversion losses. Where different systems are deployed, their individual contributions add up:

$$\mathbf{P(total) = \sum_i N_i \cdot p(i, net)}$$

This relationship opens a different view of energy planning. A national output target can be distributed across regions, municipalities, companies and individual points of consumption. Each level receives a defined contribution to the overall target. A government can thus trace its planning down to the individual supply unit and verify it against real operating data.

From a desired additional output, the required number of units can be derived first:

$$\mathbf{N(required) = \lceil P(target) / p(planning) \rceil}$$

The brackets mean rounding up to a whole unit. The decisive value is p(planning). It must be derived from demonstrated net output and the intended operating conditions. For secured supply, a further condition applies: reserves, maintenance and possible common-cause failures must also be taken into account. Mathematics creates clarity when its input values are reliable. A large unit count does not turn an unverified output figure into reliable supply.

Equally, output and energy must be distinguished. Output describes what is available at a given moment. The amount of energy results from how long this output is actually delivered:

$$\mathbf{E = \int P(total)(t) dt}$$

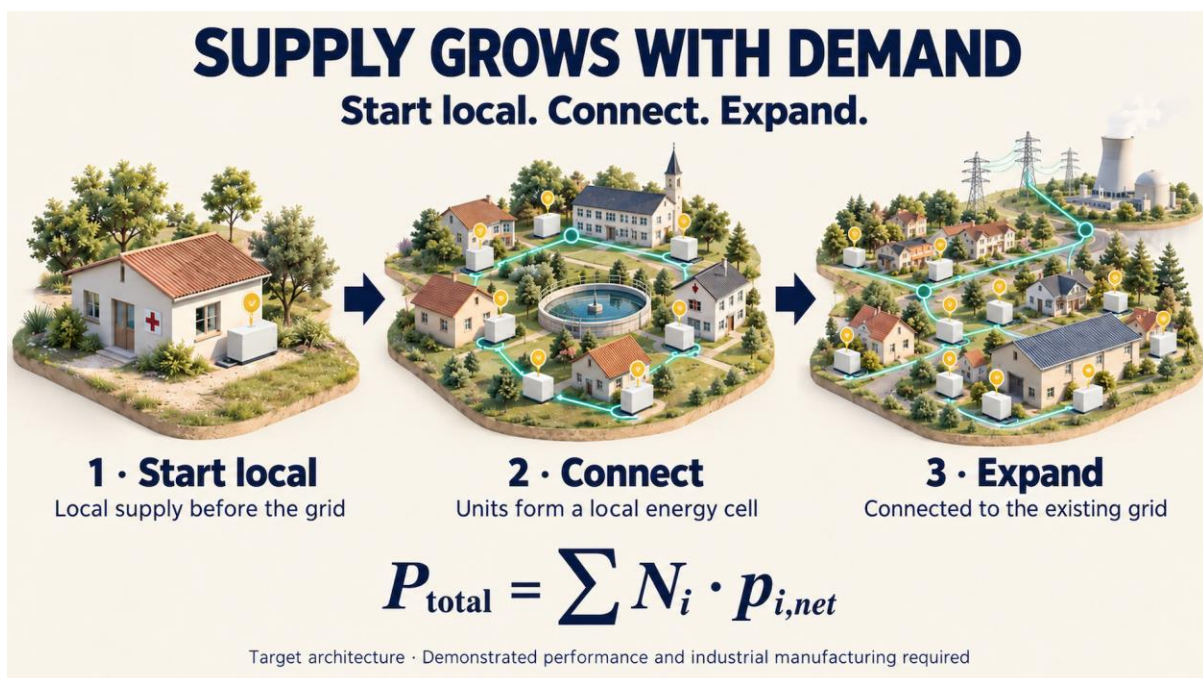
This allows every country to compare its consumption profiles with the planned generation. Continuous demand, temporary load peaks and seasonal changes become visible. From this follows which tasks the generating units take on and where additional storage, larger clusters or a grid connection are needed.

For countries with developed grids, this approach opens up step-by-step integration.

Decentralised units can be located where energy is needed and take over a measurable share of supply. Their actual contribution to relieving the grid depends on local loads and grid

conditions. Existing power plants remain part of the supply during the build-up. New capacity can be added with every unit commissioned.

For regions without sufficient infrastructure, a different possibility arises: leapfrogging, skipping individual historical stages of development. Local supply could begin before a nationwide transmission grid has been built. Individual generators could be connected into local energy cells and later integrated into larger grids. This requires suitable systems, safe operation and a sound organisation of installation and maintenance. It makes a development path conceivable in which usable supply emerges while the wider infrastructure is still being built.



Every country has different needs. The scaling logic can be tailored to them. Shown as a target architecture; implementation requires demonstrated performance and industrial manufacturing.

The speed of this build-up can be calculated too. What matters is the number of tested units that are actually installed and put into operation:

$$\Delta P = \Delta N(\text{in operation}) \cdot p(\text{net})$$

Industrial manufacturing thus becomes a variable of energy planning in its own right. Production yield, supply chains, installation and financing together determine the achievable growth. If series production succeeds, a modular build-up could provide usable partial capacity earlier than a large project whose generation only begins at commissioning. Whether this results in faster expansion overall must be assessed against concrete manufacturing and project plans.

The political task thus becomes precise: determine your own needs, verify the technical performance independently and organise an industrial build-up whose progress can be measured. A government does not have to adopt another country's example for this. It can calculate its own supply path.

Mathematics turns a large possibility into a verifiable task. How many units must we produce, where must we deploy them, and what output will actually be available as a result?

The Power of Scale

A single system has limited output. A technology reproduced millions of times opens up a different order of magnitude. This is where the strategic perspective of neutrinovoltatics lies: an energy supply whose total output grows with the number of its demonstrably functioning units, across buildings, communities and countries.

The target vision is a globally distributed power plant. Its generating units stand where electricity is needed. They can operate individually, form local supply systems or be integrated into existing grids. With every additional unit, the available generating capacity grows.

The mathematical relationship is:

$$\mathbf{P}(\text{fleet})(t) = \sum_{j=1}^{N(t)} \mathbf{p}(\mathbf{j}, \text{net})(t)$$

Each unit contributes its actual net output. For identical systems with the same output, the relationship simplifies to:

$$\mathbf{P}(\text{fleet}) = \mathbf{N} \cdot \mathbf{p}(\text{net})$$

On our internal planning basis of five kilowatts per Power Cube, the orders of magnitude look like this:

$$200,000 \text{ units} \times 5 \text{ kW} = 1 \text{ GW}$$

$$1,000,000 \text{ units} \times 5 \text{ kW} = 5 \text{ GW}$$

$$10,000,000 \text{ units} \times 5 \text{ kW} = 50 \text{ GW}$$

These figures follow directly from the multiplication, under the four conditions set out above. The dimension arises from the combination of usable individual output and industrial replication.

Neutrinovoltaics is intended to absorb external excitations in nanostructured materials and make part of the transferred energy available as electric current. The system does not create energy out of nothing. Its task is to make existing energy technically accessible.

For a single unit, this task can be described as a power balance:

$$p(\text{net}) = \sum_k \eta_k \cdot p(k, \text{coupled}) - p(\text{self-consumption})$$

Here, $p(k, \text{coupled})$ denotes the power actually absorbed through excitation channel k . The factor η_k describes the electrically usable share after the respective conversion losses. At this level, a further condition applies: the contributions must be separately determinable and must not be counted twice; for coupled mechanisms, a joint system balance is required.

This distinction is essential. The size of an energy flux in the environment does not yet say what share arrives in the material and becomes electrically usable. It is precisely this coupling that determines the achievable power density. The material architecture must therefore be assessed on the basis of its measured energy balance.

Then industrial scaling begins. Active structures are connected into modules, modules into supply units and supply units into a growing fleet. Each transition must preserve its output under real operating conditions. Manufacturing determines how fast this fleet can grow:

$$dN/dt = R(\text{commissioning}) - R(\text{decommissioning})$$

With unchanged net output per unit, total output grows accordingly:

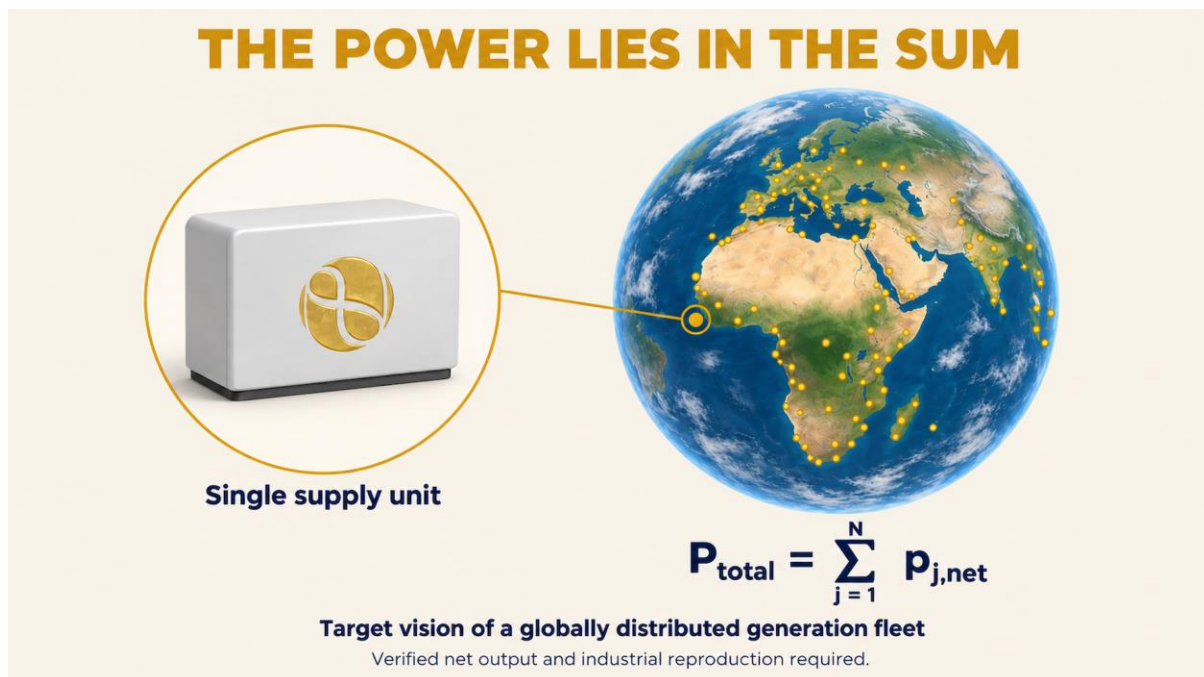
$$dP(\text{fleet})/dt = p(\text{net}) \cdot dN/dt$$

Production capability thus becomes a directly measurable variable of energy supply. An additional production line first creates manufacturing capacity. Only tested, installed and operating systems create additional generating output.

For baseload capability, a further condition applies: this output must also be available during the critical supply hours. Long-term operation, maintenance, common-cause failures and electrical integration determine the secured contribution. A large fleet therefore only has large secured output once its availability has been demonstrated accordingly.

Under these conditions, a far-reaching goal opens up: a decentralised generation fleet whose total output can exceed that of a single large power plant. Whether it one day becomes the world's largest baseload-capable generation fleet will be decided by the expansion actually achieved, together with its demonstrated security of supply.

Mathematics makes this order of magnitude calculable. Technical performance and industrial implementation make it achievable.



Target vision: the gold points represent a future concept of distributed generation sites, not existing installations.

A Future We Must Understand Before We Can Build It

This article does not offer a product for sale. It presents an architecture for examination: a way of translating scientific findings, measured effects and consistent mathematics into a possible future energy supply.

We want to make clear which variables are connected. How much energy actually reaches a material structure? What share becomes electrically usable? What net output can be reproduced continuously? And what total output results when such systems are manufactured industrially and deployed in large numbers?

These questions lead from the laboratory to a country's infrastructure. Each answer becomes the basis for the next step. A measured effect opens a technical investigation. A reproducible output enables a reliable system calculation. Qualified manufacturing creates the precondition for large unit numbers. Mathematics connects these steps. The measurements must supply its input values.

New possibilities arise where scientific understanding and technical capability come together. Nanostructured materials, precise manufacturing processes and advanced data analysis are expanding the range of what can be investigated and engineered today. Which of these possibilities can carry a lasting energy supply must be established through independent reproduction, complete energy balances and long-term operation.

The order of magnitude can already be calculated today. For a demonstrated net output p and a number of units in operation N :

$$\mathbf{P(total) = N \cdot p}$$

This relationship contains neither enthusiasm nor doubt. It contains two variables whose values we must determine and whose technical preconditions we must meet.

The low output of a single unit does not yet answer the question of its possible combined effect. Equally, a large unit count on paper does not prove a technically achievable supply. What matters is the connection: reliable individual output, reproducible manufacturing and dependable operation at large numbers. We therefore disclose knowledge, assumptions and logic. We invite you to check the calculation, find its weakest points and identify the next decisive measurements. A sound approach gains substance through this scrutiny.

If this connection succeeds, the possibilities for society become concrete. Additional supply can be created close to consumers. Local systems can grow and later be interconnected. Energy planning can be structured into verifiable expansion stages. How large the benefits actually are can be measured in security of supply, lifetime costs, resource requirements and accessibility.

A globally distributed generation fleet could emerge step by step: first at individual points of consumption, later in local supply systems and finally as a substantial component of national energy grids. Existing infrastructure could continue to be used along the way. Regions with inadequate supply could pursue their own development paths, with expansion guided by their actual needs.

That is the significance of the target vision described here. It directs attention beyond the individual experiment towards a development spanning twenty to thirty years. This period is a planning horizon, not a promised completion date. The picture shows what research, industrial development and public planning could work towards together.

Twenty to thirty years is long enough to change an energy infrastructure profoundly. It is also short enough that today's decisions will determine how far that change can go. The picture of such a future therefore demands precise work. Anyone who takes it seriously must ask today about the technical evidence, the production processes required and the conditions under which individual systems become a reliable supply.

Perhaps this is the thought that should remain after reading: a possibility does not have to be realised yet to deserve attention. But once its preconditions are clearly named and its relationships can be calculated, it can no longer be dismissed with a shrug.

Then the responsibility to examine it begins.

What We Owe the Future

The coming generations will live with the consequences of our decisions. With the power plants we plan today. With the grids we build. And with the possibilities we either grant a serious investigation today or deny one.

That is why it is not enough to judge a new perspective by how familiar it seems to us.

We have learned to understand the splitting of an atomic nucleus as the starting point of enormous technical output. This experience should sharpen our view. With the next microscopic process, we must once again ask about energy transfer, usable output and achievable replication. The answer requires its own investigation. The question deserves the same intellectual openness.

The most consequential mistake would be to take what has been achieved today for the limit of what can be achieved.

Because then every coming generation would have to begin within the boundaries of our imagination.

We owe them more.

We owe them the willingness to follow an uncomfortable connection all the way to its end. Even when its beginning is inconspicuous. Even when its possible order of magnitude at first contradicts our intuition. That is precisely when we must measure more carefully and calculate more precisely.

Mathematics demands no followers. Its assumptions can be disclosed, its steps traced and its results checked. Whoever disagrees can name the error. Whoever finds a sound connection must take its consequences seriously.

That is where its authority lies.

A company can fail. A person can be wrong. A verifiable insight remains accessible even when its first advocates have long been forgotten. That is why the perspective described here should be measured against its preconditions: against what can be observed, reproduced and technically implemented.

If these preconditions hold, responsibility arises. Then we must find out how far the path leads, what means it requires and whom it could supply with energy. A possible advance of this magnitude deserves a place in the decisions about our shared future.

The golden key is not a deed of ownership. It is a way of thinking: describing connections so clearly that others can check them and carry them further.

This turns the future into a task on which people can work across borders and generations.

We do not have to claim today that we know its final extent. But we should not let a serious possibility end at the convenience of our judgement.

Our imagination may fall behind the calculation. Our responsibility must not.

"Those who think the small are powerless have yet to calculate their combined strength."

Holger Thorsten Schubart, Mathematician, CEO of Neutrino Energy Group

The picture extends further: neutrinos are only one part of our technology's multi-channel approach, which also investigates contributions from cosmic particles, electromagnetic radiation, thermal processes and mechanical vibrations. Explore how these channels interact within the material architecture: [How Neutrinovoltaic Technology Works](#)