

An open foundation for modern grid planning

Launching OpenGrid to accelerate a future of energy abundance through modern grid planning, in every grid stakeholder's hands

Every new, large-scale electricity project requires a series of complex planning studies to ensure the result works and is reliable. A single study can rely on three to five specialized modeling tools, and data rarely moves cleanly between them. Out of necessity, utilities and grid planners often build and maintain their own pipelines to bridge those gaps, so even in the best-resourced systems, planning is slow, bespoke, and costly.

Planning is also getting harder. Growing shares of variable generation, storage, and distributed energy resources, along with more flexible, two-way power flow between customers and the grid, call for more studies, at finer resolution, than the current modeling stack was built to handle.

As studies demand more tools, compute, and specialist staff, reliable planning moves further out of reach for many who need it: planners in emerging market and developing economies (EMDEs), where much of the grid has yet to be built, as well as smaller utilities, regulators, and advocates in more mature markets.

There is a real opportunity to make grid planning faster, more accurate, and more transparent. Demand for planning is accelerating, and everyone from existing system planners to AI companies and local governments want new data and tools to plan for faster growth and better integration of new energy technologies. As we have seen in other industries, open-source software can facilitate greater interoperability, transparency, and innovation while lowering the cost of building reliable digital infrastructure.

Capable open-source grid planning tools already exist for most types of analysis, developed by universities, national labs, nonprofits, and grid operators themselves. What they lack is the shared layer that would make them usable together: common data, interoperability between tools, repeatable workflows, and the support regulated organizations need before relying on a tool. That layer is nobody's job today. Each organization builds its own version, and many

open-source developers are funded primarily to produce studies, with little left over for maintaining the tools and connections others depend on.

That is why we are launching OpenGrid, an open foundation for modern grid planning. OpenGrid exists to build the shared layer: an open, vendor-neutral core that lets open-source and commercial planning tools, data, and models work together instead of existing as disconnected point solutions. That means a shared foundation of data and standards, with applications built on top: translators that move models between tools, plugins that connect existing software, and workflows that make any study repeatable, all developed in the open by the tool builders and planners who will use them.

OpenGrid is seeded with philanthropic capital and aims to move toward a membership model as the ecosystem matures. Grid planners and operators already develop many open-source tools they depend on, and that model works well for individual tools. The shared layer between tools is harder to fund that way: its value is spread across every tool and user, no single organization captures enough of it to pay for it alone, and many who would benefit most, such as regulators, smaller utilities, and planners in EMDEs, have the least to spend. Philanthropy can pay for that layer first, until enough organizations rely on it to sustain it through membership.

By 2030, OpenGrid aims to make open-source planning viable anywhere, so that grid planning becomes a global public good. Its first components, planned for 2027, focus on data and interoperability: open standards, a Data Hub and the APIs to reach it, and a Translator between tools. Our vision is to accelerate a future of energy abundance. Our mission is modern grid planning in every grid stakeholder's hands, putting every planner on the same technical footing: tools anyone can afford, models anyone can inspect, and plans anyone can implement.

The Gap Today

More than 2,500 gigawatts of energy, storage, and large-load projects are waiting in grid connection queues worldwide,¹ and annual grid investment needs to roughly double to more than USD 600 billion by 2030.² Grid decisions made this decade will shape energy outcomes

for the next 30 to 60 plus years. Together, these figures capture the scale, cost, and permanence of the decisions ahead.

Skeptics raise fair questions about each. First, the 2,500 GW figure is inflated: developers often submit the same project in several locations while searching for a viable site. That is true, and it strengthens the case for better planning. When developers can see where the grid has room, they have less reason to file speculative requests that slow studies for every project in the queue. Second, doubling grid investment raises real affordability concerns. Transparent, inspectable planning helps regulators, utilities, and the public see what is needed, where, and why, so each dollar goes where it has the highest impact. Finally, because these assets will serve communities and economies for generations, planning errors made now will be difficult and costly to reverse.

Three trends make this the right moment to modernize grid planning worldwide:

1. **Open-source grid planning tools** are now offering much of what commercial software does at a fraction of the cost. First started in the 1990s, major institutions are now testing or adopting them: Europe's network of transmission operators and Austria's grid operator both run forecasts on PyPSA (in parallel or stand-alone) and several leading utilities and transmission operators have developed their own open tools, such as RTE and Alliander³⁴
2. **Artificial intelligence** is lowering the barriers for non-specialists to examine complex models. Of course, mistakes can be costly in an industry where modeling errors can cause system-wide outages.
3. **Rising electricity demand in both Developed and EMDEs** coupled with improving energy economics on new technologies necessitates updated modeling approaches. Variable technologies can deliver electricity up to 40% cheaper than the least expensive dispatchable options in many regions (on an energy basis); however, the increasing share of weather-dependent resources on grids increasingly compounds the value of accurate interoperable modeling.⁵

What's missing is a platform that connects the advantages offered by these developments and makes them accessible and transparent to anyone.

Three structural shortcomings in today's grid planning

Out of necessity, modern grid planning must move faster, reach more people, and model the grid we're building. A grid planning ecosystem should deliver three capabilities:

- (1) *Speed – the ability to generate accurate outputs quickly to support analysis and decision making for grid planning and investment decisions;*
- (2) *Reach – the accessibility to be used by all those who need to do grid planning, at a reasonable cost and level of technical know-how;*
- (3) *Fidelity – the accuracy to model the grid we're building: to appropriately reflect the physics of our increasingly complex energy system, and to translate those parameters into inputs usable in an economic analysis.*

Yet, realities from across the global grid system suggest that the planning landscape is falling short on all three dimensions.

(1) The extended time it takes to conduct grid studies and model grid capacity expansion has contributed to a 5–15 year average timeline to move from plan to power.⁶

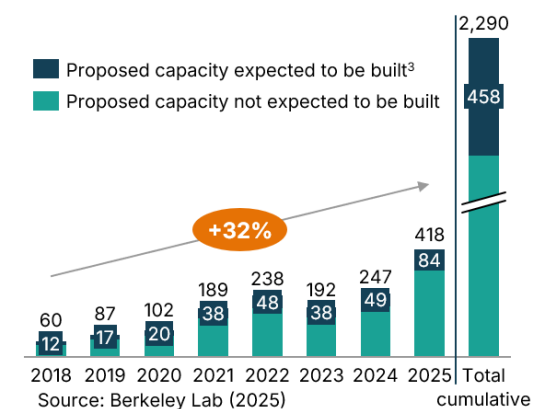
The United States is expected to see 166 GW of peak demand growth by 2030, according to utility forecasts (Grid Strategies, 2025), though analysts suggest roughly 140 GW may be more realistic. There is now over 2 TW of generation and storage stuck in the global interconnection queue (with over 500 GW fully executed) (see Figure 2).⁷ The need to study each individual project, its potential impact on the system, and the associated network upgrade cost associated has led to the backlog and queue prospecting. If one of the world's best-resourced grids is met with such a significant modeling bottleneck, less-resourced systems have little chance at building out the new capacity that

they urgently need at scale. In India, renewable capacity buildout is significantly slowed down by curtailment. Between April and June 2026, among the hottest months of the year, 11% of solar power produced was lost to curtailment, much of it due to grid and transmission

Figure 2.

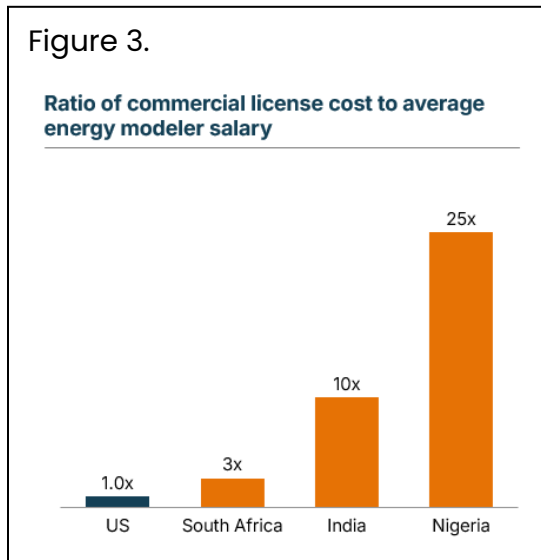
New capacity added to IC queue has grown at 32% since 2018 and now totals >2TW

New annual interconnection capacity added to queue in the US (GW)²



constraints.⁸ Could long-term planning with greater fidelity help to avoid curtailment risk of projects and ensure energy is not lost?

(2) Although powerful commercial modeling tools exist, ~90% of all potential grid modelers – many of them in EMDEs – do not have access to them today.⁹



High licensing cost is part of the problem: a multi-user, enterprise license for an energy market simulation tool costs roughly 1x an energy modeler's average annual salary in the US, but 10x in India, and 25x in Nigeria, making tools virtually unaffordable outside of the Global North (see Figure 3).¹⁰ Some energy ministries in emerging markets are only able to access commercial grid modeling tools through financial support from donors.¹¹ Even in organizations that can afford the ticketed price of a license, teams may not consistently have the technical personnel to justify multi-year, organizational-level investment

into a commercial modeling tool. Moreover, the adoption of proprietary modeling tools in isolated pockets becomes significantly less meaningful, when other actors in the electric system cannot interpret or inherit the outputs of these models. Generally, only well-funded and well-resourced organizations can plan and represent a modern grid, while others are forced to rely on outside consultants and donors, or are simply unable to accommodate the complex technologies and decisions that the energy system increasingly requires.

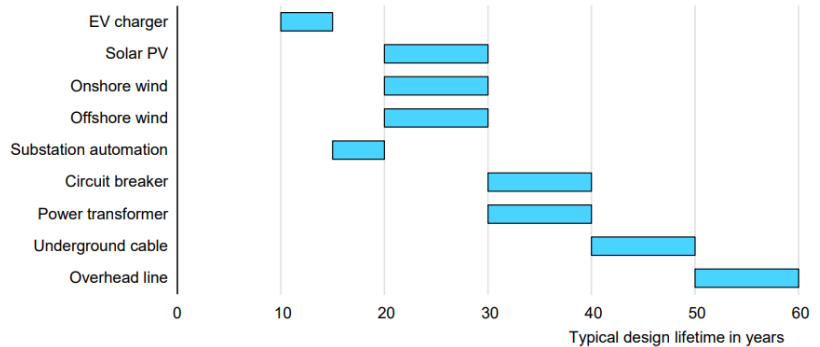
(3) Finally, legacy tools are not designed to model innovative resources.¹²

Most tools were built for a grid running on dispatchable thermal generation and struggle to accurately represent variable resources or other innovative technologies like long-duration storage. Capacity factor estimates for variable resources can vary wildly, which undermines investors' confidence. Meanwhile,

storage solutions that improve variable resources' output profile continue to be under-modeled. As a result, decision-makers default to legacy infrastructure because they lack an accurate and high-confidence in understanding of innovative alternatives.

Well-resourced players can build bespoke, costly software solutions to overcome the speed and fidelity challenges, but the reach gap hurts the whole system. Even the best-resourced utility does not exist in isolation from smaller downstream players, who often struggle to provide key inputs such as usable customer distributed energy resource (DER) capacity data or distribution grid electrical parameters. In emerging economies, which will account for nearly 80% of global electricity demand growth through 2030, much of the grid needed to serve growing demand does not yet exist and grid-planning challenges are heightened.¹³ In Sub-Saharan Africa (excluding South Africa), businesses and households spend roughly \$20 billion a year on backup generator fuel, about 80% of what they spend on grid electricity, for just 7% of supply (Wood Mackenzie). The cost of this gap compounds over time. Every project planned with inadequate tools risks locking in generation capacity that will run for decades. There is a clear need to cohere efforts across the ecosystem, to ensure that planning tools and data-sharing practices are upgraded together.

Typical design lifetimes for high-voltage equipment, solar PV, wind and EV charging stations



IEA. CC BY 4.0.

Why markets and government cannot solve these problems alone

While the three problems outlined here are well-documented, neither the private sector nor the government has supplied an adequate solution so far.

Private vendors operate on a licensing revenue model that can limit the accessibility of their tools. The public sector has strong incentives to improve grid planning but is poorly placed to supply the technical solutions required to address the problems of extended modeling timelines and poor fidelity. Furthermore, no individual government has a mandate to solve coordination problems that exist between grid operators that send electricity across sovereign borders.

Standalone open-source tools are maturing, and provide powerful capabilities to planners, but lack the connective infrastructure, shared data schemas and standards, and durable funding to achieve their collective potential. Rather than rebuild what already works, any serious effort to modernize grid planning must build on existing tools, including but not limited to the following:

- Power flow modeling tools: OpenDSS, Pandapower, PyPSA, Sienna
- Capacity expansion modeling tools: GridPath, OSeMOSYS, RESOLVE
- Production cost modeling tools: Antares simulator, IRENA FlexTool

Philanthropy is uniquely placed to serve a catalyzing role that no other actor in the ecosystem is positioned to: funding work that is investment-intensive, benefits everyone, but does not guarantee profitable returns. With no commercial stake, a philanthropic initiative can stay neutral and convene competing players.

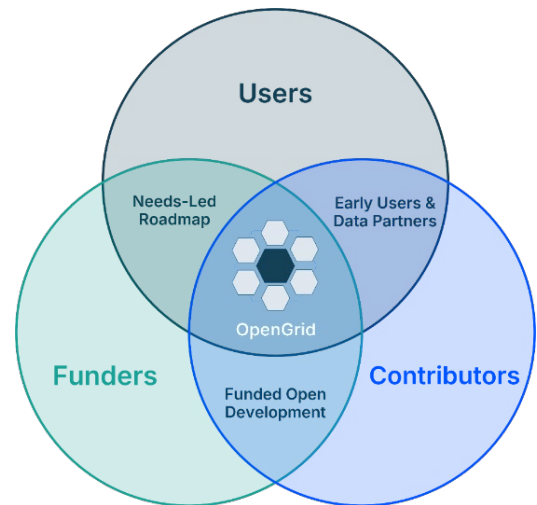
How OpenGrid is built and governed

OpenGrid is being established as an open foundation for modern grid planning. It funds the development of shared planning infrastructure, while the code is built in the open and governed through the Linux Foundation. A growing network of funders and technical partners backs the initiative. We are proudly supported by Breakthrough Energy, the Connected Grid

Initiative, Global Grids Catalyst, and Google.org, and our technical development and delivery partners (to date) include Open Energy Transition, TransitionZero, QXT Energy, and Tapestry.

That infrastructure, a common set of tools, data, standards, and community connections that any planner anywhere can access, relies on three mutually reinforcing elements:

- **Platform** will bring data access and modeling capabilities to all users. It is being built to reflect today's grid complexities and to connect with tools modelers already rely on.
- **Ecosystem** improves the product over time. As an open-source platform, OpenGrid is committed to sourcing community input and fostering collaboration on the development of open-source solutions. This helps ensure OpenGrid's platform meets the needs of users and has a path towards self-sustainability through an open contributor base.
- **Governance** makes the product durable. OpenGrid is establishing a governing home in the Linux Foundation, with a charter that gives its three stakeholder groups (contributors, users, and funders) a voice in its direction. Together with committed funding, this gives OpenGrid the runway it needs to build its platform and remain neutral.



How the ecosystem sets OpenGrid's priorities

OpenGrid conducted deep user research to understand which elements to fund and prioritize. We spoke with more than 70 individuals across 46 organizations in 13 countries, spanning the full grid-planning ecosystem, from utilities and regulators to large loads and developers. This research revealed a clear prioritization of needs:

- **Data was the clear top need.** Grid planners today spend 60-80% of their time translating data across fragmented proprietary tools, incompatible formats, and one-off integrations. Utilities, governments, and analytics vendors each build this bespoke but highly-similar plumbing and modelers struggle to get data that is fit for purpose, accurate, accessible, and consistent with what other modelers use. Smaller

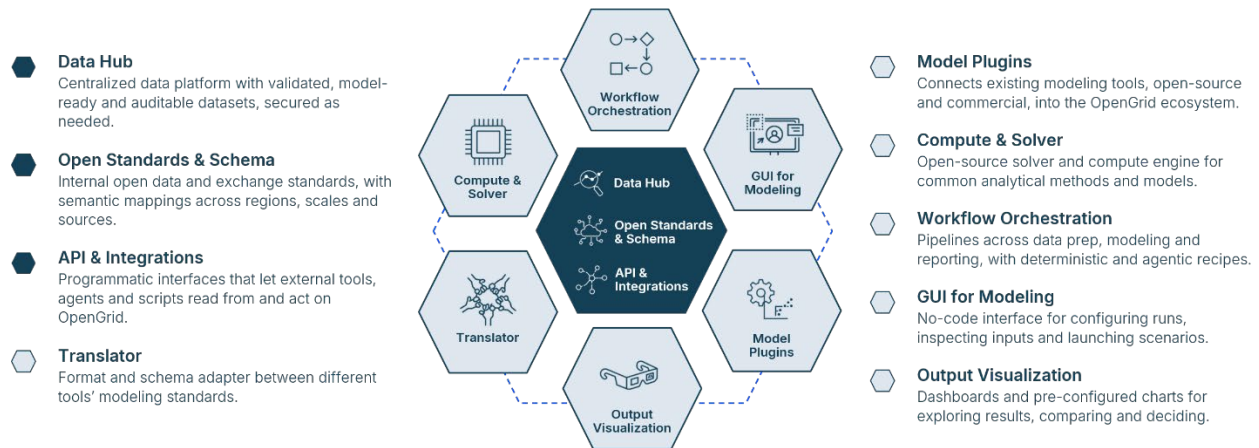
organizations face the most data access issues since they hold little leverage with data providers and larger grid operators who own the data that they need. Large players often describe challenges in moving data across model workflows, teams, and geographies.

- **Trust and governance came next.** Most commercial tools are black boxes: their assumptions are hard to inspect, which leaves their outputs difficult to validate, defend to regulators, or reproduce. This becomes particularly problematic when model outputs are used to support billion-dollar public investments, but cannot be properly scrutinized. Governance concerns compound this. Grid data is often sensitive or security-classified, and digital sovereignty makes organizations wary of routing it through proprietary, foreign-controlled software.
- **Usability came up too**, especially for organizations with fewer technical staff, such as intervenors, consumer advocates, and smaller co-ops and municipal utilities. More advanced users want easier ways to orchestrate workflows across multiple modeling tools, while less technical users need no-code interfaces to run their own analyses. Those who have experimented with open-source tools flagged a common gap: these tools often lack the ongoing technical support that commercial suites tend to provide.
- Modeling needs are largely met by existing tools, but modeling newer technologies like battery storage, DER, and inverter-based resources in general remains a challenge. Compute cost at scale is a related hurdle, as planners increasingly have to run across an escalating number of scenarios.

Because data is the most urgent need, OpenGrid will start with data and interoperability: open standards, a Data Hub and the APIs to reach it, and a Translator between tools. building a foundational layer: an open data hub tied to a standardized schema and connectors. Usability and modeling components follow and are well suited to community contributors motivated by their own use cases.

OpenGrid's Platform

OpenGrid's platform vision will feature three components that establish a shared foundation of data and standards, and six applications that address specific software uses, all designed to augment the tools modelers already use rather than replace them.



OpenGrid will be an open, trustworthy front door to the world's grid-modeling data. From a single query interface, any user or their AI agent will use the **Data hub** to find the right datasets for their study. Through the **Open standards & schema**, which will define the properties of the datasets in OpenGrid's Data Hub, they will be able to see not just what each dataset contains but how they can use it, how far to trust it, and how it relates to and can be joined with others. They will then pull exactly the data they need through **API & Integrations**, which will hand back an access plan. They will also be able to work directly from their own environments: calling OpenGrid from their own language (Python, Julia, R), getting results as native objects, defining data transformations as code, and discover, access, and plan the workflow through an MCP server.

The modeler or agent will then be able to bypass slow data and format conversions using OpenGrid's **Translator**, which will move models and datasets between tool languages. Whether the modeler is using a commercial tool or an open source one like PyPSA, they will be able to build in one tool and then run, check, or extend their model in another. Composite analyses that today require chaining tools together by hand will become seamless, and results will no longer be trapped in the tool that produced them. Modelers with expertise in their preferred software will even be able to use **Model plugins** to access OpenGrid's capabilities natively, finding datasets and generating insights from within their own tools.

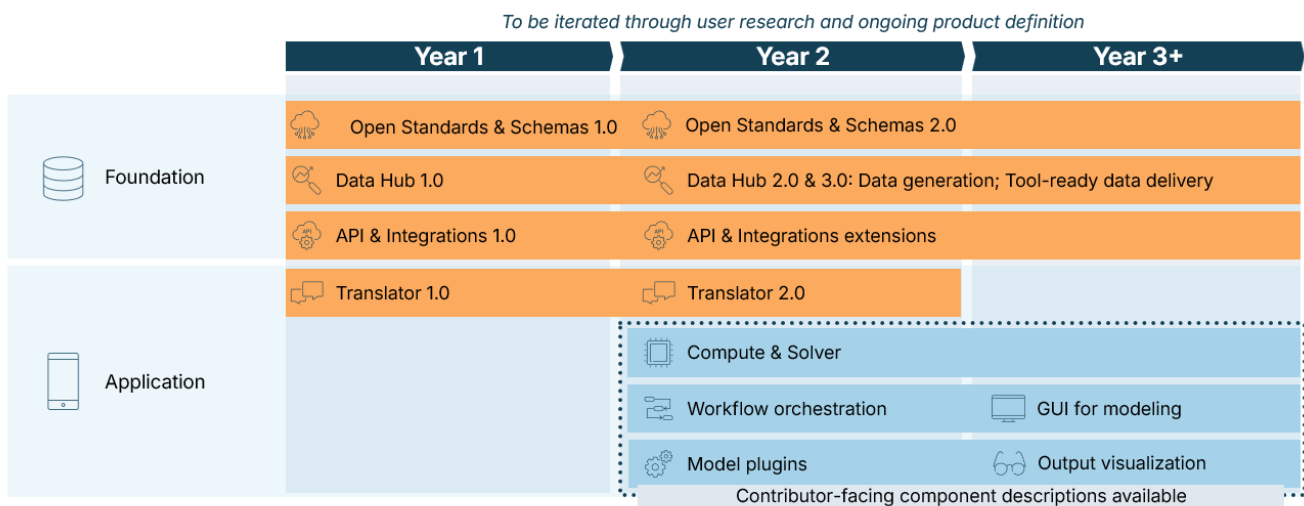
To enable cutting-edge capabilities that solve complex optimization problems, **Compute and solver** will invest in existing open-source solvers and execution stack for the most common planning analyses. Once a modeler has defined an analysis, they will be able to

use **Workflow orchestration** to run it again on demand and validate each step, making each new study a rapid re-run rather than manual re-work.

Next, OpenGrid will extend these powerful capabilities to a broader community. A graphical user interface (**GUI**) **for modeling** will allow non-coding modelers to configure model runs, inspect inputs, and launch scenarios through an interface. **Output visualization** will turn results into dashboards and charts that a board member, a regulator, or the public can read, so the analysis behind a billion-dollar decision can be examined by everyone it affects.

Finally, developing a new product suite alone will not put sophisticated modeling tools in the hands of users that need them. Some of our components are designed to lower barriers to understanding model outputs, such as the visualization layer which makes results legible to the decision-makers and public who need to scrutinize them without specialist knowledge. Moreover, OpenGrid is committed to pairing its tools with thorough documentation and a community of practitioners to support users with sustained tool adoption.

Roadmap from launch to self-sustaining platform



OpenGrid plans to release its first foundational components in 2027, as the first step on its path to becoming trusted infrastructure in three years. As details around OpenGrid's governance structure are finalized in Year 1, and the user and contribution intake mechanisms defined, we will be publishing them on our website. In years two and three,

OpenGrid will use feedback from early users to refine the additional components that it plans to develop, and in the meantime, publish product briefs that developers in the community can pick up and start building. Kicking off this collaboration from day one lays the groundwork for users and contributors to own the platform's direction and extend its capabilities after the initial three years.

How to support OpenGrid

As OpenGrid launches, it needs data and technical contributions, user testing and use case development, and financial and governance backing:

- **Grid modelers, planners, and analysts** can test the product with their real workflows and provide feedback,
- **Developers and data contributors** can link their datasets and support product development,
- **Researchers, regulators, and advocacy groups** can engage with the data and develop impactful uses of OpenGrid's offerings,
- **Partners and funders** can back OpenGrid financially and help govern it alongside contributors and users, the three stakeholder groups represented in its charter.

To receive occasional updates from OpenGrid, sign up for our Substack mailing list [here](#). Contributors may also want to join our Zulip or monitor our GitHub for product releases.

Building OpenGrid will take all of us. Join us now and help set the direction from the start.

Plan the grid, together.

¹ International Energy Agency, "Global electricity demand is set to grow strongly to 2030, underscoring need for investments in grids and flexibility" (2026). [iea.org/news/global-electricity-demand-is-set-to-grow-strongly-to-2030](https://www.iea.org/news/global-electricity-demand-is-set-to-grow-strongly-to-2030)

² International Energy Agency, "Lack of ambition and attention risks making electricity grids the weak link in clean energy transitions" (2023). [iea.org/news/lack-of-ambition-and-attention-risks-making-electricity-grids-the-weak-link-in-clean-energy-transitions](https://www.iea.org/news/lack-of-ambition-and-attention-risks-making-electricity-grids-the-weak-link-in-clean-energy-transitions)

³ Austrian Power Grid, "Zusammen 2040" (n.d.), <https://www.apg.at/projekte/zusammen-2040/> ; <https://www.apg.at/projekte/zusammen-2040/> ; Open Energy Transition and ENTSO-E, "Open-TYNDP" (2026), <https://open-tyndp.openenergytransition.org/>

⁴ Linux Foundation Energy, *The Open Source Value Proposition for the Energy Sector* (2026): <https://www.linuxfoundation.org/press/lf-energy-research-finds-open-source-software-can-deliver-2-5x-greater-net-value-for-grid-operators>

⁵ International Renewable Energy Agency, *Renewable Power Generation Costs in 2024* (2025), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Jul/IRENA_TEC_RPGC_in_2024_2025.pdf

⁶ International Energy Agency, *Electricity Grids and Secure Energy Transitions* (2023), <https://www.iea.org/reports/electricity-grids-and-secure-energy-transitions>

⁷ Lawrence Berkeley National Laboratory, *Queued Up: 2026 Edition, Characteristics of Power Plants Seeking Transmission Interconnection* (2026), <https://emp.lbl.gov/publications/queued-2026-edition-characteristics>

⁸ Bloomberg, "India Wasted 11% of Solar Power During Record Summer Demand," (July 2026), <https://www.bloomberg.com/news/articles/2026-07-29/india-s-grid-curtailed-11-of-solar-power-during-heat-wave>

⁹ BCG analysis (2026) estimated that there are <1000 logos using commercial modeling software out of 16,000+ potential users. Estimates include North America, Europe and APAC; excludes policymakers, civil society, etc.

¹⁰ Boston Consulting Group analysis for OpenGrid (2026), comparing multi-user enterprise license cost to average energy modeler salary by country.

¹¹ OpenGrid user research, 2026: interviews with 70+ individuals across 46 organizations in 13 countries.

¹² International Renewable Energy Agency and Climate Policy Initiative, *Global Landscape of Energy Transition Finance 2025* (2025), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Nov/IRENA_CPI_FIN_Global_landscape_energy_transition_finance_2025.pdf

¹³ International Energy Agency, *Electricity 2026* (2026), <https://www.iea.org/reports/electricity-2026/executive-summary>