

Unlocking Flexibility Without Curtailment

*How Piq's agentic grid planning
platform helped Base Power
prove the value of its distributed
battery fleet in ERCOT*

Executive Summary

Data centers are driving the fastest growth in U.S. electricity demand in decades, but long grid interconnection timelines mean these loads are struggling to access firm power connections.

Base Power, a home battery manufacturer, developer, and operator based in Texas, believes its fleet of over 1 GW of battery energy storage can unlock such firm connections. Base Power's residential batteries represent the fastest deployment of energy storage on the grid. Yet while these batteries could be rapidly installed to address potential grid constraints and accelerate grid interconnections without requiring curtailment, a lack of analysis and clear market rules is limiting their impact today.

To help shape ERCOT's final rules for the ADER (aggregated distributed energy resources) Pilot Project Phase IV, Base Power needed a bespoke analysis that could map its distribution-level fleet of over 20,000 battery sites and analyze their ability to resolve real constraints across ERCOT's transmission grid.

This type of study had rarely been done before and never within the time frame to meet ERCOT implementation timeline.

Designed decades ago, traditional grid planning systems are ill-equipped to handle the complexity of novel grid technologies like aggregate DERs. Using traditional grid planning tools and methodologies, this analysis would take months of labor from specialized power system engineering consultants. **Using Piq Energy's agentic grid planning platform, Base Power got results in just a few days.** In a recently published [white paper](#), Base Power and Piq Energy showed that at one Fort Worth-area substation, just 81.5 MW of battery dispatch could resolve all 8 constraints introduced by a new 100 MW load.

The result is a template not just for Base Power and ADER, but for any grid solution that needs fast, rigorous analysis to unlock power and accelerate interconnection.

Piq Compresses Grid Study Timelines



Context

Today's electric grid is constrained. Demand for power, largely driven by AI data centers, is surging at rates not seen in over 60 years.¹ Yet, today's grid is struggling to manage the capacity required to supply these data centers with firm power.

A firm power connection means the load is always guaranteed access to power. This type of connection is almost always required for data center operations.

A non-firm power connection means the load may be asked to curtail during times of grid stress.

Traditional solutions for unlocking firm connections, such as upgrading transmission lines or even constructing new lines, are increasingly expensive and their 5-10 year development timelines are misaligned with the grid's needs today. Introducing flexibility on the grid through innovative solutions has become one of the leading alternatives to unlock power, often offering the fastest and most cost effective path to firm capacity.

Federal regulators are pushing in the same direction: FERC Orders No. 2023 and 1920 now require grid planners to consider some of these flexible solutions, such as grid-enhancing technologies (GETs), in generator interconnection studies and long-term transmission planning, respectively. While ERCOT is not subject to these orders, they signal a broader shift toward solutions that make better use of existing infrastructure.

As one of the fastest growing home battery manufacturers, developers, and operators in Texas, Base Power is well positioned to provide grid flexibility to unlock power. Base Power offers heavily discounted residential batteries and, in exchange, manages the devices to provide power to the grid when needed, while still preserving backup power for the households. As a recent report from The Brattle Group demonstrates, these residentially sited batteries can provide significant value to the grid—up to 66% more value than utility-scale transmission sited batteries.² Given its popularity and rapid growth, Base Power's fleet is now approaching over 1 GWh, distributed across over 20,000 sites throughout ERCOT, and is growing by roughly 2 MW per day.

Base Power's offering is a form of an increasingly popular grid flexibility solution: aggregated distributed energy resources (ADERs). These ADER solutions can include smart thermostat fleet management, managed EV charging networks, and commercial demand response aggregations.

While Base Power's batteries and other ADERs can provide power to the grid today, their value is still not fully recognized. There is a missed opportunity to collectively use these assets to unlock firm power connections. ADERs can be rapidly installed to specifically target expected constraints that a new load would introduce on the system. By preemptively addressing these constraints, ADERs can accelerate that load's interconnection and help avoid costly grid upgrades that would risk increasing costs for other ratepayers.

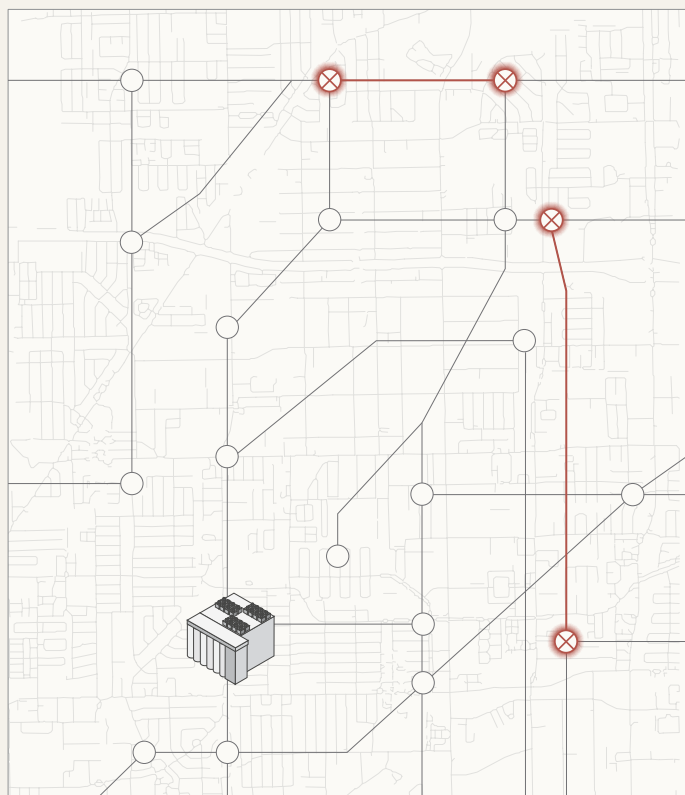
¹ *Power Demand Forecasts Revised Up for Third Year Running, Led by Data Centers*, Grid Strategies, November 2025.

² *Valuing Distributed Batteries: Benefits of an Emerging Deployment Model*, The Brattle Group, October 2026.

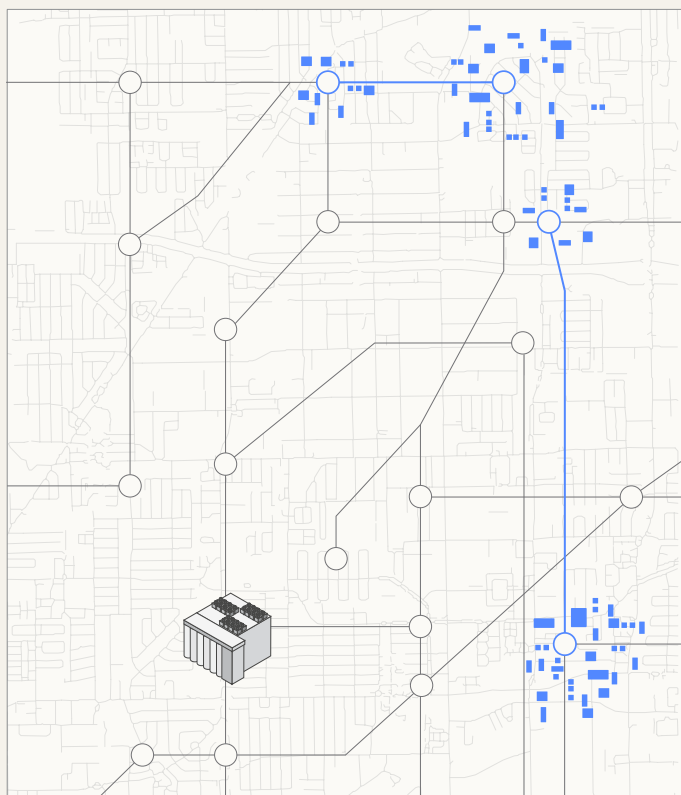
ERCOT sets rules for these resources through its ADER Pilot Project, which was launched in 2023. Phase IV of the pilot is set to launch later this year, and will consider how these distribution-connected resources can be effectively aggregated and dispatched at the nodal level to manage transmission constraints. Ahead of that launch, ERCOT opened a comment period to help shape the final rules. Base Power had just a few weeks to submit those comments.

Before an RTO like ERCOT would consider recognizing distributed batteries as a transmission-level resource for reliability purposes, Base Power needed to answer a foundational question: **can a fleet of distribution-level residential batteries actually be deployed and coordinated for the benefit of the transmission system, at the scale and reliability a transmission-connected load like a data center would need?**

ADERs Can Solve Grid Constraints



Before



After

Challenge

Base Power needed a credible, reviewable analysis within **just a few days** to inform discussions about ERCOT's ADER pilot. Answering whether its distributed batteries could be used for the benefit of the transmission system meant determining where the batteries would be effective, which resources to use, and how much flexibility was needed. Such an analysis **could take months** of dedicated work by specialized power system engineering consultants.

To understand why, consider the complexity inherent in the process to run a conventional grid expansion planning study:

- **Prepare consistent datasets and models:**

Gather network cases, project assumptions, resource information, and study criteria; reconcile differences and prepare the study cases.

- **Identify and analyze constraints:**

Compare conditions with and without the proposed resource (injection or withdrawal), screen for material impacts, and investigate the causes of the relevant violations (e.g., overloads, limits due to contingencies, voltage stability).

- **Develop candidate mitigations:**

Translate identified constraints into potential solutions, including network upgrades, operating changes, and flexible resources. Such solutions could include: new lines, new parallel lines, reconductoring, topology changes, curtailment criteria, special protection schemes, GETs, among others.

- **Select and optimize mitigations:**

Determine which measures to use and by how much. Existing simulation and dispatch-optimization capabilities still require suitable candidate resources, controls, limits, and objectives to be represented in the analysis and the network models.

- **Evaluate combinations and tradeoffs:**

Consider whether a combination of solutions offers a better solution than any single technology. Compare effectiveness, resource requirements, cost, and implementation time where supporting data exists.

- **Validate and iterate:**

Check that mitigations address the relevant constraints without creating new violations; revise the proposed solution and rerun the analysis as needed.

- **Maintain consistency and prepare the report:**

Track assumptions, model versions, and results across tools and iterations, then assemble a clear, reviewable account of the findings.

Much of the grid study process is not spent running the actual power system simulations, but rather is dedicated to the work surrounding them. These steps often span separate files, scripts, and applications, meaning engineers spend considerable time moving data, reconciling assumptions, and checking that results correspond to the right model.

While established planning software does support some scripting and batch execution, engineers often need to cobble together custom workarounds and scripts to connect disparate pieces into a complete study. Those custom solutions are often tightly coupled to particular datasets, software versions, or an individual engineer's setup and experience, making them fragile when inputs change and difficult for colleagues to share, understand, and reuse.

When a study is scoped properly and all inputs are readily available, this process can take roughly a week or two. But as studies become more ambitious and complex, the process does not scale. A single revision can trigger another round of analysis, meaning another week manually updating, reconciling, and verifying results across tools. **This conventional approach is slow to repeat and vulnerable to errors, even for the most straightforward analyses.** As the grid grows more complex, these workflows are a major driver of lengthening study timelines.

Base Power's analysis was far from straightforward. It introduced two significant challenges:

Novel Technologies:

ADERs are a new grid solution, so they are not considered in original network models. This means engineers must define and represent those missing ADER capabilities, then evaluate their location, size, and operations across different system conditions.

Scale:

Resolving constraints means evaluating many possible combinations of solutions, along with their interactions and tradeoffs. Base Power's fleet spans over 20,000 sites, aggregating to hundreds of transmission nodes. Each additional location adds options for relieving constraints but also multiplies the combinations to evaluate. Benefits can also diminish as more resources are added and a resource that cannot resolve every constraint on its own may still be essential to an effective combination.

However, today's grid planning systems are ill-equipped to handle this complexity. The power system modeling software tools and methodologies widely used today were developed decades ago when the grid was more centralized, more predictable, and moved more slowly. But as the grid has evolved and become more distributed, more variable, and more constrained, these tools have remained fundamentally unchanged. The discrepancy between the grid the tools were designed to study and the grid they are asked to study today has led to ever growing grid study timelines and ballooning interconnection queues.

Legacy systems hit novel solutions hardest. Solutions like Base Power's ADERs are the hardest to study and, therefore, the most delayed by slow studies. Because these solutions can be deployed so rapidly, grid studies that take months have become the main bottleneck to energizing a resource that could otherwise have been connected in weeks. **Anyone who is actively deploying novel solutions is constrained by how fast they can study the grid, whether to communicate the value of their solutions or to find suitable points of interconnection.**

Base Power therefore needed a way to evaluate many possible portfolios quickly while preserving the rigor required for engineering review. Meeting its deadline called for a connected, repeatable workflow that could carry the analysis from network data through resource selection to results.

THE OLD GRID

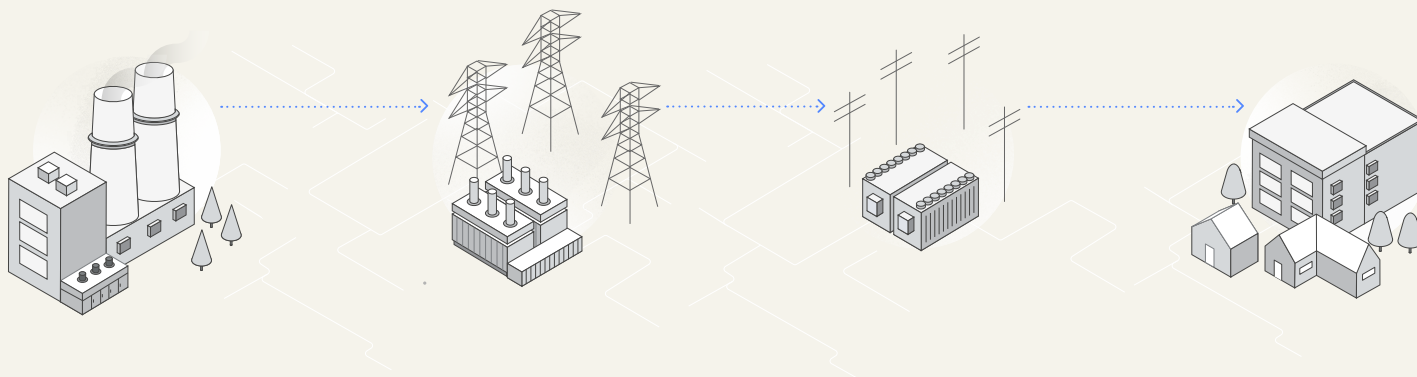
One way flow. Fewer resources. A simpler system.

CENTRAL GENERATION

TRANSMISSION SYSTEM

DISTRIBUTION SYSTEM

END USES



TODAY'S GRID

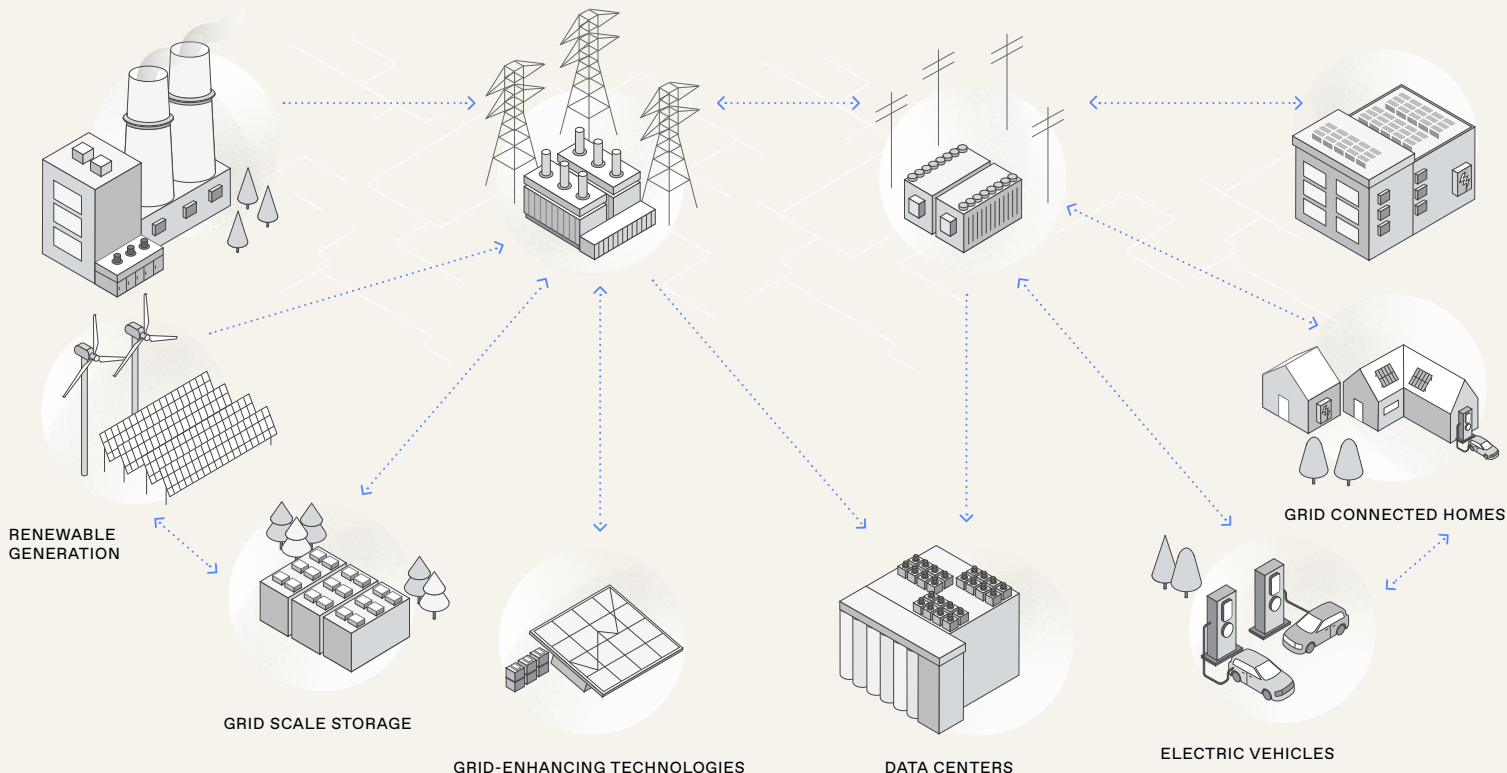
Bidirectional flows. Many resources. A more complex system.

CENTRAL GENERATION

TRANSMISSION SYSTEM

DISTRIBUTION SYSTEM

FLEXIBLE LARGE LOADS



Solution

Piq Energy's agentic grid planning platform is designed to unlock the grid by handling exactly this kind of complexity.

Base Power partnered with Piq Energy to conduct an independent study to evaluate the transmission benefit of Base Power's distribution-connected batteries. Piq's agentic platform leverages deterministic workflows verified by Piq's expert team of power system engineers. These deterministic workflows run on trusted simulation engines, connecting network data and engineering workflows in a single, repeatable process. Its consolidated data infrastructure gives engineers a consistent foundation for building study datasets, and each result can be traced to the inputs and workflow configuration that produced it, supporting review and iteration.

By combining this agentic platform with deep human power system expertise, Piq handles the time-consuming parts of each study, allowing engineers to focus on solving the hardest problems on the grid.

For Base Power, the team incorporated candidate resources at 513 locations across the Oncor footprint, with modeled flexibility of 2 to 45 MW per location. These resources were not explicitly represented in the original network cases. The workflow then identified which resources to use and optimized their charging or discharging for each contingency. In practice, some batteries absorb power while others supply it, shifting flows away from overloaded lines.

BURLESON SWITCH (100 MW and 200 MW cases)

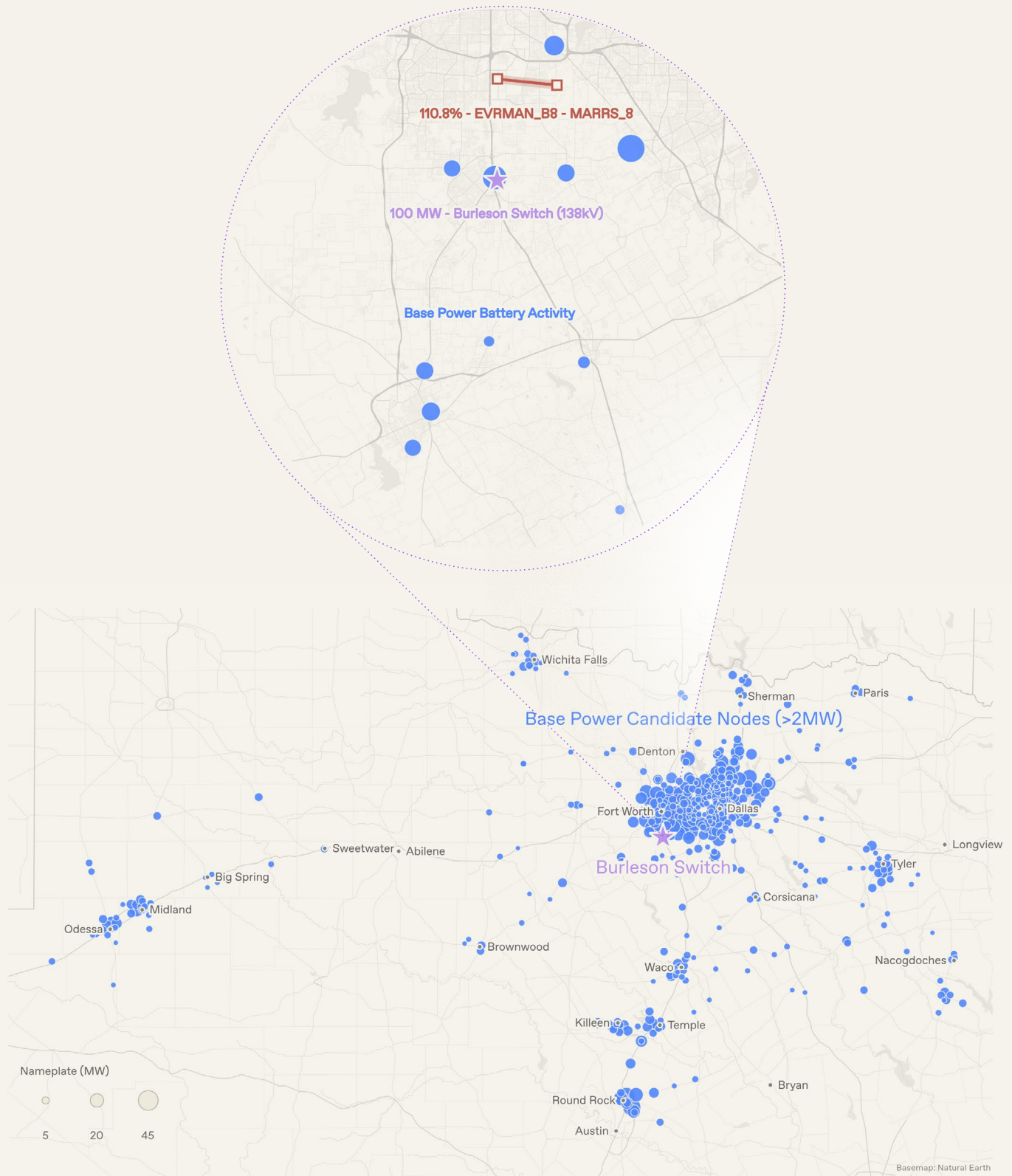
In the study, Piq considers how a fleet of ADERs could relieve constraints imposed by a new load added to a specific point of interconnection (POI) in ERCOT, the Burleson Switch outside Fort Worth. These constraints refer to the specific facilities that become overloaded under a specific contingency event. Adding 100 MW of load at this POI would introduce 8 thermal constraints across five transmission facilities. Coordinated dispatch across 11 locations resolved all 8, requiring approximately 81.5 MW of battery dispatch to unlock a firm connection.³

The study goes further, showing how a 200 MW load would introduce 30 grid-related constraints. Efficiently addressing these constraints (i.e., using the fewest ADERs to address the most constraints) would require 296.3 MW of battery dispatch, resolving 25 of 30 constraints. Completely addressing all 30 constraints using only ADERs would require 1,245.5 MW of battery dispatch. That sharp increase shows the inflection point, where adding more batteries brings diminishing returns and where complementary solutions may merit investigation. The full study and results are available in the [technical white paper](#).

³ Dispatch totals include both charging and discharging, with the modeled fleet kept approximately balanced. Results address transmission thermal constraints; additional voltage, stability, and operational assessments would be required before implementation.



Piq Study Results: Burleson Switch 100 MW



512 of 528 candidate nodes > 2 MW shown (4,194 of 4,295 MW). 1 node lies off-frame in South Texas; 15 have no catalogue coordinates.

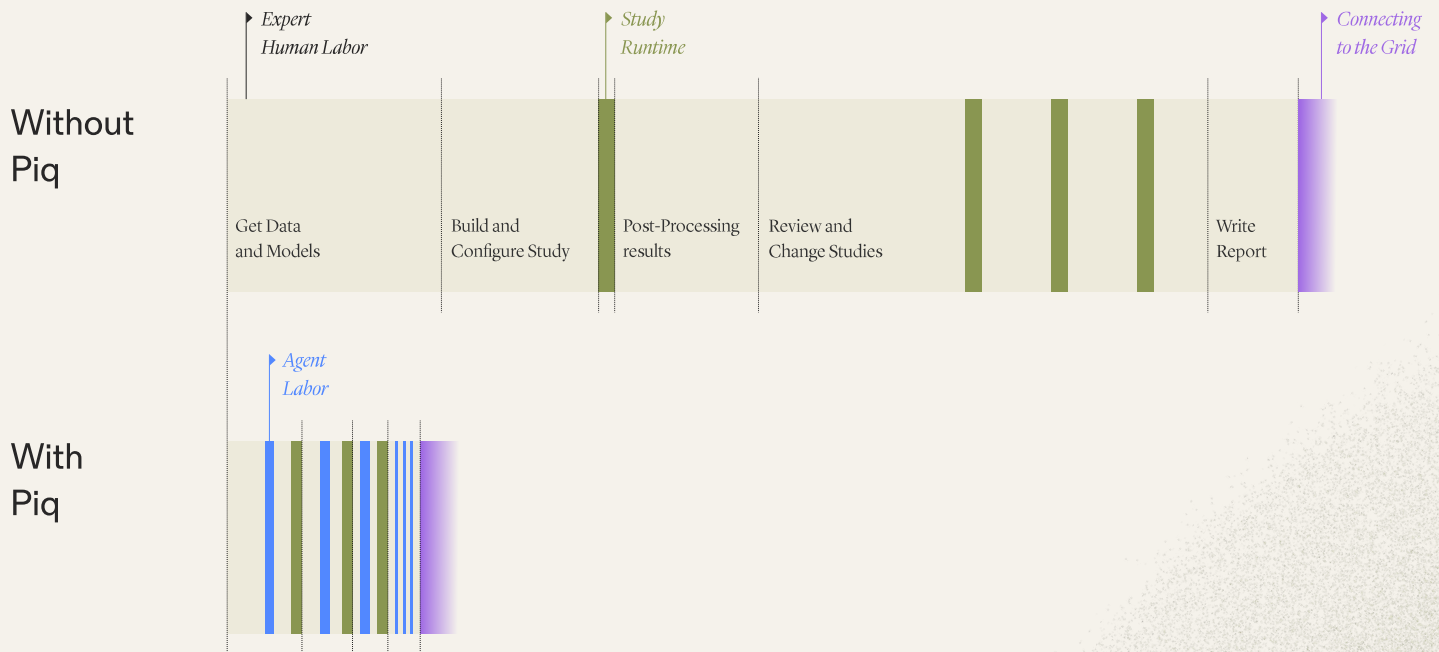
The study shows how a fleet of distribution-connected batteries can resolve transmission-level constraints just as directly as curtailing the load itself. As Base Power has noted, generating and delivering more energy at ~\$40/MWh is more economic than using less energy at a cost of ~\$40,000/MWh.⁴ This was exactly the detailed evidence Base Power needed to show ERCOT that ADER flexibility is a legitimate solution to avoid data center curtailment.

Piq compressed a process that could otherwise require months of specialized power system engineering work into just a few days end-to-end, including reviewing results, rerunning scenarios, and writing the final report. By rapidly running studies, engineers evaluated different load sizes and Base Power portfolios using

the same deterministic workflow. This made it practical to move beyond a single result and compare how resource requirements and constraint relief changed across scenarios. Within its deadline, Base Power gained a clearer basis for exploring where its batteries could help and which constraints needed further investigation.

Before Piq, running a study of this magnitude would have been infeasible within Base Power's timeline. Not only would such a study have demanded a significant commitment of financial and personnel resources, but the required timeline simply would not have met Base Power's goals. Piq's agentic grid planning platform makes these complex grid studies achievable for Base Power—and everyone else looking to study novel grid technologies, from other flexibility solution providers to electric utilities.

Piq Compresses Grid Study Timelines



⁴ What's happening in Texas can help solve the capacity crunch: ADER Phase IV, Base Power, September 2026.

Conclusion

Base Power partnered with Piq to demonstrate that its fleet of distribution-connected batteries could resolve transmission-level constraints. This insight was crucial in communicating how ERCOT could use Base Power's distributed assets to unlock capacity and move assets faster through its interconnection queue. Piq's agentic grid planning platform screened tens of thousands of contingencies and searched hundreds of possible battery locations to arrive at those results. Because the analysis ran through a connected, repeatable workflow, each result could be traced back to its inputs and reviewed.

This pace and depth of analysis would have taken months for power system consultants using traditional grid planning systems, but Piq was able to produce results in just a few days.

This is the broader shift Piq is built for. Grid planning tools and methodologies widely used today were designed for a grid that no longer exists: a grid that was simpler, more centralized, and far slower moving. But as the grid has become more distributed, variable and faster moving, it has also become more constrained, making it harder than ever to run the complex grid studies that unlock power. Now, the delays from these outdated tools have turned from a minor inconvenience into the primary constraint.

Today, grid studies are the limiting factor for how quickly new loads can interconnect, innovative grid technologies can be deployed, and novel flexibility solutions can be adopted.

While grid studies are constraining the grid today, they can become a key catalyzing force for the grid of tomorrow. Just as distributed batteries require more advanced grid studies, so will other novel solutions such as grid-enhancing technologies, flexible compute solutions, and other flexibility arrangements. Give those solution providers access to fast and powerful grid studies, and it can catalyze the pathway to interconnection. **Finding the right site becomes possible. Making the case for flexibility and reliability to grid planners becomes possible. Unlocking power faster becomes possible.**

This is what Piq's agentic grid planning platform is built to do: unlock the grid.



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