ADVANCED ENERGY UNITED

Energy Industry Macro Trends

Building an Advanced Energy Ecosystem in New Mexico

September 23, 2024

Advanced Energy United

We are the association of businesses united in our mission to achieve 100% clean energy in America

We provide:

- ✓ **Credible research and analysis** about the advanced energy industry
- ✓ **Knowledge about technologies** and services available to consumers and the power grid
- ✓ **Policies and regulations** that drive the transition to 100% clean energy in the power sector, the built environment, and in transportation.

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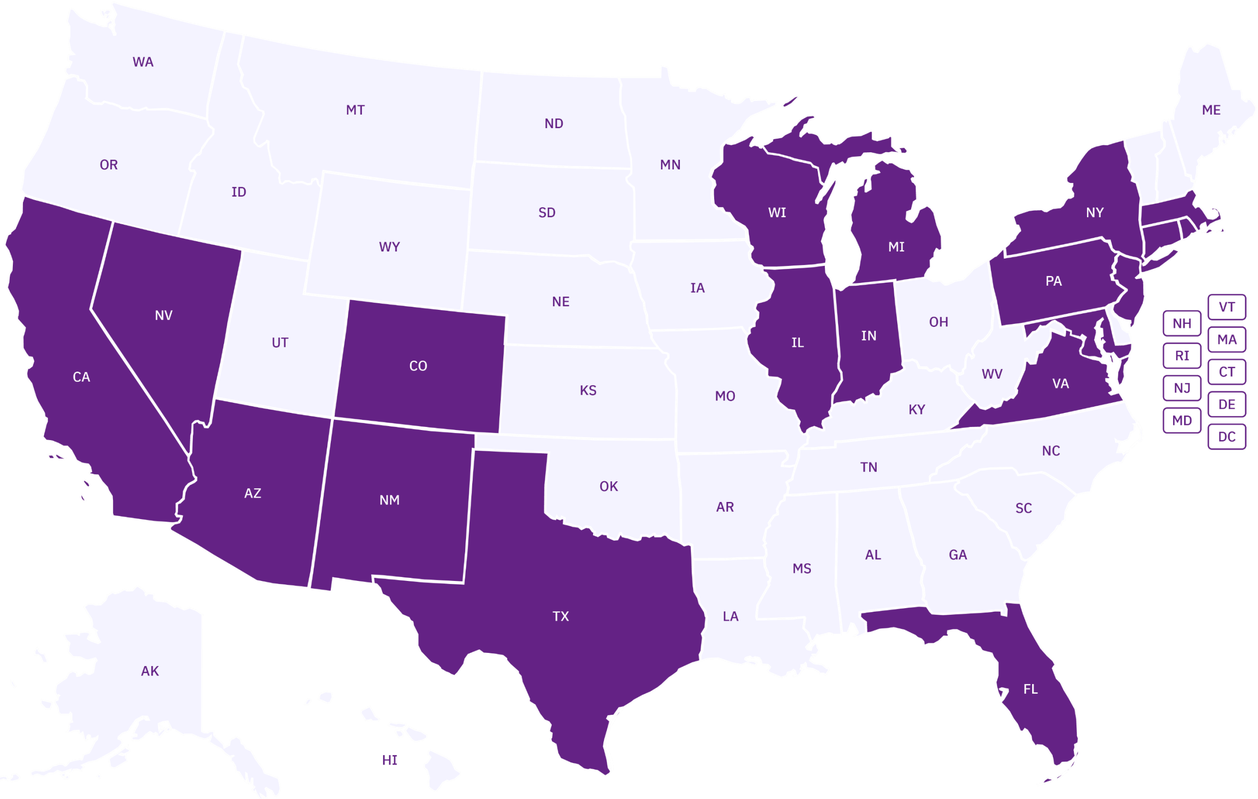
Where We Work

Regulatory, legislative, and gubernatorial engagement in 19+ states



Energy market advocacy at Federal Energy Regulatory Commission (FERC) and Regional Transmission Organizations (RTOs) / Independent System Operators (ISOs)

Policy engagement with Congress and federal agencies relating to infrastructure investments and manufacturing

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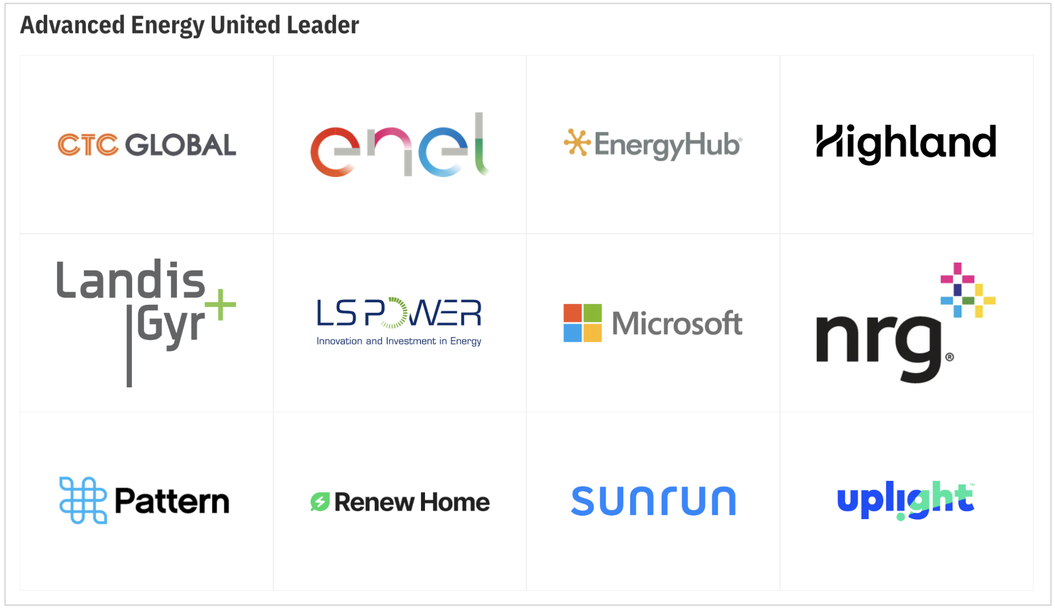
Our Members

100+ business members providing solutions



Our Member Companies:

- Develop renewable energy projects that serve everyone from homes to utilities
- Build, enhance, and strengthen the transmission grid
- Create solutions to manage data and demand making energy use more efficient
- Provide storage solutions to increase reliability
- Support clean energy development through large-scale purchasing commitments
- Build electric vehicles and the charging infrastructure to support them

And so much more!

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An energy transformation is underway, driven by technology, customer preferences and policy

Technology

- Clean technology has become or is becoming a least cost option
- Performance is often superior to traditional options
- Information technology (IT) enables new ways to engage customers

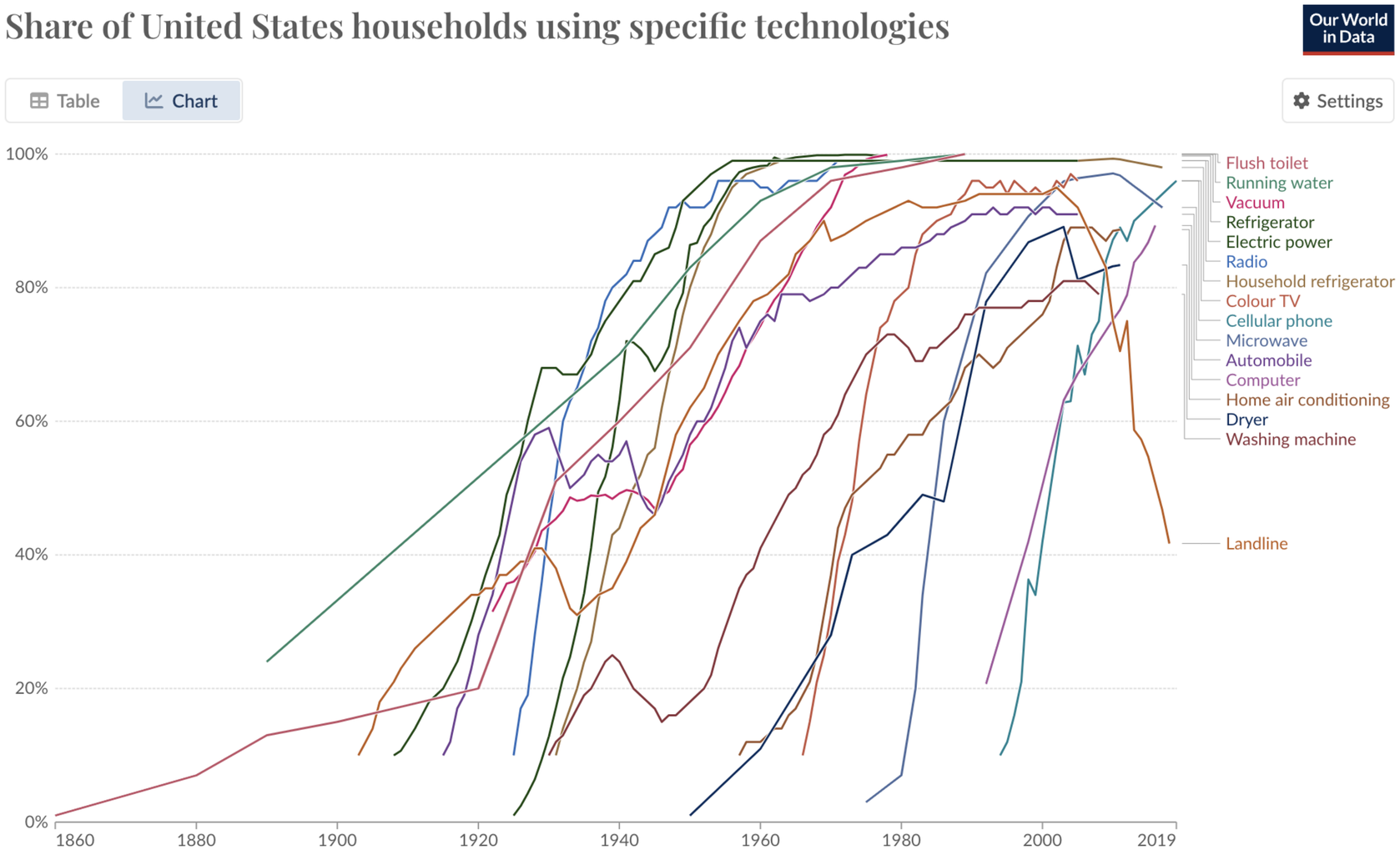
Customer Preferences

- Want greater control over energy use and costs
- Some prefer clean options
- Many corporations with aggressive sustainability goals

Policy

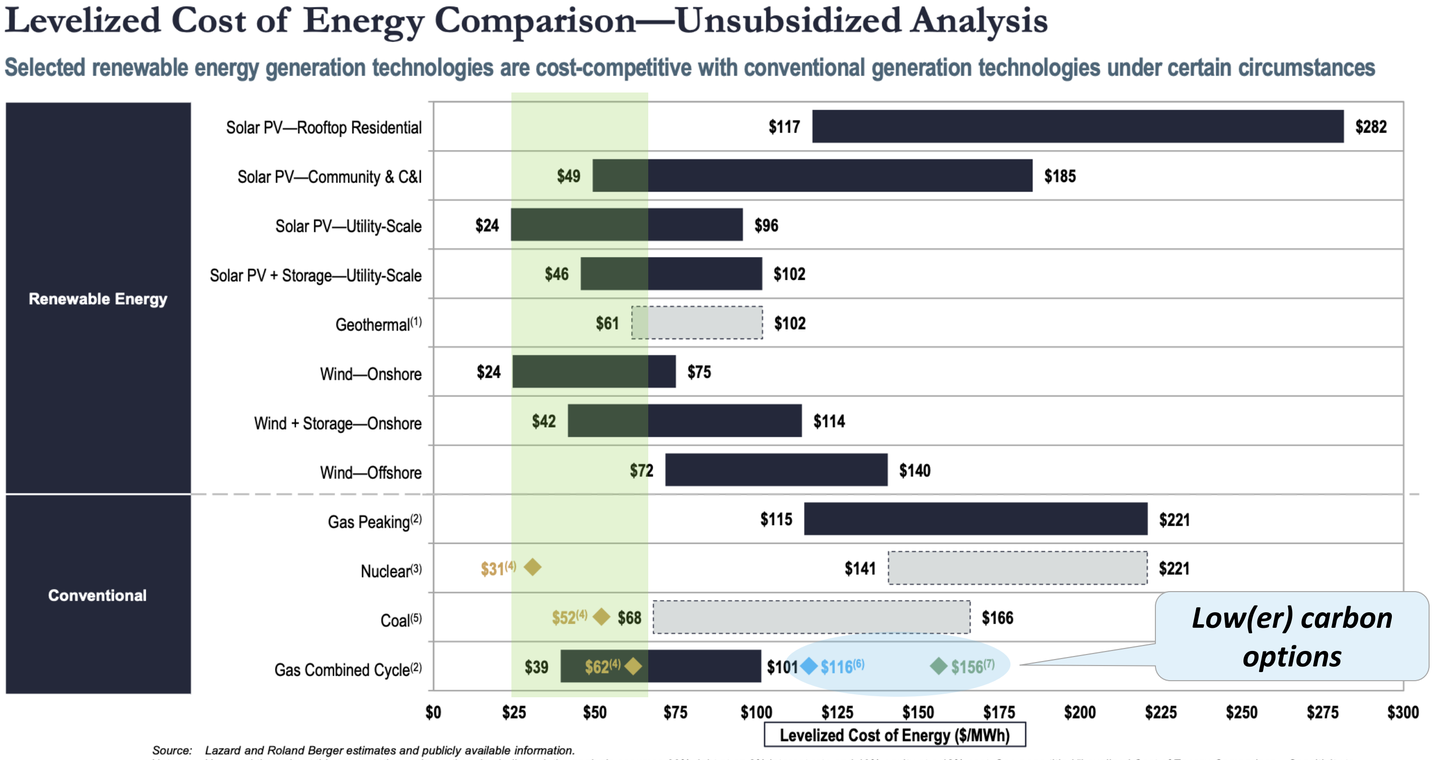
- 100% clean policies in states (electricity and/or economy-wide)
- Focus on reliability & resilience
- Affordability and customer equity
- Once in a generation federal financial commitment (IIJA & IRA)

Technology adoption is usually not linear and can sometimes be disruptive



Source: Our World in Data

Macro trend #1: Renewables (+ storage) are least cost for new generation



Source: *Lazard and Roland Berger estimates and publicly available information.*

Note: Here and throughout this presentation, unless otherwise indicated, the analysis assumes 60% debt at an 8% interest rate and 40% equity at a 12% cost. See page titled "Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital" for cost of capital sensitivities.

(1) Given the limited data set available for new-build geothermal projects, the LCOE presented herein represents Lazard's LCOE v15.0 results adjusted for inflation.

(2) The fuel cost assumption for Lazard's unsubsidized analysis for gas-fired generation resources is $3.45/MMBTU for year-over-year comparison purposes. See page titled "Levelized Cost of Energy Comparison—Sensitivity to Fuel Prices" for fuel price sensitivities.

(3) Given the limited public and/or observable data set available for new-build nuclear projects and the emerging range of new nuclear generation strategies, the LCOE presented herein represents Lazard's LCOE v15.0 results adjusted for inflation (results are based on then-estimated costs of the Vogtle Plant and are U.S.-focused).

(4) Represents the midpoint of the unsubsidized marginal cost of operating fully depreciated gas combined cycle, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas combined cycle or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas combined cycle, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper- and lower-quartile estimates derived from Lazard's research. See page titled "Levelized Cost of Energy Comparison—Renewable Energy versus Marginal Cost of Selected Existing Conventional Generation Technologies" for additional details.

(5) Given the limited public and/or observable data set available for new-build coal projects, the LCOE presented herein represents Lazard's LCOE v15.0 results adjusted for inflation. High end incorporates 90% carbon capture and storage ("CCS"). Does not include cost of transportation and storage.

(6) Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Blue" hydrogen, (i.e., hydrogen produced from a steam-methane reformer, using natural gas as a feedstock, and sequestering the resulting CO_2 in a nearby saline aquifer). No plant modifications are assumed beyond a 2% adjustment to the plant's heat rate. The corresponding fuel cost is $5.20/MMBTU, assuming ~$1.40/kg for Blue hydrogen.

(7) Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Green" hydrogen, (i.e., hydrogen produced from an electrolyzer powered by a mix of wind and solar generation and stored in a nearby salt cavern). No plant modifications are assumed beyond a 2% adjustment to the plant's heat rate. The corresponding fuel cost is $10.05/MMBTU, assuming ~$4.15/kg for Green hydrogen.

LAZARD

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Some Notes & Observations

- These are "unsubsidized" costs (i.e., before Federal tax credits)
- All-in costs for **new** large-scale renewables competitive with operating costs of **existing** coal, and nuclear
- Natural gas costs based on $3.45/MMBtu
  - Prices for electricity generation were $7.50/MMBtu in 2022*
- High-end costs for coal include carbon capture.
- Decarbonizing natural gas only increases costs.

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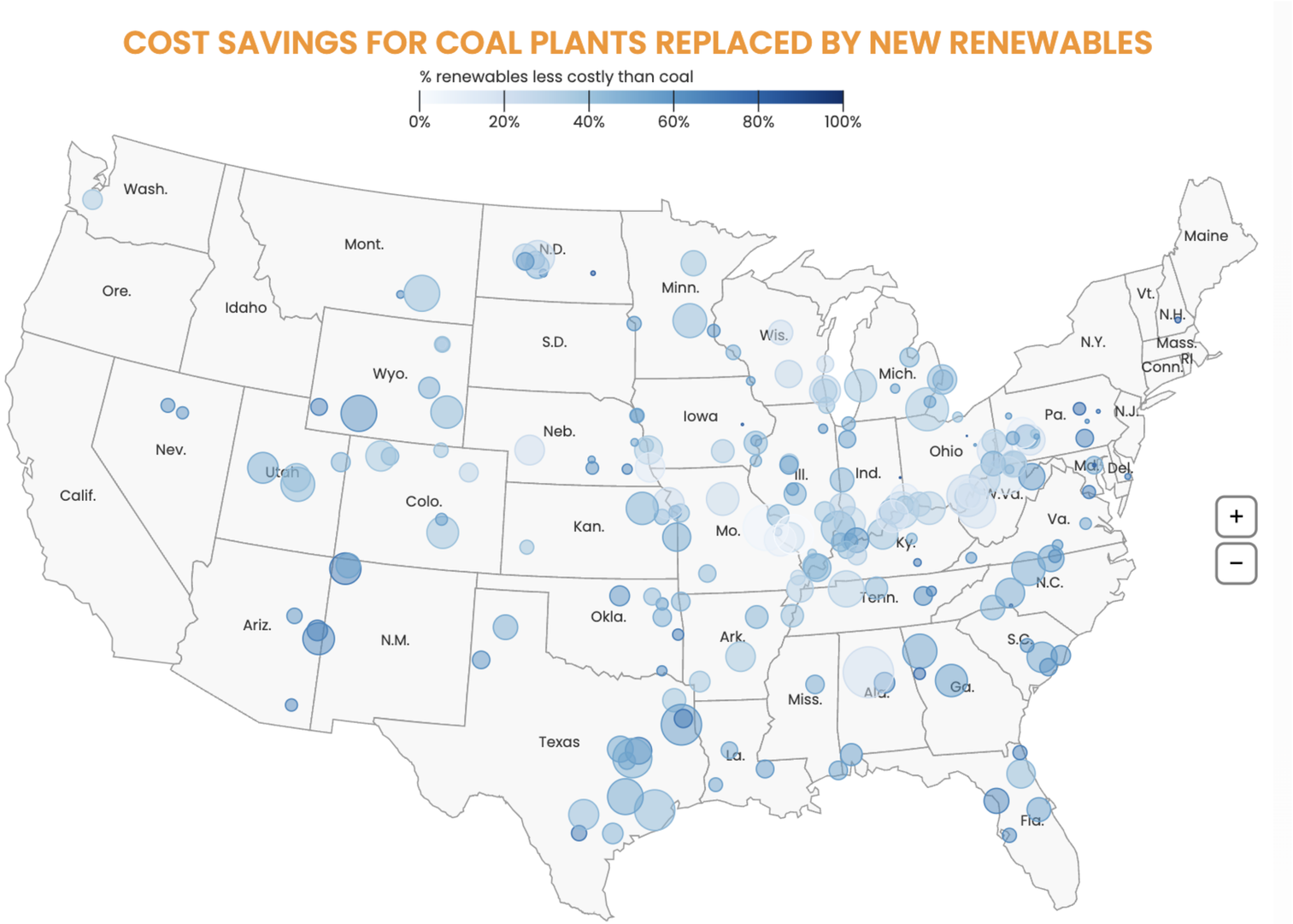
Source: Lazard's Levelized Cost of Energy Analysis, v16.0, April 2023.

* Energy Information Administration: https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm.

Renewables often outcompete existing generation



Source: [Coal Cost Crossover 3.0](#) (Energy Innovation, 2023)

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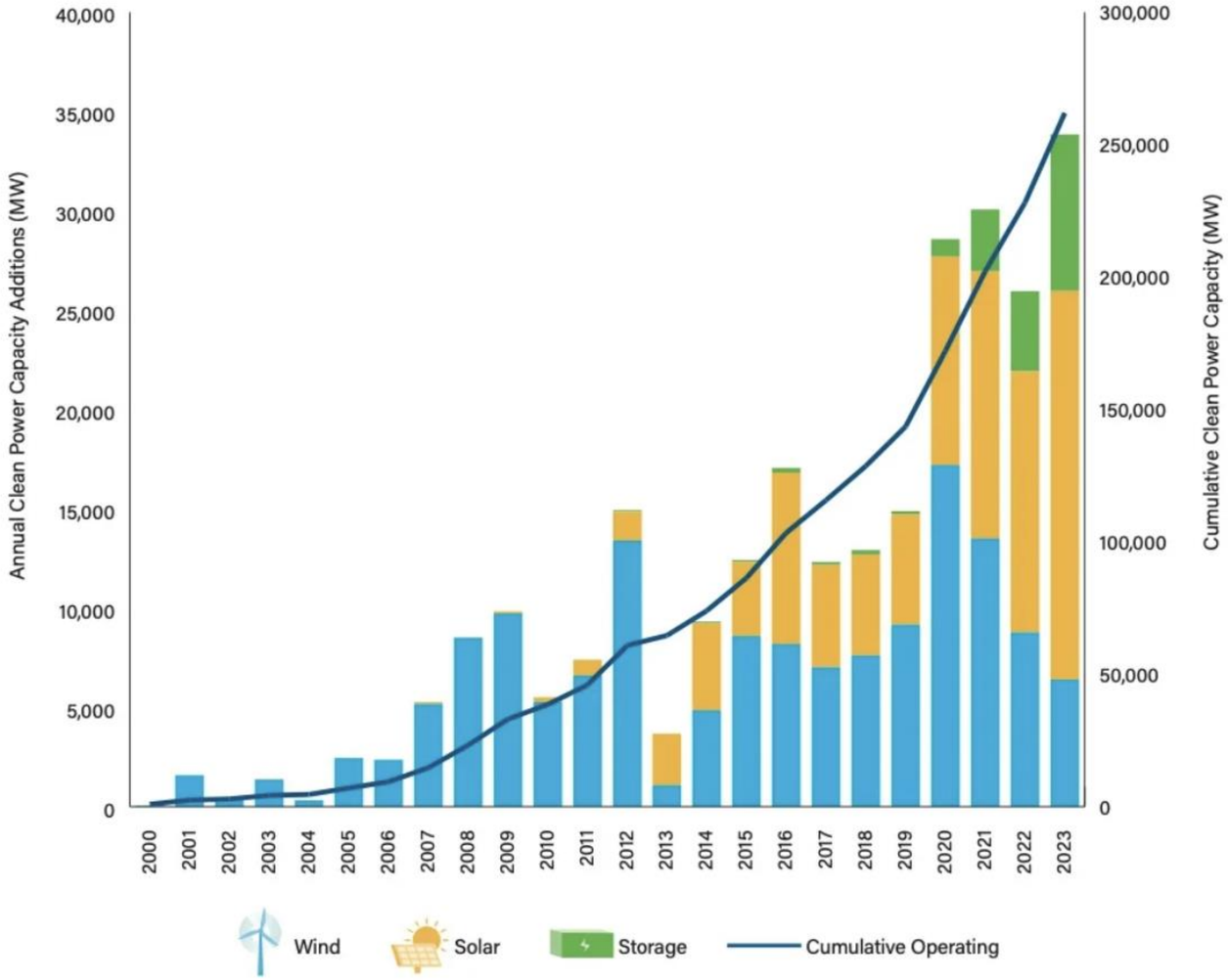
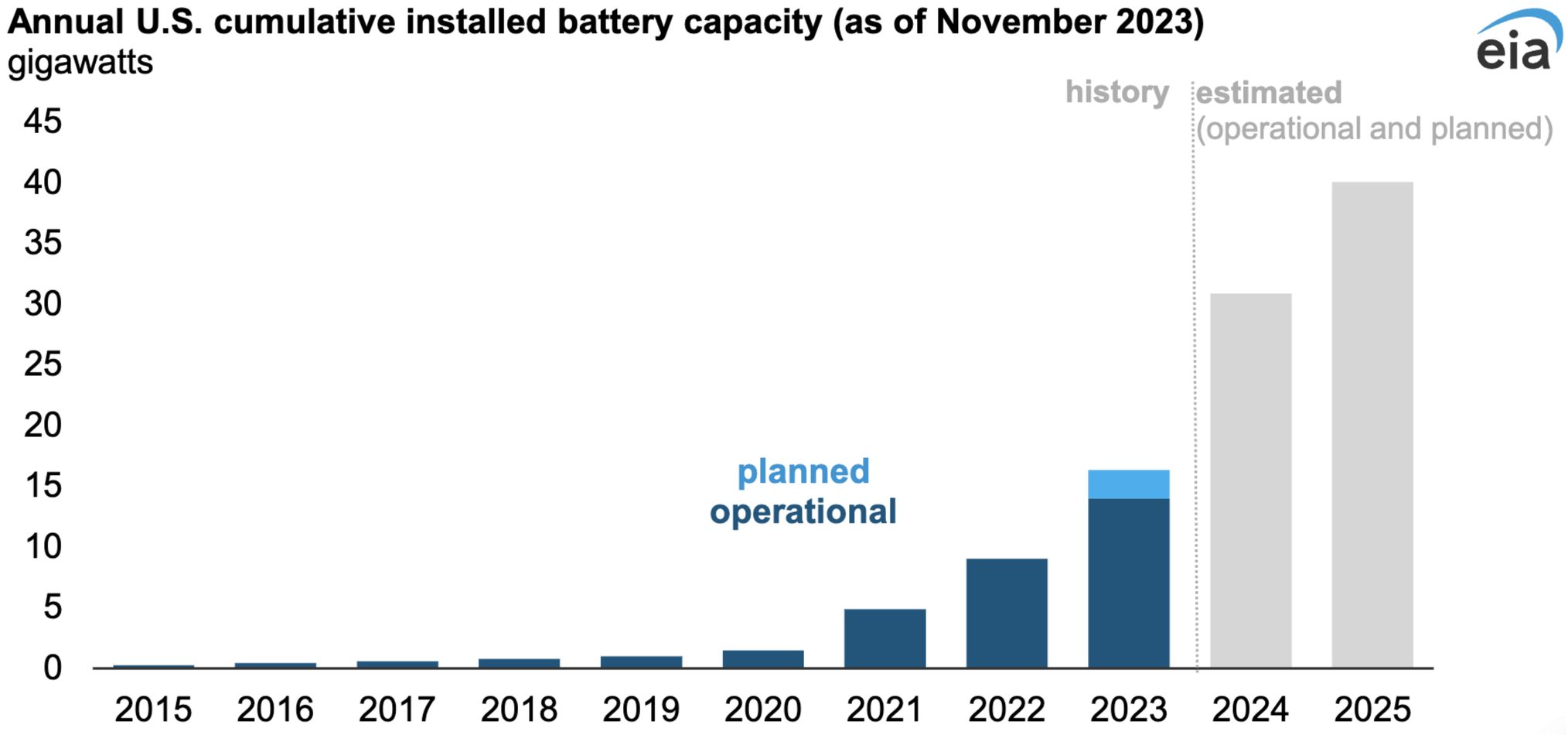
Deployment of renewables and storage is rising rapidly

U.S. Annual and Cumulative Clean Power Capacity Growth



Source:, American Clean Power Association, 2023

Macro trend 2: Storage deployment is growing rapidly as the grid decarbonizes



Data source: U.S. Energy Information Administration, *Preliminary Monthly Electric Generator Inventory*, based on Form EIA-860M

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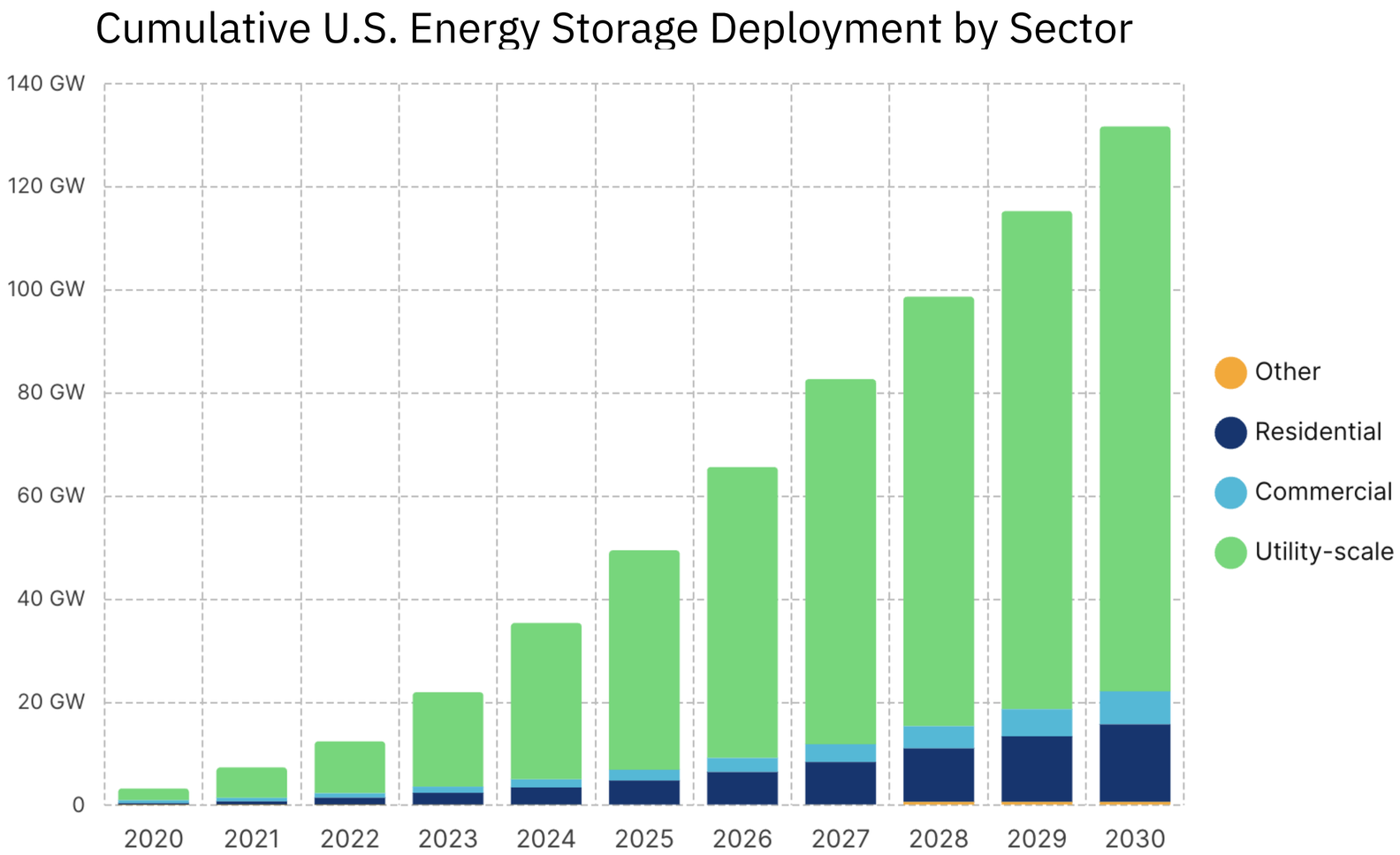
Storage deployment is growing rapidly across sectors



Source: Bloomberg New Energy Finance 2H 2023 Energy Storage Outlook, ORNL EHA Capacity Plant Database

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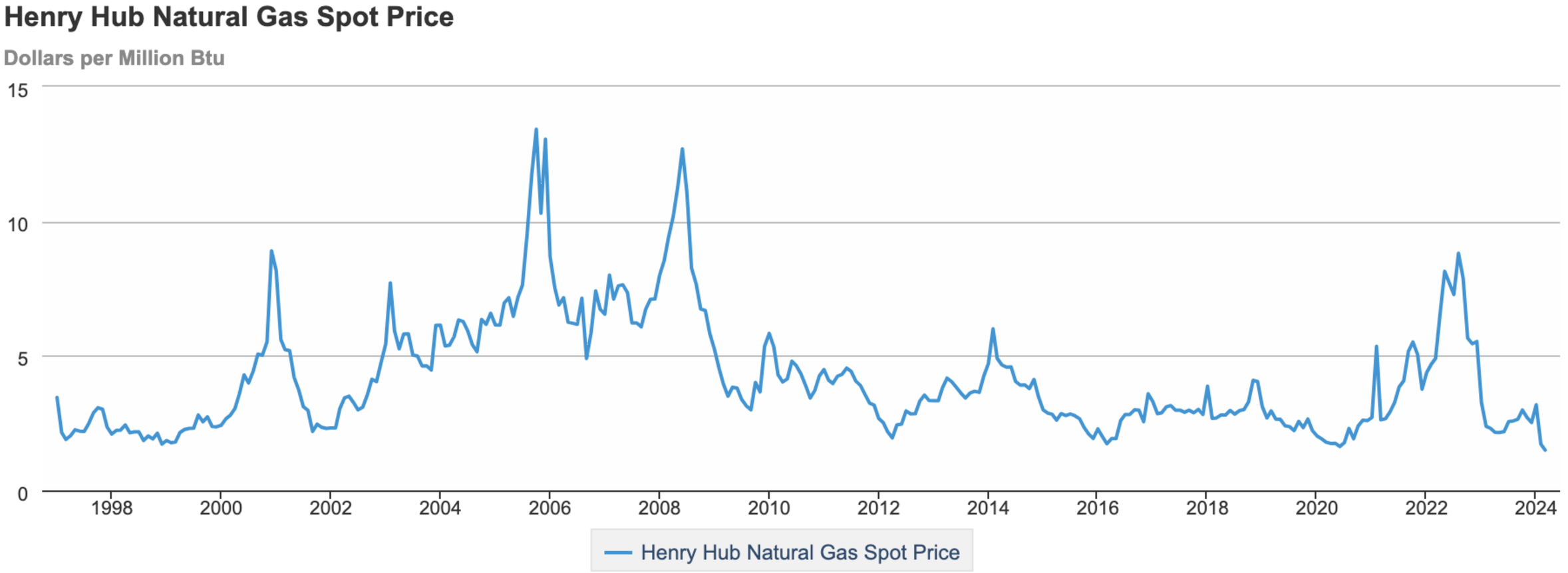
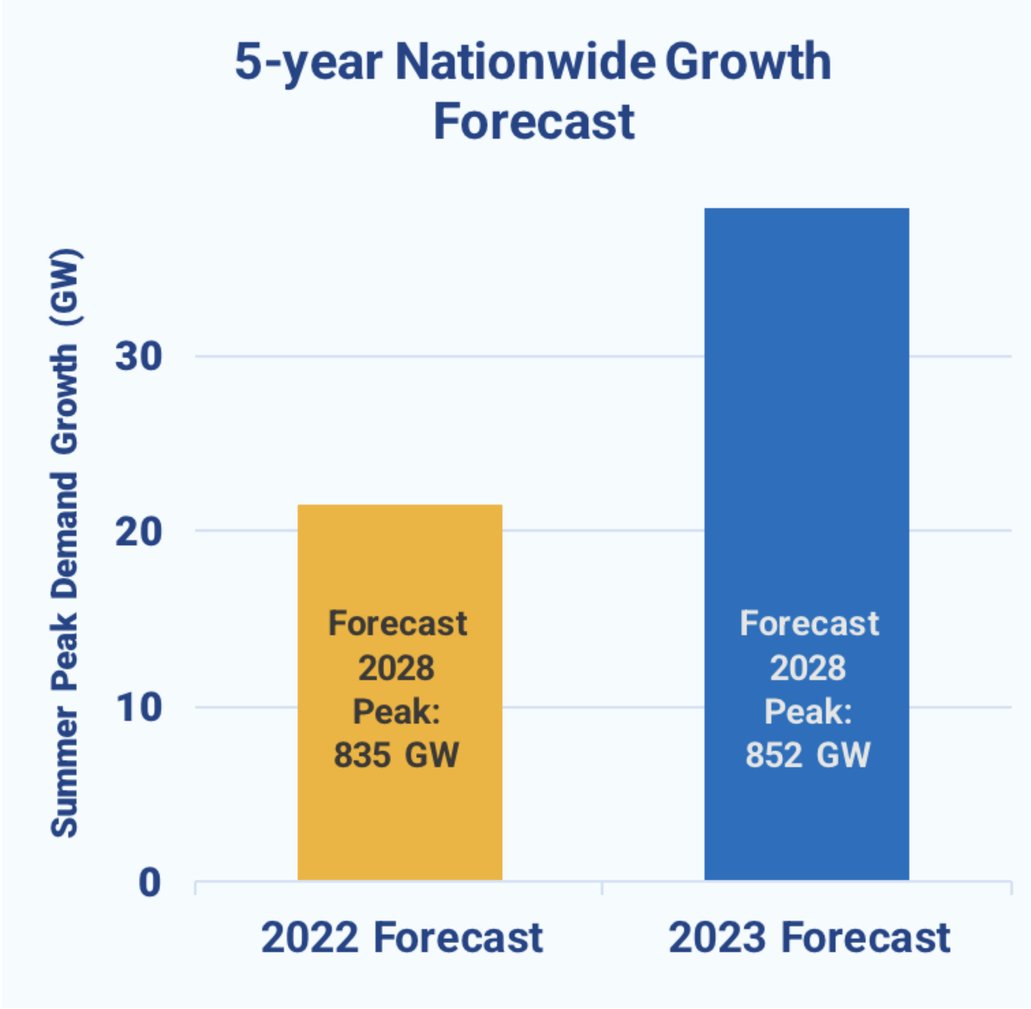
Macro trend #3: Natural gas volatility has returned



Source: Henry Hub Natural Gas Spot Price (U.S. Energy Information Administration, retrieved April 2024)

Macro trend #4: The era of flat power demand is over

- Load growth forecasts are increasing
- Grid planners now forecast 38 GW in peak demand growth through 2028
- Key drivers: data centers and industrial growth
- Transportation and building electrification will also contribute to load
- Generation, transmission, and demand flexibility must work in concert to manage new load



Source: "The Era of Flat Power Demand is Over" (Grid Strategies, 2023)

Macro trend #4: The era of flat power demand is over… but we've managed and met load growth before

1950s–1970s

- Electricity demand increases over 5% per year
- **Key factors:** population growth, increased standard of living, and realizing economies of scale

1980s–1990s

- Increase in electricity demand slows to 2-3% per year
- **Key factors:** slower population growth, market saturation, and inflation

2000s–recent past

- Electricity demand stagnates
- **Key factors:** increased energy efficiency

Present

- Increasing electricity demand returns
- Load profiles have different sizes, shapes, and levels of flexibility
- **Key factors:** new use cases for electricity

Compared to the past, we also have an expanded solution set to meet demand

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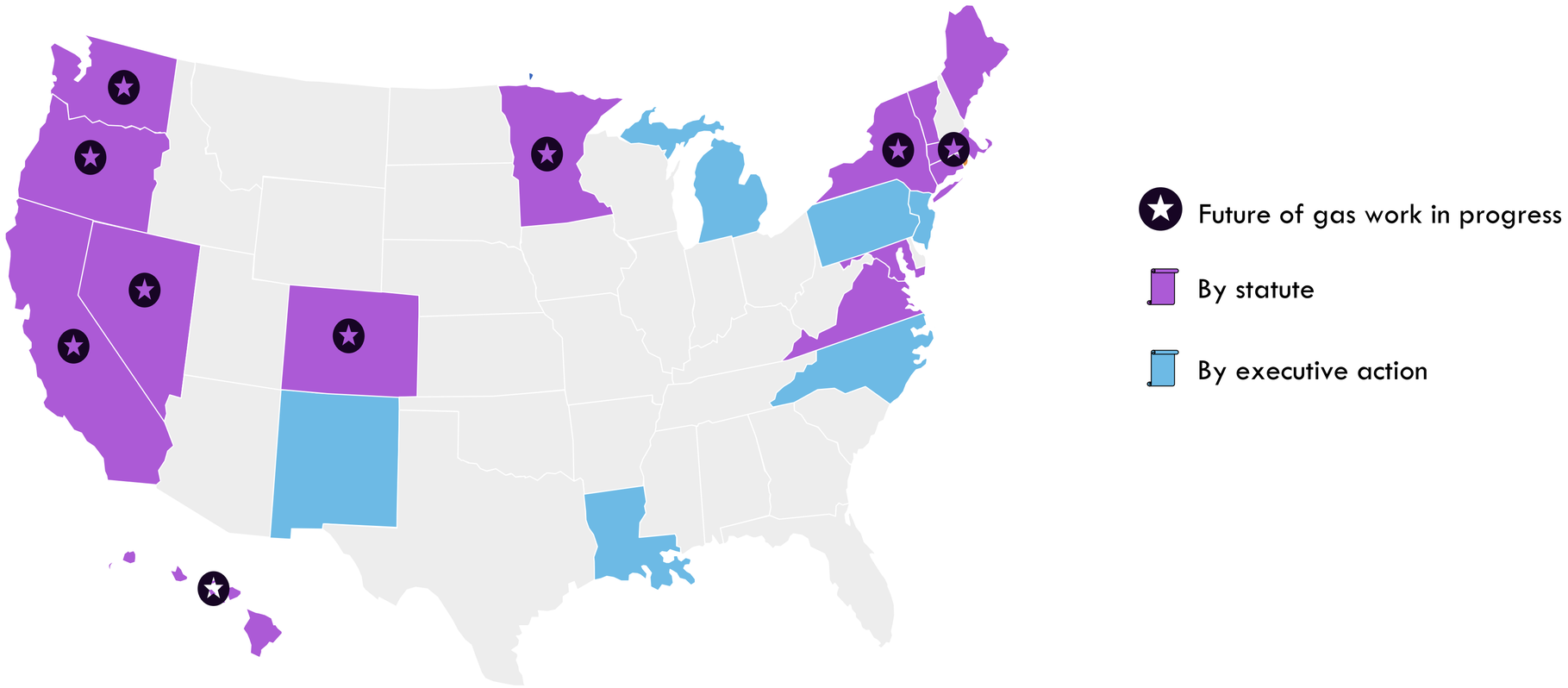
Macro trend #5: Decarbonization / Electrification of buildings is a new frontier

States with Economy-wide Decarbonization Targets



Source: Advanced Energy Institute analysis

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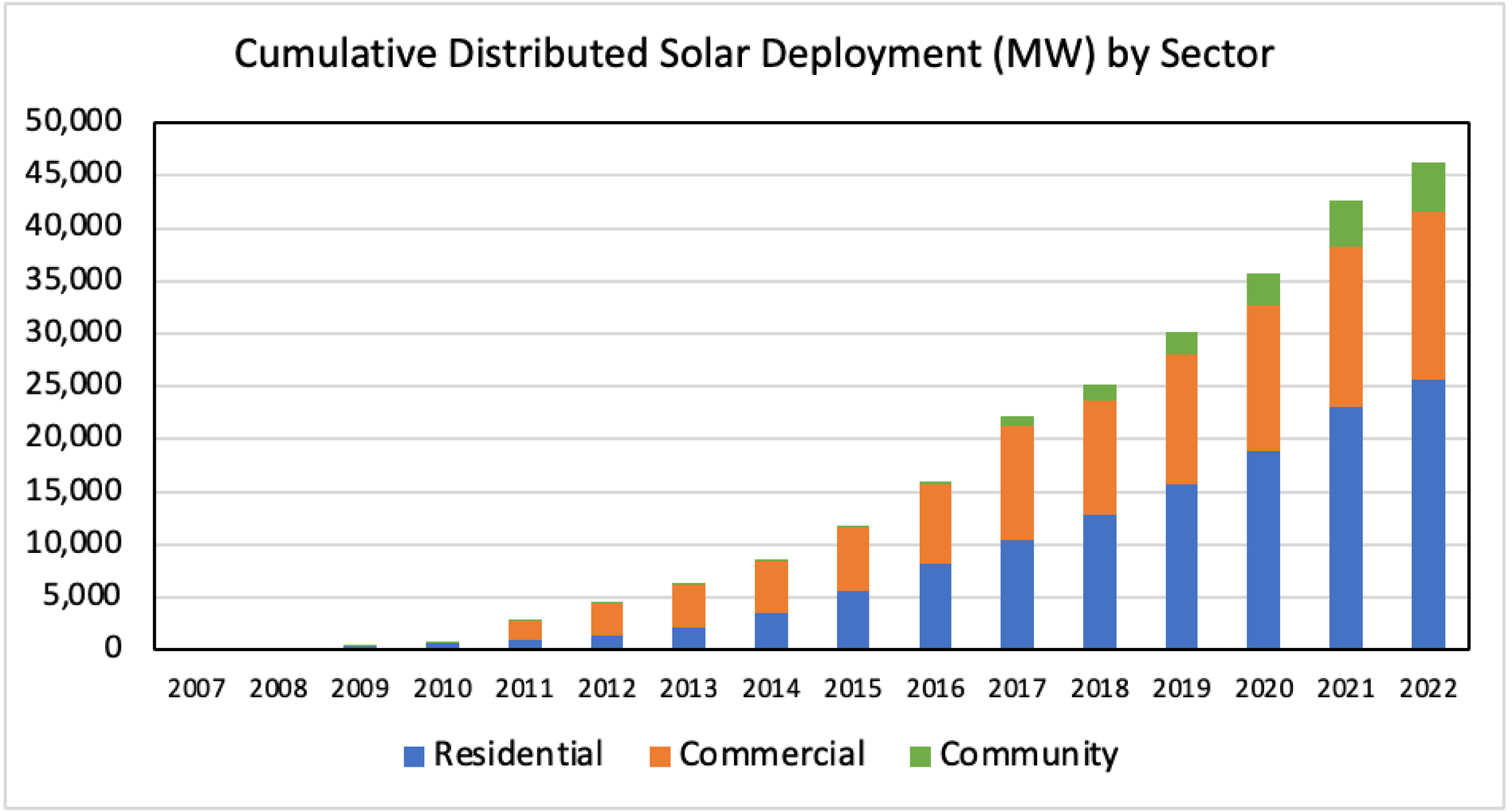
Macro trend #6: The future of the grid is distributed



Source: SEIA Solar Industry Research Data

Note: 2022 is though Q2 only

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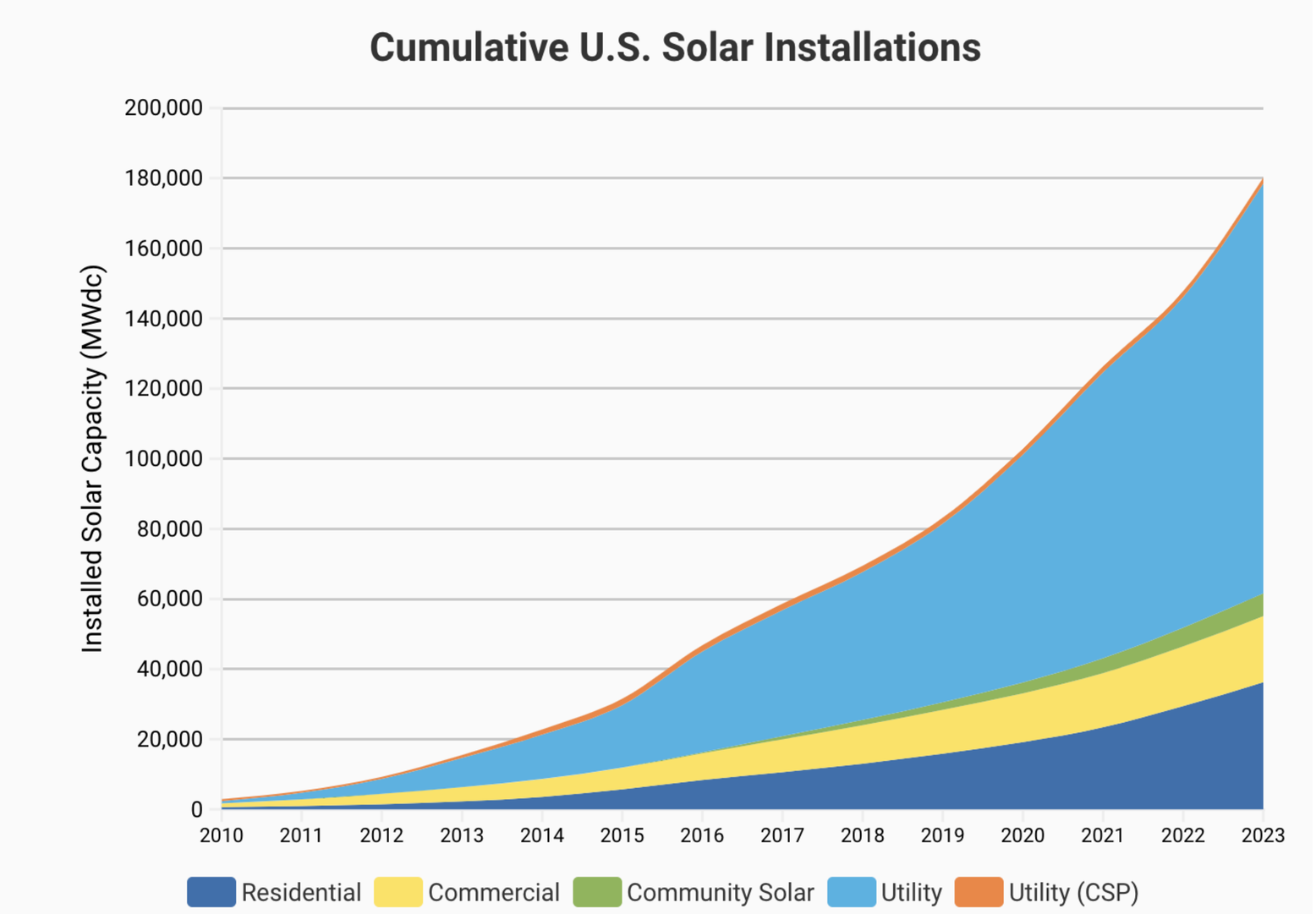
Macro trend #6: The future of the grid is distributed (not entirely, but a lot more than it is now)



Source: SEIA/Wood Mackenzie [Power & Renewables U.S. Solar Market Insight 2023 Year in Review]

Defining DERs and VPPs

Distributed energy resources

- Distributed generation
- Energy efficiency
- Demand response / flexible demand
- Energy storage
- EVs & EV charging equipment
- Microgrids

Virtual Power Plants

- Aggregations of DERs (can be of same type or multiple types) (**hardware**)
- Managed as a single resource like a power plant (**software**)
- Can be formed within a single rate class or across different rate classes (**subscribers/ participants**)
- Can provide grid services at the wholesale or retail levels, or both (**products**)
- Can be created/managed by utilities or third parties (**the aggregators**)

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Demand flexibility and DERs playing an increasingly important role as part of a distributed grid

DIVE BRIEF

Texas expands industrial demand response program as grid goes to the brink of rolling outages

Published July 15, 2022

Electric Vehicles

Cars instead of cables: V2G's potential to enhance a flexible energy system

Guest Contributor • May 01, 2024 Share

TOP STORY

Heat Wave Prompts Conservation, Demand Response in Southwestern States

Abigail Sawyer Sep 9, 2022

Tripled VPP capacity can save $10bn in grid costs finds US energy department

Yusuf Latief • Sep 19, 2023 Share

VPPs could cover 15% of peak California demand by 2035 using home batteries, demand response

By Jonathan Touriño Jacobo

April 11, 2024

Study finds virtual power plants could provide resource adequacy and save utilities billions

John Engel

5.4.2023

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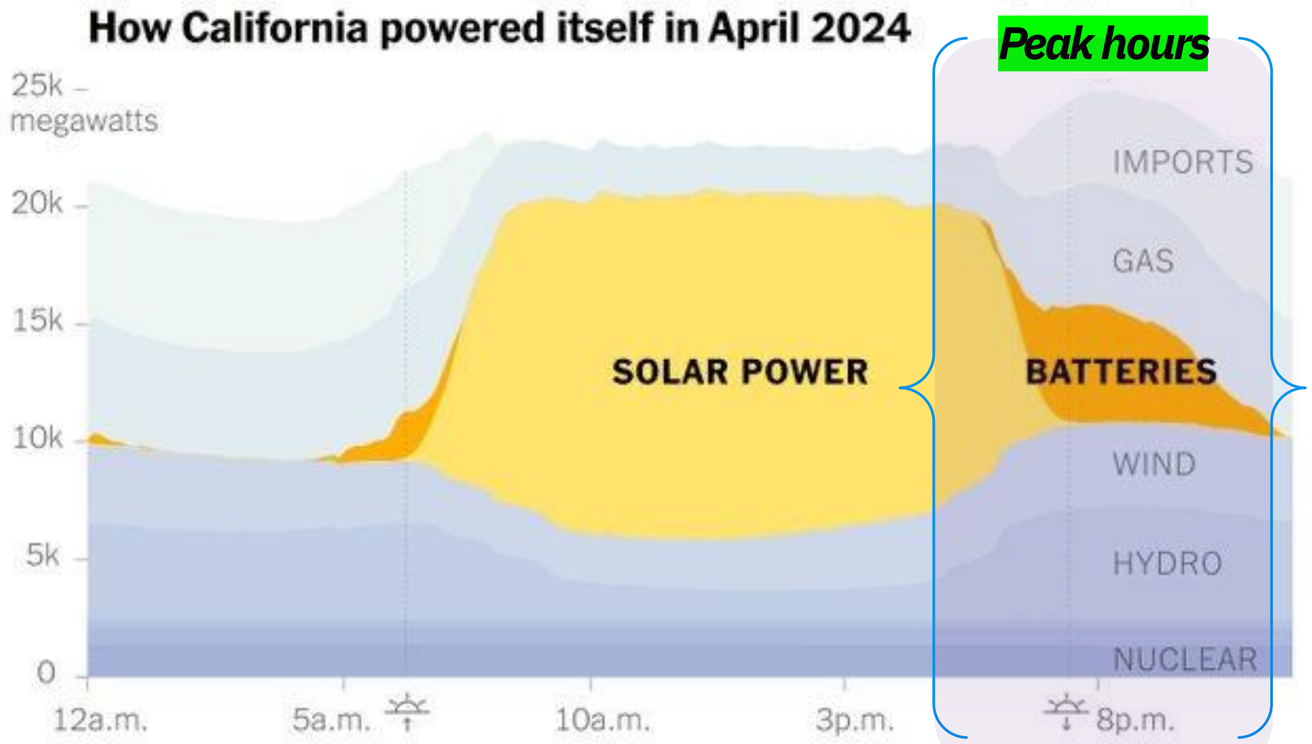
Timing is everything: VPPs help manage peaks

- Peak demand hours - the period of time when electricity demand is highest – varies by place, season, and conditions
- Peaker plants ramp up during peaks. By shaving peaks, we reduce the need for FF peakers
- VPPs can curtail load during the highest cost hours of the day, shifting it to lower cost hours



(Where VPPs shine)

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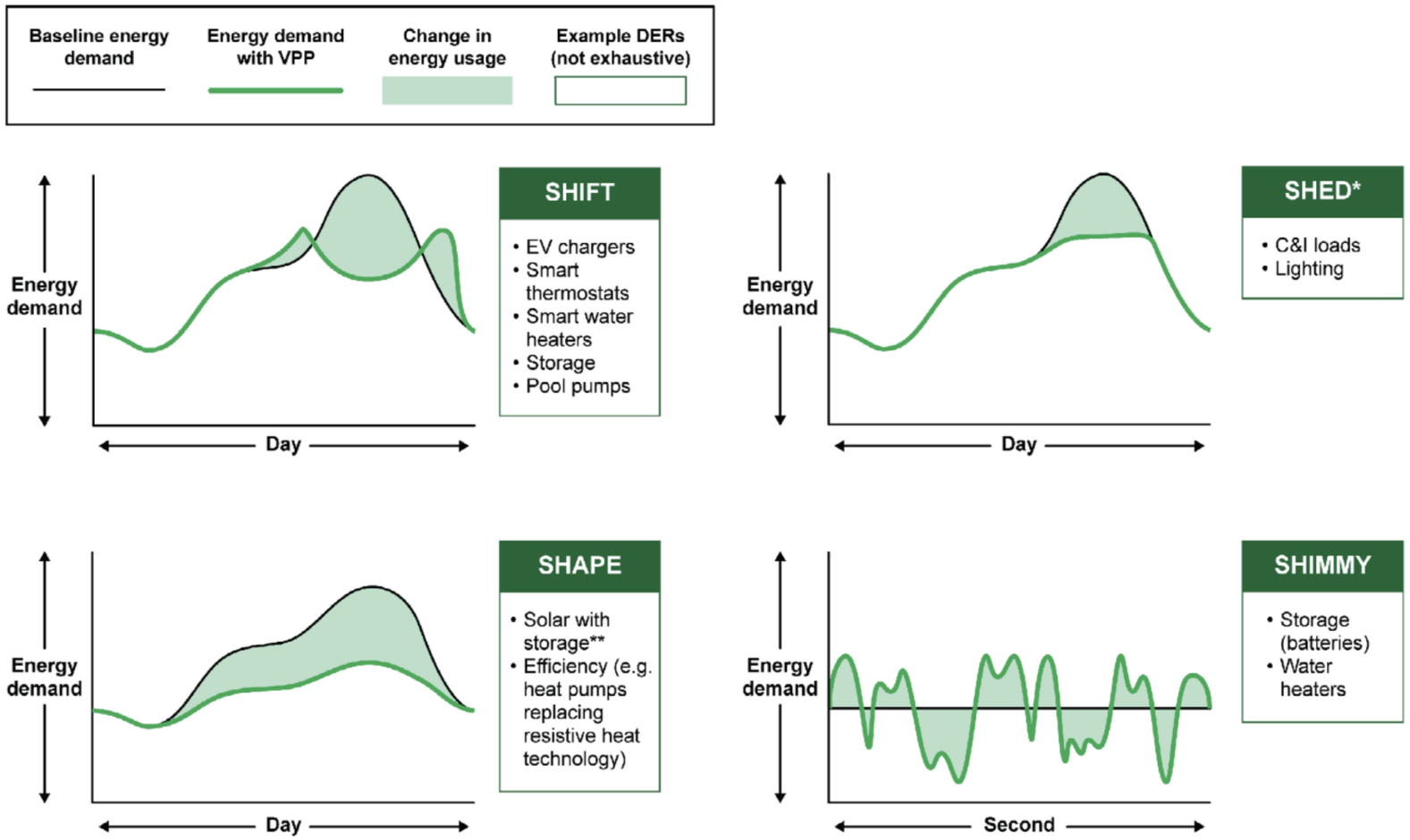
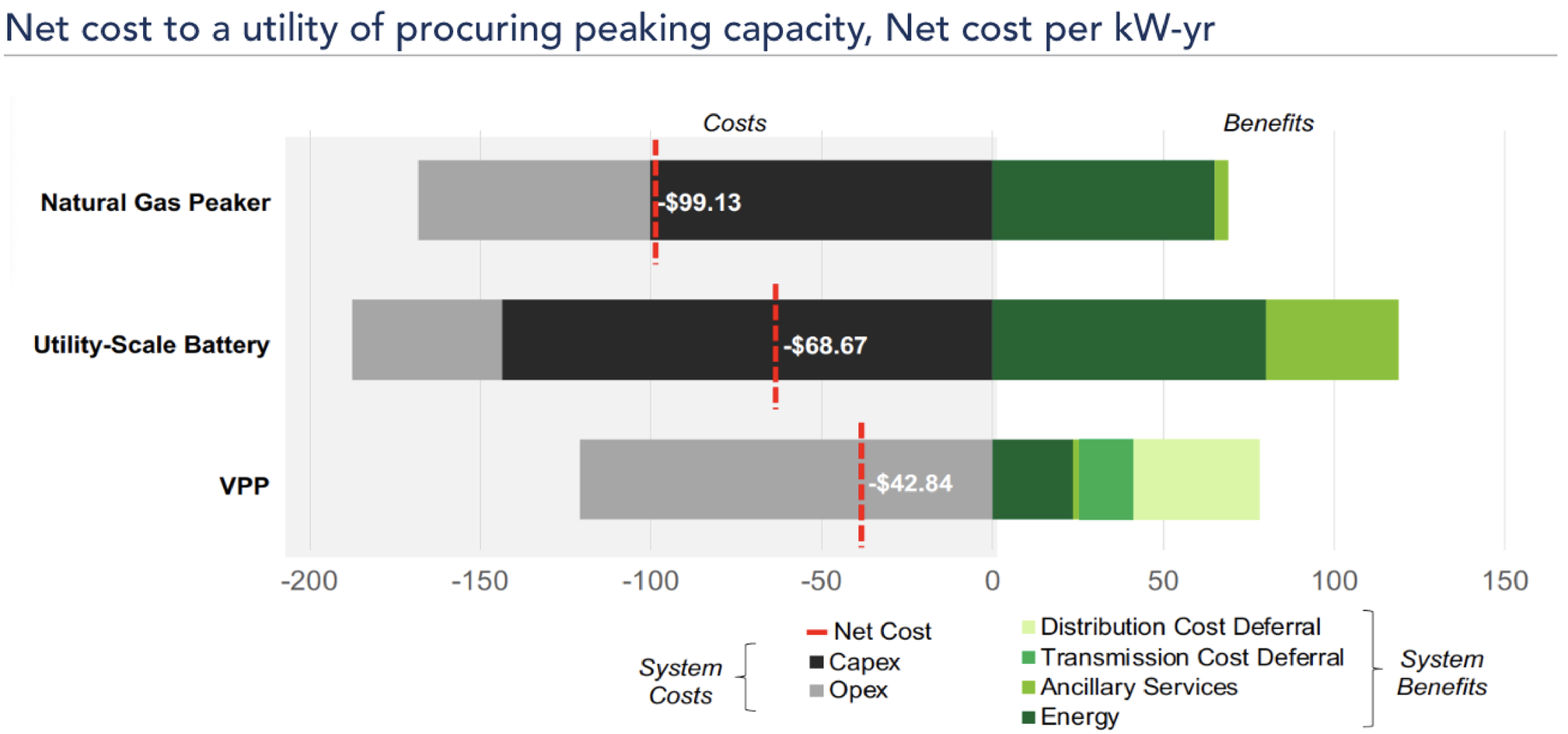
Demand flexibility and DERs are playing an increasingly important role as part of a distributed grid

Ways in which DERs can shape demand on the grid



Source: DOE VPP Liftoff Report (2023)

Demand flexibility and DERs are playing an increasingly important role as part of a distributed grid



Source: DOE VPP Liftoff Report (2023) / Brattle Group Real Reliability: The Value of Virtual Power (2023)

Macro trend #7: Affordability and customer equity are focal issues as the energy system transforms

- Moving beyond traditional considerations like LIHEAP and bill discounts
- State clean energy legislation increasingly including focus on equity, e.g.
  - WA CETA requires that equity considerations become an explicit part of utility planning
  - NY CLCPA requires 40% of benefits to flow to disadvantaged communities
  - IL CEJA includes performance metrics targeting disadvantaged communities
- IRA contains specific provisions to support equity & EJ, including
  - Tax credit adders for certain projects and communities
  - Env. & Climate Justice Block Grants
  - Rural Energy Programs (Administered by USDA)
  - Coal Transition, incl. Tribal Energy Loan Guarantee Program

Macro trend #8: Momentum is building for increased transmission investment, including an RTO in the West

- Interconnection backlogs growing as >1TW of renewables are in the queue
  - IIJA & IRA funding for transmission buildout and optimization
  - FERC Order 2023 on interconnection reform

- FERC issued landmark transmission planning order - Order 1920
  - Provides a formalized role for states to engage in transmission planning
  - Encourages cooperation and prioritizes system reliability and affordability

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** AEE report, *Western RTO Economic Impact Study: Colorado Results.*

Macro trend #8: Momentum is building for increased transmission investment, including an RTO in the West

- Western market developments:
  - Utilities are making day-ahead market decisions now, choosing between EDAM (CAISO) and Markets+ (SPP)
  - West-Wide Governance Pathways Initiative developing new approach to enable independent governance for EDAM, multiple states participating including NM
  - NM PRC has open investigatory docket on markets
  - Economic benefits of RTO will result from lower electricity costs and additional clean energy development - estimated to be as high as $1.6 billion/year in increased GSP for New Mexico
- Western transmission developments:
  - NM has nation-leading transmission authority in RETA, other states (CO) establishing them too
  - Policymaker interest in advanced transmission technologies is on the rise, bills passed in CA, VA
  - Western regional cooperation on transmission through Western Transmission Expansion Coalition and CREPC transmission collaborative; tackling issues of regional planning and cost allocation

Macro trend #9: Reliability, resilience and risk (the 3Rs) are looming large as the energy system transforms

- Increased variable renewable energy generation
- Entering an era where we expect to see new and growing loads (driven by data centers, manufacturing, building and transportation electrification)
- Effects:
  - Changing load patterns
  - Increased need for transmission capacity
  - At the same time, greater reliance on electricity for all energy-related services
- Extreme weather events are becoming more severe and frequent:
  - Power shutoffs and extended outages
  - Impacts on physical infrastructure
  - Impacts on energy supply (hydro production, natural gas supply & competing uses)

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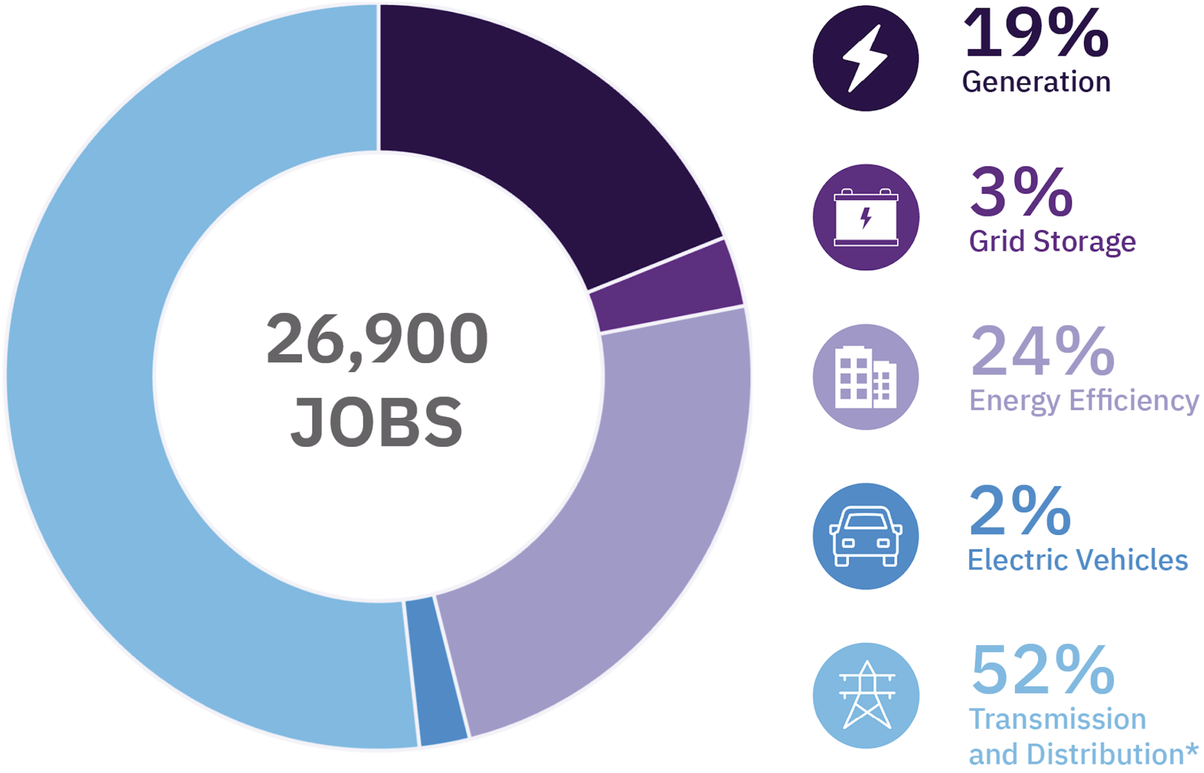
Macro trend #10: Advanced energy is an economic driver

Employs 26,900 in New Mexico, nearly six times as many jobs as oil & gas extraction, twice as many jobs as hotels & motels



Source: Department of Energy 2024 USEER Jobs Report

**Department of Energy state-level data for Transmission and Distribution includes all jobs, not just clean energy jobs. Nationally, the DOE estimates that 68% of T&D jobs are considered clean energy jobs.*

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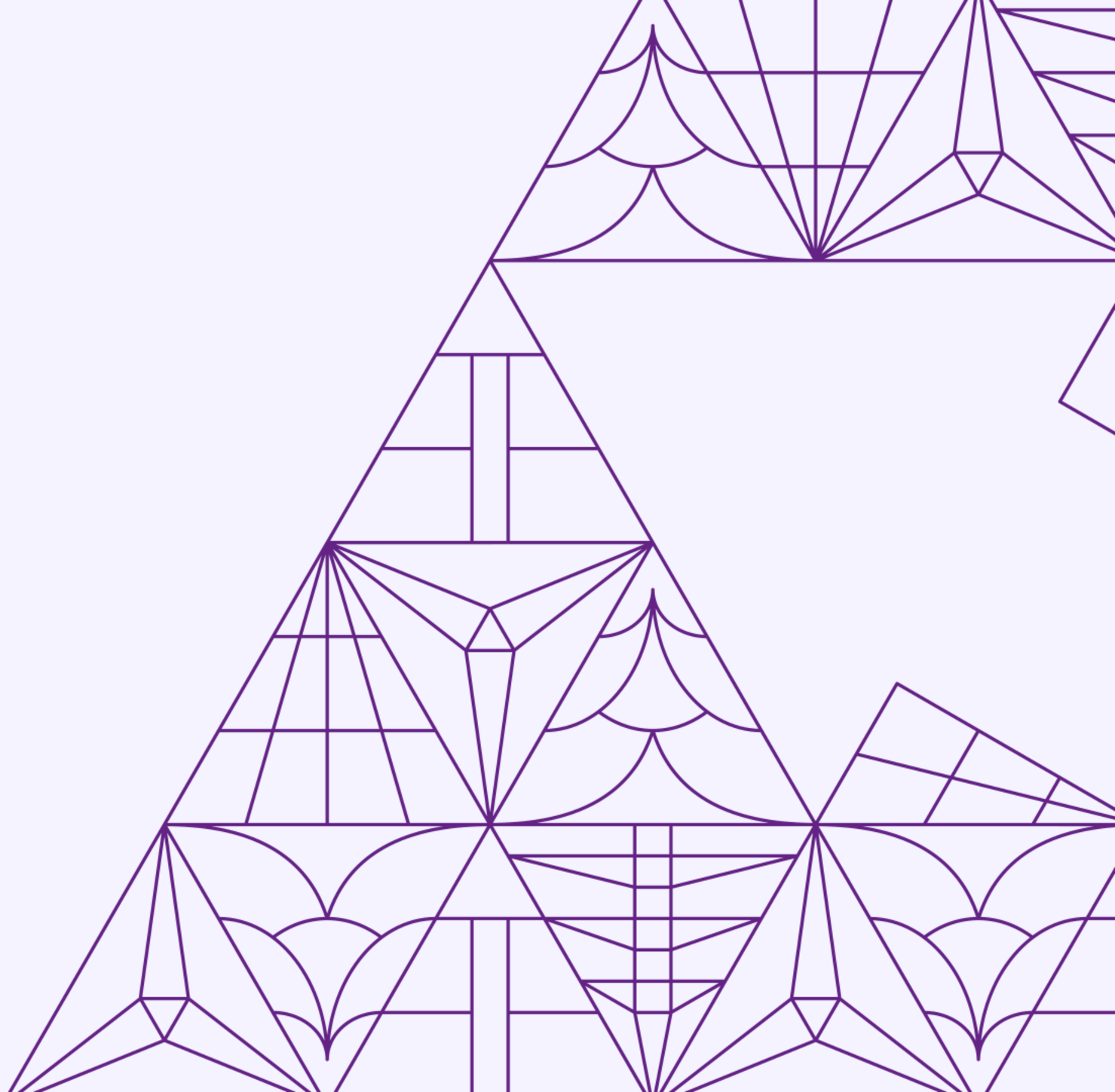
Thank you.



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