Cost, Complexity, and Consequences: Rethinking ERCOT's Ancillary Services

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Executive summary – Cost, Complexity, and Consequences: Rethinking ERCOT's Ancillary Services

On the Electric Reliability Council of Texas (ERCOT) grid, keeping the lights on requires more than wholesale energy. ERCOT relies on ancillary services (AS) — reserves, regulation, and frequency response — plus price adders and other non-energy mechanisms that function like insurance, allowing the system to respond instantly when a generator trips or demand spikes.

While indispensable, costs and complexity have climbed. In 2023, total non-energy charges — ancillary services, ORDC adders, reliability adders, uplifts, and administrative fees — exceeded $2.1 billion. Even after falling to $1.05 billion in 2024, they remain well above mid-2010s norms. Some mechanisms track wholesale energy prices while others do not — and several target overlapping capabilities. ERCOT rules prevent double-counting of the same megawatt, but layered product qualifications and opaque bilateral arrangements can make it difficult to trace what Texans are truly paying for.

This report explains what each AS does, how it interacts with energy markets, and where costs concentrate. It also highlights how overlapping qualifications, self-arrangement, and procurement rules shape outcomes. For quick reference, key terms used in this report are defined in Appendix A.

Key findings

- **Transparency limits** — ERCOT publishes aggregate totals of self-arranged AS, but not details such as contract prices, counterparties, or resource-level participation. This leaves the systemwide cost and liquidity impact of self-arrangement less visible.
- **Procurement rigidity** — some services are procured in preset volumes regardless of real-time conditions, risking overbuying lower-value products.
- **Layered qualifications** — the same physical capability can qualify for multiple AS. Rules prevent explicit double-counting, but layered awards make it harder to separate incremental reliability value from overlapping payments.
- **Market shifts** — rapid storage growth saturated some AS products by late 2024, lowering clearing prices even as batteries continued to depend heavily on AS revenues.

Policy implications

- Expand reporting on **self-arranged AS** to include detail beyond systemwide totals — clarifying contract structures, counterparties, and impacts on clearing prices.
- Link procurement volumes more closely to **marginal system needs** rather than static blocks.
- Provide **contextual reporting of per-MW revenues** across AS categories, to show how layered awards accrue even where physical double-counting is avoided.
- Revisit **product definitions** to reflect modern operational challenges such as steep ramps and duration needs.

Key takeaway: Reliability at the right cost

Texans already pay billions each year for the grid's "insurance policy." The question is whether those premiums are:

- **Clear** — with transparency into how self-arrangement and layered awards function in practice,
- **Efficient** — ensuring payments reflect distinct, deployable capability,
- **Risk-based** — tied to real-time system needs rather than static volumes, and
- **Modernized** — aligned with today's operational risks, from steep ramps to longer-duration coverage.

Reforms could ensure that every dollar Texans spend on reliability delivers genuine protection.

1. Introduction – Texans pay billions each year for grid "insurance" — but are the costs always as clear as they should be?

When you buy home or auto insurance, you expect two things: protection when something goes wrong, and clarity about what you are paying for. Texans face something similar on the electric grid. Beyond the cost of energy itself, the Electric Reliability Council of Texas (ERCOT) procures a set of "insurance policies" — ancillary services (AS) such as reserves, regulation, and frequency response — along with price adders and other non-energy mechanisms. These tools safeguard reliability against sudden shifts in supply or demand, helping to keep the lights on when conditions change unexpectedly.

The cost of this protection has grown. According to Potomac Economics (2023 and 2024), ERCOT's independent market monitor, non-energy costs — including AS, ORDC and reliability adders, uplifts, and administrative fees — totaled $2.12 billion in 2023, more than double mid-2010s levels, and remained high at $1.05 billion in 2024. Some of these charges track wholesale energy prices, while others operate independently. And although ERCOT rules prevent the same megawatt from being paid twice for delivering multiple services at once, overlapping product definitions, procurement rigidity, and self-arranged capacity can still make total spending appear larger than the distinct reliability benefit being delivered.

This report explains ERCOT's ancillary services and other non-energy cost components in plain terms: what they are, how much they cost, how they interact with wholesale markets, and where overlapping qualifications and procurement practices complicate visibility. It also examines why some market participants choose to "self-arrange" AS outside of ERCOT's centralized auctions — and what that means for both cost allocation and transparency across the system.

For ease of reference, key terms used in this report are defined in Appendix A. The following sections walk through ERCOT's AS taxonomy, their price behavior, and the transparency challenges they present — setting the stage for cost and policy implications.

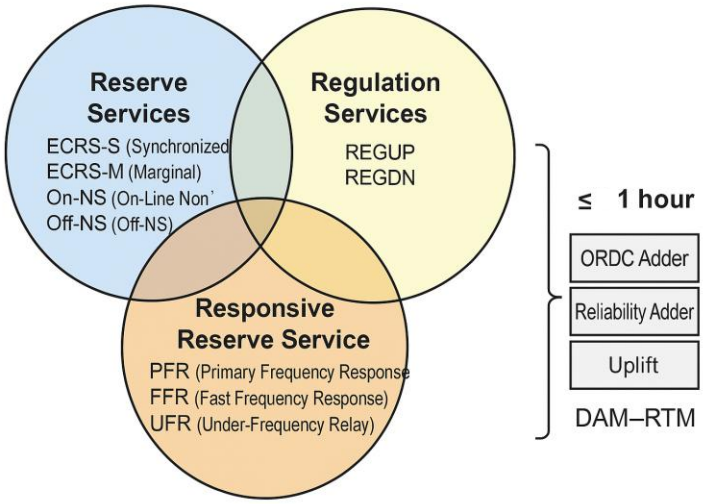
2. A taxonomy of ERCOT's ancillary services

ERCOT's menu of ancillary services (AS) can feel like alphabet soup — ECRS, NSRS, REGUP, PFR, FFR, UFR — with limited external guidance on what each product does. In practice, these services fall into three functional "families," grouped by their purpose and speed of response.

Think of them as different types of insurance riders: some cover short-term shocks, others smooth continuous fluctuations, and a few provide last-resort protection. Together, they give ERCOT the ability to bridge immediate supply–demand gaps until the market rebalances through real-time dispatch or next-day scheduling.

All ERCOT AS products are short-duration by design — deployable within an hour or less. They are not substitutes for long-term adequacy but rather buffers that provide operational continuity when the grid is under stress.

Figure 1. ERCOT's ancillary services fit into three families — reserves, regulation, and responsive reserves — each designed to cover short-term reliability risks within an hour or less.



AS families and functions

ERCOT groups its ancillary services into three broad families, aligned with its Day-Ahead Market (DAM) and Real-Time Market (RTM) timelines. Quantities are primarily secured in the DAM based on forecasts and fine-tuned in the RTM to reflect actual conditions:

- **A. Reserve Services – Standby capacity, deployable within minutes to half an hour**
  - **ECRS (ERCOT Contingency Reserve Service, including ECRS-S and ECRS-M):** Online units holding headroom, able to ramp quickly when called. Introduced in 2023, this service reflects ERCOT's evolving AS design.
  - **On-NS (On-Line Non-Spin):** Online but not at full output, available within 30 minutes.
  - **Off-NS (Off-Line Non-Spin):** Offline but able to start and deliver within 30 minutes.
- **B. Regulation Services – Continuous balancing of system frequency around 60 Hz**
  - **REGUP:** Increases output or reduces load when frequency dips.
  - **REGDN:** Reduces output or increases load when frequency rises.
- **C. Responsive Reserve Services – Last line of defense against sudden frequency drops**
  - **PFR (Primary Frequency Response):** Automatic governor response from synchronous generators.
  - **FFR (Fast Frequency Response):** Batteries or loads reacting in under a second.
  - **UFR (Under-Frequency Relay):** Automatic load shedding at a preset threshold.

Ancillary services as insurance policies

Just as households carry different insurance riders for routine risks and rare disasters, ERCOT layers ancillary services to safeguard the grid.

AS family	Role in the grid	Insurance analogy
Reserve Services (ECRS, On-NS, Off-NS)	Standby capacity that can be called within minutes to half an hour	Like **comprehensive coverage** — pays for sudden but expected incidents (e.g., fender-benders, burst pipes)
Regulation Services (REGUP, REGDN)	Fine-tunes frequency around 60 Hz every few seconds	Like **collision insurance** — keeps you balanced after small bumps, correcting quickly before bigger problems build
Responsive Reserve Services (PFR, FFR, UFR)	Last line of defense against sharp frequency drops	Like **catastrophic coverage** — only kicks in when the worst happens (e.g., major accident or house fire)

Other non-energy charges — such as ORDC adders, reliability adders, and uplift — act more like premium surcharges. They provide additional protection but can overlap with existing coverage, making total costs harder to parse.

Bottom line: Texans are effectively paying for a layered insurance package. The key questions are whether that coverage is transparent, efficient, and aligned with the risks the grid actually faces.

Because these products operate on near-instant to sub-hour timelines, they function like an emergency fund: rarely the main plan, but essential when shocks occur.

Other non-energy "premiums"

Ancillary services are only one part of ERCOT's broader reliability framework. Other charges also act as reliability premiums:

- **Operating Reserve Demand Curve (ORDC) adder:** Raises energy prices when reserves are tight, signaling scarcity.
- **Reliability adder:** Maintains conservative reserve levels, even above minimum requirements.
- **Uplift:** Recovers costs from out-of-market operator actions not captured in clearing prices.

These charges often operate alongside AS procurement — and in some hours, they can exceed AS costs. Understanding how they interact is critical to assessing whether ERCOT's portfolio of reliability tools is efficient and complementary.

Comparison with other ISO/RTOs

ERCOT's AS portfolio is narrower and shorter in duration than that of PJM, CAISO, or MISO, which offer multi-hour ramping reserves, distinct contingency categories, or market-priced services such as black

start and inertia. ERCOT manages many of these attributes administratively — consistent with its energy-only market design and real-time focus.

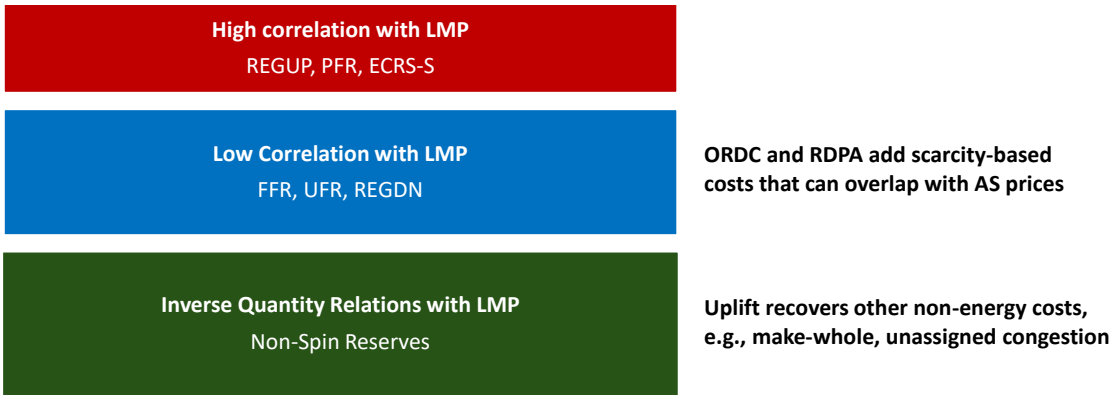
In insurance terms, ERCOT emphasizes short-term, pay-as-you-go coverage rather than the layered, longer-duration protections common in other regions. This focus keeps reliability tools closely tied to real-time operations but also means ERCOT spends more on immediate coverage while longer-duration risks remain outside transparent market mechanisms.

Understanding this taxonomy is essential, because while each product serves a clear operational purpose, the way ERCOT layers them — together with price adders and other non-energy charges — can make total reliability spending less transparent than the functions themselves.

3. How ancillary services relate to power prices

Ancillary service (AS) prices do not all move in lockstep with wholesale electricity prices (locational marginal prices, or LMPs). Their relationship depends on the type of resource providing the service, the opportunity costs it faces, and how ERCOT procures it. In insurance terms, some "premiums" are priced dynamically against market risk, while others remain relatively fixed regardless of conditions.

Figure 2. Ancillary service prices diverge in their correlation with energy prices — some rise with scarcity, others stay stable, and Non-Spin often declines.



High correlation with LMP – opportunity-cost driven

- REGUP, PFR, and ECRS-S are mainly provided by online dispatchable generators. These units can either sell more energy into the real-time market or hold back capacity for reserves.
- To commit to AS instead of energy, providers must be compensated at least the value of foregone energy sales. This pulls AS prices upward during high-LMP hours.
- As a result, these products often rise in step with scarcity events — even without an AS shortage being declared.

Low correlation with LMP – fixed-cost driven

- FFR, UFR, and REGDN are typically supplied by batteries, demand response, or automated relay controls that do not participate in real-time energy sales.

- Their prices reflect capital recovery and operating costs, plus any scarcity-driven procurement adjustments, rather than wholesale price movements.
- These services are therefore less tied to LMPs and tend to remain more stable across hours.

Inverse quantity relationship with LMP

- Non-Spin reserves come from offline units that take longer to start.
- During scarcity, ERCOT often reduces Non-Spin procurement in favor of faster products like ECRS or PFR.
- This can cause Non-Spin volumes — and costs — to fall even as LMPs climb.

Why this matters

These patterns explain why AS costs can diverge from energy costs — and why introducing new AS products can create unexpected interactions. In some hours, a fast-responding service may substitute for higher-priced reserves, lowering total costs. In other hours, it may layer on top of existing commitments, raising costs by inflating payments for overlapping functionality. Importantly, ERCOT's rules prevent literal double-payments for the same megawatt, but the interaction of product definitions and procurement choices can still make reliability spending appear larger than the incremental reliability being delivered.

In insurance terms, it is the difference between a supplemental rider that replaces existing coverage and one that simply adds another charge on top of it. The design of each AS product — and how it interacts with others — determines whether Texans are paying for efficient protection or for premiums that layer without always adding commensurate value.

Context with other non-energy costs

Ancillary services are only one part of ERCOT's broader reliability cost framework:

- **Operating Reserve Demand Curve (ORDC) adders** – Raise energy prices when reserves are scarce, signaling risk.
- **Reliability Deployment Price Adder (RDPA)** – Compensates resources when ERCOT operates conservatively, such as by holding additional reserves.
- **Uplift charges** – Recover costs from out-of-market reliability actions, such as make-whole payments or unassigned congestion.

ORDC and RDPA can overlap with AS in that they reward the same online resources holding reserves, though through different mechanisms (energy price adders versus explicit service awards). Uplift charges add yet another layer — costs not tied directly to either energy or AS clearing prices.

In short: ERCOT's reliability "premiums" don't all move with energy prices in the same way. Some track them closely, others operate independently, and a few even decline as prices rise. While no single product produces outright duplicative payments, the combined effect of overlapping mechanisms blurs transparency — making it harder to know how much Texans are truly paying for reliability, and whether today's mix of premiums is the most efficient way to cover the grid's risks.

4. Overlaps and transparency challenges

ERCOT's ancillary service (AS) design allows a single physical unit to qualify for multiple products at the same time. This flexibility helps ERCOT meet diverse operational needs quickly — but it can also create functional overlaps, where the same megawatt of headroom or storage duration is credited across several services. In insurance terms, this can resemble buying riders that all draw on the same coverage: the protection is real, but the total premiums may exceed the incremental value.

Overlapping qualifications

This is not just theoretical. In early 2024, battery storage systems in ERCOT earned up to 85% of their revenues from ancillary services — averaging about $55,000 per MW annually — much of it from stacked awards across multiple products (Dekshenieks 2024).

Example: An online natural gas combined-cycle unit could simultaneously offer its unused headroom as:

- **ECRS-S** for synchronized reserves,
- **REGUP** for regulation up,
- **PFR** for primary frequency response, and
- **On-NS** for online non-spin.

All four products draw on the same physical headroom — the difference between current output and ramping capability. ERCOT rules generally prevent double-counting for delivery, but the same capability can still be priced under multiple categories, complicating cost attribution.

A real-world case occurred during **Winter Storm Heather (January 2024)**, when scarcity touched multiple AS products at once. Some batteries delivered ECRS, REGUP, and PFR in the same hours, earning as much as 74% of their two-month revenue in just a few scarcity days.

Self-arrangement: A parallel track

Self-arrangement introduces another layer of opacity, where load-serving entities (LSEs) can satisfy AS obligations with their own resources.

- *Mechanism*: LSEs notify ERCOT of self-arranged capacity before the operating day, which is credited against their procurement obligation.
- *Compensation*: Payments are internal (e.g., between a retail affiliate and a generator) or bilateral, not tied to the market-clearing price.
- *Market effects*: While often lowering costs for the LSE, self-arrangement reduces liquidity and transparency in ERCOT's AS markets. With fewer offers in the stack, clearing prices for others may be higher.

Self-arrangement as self-insurance

Self-arrangement introduces another layer of complexity. By allowing Load-serving entities (LSEs) to satisfy AS obligations with their own resources, it reduces market procurement volumes. While efficient for individual LSEs, this practice limits price transparency and can influence clearing prices for remaining market participants.

How it works

- LSEs commit capacity from their own or affiliated resources.
- ERCOT credits this against their AS procurement obligation.
- Transactions are settled internally (through corporate affiliates or bilateral contracts) rather than at the market-clearing price.

Benefits for the LSE

- Can reduce costs by avoiding high market prices.
- Provides more control and certainty over AS obligations.
- Useful hedge during volatile AS pricing periods.

System-wide consequences

- Reduces liquidity in ERCOT's AS auctions.
- Fewer bids in the stack can push clearing prices higher for others.
- Erodes transparency — ERCOT and market participants see less of the true cost and availability of reserves.

Bottom line: Self-arrangement can be an effective hedge for individual LSEs, much like a company choosing to self-insure. But system-wide, it creates blind spots and can shift costs onto others, raising questions about fairness and efficiency.

Patterns of functional overlap

Overlapping qualifications tend to cluster into three groups:

1. **Online headroom products** (ECRS-S, REGUP, PFR, On-NS) – All draw on ramping capability from online units; their values can be additive in price but not in physical deliverability.
2. **Offline quick-start products** (Off-NS, ECRS-M) – Depend on fast-start capability; lower cost in normal hours but more valuable in scarcity.
3. **Load/storage-based products** (FFR, UFR) – Supplied by batteries or responsive load; very fast, but often priced by capital recovery rather than energy opportunity cost.

Battery strategies and market evolution

Batteries highlight how these overlaps translate into revenues:

- **Short-duration systems (≤1 hour):** Averaged ~36% of revenues from regulation.

- **Longer-duration systems (≥2 hours):** Averaged ~43% from responsive reserves.
  High AS prices in 2022–2023 spurred development; by late 2024, saturation drove down some clearing prices. Short-duration batteries pivoted toward energy arbitrage, while longer-duration systems retained stronger AS positions.

At the same time, **self-arrangement** expanded as a hedge against volatile AS costs, further reducing system-wide price discovery.

Table 1. ERCOT ancillary services: Product attributes, market links, and cost drivers

Functional cluster	AS product	Deployment time	Primary resource types	Prioce correlation	Common overlaps	Self-arrange potential
Online headroom products	ECRS-S	Seconds-minutes	Online thermal units (CCGT, CT)	High	REGUP, PFR, On-NS	Yes
Online headroom products	REGUP	Seconds	Online thermal units, some batteries	High	ECRS-S, PFR, On-NS	Yes
Online headroom products	REGDN	Seconds	Online thermal units, some batteries	Low	ECRS-S, PFR	Yes
Online headroom products	PFR	Seconds	Synchronous thermal units	High	ECRS-S, REGUP, On-NS	n/a
Online headroom products	On-NS	< 30 min	Online thermal units at partial load	High	ECRS-S, REGUP, PFR	Yes
Offline quick-start products	Off-NS	< 30 min	Offline thermal units, some engines	Medium	ECRS-M	Yes
Offline quick-start products	ECRS-M	< 30 min	Offline quick-start thermal units	Medium	Off-NS	Yes
Load/Storage-based products	FFR	<1 sec- 30 secs	Batteries, responsive loads	Low	UFR	Yes (via RRS)
Load/Storage-based products	UFR	Instant (relay)	Automated load shedding	Low	FFR	n/a

Table 1 summarizes how each AS product aligns with resource characteristics and market behavior, shading where functional overlaps occur. Resources able to provide multiple services from the same physical capacity may qualify for — and be paid under — more than one product, particularly among headroom-based AS and storage-based services.

Insurance analogy: Texans may be paying for layered riders on the same risk. The coverage is real, but without clearer disclosure it is difficult to tell how much of the cost reflects genuine incremental protection versus overlapping categories priced in parallel.

5. Cost and policy implications

ERCOT's ancillary services portfolio has become a material driver of wholesale electricity costs. In 2023, non-energy charges — including ancillary services, ORDC and reliability adders, and uplifts — exceeded $2.1 billion, more than double mid-2010s levels. Even after falling to $1.05 billion in 2024, costs remain elevated relative to historical norms. For large industrial consumers whose bills directly reflect these charges, the stakes are significant.

Three main areas of concern

1. Functional overlaps can inflate costs

- Several AS products draw on the same physical capability — such as the ramping headroom of a natural gas unit or the dispatch range of a battery.
- The same megawatt of flexibility can qualify across multiple products, even though it cannot be deployed simultaneously for all of them.
- While consistent with current rules, this gap between physical deliverability and financial qualification can lead to compensation that exceeds the unique reliability contribution.

2. Limited transparency from self-arrangement

- Load-serving entities (LSEs) can meet AS obligations with their own resources rather than through ERCOT's centralized procurement.
- These self-arranged volumes are reported for compliance and appear in aggregate in ERCOT reports. But ERCOT does not disclose bilateral terms, counterparties, or resource-level details, limiting visibility into their true cost and liquidity impacts.
- For arranging LSEs, self-supply can reduce costs. But at the system level, reduced participation in centralized markets weakens price discovery and can push clearing prices higher for others.

3. Procurement rigidity

- Some products — such as Non-Spin or Off-NS — are procured in fixed blocks regardless of real-time conditions or substitutability.
- This "set-and-forget" approach can lead to over-procurement of lower-value services, adding costs without proportional reliability gains.

Policy implications

Together, overlapping payments, limited transparency, and procurement rigidity point to reforms that would make ERCOT's reliability "premiums" more transparent, efficient, and risk-based:

- **Enhance disclosure** — show how self-arranged volumes affect liquidity, clearing prices, and fairness between LSEs.
- **Link payments to deliverability** — compensate only when services reflect distinct, physically deployable capability.
- **Procure to marginal need** — tie volumes to real-time system conditions, not static blocks.
- **Contextualize overlaps** — report per-MW compensation across AS categories to illuminate where layered revenues occur, even if physical double-counting is avoided.
- **Revisit product definitions** — align ancillary services with today's operational risks, including steep ramps and longer-duration events.

Bottom line: These steps would help ensure Texans pay for reliability that is transparent, efficient, and aligned with actual system needs.

Table 2. From current structure to proposed adjustment — with insurance analogy

Current structure	Issue	Proposed adjustment	Insurance analogy
Overlapping qualifications allow the same headroom to count toward multiple AS	Leads to compensation that exceeds unique reliability contribution	Link payments to distinct, physically deployable capability	Avoid paying layered premiums for the same coverage
Self-arranged volumes published only in aggregate totals	ERCOT publishes aggregate totals but not bilateral terms, resource-level details, or price impacts — limiting transparency and obscuring liquidity effects	Enhance disclosure — show how self-arranged volumes affect liquidity, clearing prices, and system-level cost allocation	Avoid hidden fine print by making all coverage costs transparent
Fixed-block procurement of some products (e.g., Off-NS)	Creates risk of over-procurement without proportional reliability gains	Apply marginal-cost logic — procure to real-time system conditions and substitutability	Avoid paying for coverage you don't always need
No contextual tracking of stacked awards across AS	ERCOT reports per-MW compensation by product, but not in a way that illuminates how overlapping qualifications affect total revenues	Contextualize overlaps — report per-MW compensation across categories to show where layered revenues occur, even when physical double-counting is avoided	Avoid hidden overlaps by receiving a clear itemized bill

6. Conclusion – Making sense of ancillary services

Ancillary services are indispensable to ERCOT's real-time reliability. Yet their costs and complexity have grown to the point where closer scrutiny is warranted. What were once routine functions — frequency control, spinning reserves, contingency backup — now account for billions in annual costs and shape new market dynamics for flexible resources such as batteries and quick-start natural gas units.

For all their necessity, ERCOT's AS framework shows signs of strain:

- **Transparency gaps.** Self-arranged volumes are reported in aggregate but without bilateral terms or resource-level detail, limiting visibility into cost impacts, liquidity, and fairness across participants.
- **Procurement rigidity.** Some services are procured in static blocks regardless of marginal need, creating the risk of systematic overbuying with limited incremental reliability value.
- **Functional overlaps.** A single megawatt of capability may qualify for multiple AS categories. While ERCOT rules prevent physical double-counting, the financial results can appear layered, making it harder to see how much compensation reflects unique reliability value.
- **Market shifts.** Batteries, once expected to rely mainly on energy arbitrage, now earn the majority of their revenues from AS. This underscores both their operational value and their dependence on today's market design.
- **Cost recovery blurring.** Mechanisms like ORDC and reliability adders blur distinctions between energy and reliability charges, complicating accountability.

These are not signs of failure — ERCOT's AS framework has enabled reliability through rising net-peak load, variable generation, and tighter reserves. But they do highlight a system that has scaled beyond its original design, trading simplicity for complexity in ways that obscure efficiency and transparency.

Where to go from here

To ensure Texans receive reliability at the right cost, ERCOT and policymakers should:

- **Disclose self-arranged AS in more detail** — clarify their impact on clearing prices, liquidity, and cost allocation.
- **Apply marginal cost logic** — avoid routine overbuying, particularly in low-scarcity hours.
- **Contextualize overlaps** — provide systemwide reporting on how per-MW revenues are distributed across AS categories to illuminate layered payments, even when physical double-counting is not occurring.
- **Revisit product definitions** — modernize AS to better reflect operational risks such as steep ramps and duration needs.

Bottom line: Ancillary services remain the grid's insurance layer — but that insurance should be transparent, efficient, and aligned with today's reliability challenges. Reforms could help ensure that every dollar Texans spend delivers clear, distinct, and proportionate value.

Appendix A: Definitions

This glossary provides concise definitions of specialized market and reliability terms used throughout the paper. It is intended as a quick reference for readers who may not be familiar with ERCOT-specific terminology.

Ancillary Services (AS): Reliability tools ERCOT procures beyond energy to keep the grid stable, such as reserves, frequency response, and regulation.

Battery Storage: A grid resource that can charge when supply is abundant and discharge when demand is high. In ERCOT, batteries increasingly derive most revenues from ancillary services rather than energy arbitrage.

Black Start Service (BSS): Specialized generating units that can restart without an external power supply and help restore the grid following a blackout. In ERCOT, these are procured administratively, not through the market.

ECRS (ERCOT Contingency Reserve Service): Reserves deployable within 10–30 minutes.

- **ECRS-S (Synchronized):** Online units holding back headroom, able to ramp quickly.
- **ECRS-M (Marginal):** The highest-priced portion of ECRS offers, typically more costly to deploy.

Energy Arbitrage: The practice of charging storage when prices are low and discharging when prices are high. Once viewed as the primary business case for batteries, it is now often secondary to ancillary service revenues.

ERCOT (Electric Reliability Council of Texas): The independent system operator (ISO) that manages most of the Texas power grid and its wholesale electricity markets.

Fast Frequency Response (FFR): A form of responsive reserve, usually from batteries or load, that reacts to frequency drops almost instantaneously (often within a second).

Headroom: The unused capability of a generator — the margin between its current output and its maximum capacity. Headroom is often the basis for ancillary service offers.

Inertia Services: The physical momentum of synchronous generators that resists sudden changes in frequency, buying time for other resources to respond. In ERCOT, inertia is not market-priced but managed operationally.

Load-Serving Entity (LSE): A utility, cooperative, or retail electric provider responsible for meeting end-use customer demand in ERCOT. LSEs may self-arrange some ancillary services rather than purchasing them through ERCOT's centralized procurement process.

Non-Spin Reserve Service (NSRS): Capacity deployable within 30 minutes.

- **On-NS:** Online units not at full output, available within 30 minutes.
- **Off-NS:** Offline units that can start and deliver within 30 minutes.

Operating Reserve Demand Curve (ORDC): A mechanism that raises wholesale energy prices when operating reserves fall below certain thresholds. ORDC adders are applied on top of the energy price and paid to all generators producing at that moment, compensating them for being online during tight conditions.

Out-of-Market (OOM) Actions: Reliability interventions directed by ERCOT, such as committing generation or deploying reserves outside of market clearing. Their costs are recovered through adders or uplift charges.

Overlapping Qualifications: A condition in which the same physical megawatt qualifies for — and is paid under — multiple ancillary service products, raising concerns about overlapping compensation.

Primary Frequency Response (PFR): The immediate, automatic adjustment of generation output (or demand) within seconds of a frequency disturbance, such as a generator trip.

Regulation Up/Down (REGUP, REGDN): Ancillary services that fine-tune supply-demand balance every few seconds.

- **REGUP:** Increases generation (or reduces load) when frequency dips.
- **REGDN:** Reduces generation (or increases load) when frequency rises.

Reliability Deployment Adder (RDA): A price uplift applied when ERCOT directs out-of-market actions (such as deploying reserves or committing units for reliability).

Reserve Price Adder (RPA): An automatic price uplift that increases wholesale energy prices when operating reserves fall below specified thresholds.

Responsive Reserve Service (RRS): Quick-acting capacity to arrest frequency decline when a large generator trips offline.

- **PFR (Primary Frequency Response):** See above.
- **FFR (Fast Frequency Response):** See above.
- **UFR (Under-Frequency Relay):** Automatic load shedding at a preset frequency threshold.

Self-Arranged Capacity: Ancillary services procured directly by load-serving entities outside ERCOT's centralized market. While this allows LSEs greater control, it reduces liquidity and transparency in ERCOT's AS markets.

Stacked Revenues (Revenue Stacking): The ability of a single resource — often batteries — to earn revenue from multiple services simultaneously (e.g., energy, regulation, contingency reserves). ERCOT rules prevent the same megawatt from being counted twice for delivery, but overlapping qualifications can yield layered revenues across categories. This is not literal double compensation for a single action, but it can inflate revenues and blur transparency around costs.

Transparency Gaps: Areas where overlapping awards, self-arranged volumes, or uplift charges obscure visibility into the true cost of reliability.

Under-Frequency Response (UFR): A form of automatic load shedding triggered when system frequency drops below a critical threshold.

Uplift Costs: Charges allocated to market participants to recover the costs of out-of-market reliability actions that are not directly priced into energy or ancillary service markets.

References

Dekshenieks, A. (2024) "ERCOT: Battery Energy Storage Revenue Breakdown - Jan/Feb 2024." Modo Energy. Accessed August 12, 2025. https://modoenergy.com/research/ercot-bess-index-january-february-2024-battery-energy-storage-systems-revenues-ancillary-services-energy-arbitrage-eolian-key-capture-energy-jupiter-power-triple-butte.

Electric Reliability Council of Texas (ERCOT). Nodal Protocol Revision Request (NPRR) 1113: Clarification of Regulation-Up Schedule for Controllable Load Resources in Ancillary Service Imbalance. Approved March 31, 2022. Effective May 27, 2022. https://www.ercot.com/mktrules/issues/NPRR1113.

Electric Reliability Council of Texas (ERCOT) (2023). Nodal Protocol Revision Request (NPRR) 1196: Updates to Ancillary Service Failed Quantity Calculations for Non-Controllable Load Resources. Posted August 24, 2023. https://www.ercot.com/mktrules/issues/NPRR1196.

Potomac Economics (2024) 2024 State of the Market Report for the ERCOT Electricity Markets, https://www.potomaceconomics.com/wp-content/uploads/2025/05/2024-SoM-Report-Revision-Jul2025.pdf

Potomac Economics (2023) 2023 State of the Market Report for the ERCOT Electricity Markets, p. 103–104. https://www.potomaceconomics.com/wp-content/uploads/2024/05/2023-State-of-the-Market-Report_Final_060624.pdf