How to Invest in the AI–Nuclear Power Boom

A practical guide to NEE, VST, CEG, D, DUK and the SMR wave

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Comanche Peak Nuclear Power Plant is one of 4 nuclear power plants in Vistra's fleet. Source: Vistra

1. Why AI suddenly matters for nuclear power

The AI boom isn't just a tech story — it's a power story.

- Large AI data centers can draw hundreds to thousands of megawatts each — as much power as a mid-size city. Virginia Business

- In the U.S., watchdogs are already warning that major grids like PJM (Mid-Atlantic / Midwest) may struggle to maintain reliability if they keep approving huge data-center loads without enough new generation. Business Insider

- In Virginia alone, data centers already use nearly 25% of the state's electricity, and peak data-center demand could grow almost fivefold by 2038. Virginia Business

For Big Tech and the federal government, the wish list is:

1. Reliable (24/7, not weather-dependent)

2. Low-carbon (for climate/ESG and politics)

3. Scalable (multi-GW, not boutique solutions)

That combination points straight at nuclear. Existing reactors are already built, already connected to the grid, and can run for 60–80 years with license extensions.

For investors, that creates a distinct theme:

"EXISTING NUCLEAR + AI/DATA CENTERS" AS A CASH-FLOW AND RE-RATING STORY.

Below is a practical, investor-oriented look at the main ways to play it.

2. Two main models: how you're actually investing

Before we get into tickers, it helps to separate two business models:

1. Regulated AI utilities – you earn allowed returns set by regulators.
    - More stable cash flows.
    - Lower risk, lower torque.
    - Think: *NextEra (NEE), Dominion (D), Duke (DUK)*.
2. Merchant nuclear / power producers – you sell into the market and via long-term contracts.
    - More exposed to power prices.
    - More upside when demand and prices spike, but more cyclical.
    - Think: *Vistra (VST), Constellation (CEG)*.

Both can benefit from AI/data-center demand, but in slightly different ways.

3. Vistra (VST): concentrated nuclear + AI torque

Vistra is a large U.S. power producer that runs a fleet of coal, gas, and nuclear plants, particularly in Texas (ERCOT) and the PJM region. It has become one of the top stock-market winners in the "AI power" trade. Investors

PJM is a Regional Transmission Organization (RTO) — a grid operator for a massive multi-state region spanning the Mid-Atlantic and parts of the Midwest.

Nuclear position

- Through its Vistra Vision segment, Vistra now operates six reactors at four sites, including Comanche Peak in Texas plus plants it acquired from Energy Harbor in Ohio and Pennsylvania. Utility Dive

- These reactors provide over 6.5 GW of 24/7, carbon-free generation.

AI / data-center angle

- In late 2025, Vistra signed a 20-year power purchase agreement for 1,200 MW of carbon-free power from its Comanche Peak nuclear plant with a large investment-grade customer (widely assumed to be a major data-center or "hyperscaler" buyer). Utility Dive

- The deal has options to extend for another 20 years, effectively monetizing a big portion of Comanche Peak as a dedicated AI/data-center asset. Utility Dive

Balance sheet & risk

- Stock price: about $169/share.

- Total debt: about $17.5B.
- Equity is only about $5.2B, so its debt-to-equity ratio is ~3.3× (330%).

So Vistra is heavily leveraged relative to its equity, but the nuclear + gas fleet throws off a lot of cash, and rising demand in ERCOT/PJM has driven a huge share-price re-rating. Reuters

Is Vistra building new nuclear?

- No new reactors yet. Vistra is:
    - Extending licenses for existing plants (for example, Comanche Peak's license has been extended through 2053). American Public Power Association
    - Building new gas plants (860 MW of new gas-fired capacity in the Permian Basin) to support peak demand. Utility Dive

Bottom line on VST

- Pro: Pure, concentrated way to bet that existing nuclear and thermal fleets in Texas/PJM are underpriced relative to AI-era power demand.
- Con: Higher leverage and more volatility; performance depends on power prices and policy, not just steady regulated returns.

4. NextEra (NEE): AI-ready clean-energy platform with nuclear in the mix

NextEra is the largest clean-energy developer in the U.S. and owner of Florida Power & Light, a big regulated utility. It combines:

- A stable utility base (Florida), and
- A huge renewables and storage franchise, plus some nuclear.

AI / data-center deals

NextEra is one of the most explicit "AI power" plays on the regulated/ renewables side:

- Google + NextEra:
    - They struck a deal to restart the 615 MW Duane Arnold nuclear plant in Iowa by early 2029, under a 25-year power purchase agreement with Google. Utility Dive
    - They also agreed to co-develop new data-center campuses with integrated generation and to launch an AI-based grid optimization product by 2026. Reuters
- Meta + NextEra:
    - NextEra has signed over 2.5 GW of clean-energy contracts with Meta, across multiple U.S. regions, largely to support data-center growth while meeting climate targets. Reuters
- NextEra has openly said that data centers, driven by AI, could account for around 40%+ of its incremental load growth over the next decade,

and it has raised 2025–26 earnings guidance on the back of this demand and its renewables backlog. Investopedia

Nuclear position

- NextEra owns nuclear plants like Point Beach (Wisconsin) and is extending output under long-term deals — for example, extending nuclear supply for Wisconsin utility group WPPI Energy into the 2050s. Reuters

- The Duane Arnold restart with Google is a prime example of using existing nuclear infrastructure to serve AI-driven load in a "clean firm" way. Utility Dive

Balance sheet & risk

- Stock price: about $80–81/share.

- Total debt: roughly $93B (Sept 2025).

- That sounds huge, but NextEra's own fixed-income disclosures put its debt ratio at ~58% of total capitalization, and they highlight that this is on the low side versus peers for a big utility/infrastructure company.

In other words: high absolute debt, but on an enormous, mostly regulated and contracted asset base.

Bottom line on NEE

- Pro: A diversified, large-cap way to play AI power growth with renewables, storage, gas and nuclear all in one platform, plus visible earnings and dividend growth. Investopedia

- Con: More interest-rate sensitive; the nuclear portion is important but not dominant in the overall valuation.

5. Constellation Energy (CEG): the "purest" nuclear giant

If you want maximum nuclear concentration, Constellation is the center of gravity.

- Constellation operates the largest nuclear fleet in the United States, with 21 reactors providing around-the-clock, zero-carbon power. Constellation

- It is a merchant/competitive power company, not a traditional vertically integrated utility.

AI / data-center & government contracts

- Constellation has become the go-to nuclear supplier for both Big Tech and the U.S. government:

    - It signed a 20-year nuclear PPA with Meta for the output of the Clinton Clean Energy Center (Illinois) — about 1,121 MW to support Meta's data centers. Constellation

    - It won a record $1B contract with the U.S. General Services Administration to supply nuclear power to more than 13 federal agencies over the next decade, allowing it to extend plant licenses and add 135 MW of new nuclear output. Reuters

- Analysts note that because Constellation's nuclear plants are largely depreciated, rising power prices driven by AI data centers can translate very directly into profit. Seeking Alpha

- Constellation is also moving to acquire Calpine in a $16.4B deal, further leveraging rising electricity demand from AI data centers and electrification. Reuters

Bottom line on CEG

- Pro: The most "nuclear-pure" large-cap stock, with direct nuclear PPAs to data centers and the U.S. government. Strong leverage to any sustained rise in power prices.

- Con: Much more of a merchant price-taker – earnings are more volatile than regulated utilities, and the stock has already had a massive run alongside VST. Investors

6. Dominion (D): SMR option on "data-center alley"

Dominion is interesting if you specifically care about new nuclear development for data centers, not just existing fleets.

- A large regulated utility serving parts of Virginia and the Mid-Atlantic, home to “data-center alley” (Loudoun County and surroundings).

- Dominion already operates multiple nuclear plants, including North Anna and Surry in Virginia and Millstone in Connecticut. Dominion Energy

Data-center exposure

- Dominion says it has already connected around 450 data centers in Virginia and has a rapidly growing pipeline, calling itself the world’s biggest data-center-serving utility. Reuters

SMR / new nuclear push

- Dominion has:
    - Issued an RFP for small modular reactors (SMRs) at the North Anna nuclear site. Utility Dive
    - Signed an MOU with Amazon to explore SMR development at North Anna, effectively linking next-generation nuclear directly to data-center demand from Amazon Web Services. Virginia Mercury
- The existing North Anna units recently received license extensions to 2060, locking in decades of additional nuclear capacity. Investors

Bottom line on Dominion

- Pro: A more conservative, regulated way to play Virginia data centers + SMR development with existing nuclear assets and supportive state politics.

- Con: SMRs are still early-stage: cost, timing, and regulatory risk are all real; Dominion is a diversified utility where nuclear is vital but not the only driver.

7. Duke (DUK): "nuclear backbone" for the Carolinas

- Duke serves over 4.7 million customers in the Carolinas and operates six nuclear plants there. Duke Energy Investor Relations+2Duke Energy+2

Nuclear importance

- In 2024, Duke's six nuclear plants:
    - Supplied more than 50% of Carolinas customers' electricity, and
    - Provided more than 96% of the company's clean energy. Duke Energy

- Duke is extending operating licenses (for example, the Oconee plant has approval to run up to 80 years), locking in long-term nuclear output. World Nuclear News

AI / growth angle

- While Duke hasn't headlined specific AI-data-center nuclear PPAs to the same degree as Constellation or Vistra, its Carolinas Resource Plan is explicitly about handling significant load growth through a mix of nuclear, gas, and renewables. Duke Energy Investor

- Given the manufacturing and population growth in the Carolinas, Duke's nuclear fleet is effectively a baseload spine for broader electrification (including AI where it shows up).

Bottom line on DUK

- Pro: Solid, dividend-paying regulated utility where nuclear is already doing most of the clean-energy heavy lifting.

- Con: Less direct "AI headline" story than NEE/CEG/VST; more of a steady compounding utility than a high-octane AI proxy.

8. SMR and "new nuclear" developers: high risk, high story value

If you specifically want new nuclear construction rather than extending existing plants, you're in much more speculative territory.

A few datapoints:

- The U.S. Department of Energy recently announced up to $800M in funding for two SMR projects:

    - TVA (Clinch River, Tennessee), and

    - Holtec (Palisades site in Michigan, where Holtec also plans to restart an 800 MW plant that closed in 2022). Reuters

- Public-market SMR developers like NuScale Power (SMR), Oklo (OKLO), and Nano Nuclear Energy saw huge stock swings in 2024 as AI narratives took hold, but profits are far in the future and execution risk is high. Investors

These are more akin to venture-style bets embedded in public equities — potentially high upside, but very binary and sensitive to policy and project-level setbacks.

If you include them at all, they usually fit better as a small "call option" slice on top of a core portfolio of established operators like NEE / VST / CEG / D / DUK.

9. Putting it together: building an AI–nuclear "basket"

This is *not* investment advice, but one way to think about structuring exposure:

9.1. Core nuclear operators with direct AI/data-center deals

- Constellation (CEG) – largest U.S. nuclear fleet; 20-year Meta nuclear PPA; $1B federal nuclear contract. Constellation

- Vistra (VST) – 1,200 MW, 20-year nuclear PPA at Comanche Peak likely serving hyperscale AI loads; major beneficiary of ERCOT/PJM price strength. Utility Dive

These are the highest-torque names: more exposure to power prices, but also the clearest link between AI demand and nuclear cash flows.

9.2. Regulated utilities riding AI demand with nuclear backbones

- NextEra (NEE) – Duane Arnold nuclear restart with Google (25-year deal); multi-GW data-center deals with Google and Meta; big renewables and storage pipeline. Reuters

- Dominion (D) – largest data-center-serving utility in the world; exploring SMRs at North Anna with Amazon; strong Virginia nuclear base. Reuters

- Duke (DUK) – six nuclear plants provide over 50% of Carolinas electricity and nearly all of its clean energy; extending plant lives to support long-term growth. World Nuclear News

These names give you more stability and dividends, with nuclear serving as the backbone of a broader growth plan.

9.3. Optional speculative sleeve

- A small allocation (if any) to SMR developers (e.g., SMR, OKLO) or to ETFs covering nuclear/uranium, recognizing that this is high-volatility, long-dated risk. Reuters

10. Key risks

Even if you're bullish on the theme, a few risks are worth stressing:

1. Policy and politics
    - Nuclear benefits from bipartisan support right now, but AI/data-center policy, climate targets, and market design rules (like capacity auctions) can change, affecting cash flows and project economics. Investors
2. Project and technology risk (especially for SMRs)
    - New nuclear projects globally have a history of delays and cost overruns; SMRs are promising but unproven at scale. Reuters
3. Grid constraints and backlash
    - In PJM and Virginia, regulators are already questioning whether the grid can safely accommodate all the new data centers being proposed. That could slow or reshape build-outs. Business Insider
4. Valuation / "theme fatigue"
    - Some of the clearest winners (VST, CEG) have already had very large runs as "AI power" stories. Future returns will depend on actual earnings growth, not just narrative. Investors

11. Understanding U.S. Power Markets: PJM, ERCOT, and Why They Matter

AI-driven electricity demand doesn't affect the entire U.S. grid equally. Most of the opportunity — and the stress — shows up in a few key regional power markets. To understand why companies like Constellation, Vistra, Dominion, and NextEra are positioned the way they are, it helps to know how these markets work.

Below is a concise guide to the major U.S. grid operators.

11.1 PJM Interconnection — The Nation's Most Important Power Market

What PJM is:

PJM is a Regional Transmission Organization (RTO) — a grid operator for a massive multi-state region spanning the Mid-Atlantic and parts of the Midwest. It runs:

- The high-voltage transmission grid
- The real-time/power markets
- The "capacity market," which pays generators to be available in the future

It does not own power plants or transmission lines; it coordinates them.

Why PJM matters for AI + nuclear:

- Northern Virginia is the world's largest concentration of data centers.
- Regulators warn the PJM grid may struggle to support expected load growth without major new generation.
- Nuclear provides exactly the kind of 24/7, carbon-free power data centers demand.

For investors, PJM's tightening supply/demand balance increases the value of nuclear-heavy companies like Constellation (CEG) and Vistra (through its PJM nuclear fleet), and reinforces the need for regulated nuclear assets at Dominion and Duke.

11.2 ERCOT — The Wild West of Electricity (Texas)

What ERCOT is:

ERCOT operates the Texas grid, which is largely isolated from the rest of the U.S. ERCOT is a pure "energy-only" market, meaning:

- Power plants are paid mostly for energy produced, not for capacity
- Prices can swing wildly
- Merchant generators enjoy high upside when demand spikes

Why ERCOT matters for AI + nuclear:

Texas is experiencing national-leading load growth driven by:

- AI data centers
- Crypto mining
- LNG export terminals
- Population and industrial expansion

Vistra's Comanche Peak nuclear plant, along with its gas fleet, places it at the heart of ERCOT's AI demand surge.

11.3 CAISO — The Solar-Heavy California Market

What CAISO is:

CAISO runs most of the California grid. It is dominated by solar generation, with heavy policy involvement and growing electrification needs.

Relevance to AI-nuclear:

- Limited nuclear exposure (Diablo Canyon is the major exception).
- Strong demand growth, but most new capacity is renewables + batteries, not nuclear.
- Less direct as an AI-nuclear investment theme.

11.4 SPP — The Wind Corridor

SPP (Southwest Power Pool) covers states like Kansas, Oklahoma, Arkansas, and parts of the Texas Panhandle.

- Extremely high wind penetration
- Increasing transmission constraints
- Limited nuclear presence
- More relevant for wind developers than nuclear operators

11.5 MISO — The Coal-to-Renewables Transition Belt

MISO spans the Midwest down to Louisiana.

- Significant coal retirements pending
- Rising renewable additions
- Some nuclear units (e.g., Entergy), but not a core AI nexus
- Load growth is more industrial than data-center-led

12. Investor Takeaway: Why PJM & ERCOT Dominate the AI–Nuclear Thesis

Among all U.S. power markets, two stand out for investors:

12.1 PJM: the grid under the most stress from data centers

- Largest cluster of global data centers
- Rapidly rising load forecasts
- Limited new firm generation
- Nuclear becomes more valuable the tighter PJM gets

This favors: CEG, VST (PJM units), Dominion, Duke

12.2 ERCOT: the grid with the highest upside & volatility

- Explosive demand growth from AI, crypto, and industrial expansion
- Highly competitive market with big price swings
- Nuclear scarcity (one major plant) boosts value of Comanche Peak's output
- Merchant models benefit if prices rise

This favors: Vistra (VST)

12.3 Know the Grid, Know the Investment

AI computing is not evenly distributed across the country — and electricity economics vary dramatically by region. Companies positioned in PJM and ERCOT are the most levered to the AI-nuclear theme, while utilities like NEE, D, and DUK provide a steadier, more regulated way to participate.

This geographic dimension is foundational: Where the data centers go determines which power companies win.

13. Key Takeaways

If you want exposure to AI-driven electricity demand, anchored in nuclear, you don't have to guess which SMR will work or which fusion start-up will win. A pragmatic approach is:

- Use CEG and VST for high-torque exposure to existing nuclear fleets and merchant pricing.
- Use NEE, D, and DUK as more stable, regulated platforms that embed nuclear in a broader plan to serve AI, data centers, and electrification.
- Add a small speculative SMR sleeve if you want venture-style risk.

For investors choosing between these companies, the right pick depends on your risk tolerance: more VST/CEG for upside and volatility; more NEE/D/DUK for stability and dividends.

NextEra Energy (NEE) is a solid choice for those seeking long-term stability with exposure to AI demand; it combines nuclear, renewables,

storage, and regulated utility earnings, and is a lower-volatility investment.

Dominion Energy (D) is ideal for conservative investors who want direct exposure to the world's largest data-center market in Virginia, plus future SMR potential, all within a regulated framework.

Constellation Energy (CEG) offers the strongest pure nuclear exposure and is well suited for investors who want high-quality assets with solid upside as AI increases the value of firm, carbon-free baseload power.

Vistra (VST) provides the greatest potential upside—but also the most volatility—as it benefits significantly when electricity markets tighten in ERCOT and PJM; it fits investors who are comfortable with higher risk.

Duke Energy (DUK) rounds out the group as a stable, dividend-oriented utility with a large nuclear fleet, better suited for investors who want steady returns rather than a direct AI-driven growth story.

References

1. Virginia Business — "Energy report: Data centers now use over 25% of Virginia's electricity"

   https://www.virginiabusiness.com/article/data-centers-energy-demand/

2. Business Insider — "US watchdog warns PJM grid may not handle coming AI/data-center load growth"

   https://www.businessinsider.com/pjm-grid-warning-data-centers-power-demand-2024-2025

3. Virginia Business — "Virginia data-center electricity demand could grow fivefold by 2038"

https://www.virginiabusiness.com/article/va-energy-report-data-centers-forecast/

4. Investors.com / Investor's Business Daily — "Vistra stock surges as AI data-center demand lifts power markets"

   https://www.investors.com/news/technology/vistra-stock-ai-power-demand/

5. Utility Dive — "Vistra completes acquisition of Energy Harbor, forming Vistra Vision nuclear generation unit"

   https://www.utilitydive.com/news/vistra-energy-harbor-nuclear-acquisition-vistra-vision/706964/

6. Utility Dive — "Vistra signs 20-year PPA for 1.2 GW of nuclear output from Comanche Peak"

   https://www.utilitydive.com/news/vistra-comanche-peak-nuclear-ppa-texas/709842/

7. Utility Dive — "Details emerge on Vistra's long-term PPA and extension options for Comanche Peak"

   https://www.utilitydive.com/news/vistra-nuclear-contract-texas-hyperscalers/713002/

8. Reuters — "Vistra shares jump as tight ERCOT and PJM grids benefit merchant generators"

   https://www.reuters.com/markets/us/vistra-stock-rises-tight-power-grids-2025-07-18/

9. American Public Power Association — “NRC extends Comanche Peak nuclear plant license to 2053”

   https://www.publicpower.org/periodical/article/nrc-extends-comanche-peak-license

10. Utility Dive — “Vistra to build 860 MW of new natural gas plants in Permian Basin”

    https://www.utilitydive.com/news/vistra-permian-gas-plant-texas/708555/

11. Utility Dive — “Google signs 25-year PPA tied to restarting the Duane Arnold nuclear plant”

    https://www.utilitydive.com/news/google-duane-arnold-nuclear-restart-purchase-agreement/710102/

12. Reuters — “Google and NextEra partner on AI-optimized grid technology and data-center expansions”

    https://www.reuters.com/technology/google-nextera-ai-grid-expansion-2025-12-08/

13. Reuters — “Meta signs over 2.5 GW of clean-energy deals with NextEra to power new data-center buildout”

    https://www.reuters.com/sustainability/meta-renewable-energy-contracts-nextera-2025-05-16/

14. Investopedia — “NextEra lifts earnings guidance as AI-related load boosts renewables pipeline”

https://www.investopedia.com/nextera-energy-earnings-ai-demand-2025-7837294

15. Reuters — “NextEra extends Point Beach nuclear output under long-term supply agreement”

    https://www.reuters.com/world/us/nextera-extends-nuclear-contract-wppi-energy-2025-03-11/

16. Constellation Energy — “Constellation: America’s largest producer of carbon-free nuclear power”

    https://www.constellationenergy.com/about-us/zero-carbon-nuclear.html

17. Seeking Alpha — “Constellation benefits from nuclear fleet leverage as power prices rise”

    https://seekingalpha.com/article/4657712-constellation-energy-nuclear-cash-flow-strength

18. Constellation Energy — “Meta and Constellation sign 20-year deal for clean nuclear energy (Clinton Clean Energy Center)”

    https://www.constellationenergy.com/newsroom/2025/meta-constellation-nuclear-ppa.html

19. Reuters — “Constellation awarded $1B federal nuclear contract to supply clean energy to U.S. agencies”

    https://www.reuters.com/business/energy/constellation-wins-1-billion-contract-federal-clean-power-2025-04-22/

20. Reuters — “Constellation to acquire Calpine in $16.4 billion deal amid rising AI electricity demand”

https://www.reuters.com/markets/us/constellation-calpine-acquisition-ai-energy-demand-2025-09-14/

21. Investors.com / Investor’s Business Daily — “Constellation stock outperforms as AI megatrend boosts nuclear”

https://www.investors.com/news/technology/constellation-energy-nuclear-ai-demand/

22. Dominion Energy — “Dominion’s nuclear fleet: North Anna, Surry, Millstone overview”

https://www.dominionenergy.com/projects-and-facilities/nuclear-facilities

23. Reuters — “Dominion says it now serves more than 450 data centers in Virginia”

https://www.reuters.com/technology/domion-energy-virginia-data-centers-2025-06-30/

24. Utility Dive — “Dominion issues RFP to explore small modular reactors at North Anna”

https://www.utilitydive.com/news/dominion-smr-rfp-north-anna/706443/

25. Virginia Mercury — “Dominion and Amazon Web Services to explore SMR deployment in Virginia”

https://www.virginiamercury.com/2024/07/12/dominion-aws-smr-north-anna/

26. Investors.com / Investor's Business Daily — "NRC extends North Anna nuclear plant licenses to 2060"

    https://www.investors.com/news/nuclear-reactors-license-extension-north-anna/

27. Reuters — "DOE awards up to $800 million for TVA and Holtec SMR projects"

    https://www.reuters.com/world/us/us-energy-department-smr-development-2024-09-20/

28. Investors.com — "NuScale, Oklo, and Nano Nuclear: AI-fueled SMR rally carries major risks"

    https://www.investors.com/news/smr-stocks-nuscale-oklo-nano-nuclear-analysis/

29. Reuters — "Grid regulators warn PJM transmission limits threaten AI/data-center expansion"

    https://www.reuters.com/world/us/pjm-grid-warning-data-centers-demand-2025-05-14/

30. Business Insider — "Regulators question whether grid can handle data-center proposals"

    https://www.businessinsider.com/data-centers-grid-capacity-pjm-virginia-2025