A Smarter Way: A Resilient, Proven, and Inevitable Energy Future for Santa Fe County

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I. Executive Summary: The Urgent Case for a New Model

The three most pressing issues facing the U.S. electric power transmission and distribution system are **aging and inadequate infrastructure**, **complex and slow permitting processes**, and the **need to adapt to new loads and generation sources**. Aging equipment, like transformers, is vulnerable to failure, while the system struggles to handle new demands from electrification and large facilities like data centers. Simultaneously, building new infrastructure is hampered by complex regulations and local opposition.

Aging and inadequate infrastructure

- **Aging equipment:** A significant portion of the grid's components, such as power transformers, are over 25 years old and more prone to failure, increasing the risk of widespread outages.
- **Outdated design:** Much of the existing infrastructure was built for a different era and lacks the capacity to handle the increased loads from modern energy demands and new renewable sources.

Complex and slow permitting processes

- **Regulatory hurdles:** Building new transmission lines is complicated by a complex web of federal, state, and local permitting requirements, which can take years to navigate.
- **Local resistance:** Strong local opposition to new infrastructure projects, particularly for large projects, creates significant delays and challenges for utilities.

Adapting to new loads and generation sources

- **Increasing demand:** The grid is under immense pressure to meet growing electricity demand from economic growth, including data centers and manufacturing, as well as from the push for economy-wide electrification.
- **Renewable integration:** The system must be modernized to connect and deliver power from new renewable energy sources, like wind and solar, to where it's needed, which is a major challenge for the existing transmission and distribution networks.
- **Ad-hoc approach to renewable projects:** Lack of planning and the response to marketplace needs leads to the introduction of large, utility -scale renewable

projects that don't necessarily address the future needs of the surrounding communities. These Ad-hoc projects consume the available resources of the renewable industries and hamper the ability of local communities to respond.

The Proven Solution: Transition from a theoretical "concept" to a proven, implemented strategy: the **Hybrid Smart Grid**, combining federated **Virtual Power Plants (VPPs)** with a safely-sited **Santa Fe County Energy Park**.

II. The Core Concept: A Distributed, Federated, and Hybrid Smart Grid

The foundation of a resilient energy future for Santa Fe County is the transition from our current, monolithic grid to a Smart Electric Grid. This model is not based on a single new technology but on combining proven concepts: a smart grid built on micro-grids, a hierarchical structure, centralized management, and supplemental bulk-energy capabilities.

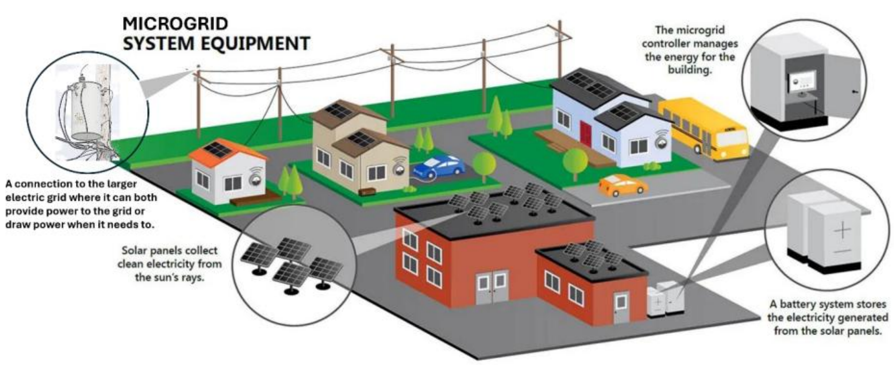
This system is defined by its three primary characteristics: it is **distributed**, **federated**, and **hybrid**.

A. Distributed: The "Smart Node"

The Smart Electric Grid is, by its nature, distributed. It is composed of "nodes," which are the specific consumer or producer end-points within the network. These nodes not only consume and produce electricity, but also information.

- **Standard Nodes:** In a purely traditional grid, customers are "standard nodes," meaning they are completely dependent on the provider's electric distribution system.
- **Smart Nodes:** The new model is built on "Smart Nodes". A Smart Node is a customer who can also **generate their own electricity** (e.g., solar panels), **store that energy** (e.g., batteries), provide **real-time data** about usage, and allow the provider's energy management system to control parts of its node. As shown in the "A Smart Node" diagram, this includes components like Solar Panels, a Node Solar Power Module, Node Battery Energy Storage, and a Node IP Address for communication.

A Smart Node:



This distributed model achieves its goals by joining, or "federating," energy produced by small consumers (like residences) with energy produced by larger consumers (like communities or towns).

B. Federated: From Micro-grids to Federations

These individual nodes are then grouped into a hierarchical structure.

- Level 1: Micro-grids (Distributed Networks)

Nodes are grouped within a community, building, or circuit to form "micro-grids". A micro-grid is a smaller-scale power system that can generate, distribute, and manage electricity on its own. They are a key technology for achieving 100% renewable energy and are defined as collections of generation sources, storage, two-way communication, and a control center.

- Level 2: Federations

Groups of micro-grids are then pooled into "federations". These federations can be organized within geopolitical boundaries like regions, cities, or counties, and may have unique power distribution requirements. For example, cities' and towns' power requirements are typically different than those that agricultural or Native Land federations may require. Other forms of Federation could include Rural and Low-income and communities subject to seasonal wildfires. Federation of micro-grids allows the smart grid manager to coordinate control at a larger scale than micro-grid by micro-grid. This federated approach allows a smart grid manager to coordinate control on a larger scale.

C. Hybrid: Combining Distributed and Bulk Energy

An effective Smart Electric Grid is "hybrid". It does not rely only on a distributed network. It combines this new federated system with the traditional "bulk components" needed to support the baseline grid, such as distribution lines and utility-scale generation elements. This hybrid model blends traditional grid infrastructure with modern digital technologies, allowing for better integration of renewables, improved efficiency, and enhanced reliability.

It will also require four other elements to fully realize the County's vision for renewable energy:

• **Interconnection to the New Mexico electric grid** - includes oversight by the New Mexico Public Regulation Commission (PRC), agreements with existing providers like Public Service Company of NM (PNM) or any of the providers and co-ops, and the ability to clearly distinguish renewable and fossil-fuel generation sources.

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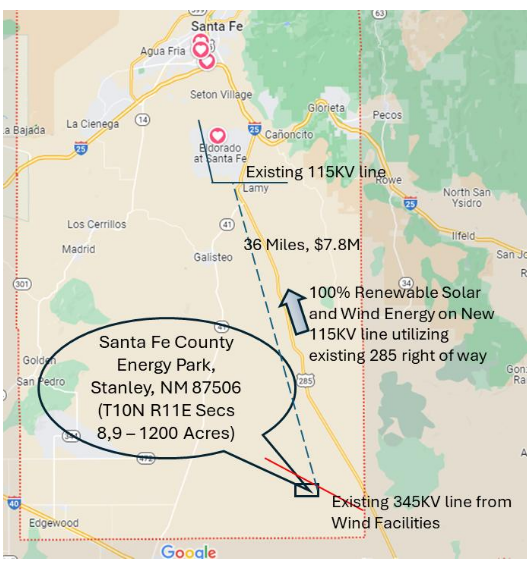
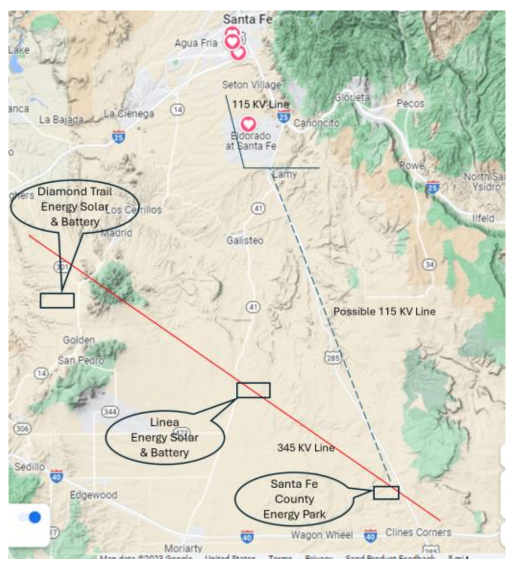
• **Utility-scale or bulk renewable energy generation and storage capability** - To close gaps that occur when energy demand exceeds the energy generated on the electric grid.

• **Bulk energy delivery to micro-grids** - The ability to transmit substantial amounts of energy (bulk energy) to the federations and distributed networks within the electric grid.

• **Fail-over capability** - A County-wide ability to transfer operations smoothly and quickly from centralized energy management to control by means of micro-grids and/or Smart Nodes in case of a failure or disruption to the primary grid.

The 2024 CEC concept papers introduced the idea of the **Santa Fe County Energy Park** for Bulk Energy production. This idea has become even more useful in that the location of the Energy Park not only cross cuts the 345 KV existing line and adjoins the 285 right-of-way, it also already has the necessary sub-station in place making the designated land already in use for energy production. The juxtaposition of the Energy Park to the proposed Linea Solar and Battery storage facility and the proposed Diamond Trail Solar and Battery Storage facility and the ties to the existing 345 KV and the link to the 115 KV would create a significant energy corridor of upwards of 3 GW of AC and Battery Storage. Maintaining energy production along this corridor eliminates the need to "pepper" the County open spaces with additional Bulk Energy Sites and will help to preserve the open spaces within the County.





III. Case Studies: From Proven Concept to Scaled Reality

The 2024 CEC concept papers cited two key examples: the federated recovery in Puerto Rico and the hybrid grid in Mueller, TX. In 2025, these concepts are no longer just models; they are a scaled reality, best demonstrated by the success of Virtual Power Plants (VPPs). A VPP is the functional, market-based term for a "federated" network of "smart nodes."

- 1. Original Model (Puerto Rico): The 2017 hurricane that ravaged Puerto Rico's grid prompted a federally-funded effort to create **Federated and Distributed Solar Microgrids**. The plan included large federated microgrids for Vieques (12.5 MW) and Culebra (3 MW), as well as a 17-megawatt VPP designed to network 7,000 home solar-plus-battery systems.
    - **2025 Success:** As of July 2025, that VPP concept is a massive success. Sunrun, the VPP operator, is now dispatching **over 37,000 home batteries** to support Puerto Rico's grid. The utility (LUMA) anticipates over 75 energy shortfall events between July and October 2025. In response, the VPP is acting as a single, dispatchable power plant, helping to address generation shortfalls of **nearly 50 MW** and "preventing multiple load shedding events" (i.e., rolling blackouts).
- 2. Original Model (Mueller, TX): The Mueller Neighborhood's SHINES project illustrates the hybrid model. It integrates 2 MW of rooftop solar panels with a **1.5 MW / 3.2 MWh bulk lithium-ion battery**. Crucially, it "does not meet the power requirements of the neighborhood," so it "integrates with the existing electric grid" for fallback capability. This project demonstrated how a hybrid system could use a bulk battery for "energy arbitrage" - storing cheap power at night and selling solar power during expensive peak hours.
    - **2025 Success:** The concept is now mainstream. In 2024, Sunrun's VPPs alone supported U.S. grids with a combined peak of **nearly 80 megawatts**—more capacity than many traditional fossil-fuel peaker plants. This was sourced from over **20,000 customers** across 16 programs. In California, Sunrun's "CalReady" VPP, with over 16,000 homes, delivered a peak of **54 MW** in 2024. In 2025, that single VPP has quadrupled to **75,000 homes** and is expected to deliver **375 MW** of peak capacity.

- 3. New Model (Policy): California's DSGS Program

This is no longer just a private-sector effort. In August 2023, California launched the "Demand Side Grid Support" (DSGS) program, creating what is now considered the world's largest VPP.

    - As of late 2024, the program had enrolled **37,558 customers** representing **288 MW** of capacity.
    - By August 2025, enrollment had surged to **over 720 MW** of customer battery capacity, with dispatchable capacity exceeding **400 MW** during grid events.
    - A recent Brattle Group study confirmed its financial value: every **$1** invested in the program saves ratepayers **$2** by avoiding the need for new, expensive gas plants.

- 4. New Model (Resilience): The NC "Beehive Microgrid"

The federated model's value for resilience, as proposed for Puerto Rico, is now being implemented in North Carolina. Following the devastation of Hurricane Helene in September 2024, a $5 million grant was funded by the NC State Energy Office (using federal Infrastructure Investment & Jobs Act funds) to create the "Beehive Microgrid" project.

    - **The "Hives":** The project will build up to **24 stationary microgrids** at critical facilities (fire stations, food banks) in the six counties most affected by the hurricane.
    - **The "Bees":** It will also create **two mobile microgrid hubs**—trailers with portable solar and batteries—that can be dispatched to disaster areas as needed and then return to the "hives" to recharge.
    - This project perfectly demonstrates the CEC's federated concept, providing a tangible, community-focused, and shareable resilience network.

IV. The Inevitability Argument: Why the Distributed Model is the Only Path Forward

The transition to a Hybrid Smart Grid is not just a strategic choice; it is an economic and physical necessity. The traditional, centralized grid model that served us for the 20th century is becoming financially and operationally unsustainable. This reality creates a powerful "push" away from the old model, while the clear advantages of the distributed model create an irresistible "pull" toward this new future.

A. The "Push": The Failure of the Centralized-Only Model

Our current grid is a marvel of engineering, but it is rigid, aging, and being overwhelmed by 21st-century demands.

- **Vulnerability:** The centralized model, which relies on a few large power plants and thousands of miles of long-distance transmission lines, is defined by **single points of failure**. As we've seen nationwide, a single wildfire, ice storm, or physical attack can sever these lines, plunging entire regions into darkness. The economic cost of these weather-related outages alone runs into billions of dollars annually.
- **Inflexibility:** The grid is straining under massive, unforeseen load growth. New demands from **AI data centers and the widespread electrification of vehicles and buildings** are creating demand spikes that the old system was never designed to handle.
- **Inefficiency & Cost:** This model is now failing the most basic cost-benefit test. It is incredibly **slow and expensive** to build new, large-scale transmission lines to meet this new demand. Furthermore, pushing all power from a central plant over hundreds of miles results in significant **energy loss** from transmission, a fundamental inefficiency that consumers are forced to pay for.

B. The "Pull": The Strengths of the Distributed Model

The distributed, federated model directly solves the failures of the centralized system. It is not just an alternative; it is a superior solution.

- **Resilience:** A distributed grid is built from the **"bottom-up"**. It has no single point of failure. If the main transmission line goes down, a community "micro-grid" can "island" itself and continue to operate, keeping critical services online. This creates a level of local resilience that is impossible in the old model.

- **Scalability & Speed:** This is perhaps its greatest strength. A utility cannot build half a power plant, but a distributed grid can be **built gradually, node by node, and community by community**. A Virtual Power Plant can be aggregated and deployed in **under 12 months** to meet new demand, while a new gas peaker plant or large-scale transmission project takes many years of planning and construction.
- **Consumer-Driven:** The distributed model changes the fundamental relationship between the utility and the customer. It empowers homeowners and businesses to become **"prosumers"** (producer-consumers). They are no longer just passive ratepayers; they are active participants who can be paid for sharing their stored energy, helping to stabilize the grid while also accelerating their own return on investment.

V. The Financial Case: A Shift from Public Cost to Public-Private Investment

- A. The Market-Driven Model (VPPs): Investment-Worthy & Profitable
  - Cheaper than Alternatives: A VPP costs utilities half as much as a new natural gas peaker plant or utility-scale battery.
  - System-Wide Savings: VPPs save all ratepayers (even non-participants) by reducing the need for expensive infrastructure builds (a 60 GW VPP could save $15-$35 billion nationally).
  - Direct ROI: Homeowners are paid for their participation, accelerating their own ROI on solar and batteries.
- B. The Resilience-Driven Model (Community Microgrids): Securing Public Grants
  - ROI as Cost Avoidance: The value is measured in "avoided downtime" for critical infrastructure (hospitals, fire stations) during outages.
  - New Federal Funding: The Public Partnership can lead efforts to secure grants specifically for this purpose.
  - Example: The NC "Beehive" project, funded by $5M from the federal Infrastructure Investment & Jobs Act.
  - Example: The DOE's "Community Microgrid Assistance Partnership" (C-MAP), which is actively funding rural and tribal microgrid projects in the Southwest.

VI. Addressing Key Hurdles: A Plan for Policy, Regulation, and Equity

- A. Political & Regulatory Hurdles (The "How-To")
  - **The NM Public Regulation Commission (PRC):**
    - Hurdle: The PRC must approve all utility plans and rates; utilities are biased toward self-owned, centralized assets.
    - Mitigation (Partnership, not Protest): Formally intervene in the PRC's **Grid Modernization Docket (22-00089-UT)**. Frame the VPP network as a cost-saving **"Non-Wires Alternative"** that the PRC's own draft rules are designed to encourage.
    - Mitigation (Legislative Action): Champion the re-introduction of the 2025 **"Power Up New Mexico" bill (HB 13)**, which provides a state-level mandate for VPPs.
  - **The Renewable Energy Transmission Authority (RETA):**
    - Role: RETA is not a hurdle for the local network, but a *potential partner* for the bulk component. They will still have to be engaged to develop that partnership. This is a significant departure from RETA's current view for the future.
    - Mitigation (Correct Engagement): Engage RETA *only* as a potential financing and development partner for the high-voltage transmission line needed to connect the **Santa Fe County Energy Park**.
  - **New Legal Pathways (The "Tailwind"):**
    - Use the new **Microgrid Law (HB 93)** as the explicit legal and regulatory path for PRC approval of the 20 MW+ Santa Fe County Energy Park, taking advantage of its 2035 "safe harbor" provision.
    - Use the **Community Solar Program (SB 84)** as the *proven precedent* for a successful, state-approved distributed energy model that works with utilities.
- B. Financial Threats (The "What If")
  - **Threat:** Pull-back of Federal Funding.

- Mitigation: Emphasize the **market-driven VPP model**, which is independently profitable by providing cost-effective grid services, making it a durable business model, not a grant-dependent project.
- Mitigation: Frame resilience hubs as **critical public safety infrastructure** (like a fire truck), justifying the use of county capital improvement funds or bonds, with grants serving as an *accelerant*, not a foundation.

- **Threat:** Push-back from Investor-Owned Utilities (IOUs).
  - Mitigation: Frame the VPP as a **"Non-Wires Alternative"**. It is a *cheaper resource* for the IOU to *purchase* peak capacity from than building a new gas plant.
  - Mitigation: Propose an explicit partnership model where the IOU can participate as the operator or primary beneficiary of the grid services, aligning their business model with county resilience goals.

- C. Societal Downsides (The "Who")
  - **Downside:** Risk of an "Energy Divide" (Equitable Participation).
    - Mitigation: Adopt the *exact* model from New Mexico's **Community Solar Program**, which *mandates* 30% of project capacity is reserved for low-income households.
    - Mitigation: Prioritize C-MAP and other grant funding to **fully subsidize** the initial "Community Resilience Hubs" in low-income, rural, and tribal communities.
    - Mitigation: Develop **"Community Smart Node"** (or Community Solar/Storage) models to allow residents (including renters) to "subscribe" and receive bill credits and resilience benefits with no upfront personal investment.

VII. A Phased Implementation Plan for Santa Fe County

- A. Phase 1: Immediate Jump-Start Actions (First 6-12 Months)
  - **Form a "Santa Fe County Smart Grid Task Force":**
    - Action: The County Commission, in partnership with the County Growth and Land Management leaders, should formally convene a task force[65].
    - Who: This group must include representatives from County emergency management, local utilities (PNM, etc.), tribal governments, and community groups like CEC.
    - Justification: This creates a single, official body responsible for the project, moving it from a "concept" to an active initiative. It directly follows the paper's recommendation for a collaborative approach.
  - **Launch a "Community Resilience Hub" Pilot Project:**
    - Action: Select 2-3 critical county or community-owned facilities (e.g., a rural fire station, a community center in Galisteo or Seton Village, or a key water pump station) to be the first "Smart Nodes".
    - What: Install solar and battery storage at these sites to create self-sufficient microgrids.
    - Justification: This is a small, tangible, and highly visible first win. It provides immediate resilience, serves as a real-world testbed for the technology, and acts as a "proof of concept" to build public and political support.
  - **Aggressively Pursue Federal Seed Funding:**
    - Action: The new Task Force's first priority should be to prepare and submit grant applications to new, highly relevant federal programs.
    - Target: Specifically, the **DOE's Community Microgrid Assistance Partnership (C-MAP)**, which is designed to fund *exactly* this type of planning and development in rural and tribal communities in the Southwest.

    - Justification: This leverages the new funding landscape we identified. Securing a federal grant would fund the initial planning, engineering, and pilot projects, removing the primary barrier (cost) and validating the approach.
  - **Initiate "Santa Fe County Energy Park" Zoning and Land Use Actions:**
    - Action: The County can begin the non-financial work on the Energy Park immediately. This includes formally identifying the 1,200 acres near Stanley in the Sustainable Land Development Code.
    - What: Begin the necessary studies and zoning changes to designate this land as a "Renewable Energy Generation & Storage Zone".
    - Justification: This is a low-cost policy action that "de-risks" the project for future private partners. It sends a clear market signal about *where* the county wants bulk infrastructure to go, reinforcing the core concept of siting it safely away from communities.
- B. Phase 2: Build the Distributed Network (The "Federation")
  - Establish policy to encourage "Smart Node" development (incentives, simple interconnection).
  - Partner with community centers, tribal governments, and local utilities to pilot community microgrids, using new federal grants (like C-MAP) as seed funding.
  - Use the pilot projects as a template to expand "Smart Node" and "Community Smart Node" development.
  - Create the **Santa Fe County Smart Energy Management Center (SEMC)**, using modern AI-driven platforms to manage the federated VPP network.
- C. Phase 3: Build the Bulk Component (The "Hybrid")
  - Re-affirm the **Santa Fe County Energy Park** as the sole location for new *bulk* BESS.
  - Leverage the "de-risked" zoning to solicit private partners for its construction, ensuring it is sited safely away from communities while connecting to existing high-voltage transmission lines.

- Purpose: To provide utility-scale renewable generation and, crucially, to co-locate large-scale Battery Energy Storage Systems (BESS) **safely away from communities**.
- Location: Re-propose the 1,200-acre site near Stanley, NM, citing its proximity to existing high-voltage lines and its safe distance from residential areas.

VIII. Conclusion: A Clear and Actionable Path Forward

- A. The Vision: The transition to a federated, hybrid smart grid is no longer a question of "if" but "when" and "how". The 2024 concept is now a proven, financially-sound, and necessary strategy being implemented across the nation. Santa Fe County has the opportunity to lead by adopting this model, enhancing resilience, reducing long-term costs, and securing a safe, reliable energy future.
- B. Immediate Calls to Action: To begin, the Santa Fe County Commission, in partnership with the CEC, should:
  - **Pass a "Smart Energy Future" County Resolution:**
    - Action: The County Commission should pass a resolution that formally adopts the "hybrid smart grid" as the county's official energy strategy.
    - Content: The resolution would state the County's commitment to prioritizing distributed "Smart Nodes" and federated microgrids, while directing that all new bulk storage be sited in the designated (and remote) Energy Park.
    - Justification: This provides clear, top-down political support and a guiding principle for all future energy-related decisions, aligning policy with the Sustainable Land Development Code.
  - **Host a "Santa Fe County Energy Future Summit":**
    - Action: The County and the CEC should co-host a public summit for citizens, local leaders, and potential private-sector partners.
    - Purpose: To present this updated, proven model, showcasing the successful VPP and community microgrid case studies (like in California and North Carolina).
    - Justification: This will shift the public narrative, build consensus, and formally invite private industry (like VPP aggregators) to the table.
  - **Issue a Formal Request for Information (RFI):**
    - Action: The County should issue a formal RFI to the energy industry.

- Purpose: To solicit concrete, innovative proposals and partnership models for financing, building, and operating both the distributed VPP network and the utility-scale Energy Park.
- Justification: This leverages the concept of shared responsibility and uses market competition to find the most innovative and cost-effective solutions, rather than having the County invent the solution itself.