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Queued Up: 2026 Edition Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2025

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2. Interconnection.fyi

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About This Slide Deck:

Queued Up presents an annual snapshot of trends in requests for generator interconnection to the bulk-power (transmission) electric grid.

This data visualization slide deck summarizes empirical data from transmission providers' (i.e., ISO/RTOs and utilities) publicly-available interconnection queues. In some cases, the analysis leverages additional (non-public) data provided to LBNL directly from transmission providers to fill in gaps from the public data. The data presented here only include resources that supply electricity to the transmission grid (i.e., generation and storage); there are separate queues for large loads and those are not included in this report.

The 2026 edition of *Queued Up* summarizes interconnection queue data through the end of 2025. Therefore, any updates to the data and trends that occurred since January 2026 would not be represented in this report.

This slide deck neither directly comments on nor recommends any specific policies – it simply summarizes and explains data trends.

The most up-to-date version of *Queued Up*, alongside a complete data file, previous versions of the report, and other resources, can always be found at:

<https://emp.lbl.gov/queues>

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Contents

- High-Level Findings
- Background, Data, Methods, and Regulatory Activity
- Active Queue Requests
 - ▣ Active queue volume and time trends
 - ▣ Generator type and regional trends
 - ▣ Service type, study phase, and proposed online dates
 - ▣ Interconnection Agreement processing and trends
 - ▣ Hybrid projects in the queues
- Operational and Withdrawn Requests
 - ▣ Volume of operational and withdrawn projects
 - ▣ Completion + withdrawn rates and trends
- Duration Trends – Time in Queues
- Conclusions

What are interconnection queues?

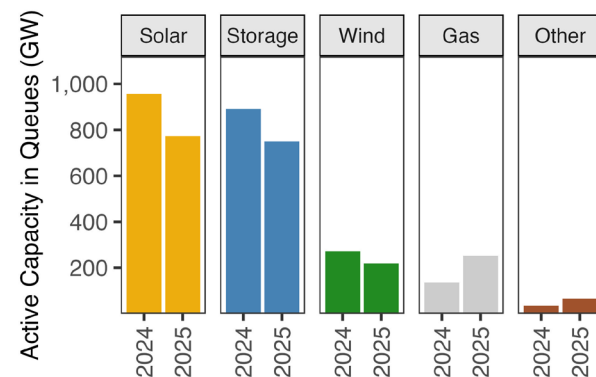
Transmission providers require proposed generation and storage plants seeking to connect to the grid to undergo a series of studies before they can be built. This process establishes what new grid system upgrades may be needed before a project can connect to the system and then estimates and assigns the costs of that equipment. The lists of projects that have applied to connect to the grid and initiated this study process are known as “interconnection queues”.

Visit <https://emp.lbl.gov/queues> to access related resources including the complete dataset used for this analysis and interactive data visualization tools

High-Level Findings

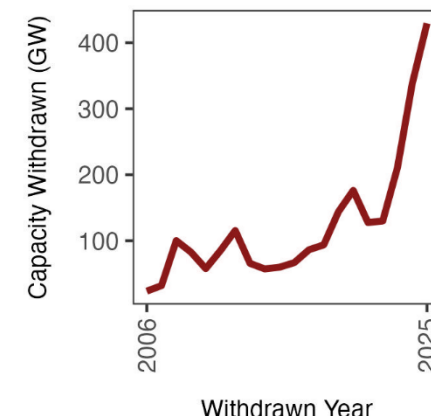
Overall queue volume decreased year-over-year, but gas increased

- Roughly 2,061 gigawatts (GW) of capacity was actively seeking interconnection (1,312 GW of generation; 749 GW of storage)
- Natural gas capacity increased (+86%), while solar (-19%), storage (-16%), and wind (-19%) decreased in 2025



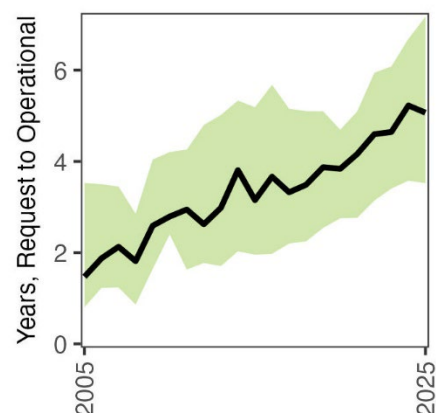
Capacity withdrawn from queues exceeded that added via new requests for the second year running

- Over 750 GW² of capacity withdrew in 2025, while about 600 GW submitted new requests³
- Interconnection process reforms, alongside market conditions, transmission constraints, permitting barriers, and other factors may be contributing to this trend



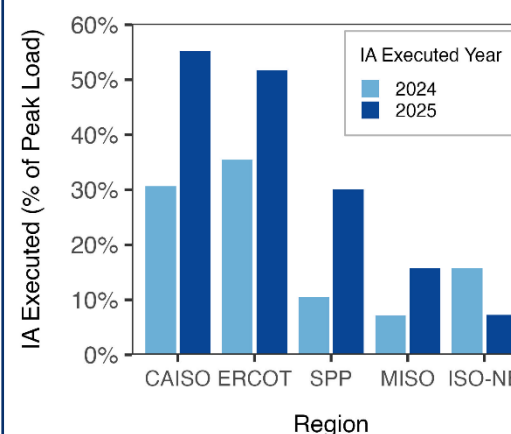
Completion rates are generally low; wait times remain long

- About 19% of projects (13% of capacity) requesting interconnection from 2000-2020 reached commercial operations by the end of 2025



- The average time projects spent in queues remains high in most, but not all, regions. The median project built in 2025 took 61 months from the interconnection request to commercial operations¹, compared to 36 months in 2015 and 22 months in 2008
- These trends raise concerns for meeting growing electricity demand and meeting resource adequacy requirements

Interconnection processing volume increased, with record capacity of new agreements executed in several regions

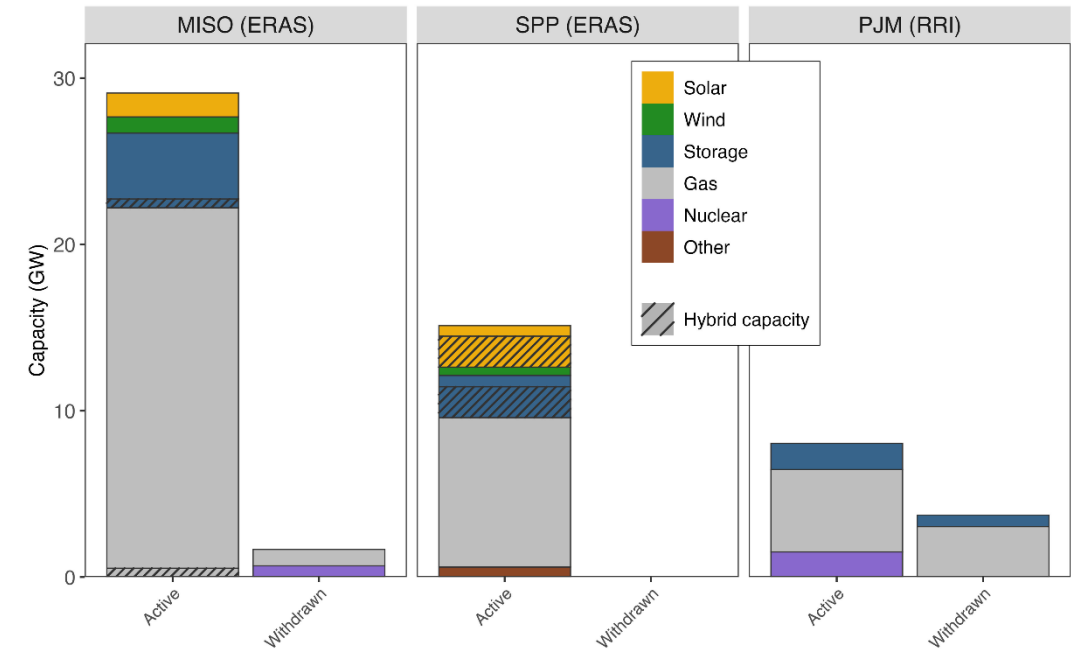


- CAISO, ERCOT, SPP, and MISO processed more interconnection agreements (IAs) than any prior year
- CAISO and ERCOT each processed IAs summing to more than 50% of their peak load capacity in 2025

(1) Valid in-service date was only available for 73% of all operational projects. (2) Withdrawn year was only available for 63% all withdrawn requests, so the chart illustrates less than the total withdrawn capacity in each year. (3) See slide 12 for illustration of year-over-year queue inflow and outflow.

New additions for the 2026 edition of Queued Up:

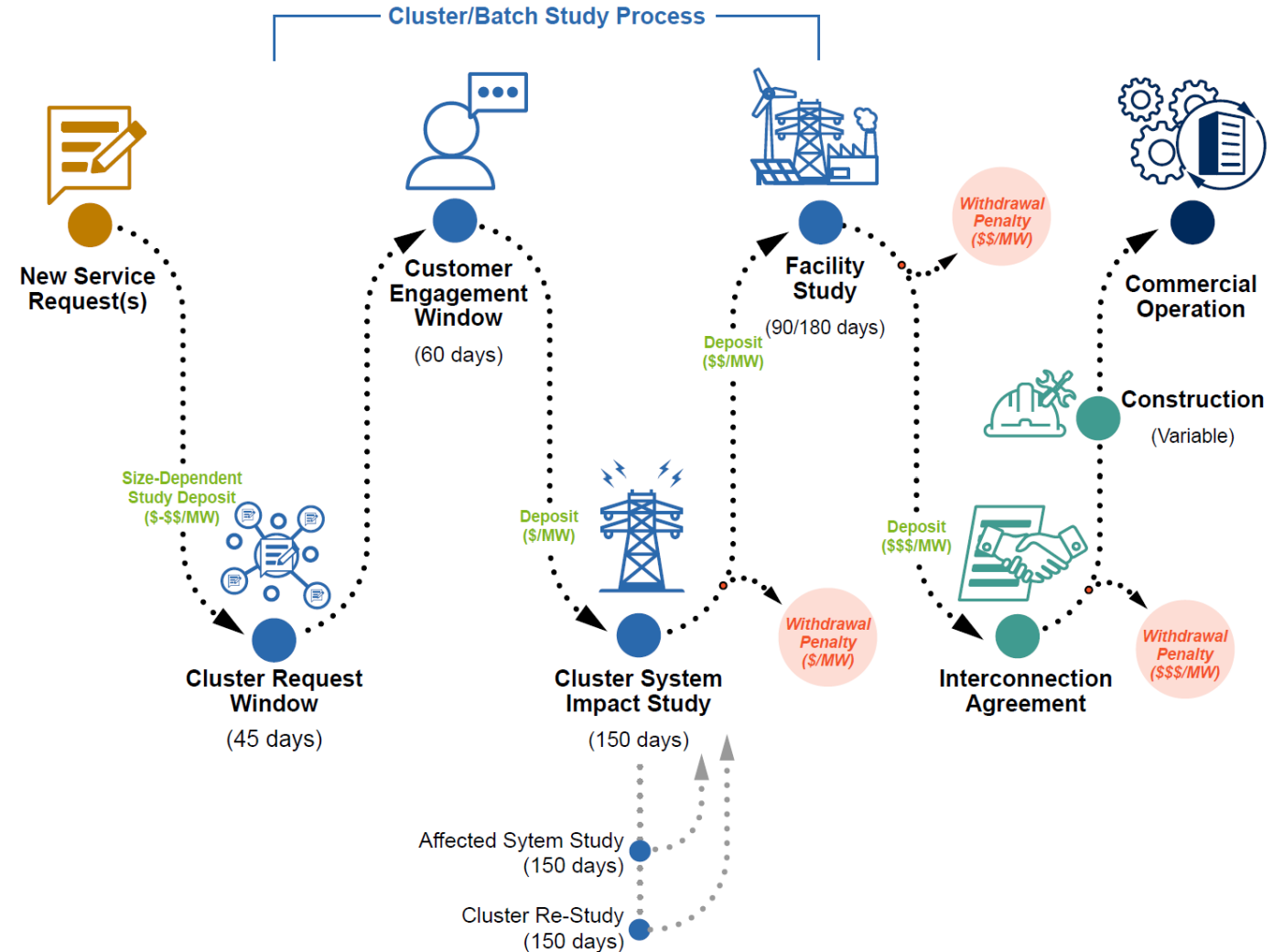
- **Updates to interconnection reforms + regulatory activities**
 - ▣ Major updates to summary of transmission provider interconnection reforms (slide 10)
- **Year-over-year queue inflow / outflow**
 - ▣ More detailed breakdown of year-over-year queue inflow and outflow, including capacity added, withdrawn, and coming online (slide 12)
- **New focus on fast-tracks for resource adequacy**
 - ▣ Summary of resource adequacy fast-track capacity by generator type in MISO (Expedited Resource Addition Study [ERAS]), SPP (ERAS), and PJM (Reliability Resource Initiative [RRI]) (slide 32)
- **Miscellaneous items**
 - ▣ Additional detail on sample sizes (appendix, slides 60-61)
 - ▣ Additional detail ERIS and NRIS interconnection service (appendix, slides 70-71)



Capacity in new resource adequacy fast-tracks introduced in 2025 in MISO, SPP, and PJM. See slide 32 for full-size figure and details.

Typical Interconnection Study Process and Timeline

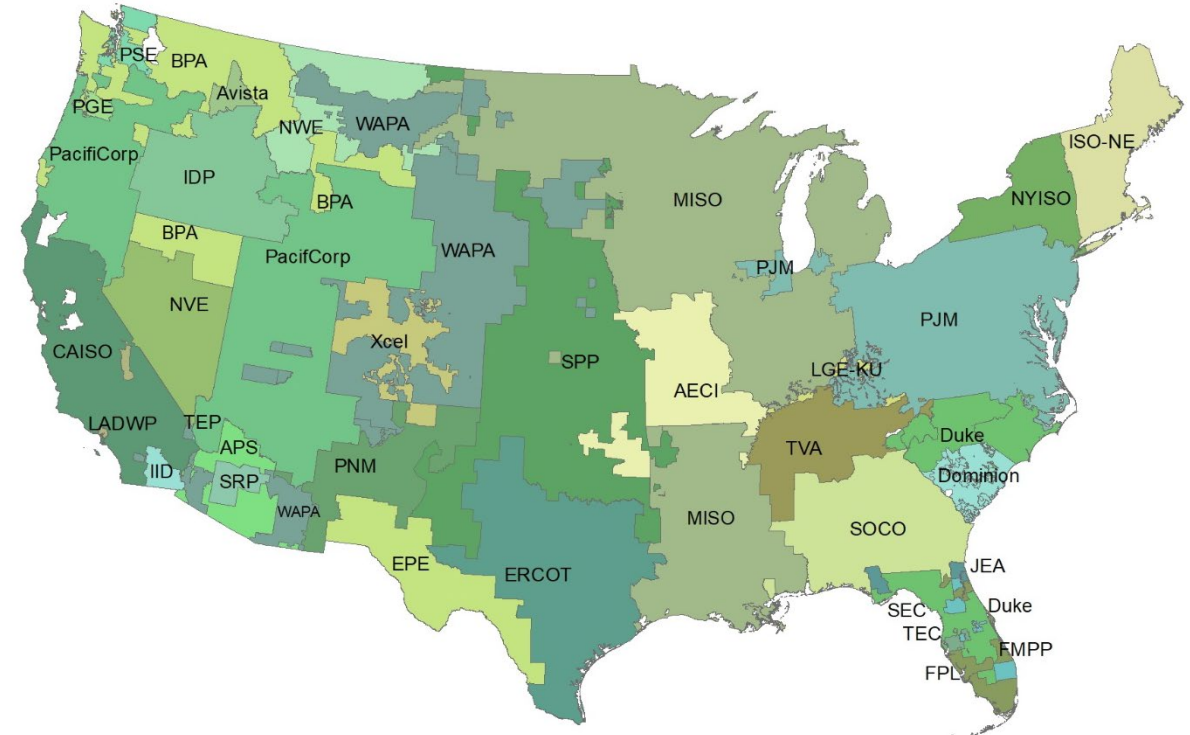
- A project developer initiates a new **interconnection request (IR)** and thereby enters the **queue**
- A series of **interconnection studies** establish what new transmission equipment or upgrades may be needed and assigns the costs of that equipment
- The studies culminate in an **interconnection agreement (IA)**: a contract between the ISO and/or utility and the generation owner that stipulates operational terms and cost responsibilities
- Most proposed projects are **withdrawn**, which may occur at any point in the process
- After executing an IA, many projects are built and reach **commercial operation**



Note: These steps are in accordance with Federal Energy Regulatory Commission (FERC) pro-forma interconnection procedures as outlined in FERC Order 2023. Some ISOs already use a cluster-study approach. The data presented in this report pre-date Order No. 2023 implementation.

Data Sources

- Data collection led by [Interconnection.fyi](https://interconnection.fyi)
- Data collected from interconnection queues for 7 ISOs / RTOs and 50 non-ISO balancing areas (BAs)¹, which collectively represent ~98% of currently installed U.S. electric generating capacity
 - Queue data files are downloaded from transmission provider websites and/or OASIS web pages
 - Includes generation and storage projects that connect to the bulk-power system, not distribution-connected or behind-the-meter²
 - Does not include load interconnection; may include generators co-located with load if the generator is transmission-connected
 - Includes “fast track” interconnection services (e.g., surplus, generator replacement, and resource adequacy fast tracks)
 - Includes interconnection requests from 2000 through the end of 2025
- The full sample³ includes:
 - 4,789 “operational”⁴ projects (~567 GW)
 - 8,244 “active”⁵ projects (~2,061 GW)
 - 668 “suspended”⁶ projects (~137 GW)
 - 24,221 “withdrawn” projects (~4,532 GW)



Coverage area of entities for which data was collected
Data source: Homeland Infrastructure Foundation-Level Data (HIFLD)
Note that service areas can overlap
No data collected for Hawaii or Alaska

A full list of included balancing areas can be found in the appendix

Notes: (1) Non-ISO BAs include utilities and power marketing administrations. (2) This report only covers generator interconnection to the transmission grid (not distribution or load). (3) “Operational” data includes installed power plants that went through interconnection queues. (4) The full ‘Queued Up’ data sample can vary somewhat year-over-year – particularly as missing records or data fields are filled in over time. (5) “Active” requests include those that are actively requesting or undergoing grid interconnection studies, as well as those that have already executed interconnection agreements but have not yet reached commercial operations. (6) The implication of “suspended” differs by balancing area but generally means the request is on hold; see slide 28 notes for detail.

Data Cleaning and Post-Processing Methods

- The initial data collection effort involves downloading >80 queue data files from 57 transmission providers (ISO/RTOs and utilities)
 - These “raw” data files are unstandardized in terms of format, layout, data fields included, and file type (Excel, CSV, PDF, HTML)
- In order to compile a clean dataset for this analysis, substantial data cleaning, standardization, and QA/QC was conducted by LBNL and Interconnection.fyi teams:
 - Standardizing all raw data fields into a specified set of columns
 - Mapping generator types into standardized categories
 - Mapping interconnection status into standardized categories
 - Generating separate capacity columns for hybrid plants (mw_1, mw_2)
 - Cleaning and standardizing other fields (e.g., dates, county, state)
 - Identifying and parsing “fast track” requests (e.g., ERAS in MISO / SPP)
 - Some validation of operational plants via external data (e.g., EIA-860)
 - In-filling missing data (e.g., dates) with other available data sources (e.g., non-public data shared by transmission providers) where possible
- Additional processing required for hybrid power plants
 - Some transmission providers do not explicitly identify hybrid (co-located) power plants; LBNL identifies and matches these
 - Many transmission providers do not provide separate capacity data for each component of hybrid plants. Where *storage* capacity is missing, LBNL estimates and imputes the missing values

The final cleaned, processed, and fully compiled dataset is available at:
<https://emp.lbl.gov/queues>

Field Name	Description
q_id	queue position / ID number
q_status	current queue status (active, withdrawn, suspended, or operational)
q_date	interconnection request date (date project entered queue)
prop_date	proposed online date from interconnection application
on_date	date project became operational (if applicable)
wd_date	date project withdrawn from queue (if applicable)
ia_date	date of signed interconnection agreement (if applicable)
IA_phase_raw	interconnection study phase / status from queue
IA_phase_clean	standardized interconnection study phase / status
county	county where project is located
state	state where project is located
fips_code	5-digit FIPS code
poi_name	point of interconnection name
region	region where project is located (ISO or non-ISO region)
project_name	project name
utility	utility name
entity	transmission provider entity name (ISO or utility)
developer	project developer name
cluster	queue cluster
service	interconnection service type (e.g., ERIS or NRIS, energy or capacity)
project_type	type of project or interconnection request (generation, replacement, surplus, or upgrade)
type_1	resource type 1
type_2	resource type 2
type_3	resource type 3
type_clean	resource type - standardized
mw_1	capacity of type 1 (MW)
mw_2	capacity of type 2 (MW)
mw_3	capacity of type 3 (MW)
q_year	year project entered queue
prop_year	proposed online year from interconnection application

Notable Interconnection Data Gaps

Data	Detail
Interconnection Agreement (IA) / study phase status	Unknown for ~39% of records ¹
Commercial operations date (actual COD for operational plants)	Unknown for ~27% of operational plants ^{2,3}
Withdrawn date	Unknown for ~37% of withdrawn requests
IA date (date of executed agreement)	Unknown for ~45% of requests ⁴ with draft or executed IA *including operational* (see <i>table</i>)
Hybrid capacity (breakdown for hybrid plants, i.e. MW_1, MW_2)	Missing or partially missing in most regions (complete in CAISO, ERCOT); imputed (estimated) where missing
Geospatial information	Additional spatial data on the location (lat/long) of requests (or their point of interconnection) is not available
Interconnection costs	The interconnection upgrade costs assigned to project developers are typically not accessible; (see emp.lbl.gov/interconnection_costs for LBNL's data and analysis of costs)

Completeness of “IA Date” data by region			
	Count with IA (includes operational)	Count with IA Date	Percent Populated
CAISO	527	445	84%
ERCOT	1237	1174	95%
ISO-NE	304	170	56%
MISO	1910	1760	92%
NYISO	<i>Unknown</i>	109	<i>N/A</i>
PJM	2623	249	9%
SPP	651	637	98%
Southeast	727	90	12%
West	1546	724	47%
All	9,525	5,246	55%

Berkeley Lab (with support from DOE’s i2X program and Office of Electricity) is actively seeking to fill these data gaps through partnerships, data sharing agreements, and data transparency initiatives.

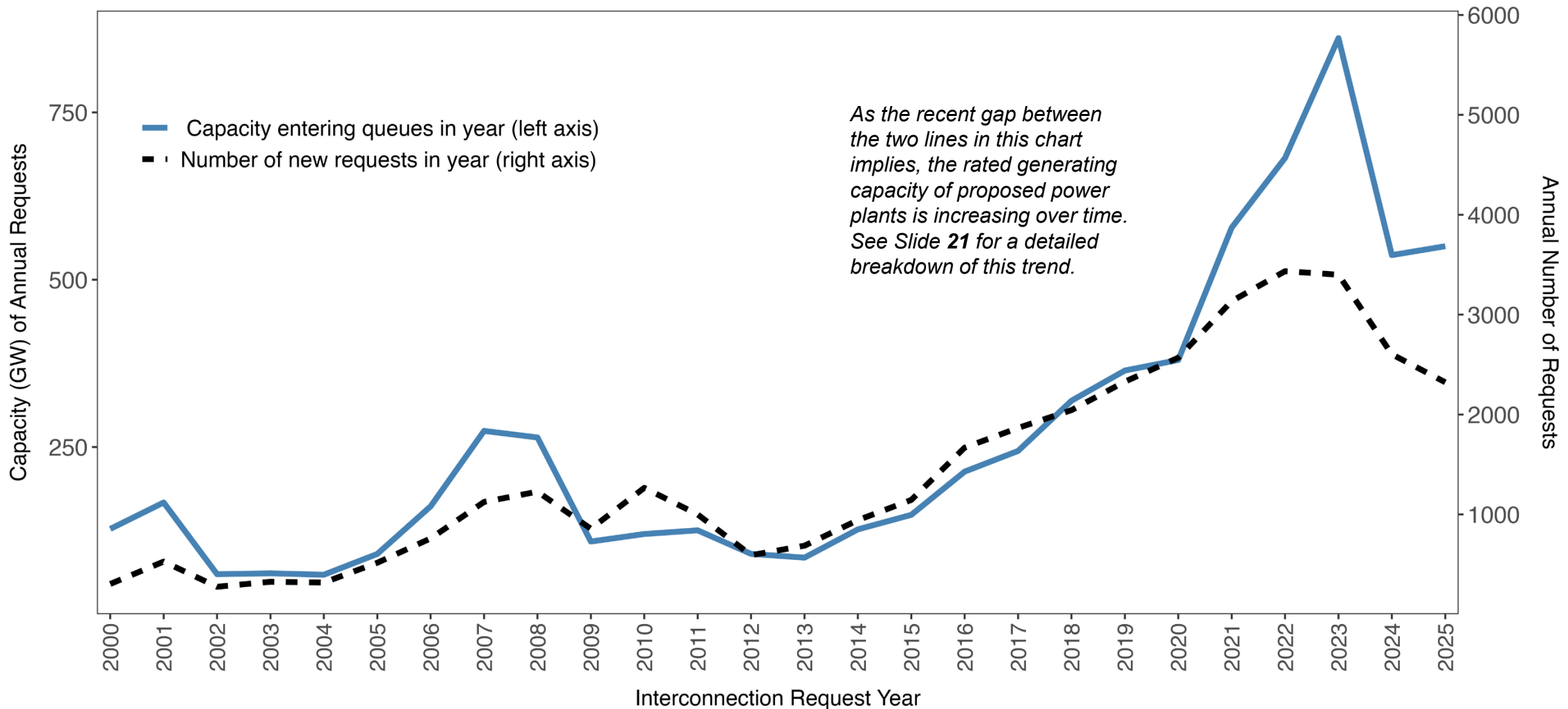
Notes: (1) Withdrawn requests where phase upon withdrawal is not indicated are considered “unknown” for this value. (2) Only COD dates that are after request submission date are considered valid. (3) Lack of interoperable IDs prevents merging dates from other sources. (4) Only IA dates that are after request submission date are considered valid. (5) Some data included in these counts are not publicly available.

All transmission providers are focused on FERC Order 2023¹ implementation; many ISO/RTOs are implementing further interconnection process updates and reforms²

Region	Major Reforms Being Implemented
CAISO	Interconnection Process Enhancements (IPE) prioritizes requests based on commercial readiness and alignment with state resource planning and transmission planning. Cluster 16 opens in October 2026. Partnered with GridUnity for interconnection process automation and management.
ERCOT³	ERCOT maintains its unique "Connect and Manage" model of interconnection, and continues to refine and automate study processes to handle record-breaking levels of new interconnection requests. New high-voltage (765 kV) transmission expansion approved in 2025.
ISO-NE	Focus on Order 2023 compliance; moving to cluster study process. First cluster opens October 2026. Moving toward improved coordination of interconnection requests with long-term transmission planning. Partnered with GridUnity for interconnection process automation and management.
MISO	Increased milestone payments, automatic withdrawal penalty, expanded site control requirements, and implemented a cap on total queue size. Pilot test of automated study using SUGAR software (Pearl Street Technologies) reduced study timeline by 98% with very high accuracy. New fast-track for high resource adequacy (RA) value projects (ERAS).
NYISO	Focus on Order 2023 compliance; moving to cluster study process. Cluster application window opens July 31, 2026.
PJM	Transitioned to cycle-based cluster process, but still working through backlog of requests submitted prior to 2023. Working with Google Tapestry to automate certain process steps like readiness review. New fast-track process for high RA value projects (RRI).
SPP	Launched the Consolidated Planning Process (CPP) in March 2026 to integrate transmission planning with interconnection process, aiming to increase speed and certainty of interconnection studies. Partnered with Hitachi to develop AI solution to reduce study analysis times, and with GridUnity for process automation. New fast-track for high RA value projects (ERAS).
Non-ISO/RTOs	Focus on Order 2023 compliance; moving to cluster study process.

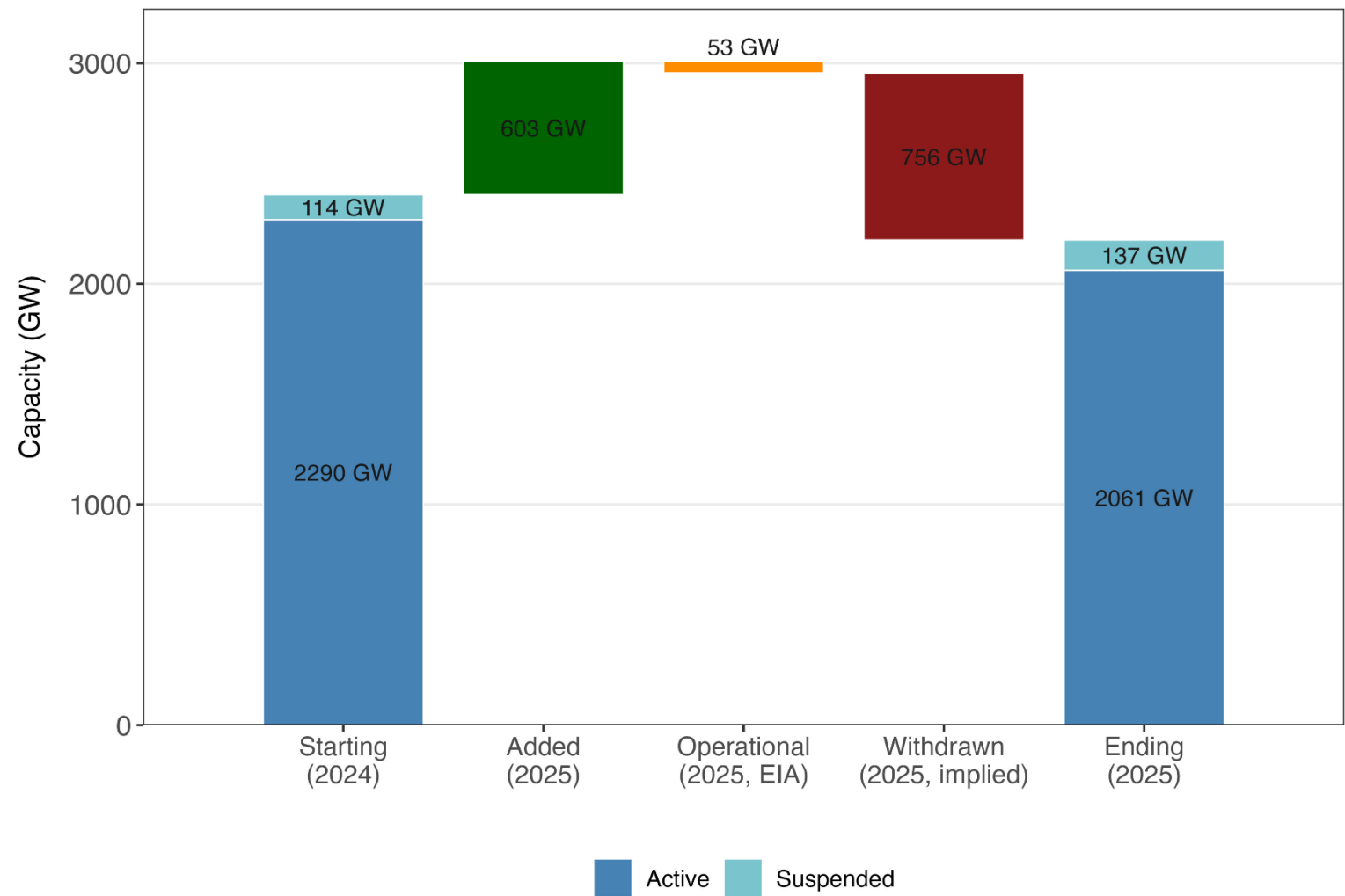
Notes: (1) FERC Order 2023 - RM22-14-000. <https://www.ferc.gov/media/e-1-order-2023-rm22-14-000>. See appendix for a brief summary of Order 2023. (2) The effects of Order 2023 and other recent reforms will not be immediate; most data presented in this report pre-date these reforms. (3) ERCOT is not under FERC jurisdiction, and therefore is not required to comply with Order 2023. (4) This brief summary of major reforms is not meant to be exhaustive.

Annual interconnection requests surged from 2013-2023, but slowed in 2024 and 2025; still, 2,300 requests representing over 600¹ GW were added in 2025



Notes: (1) The 600 GW added in 2025 includes ~50 GW of imputed capacity from hybrid storage that is missing in some queues. (2) This total annual volume includes projects with a current queue status of "active", "suspended", "withdrawn", or "operational". (3) All values – especially for earlier years – should be considered approximate.

Over 600 GW of new interconnection requests were submitted in 2025 while over 750 GW were withdrawn, resulting in a net reduction in active queue capacity



Of the 2,290 GW of active capacity in the 2024 interconnection queue, only 53 GW reached operational status in 2025, yielding an annual throughput rate of just 2%.

Notes: (1) Withdrawn capacity in 2025 is estimated as follows: [Active (2024) + Suspended (2024) + Annual Additions (2025) – Operational (2025) – Suspended (2025) - Active (2025)]. (2) “Operational” reflects EIA-reported installed capacity only for the regions for which we collect interconnection data.

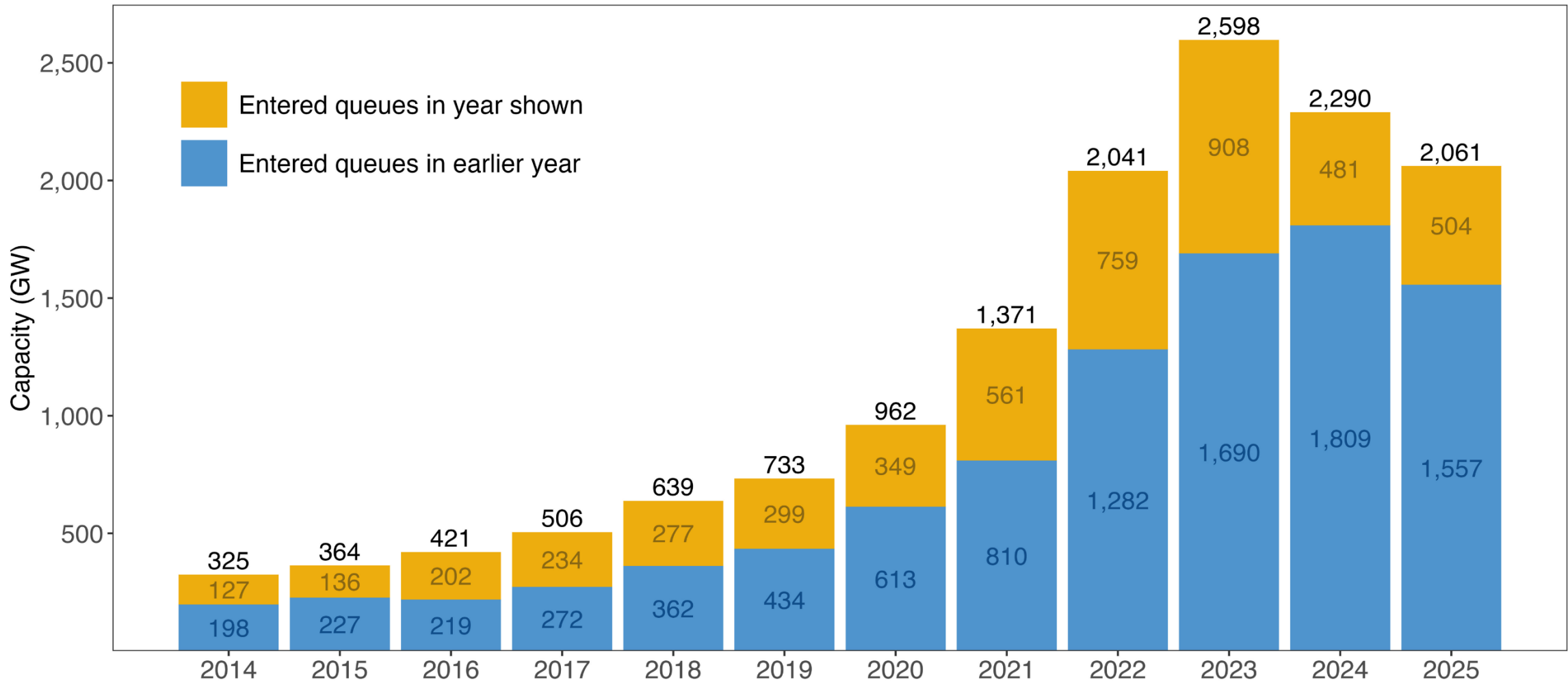
Active Projects in Interconnection Queues: Volume, Regional Trends, Study Phase, and Hybrids

Includes data from 7 ISO/RTOs and 47 non-ISO balancing areas, totaling 8,244 requests and 2,061 GW

Region	<i>n</i> (active)	Capacity (GW)
CAISO	432	191.3
ERCOT	1,527	408.0
ISO-NE	72	14.8
MISO	1,646	382.2
NYISO	190	29.2
PJM	1,134	144.3
SPP	683	171.2
Southeast (non-ISO)	957	152.9
West (non-ISO)	1,603	567.4

Notes: (1) Active capacity (GW) shown includes some estimates for hybrid storage capacity in cases where it was missing. (2) Data were sought from 7 ISOs and 50 non-ISO BAs (full list available in appendix); 3 BAs did not have any active requests. (3) Co-located hybrid requests are joined and counted as single requests. (4) CAISO includes Cluster 15. (5) “Active” requests include those that are actively requesting or undergoing grid interconnection studies, as well as those that have already executed interconnection agreements but have not yet reached commercial operations. (6) See appendix for more detailed summary tables

Total (cumulative) active capacity in queues decreased 10% in 2025 to 2,061 GW; new (annual) requests were roughly stable from 2024-2025



Note that some requests can be submitted and withdrawn in the same year; this chart only includes capacity remaining as of the end of each year. Therefore, the yellow bars are lower than the total capacity of new requests in a given year (as shown on slide 11). See <https://emp.lbl.gov/queues> to access an interactive data visualization tool.

Several factors may have contributed to the reduction in cumulative active queue capacity in 2025 (and reduction in annual requests relative to 2023)

ISO Request Pauses and Queue Caps

- **CAISO:** Cluster 15 request window closed in April, 2023. Required to re-submit in 2024; many did not. Cluster 16 not open until 2026
- **MISO:** Cap on total queue capacity in effect in 2025
- **PJM:** Withdrawals continue to exceed new requests as they transition to clusters and work through backlog
- **ISO-NE:** No new requests accepted in 2025 as they transition to a cluster approach
- **NYISO:** No new requests accepted in 2025 as they complete first cluster study from 2024

Federal Reform and FERC Order 2023

- Most balancing areas have transitioned to cluster studies, or are in the process of doing so
- Higher at-risk deposits and withdrawal penalties; stricter readiness criteria to enter and advance in queue

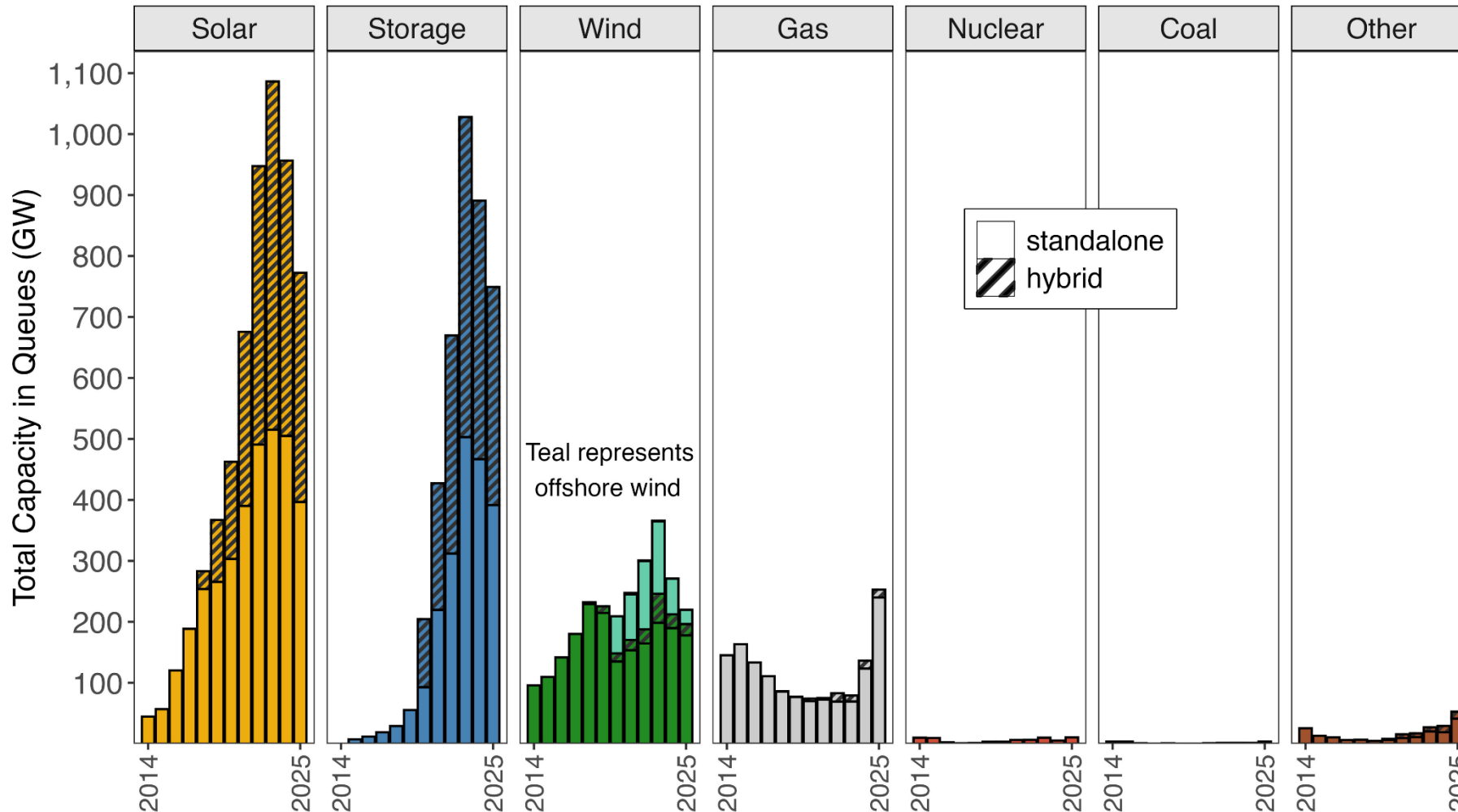
High Interconnection Upgrade Costs

- Limited available transmission capacity has resulted in high interconnection upgrade costs, which contributes to high withdrawals and may deter developers from submitting new requests
- See LBNL's research on interconnection costs: https://emp.lbl.gov/interconnection_costs

Higher Withdrawal Volumes

- In addition to fewer *new* requests, several regions experienced significant withdrawals in 2025, likely due to reforms (see left) as well as policy and market drivers. E.g.:
 - The looming expiration of federal tax credits for certain resources may encourage developers to cancel projects
 - Many withdrawals as regions implement reforms and/or transition to cluster studies; some required developers to resubmit to remain in the queue

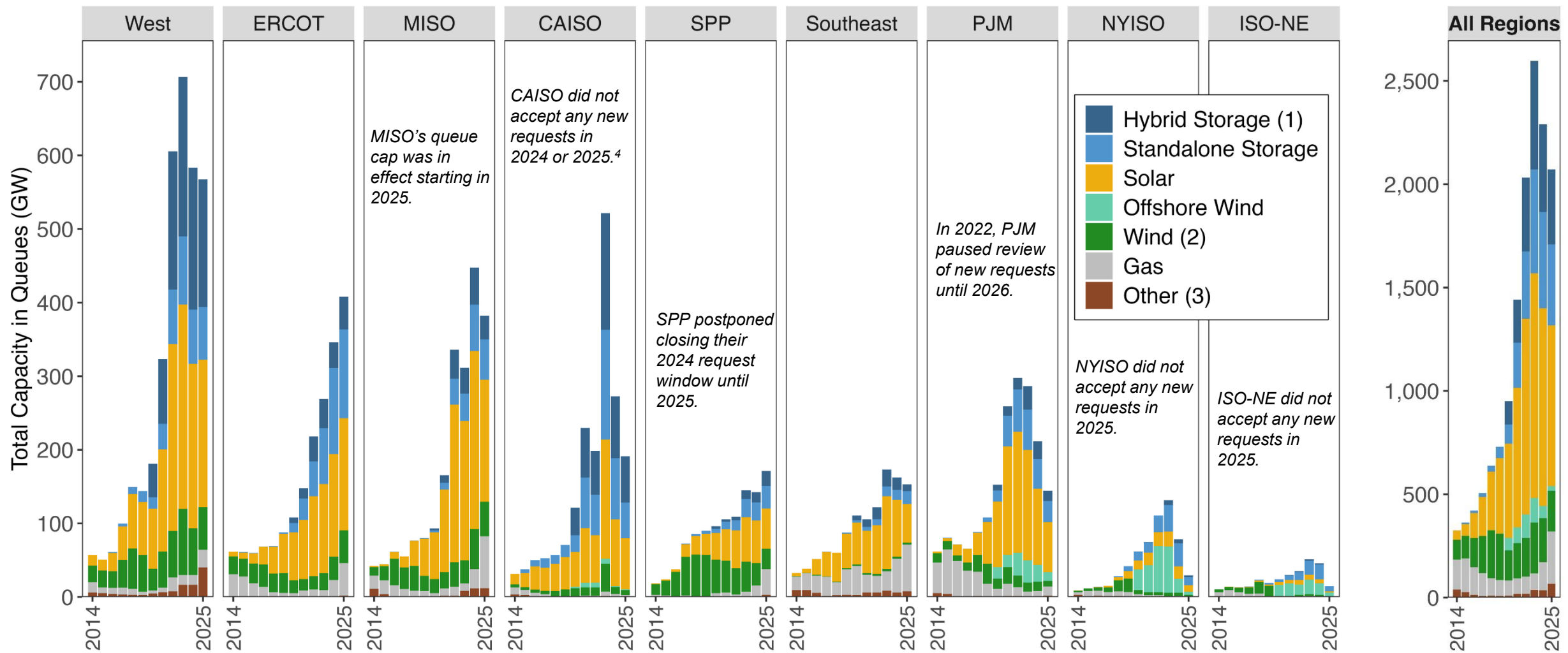
Active gas (253 GW) capacity in queues increased by 86% year-over-year, whereas solar (773 GW, -19%), storage (749 GW, -16%), and wind (220 GW, -19%) all decreased in 2025



- **Wind** includes both onshore and offshore
- **Other** includes
 - Hydropower
 - Geothermal
 - Biomass/biofuel
 - Landfill gas
 - Solar thermal
 - Oil/diesel
 - Unknown
- **Storage** is primarily (99%) battery, but also includes pumped storage hydro, compressed air, gravity rail, and hydrogen

Notes: (1) Hybrid storage capacity is estimated for some projects using storage:generator ratios from projects that provide separate capacity data, and that value is only included starting in 2020. Storage duration is not provided in interconnection queue data. Dispatch of hybrid plants (generation + storage) cannot exceed interconnection limit. (2) Wind capacity includes onshore and offshore for all years, but offshore is only broken out starting in 2020. (3) Hybrid capacity is included separately in respective resource categories (i.e., "hybrid storage" only includes the storage component of hybrid plants. See slide 30 for detail). (4) Not all of this capacity will be built.

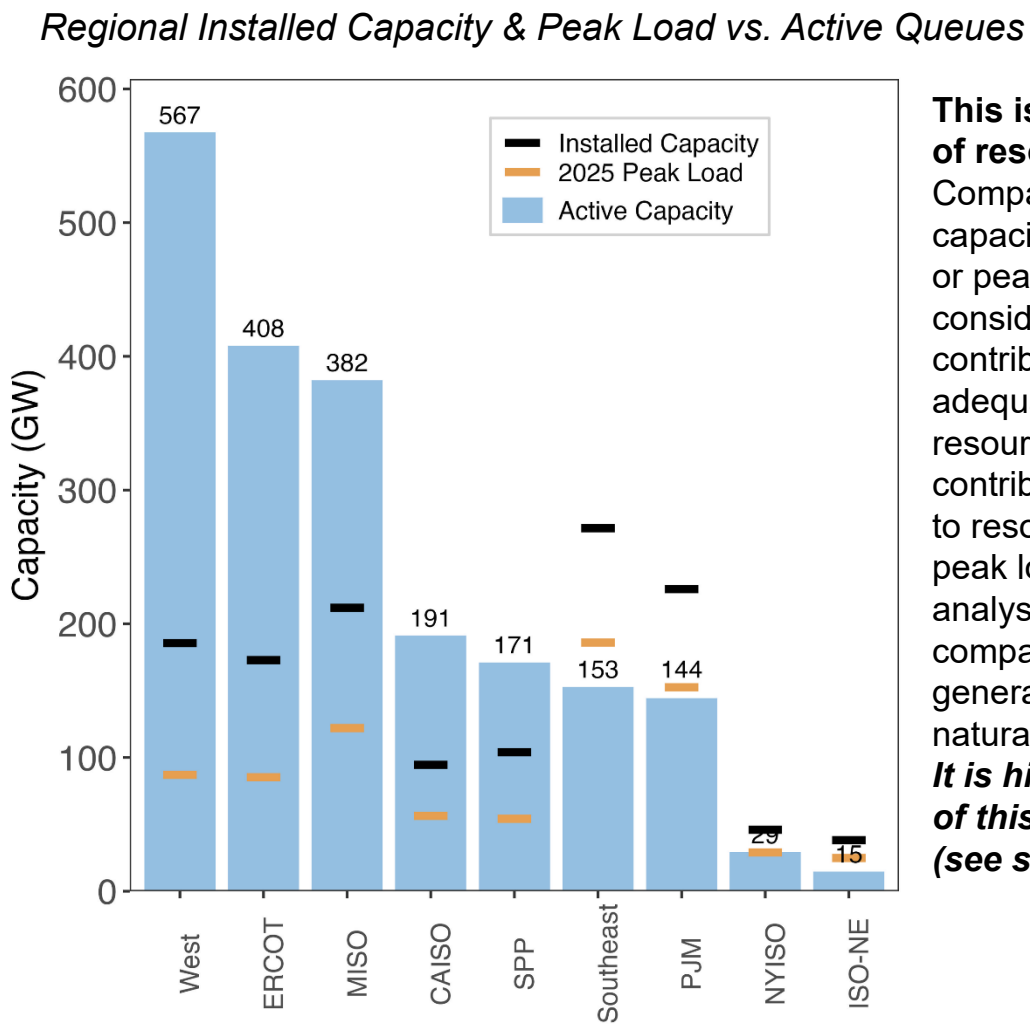
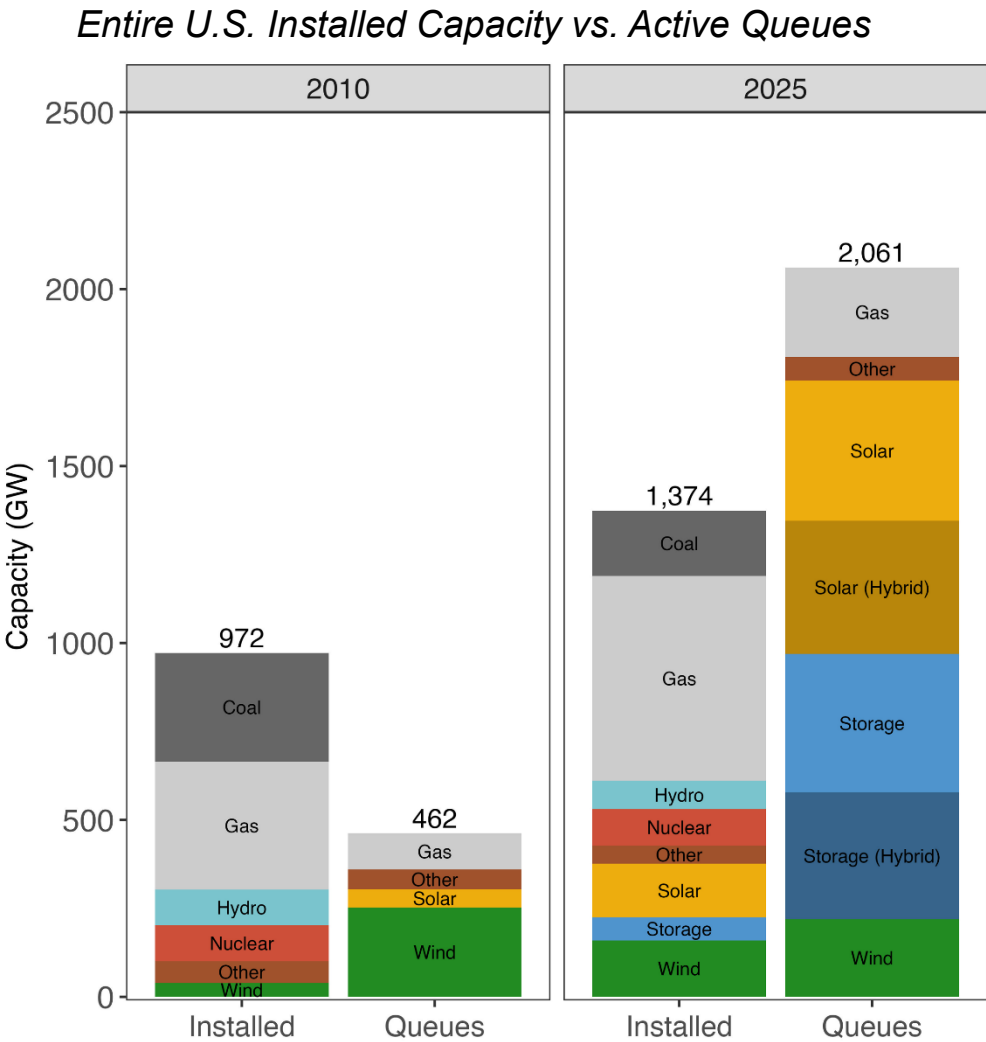
Active queue capacity is highest in the West (567 GW), followed by ERCOT (408 GW). Capacity reduced in 2025 in all regions except ERCOT and SPP



Notes: (1) Hybrid storage capacity is estimated for some projects using storage:generator ratios from projects that provide separate capacity data, and that value is only included starting in 2020. Storage duration is often not provided in interconnection queue data. (2) Wind capacity includes onshore and offshore for all years, but offshore is only broken out starting in 2020. (3) Other in this chart includes Coal, Nuclear, Hydro, Geothermal, and Other / Unknown. (4) CAISO required Cluster 15 to pause due to FERC Order 2023 and resubmit in 2024, resulting in many withdrawals and some changes to requested capacity. (5) Not all of this capacity will be built.

17

Active capacity in queues (2,061 GW) is significantly larger than total installed capacity of U.S. power plant fleet (1,374 GW); greater than peak load and installed capacity in most regions

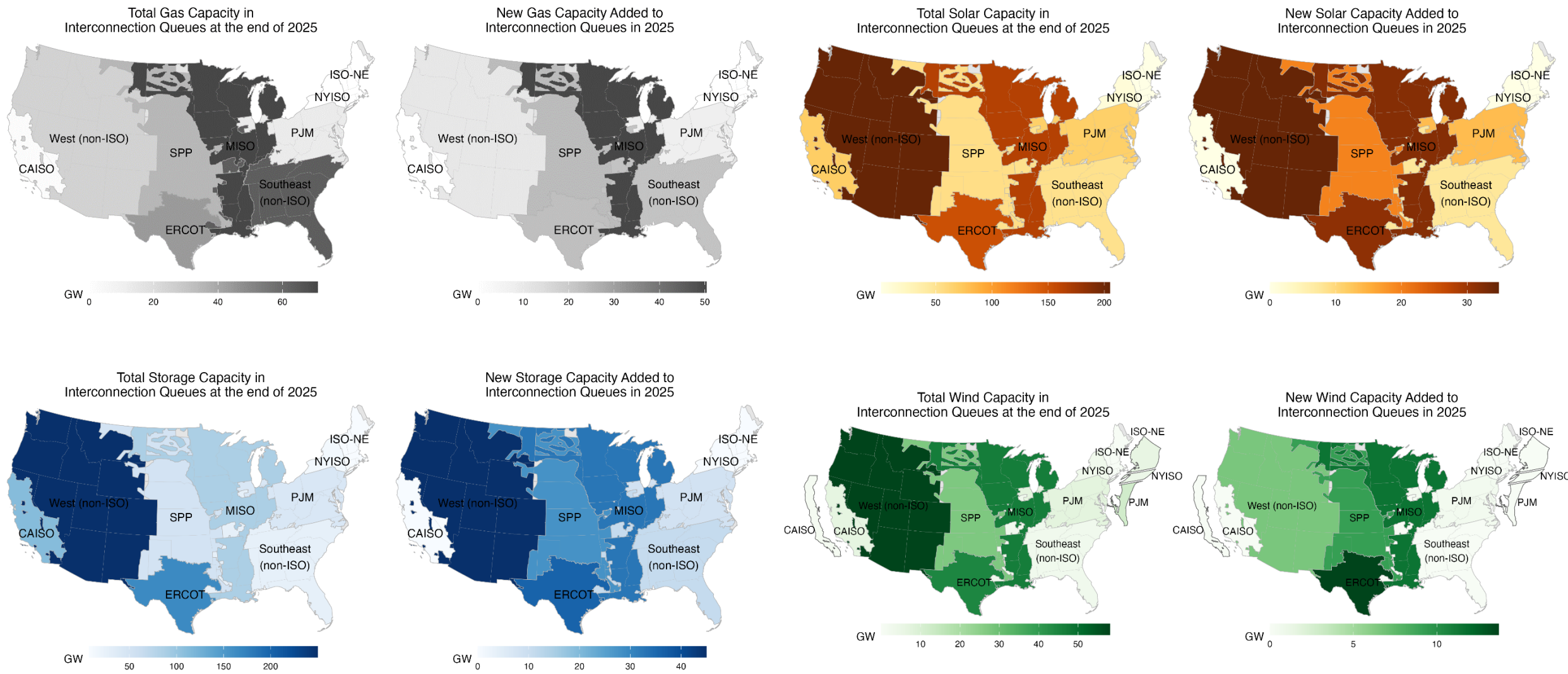


This is not an assessment of resource adequacy. Comparisons of queue capacity to installed capacity or peak load should also consider generators' contributions to resource adequacy. As variable resources, the potential contribution of solar and wind to resource adequacy and peak load requires significant analysis and it is not directly comparable to dispatchable generation resources like natural gas.

It is highly unlikely that all of this capacity will be built (see slide 35).

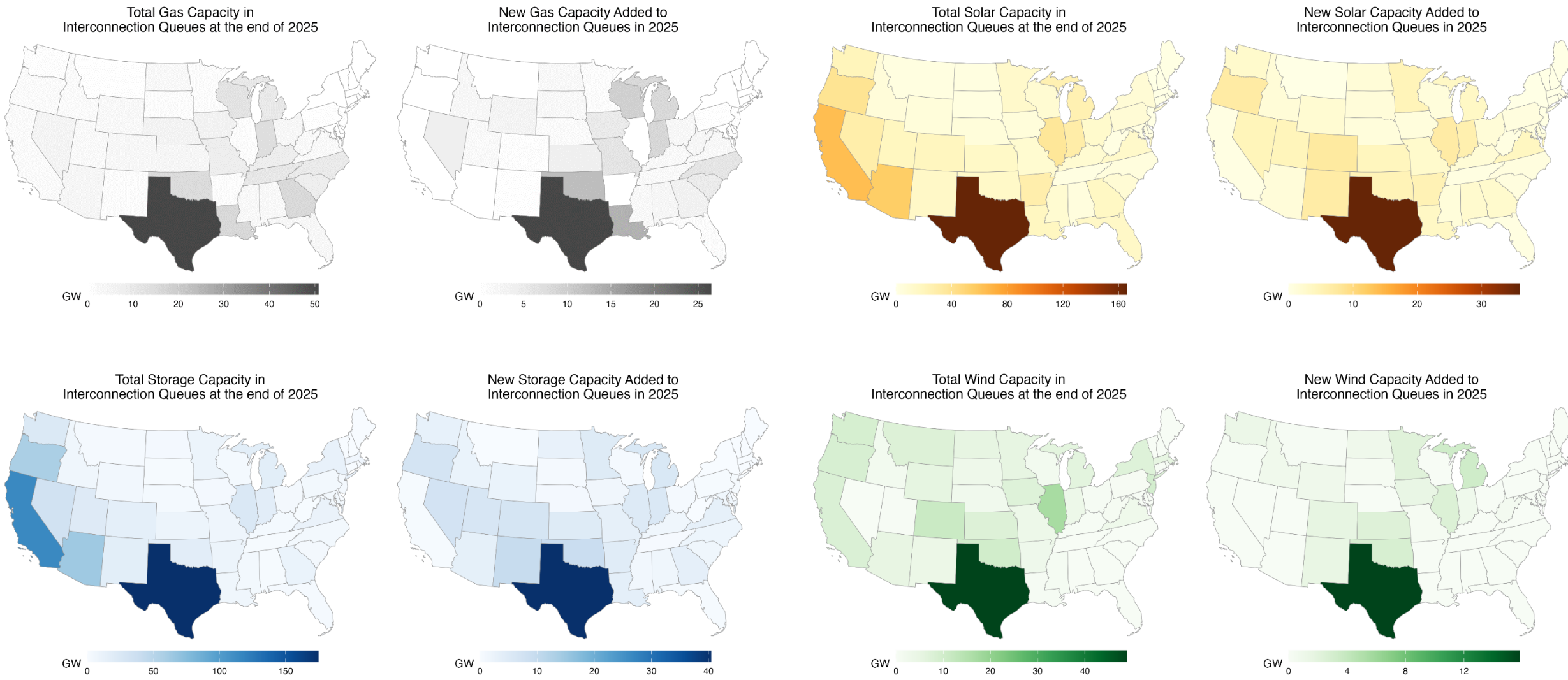
Notes: (1) Hybrid storage in queues is estimated for some projects; hybrid storage is unlikely to be dispatched synchronously with hybrid generation. (2) Total and regional installed capacity from EIA-860, December 2025. (3) Peak load data from NERC.

Active gas requests are primarily in MISO and the Southeast; solar is widespread, with most in the West; storage highest in the West but growing in ERCOT and MISO; most wind in the West, MISO and ERCOT



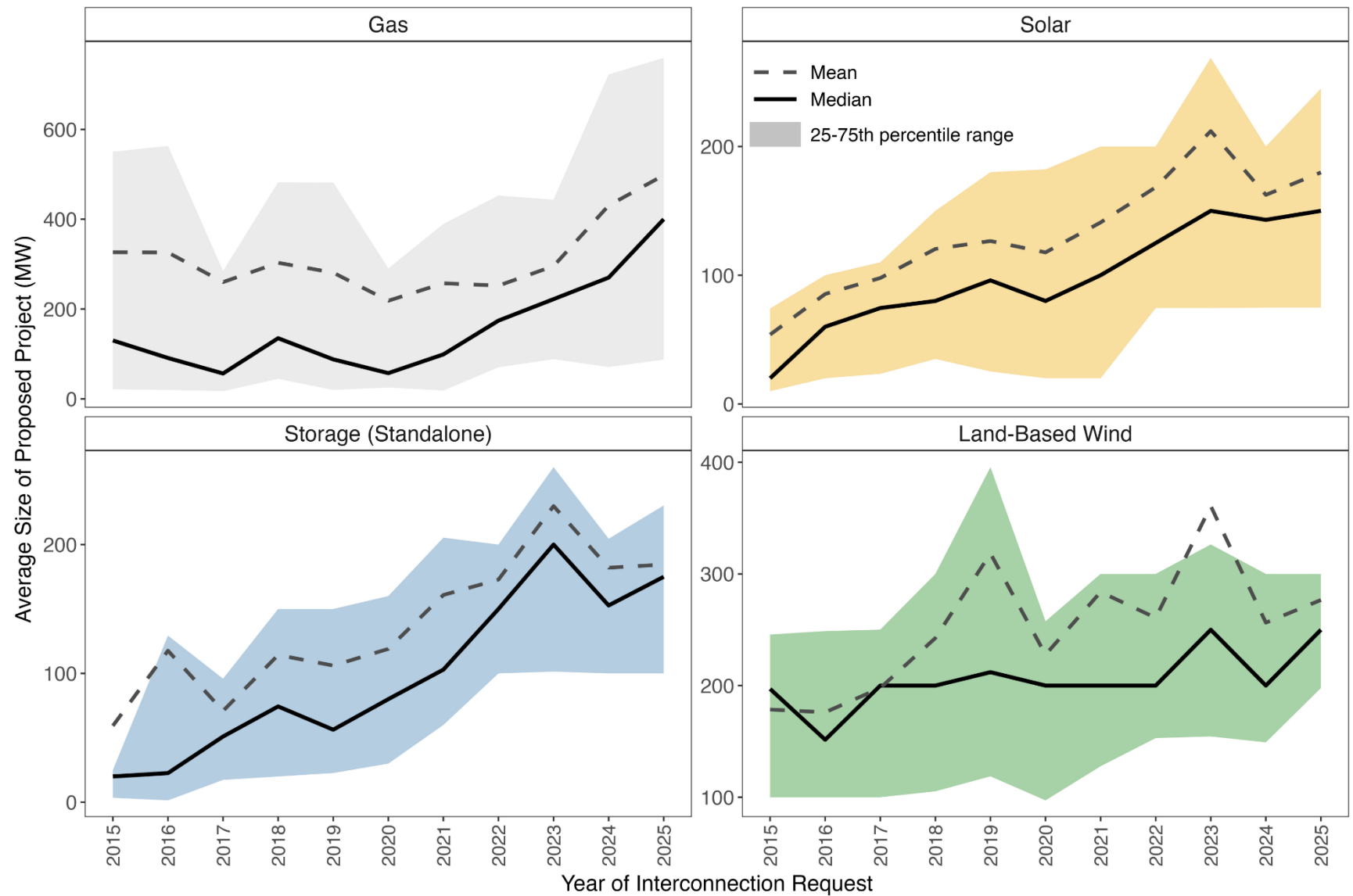
Note: Ongoing reforms in CAISO, NYISO, and ISO-NE resulted in few (or no) new requests in those regions in 2025 (see slide 10). State maps are shown on next slide and county maps in appendix.

Texas has at least 20% of active gas, solar, storage, and wind capacity. Solar requests exist in every state, but most active capacity is in the Southwestern states

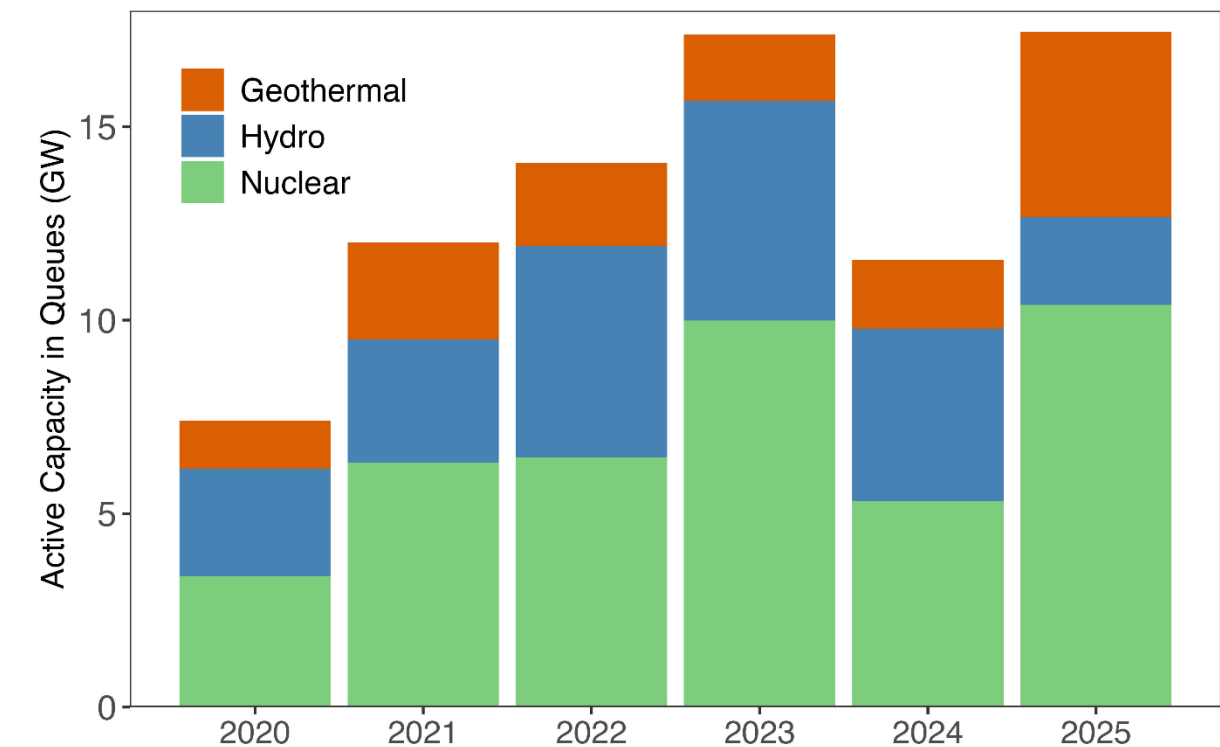


Note: See appendix for county-level maps.

The average (plant-level) interconnection request size has grown over time: Mean gas (+53%), solar (+234%), storage (+211%), and wind (+55%) plant size have all grown since 2015



Active nuclear (+96%) and geothermal (+170%) capacity grew in 2025, while hydro (-49%) decreased. These resources represent 18 GW of capacity in queues

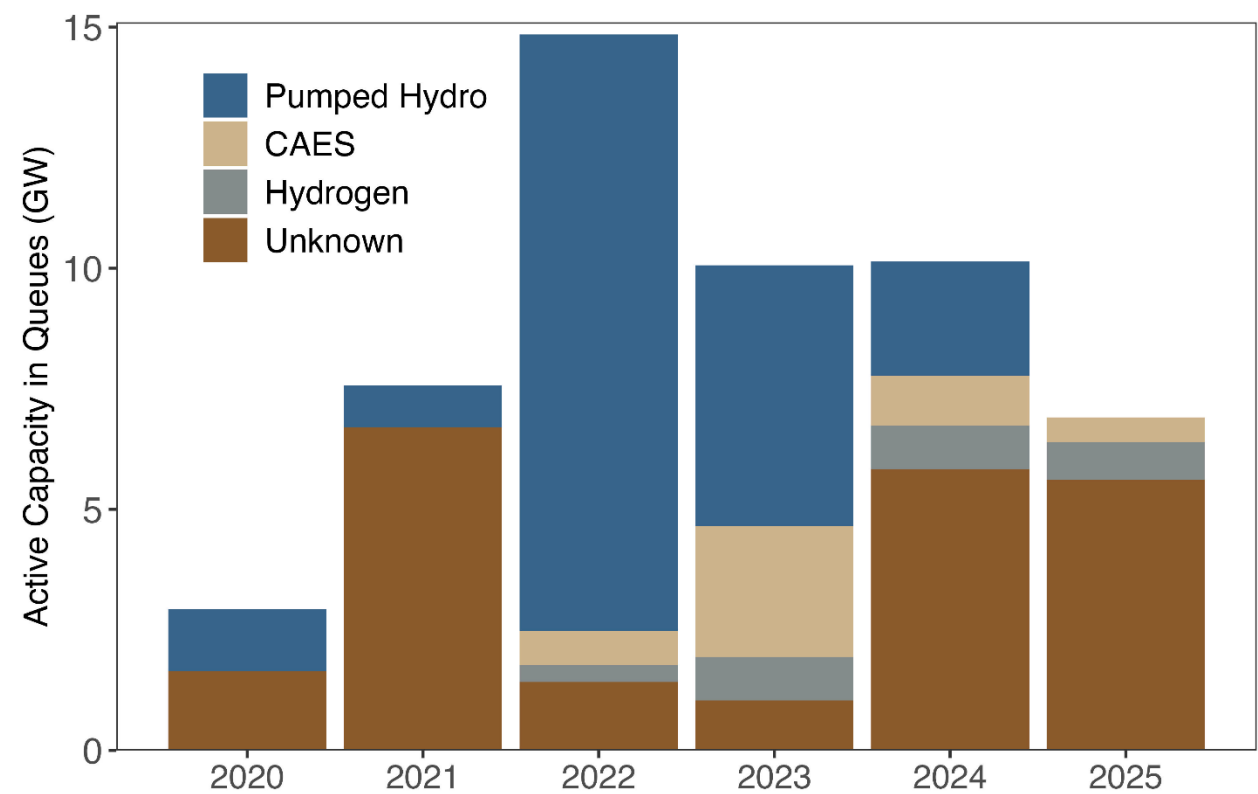


Active nuclear capacity seeking grid connection rose to 10.4 GW in 2025 (up from 5.3 GW in 2024) driven by several new entrants; the drop in 2024 largely reflects the Vogtle plant coming online. Geothermal increased to 4.8 GW (up from 1.8 GW in 2024), while hydropower capacity fell to 2.8 GW (down from 4.8 GW in 2024).

Active Capacity in Queues (MW)			
Region	Hydro	Nuclear	Geothermal
CAISO	5		53
MISO	110	2,170	
PJM	51	1,552	
Southeast (non-ISO)	410	3,736	
West (non-ISO)	1,691	2,935	4,736

MISO and PJM primarily drove the increase in nuclear capacity, with significant capacity of new requests in 2025 (2.2 and 1.6 GW, respectively) from near-zero values in 2024. Hydropower plants are proposed in several regions, but the majority of capacity is proposed in the non-ISO West. Geothermal is only requested in the West (primarily Nevada) and CAISO; the West accounted for all of the year-over-year increase in active geothermal capacity (CAISO saw no change).

Batteries make up ~99% of storage capacity in the queues, but there are 7 GW of active requests for hydrogen, compressed air (CAES), and unknown storage (combined)

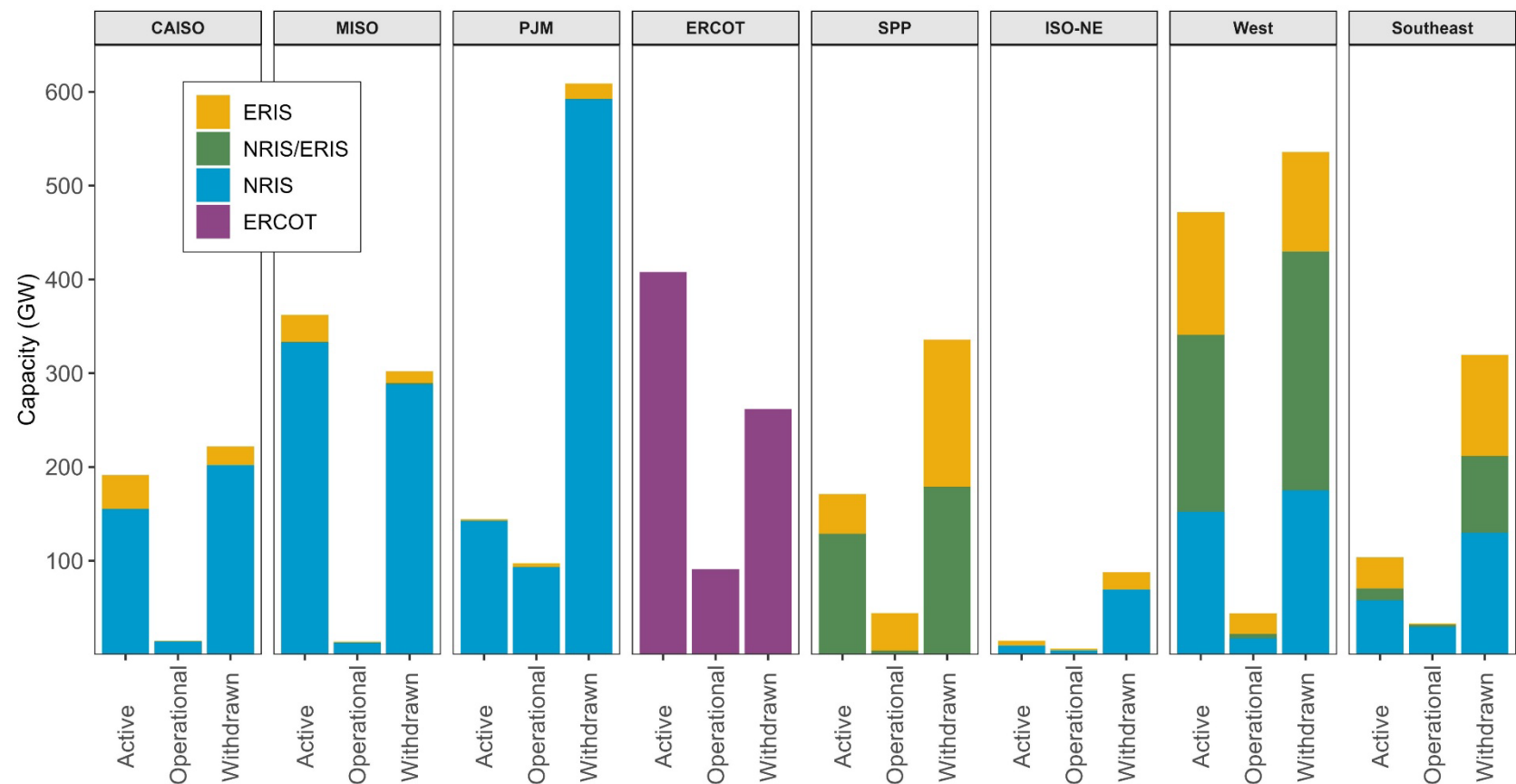


Active Capacity in Queues (MW)				
Region	Pumped Storage	CAES	Unknown	Hydrogen
CAISO		517	613	
ERCOT				230
ISO-NE			66	
MISO			70	
West (non-ISO)			4856	556

Note: (1) It is not always possible to determine the type of storage being proposed from available data (hence the “Unknown” category). Some portion of the unknown storage may, in fact, be battery storage requests.

The majority of all active capacity requested to be studied for Network Resource Interconnection Service (NRIS)

Outside of ERCOT, **81%*** of active capacity requested to be studied for NRIS.



Network Resource Interconnection Service (NRIS) allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission System and be deliverable (including during congested grid conditions), such that the generator can be designated as a capacity resource and contribute to resource adequacy requirements.

Energy Resource Interconnection Service (ERIS) allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission System to be eligible to deliver the Generating Facility's electric output using the existing firm or non-firm capacity of the Transmission Provider's Transmission System on an "as available" basis.

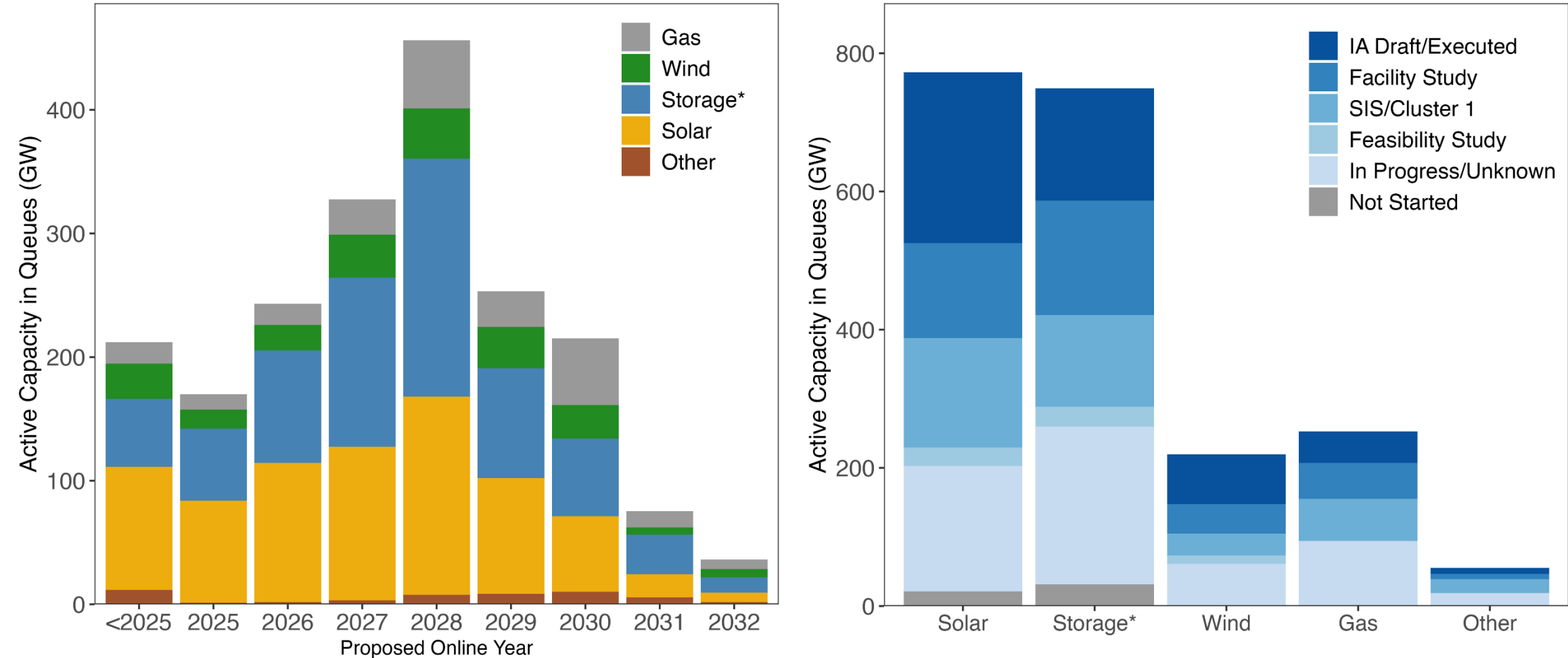
Region	% of Active Capacity	
	ERIS	NRIS*
CAISO	19%	81%
MISO	8%	92%
PJM	1%	99%
SPP	25%	75%
ISO-NE	35%	65%
West	28%	72%
Southeast	32%	68%

Notes: (1) NRIS and ERIS were developed under FERC Order 2003, and apply to FERC-jurisdictional transmission providers. (2) ERCOT is not FERC jurisdictional, but uses a "connect and manage" interconnection service that is more similar to ERIS. (3) ERIS is similar, in theory, to ERCOT's approach, though in practice varies widely across the U.S. (more information in appendix slides 70-71) (4) NYISO queue data lack ERIS / NRIS labels. (5) Data available for 30,254 requests from 6 ISOs and 34 non-ISO balancing areas.

*These calculated percentages include projects choosing the NRIS/ERIS study option at time of request, which is allowed in a few regions as indicated in the graph

69% (1,417 GW) of active capacity in queues has proposed online date before 2029; 26% (536 GW) has a draft or executed interconnection agreement (IA)

75% of solar capacity (579 GW) proposed to come online before 2029, compared to 71% of storage (534 GW), 66% of wind (139 GW), and 56% of gas (131 GW). 32% of solar has a draft or signed IA, 18% of gas, 33% of wind, and 22% of storage¹.

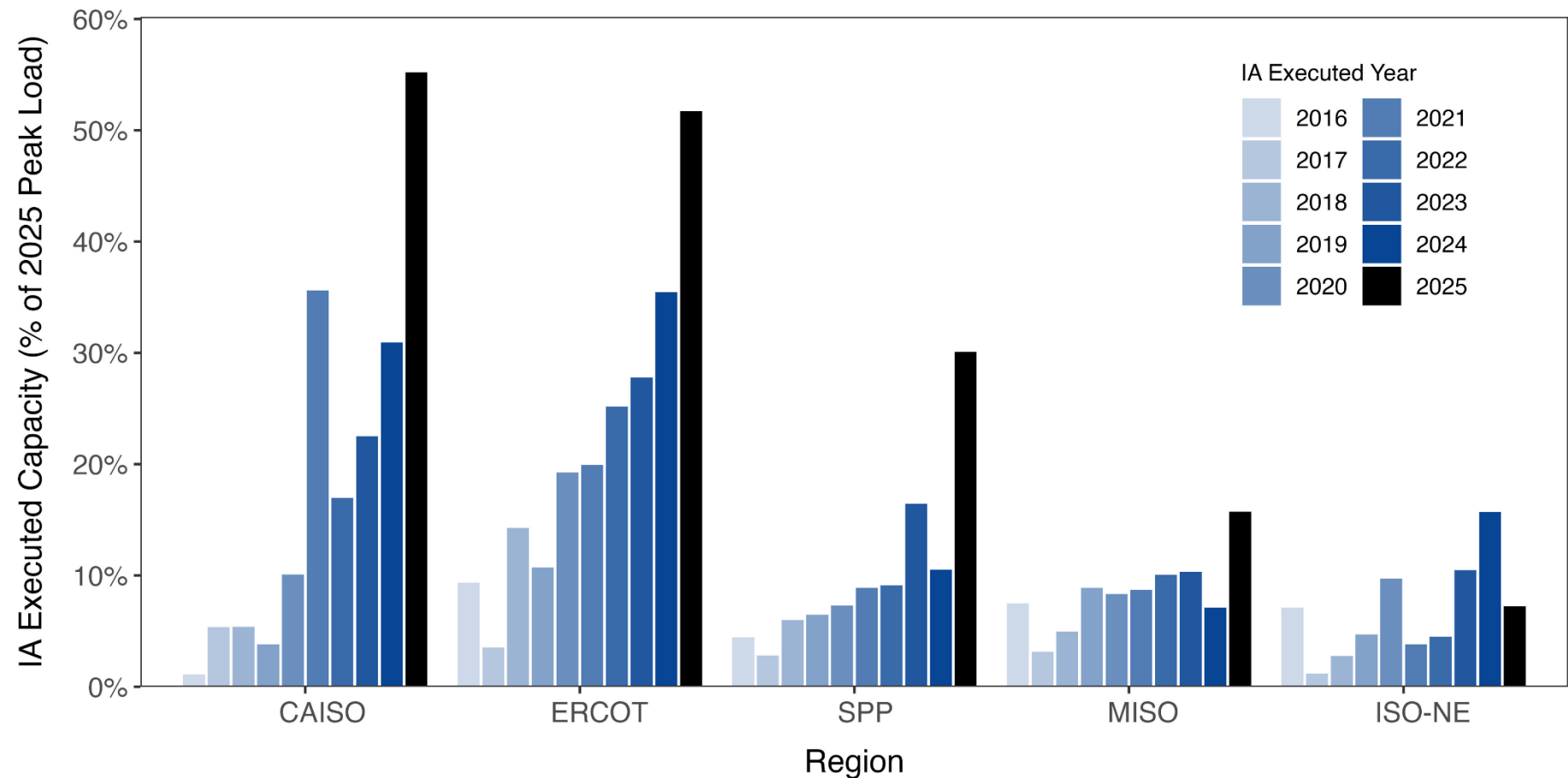


Notes: (1) See appendix for breakdown of capacity with IA by resource type. (2) *Hybrid storage capacity is estimated for some projects. (3) Proposed online dates are included in the developer's original interconnection request, and may differ from actual online date. Moreover, the proposed online date can be amended as a request progresses through the queue. (4) Not all of this capacity will be built. (5) Study status categories are simplified and correspond to the process pre- FERC Order No. 2023 reforms.

25

IA processing volume relative to peak load is increasing over time in several regions; CAISO and ERCOT executed IAs amounting to >50% of their peak load in 2025

Annual volume of interconnection agreements executed by region as a percentage of 2025 peak load

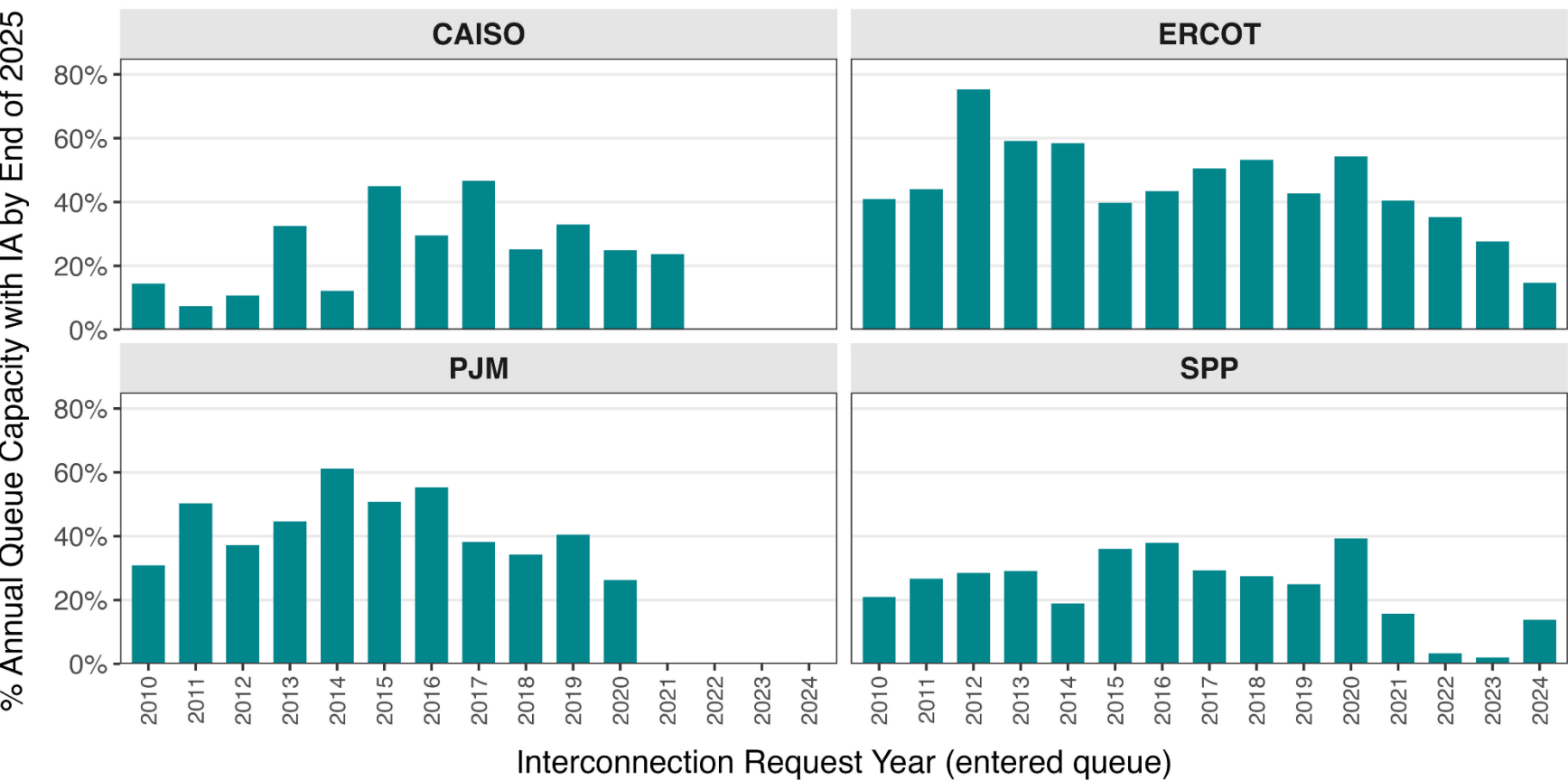


Generators do not pay for network upgrades under ERCOT’s “connect and manage” approach to interconnection. This approach differs from other regions, and is likely one reason for the higher IA rates seen in ERCOT.

Notes: (1) Chart limited to regions where “IA date” is at least 70% populated (see table on slide 9). (2) See appendix for absolute (GW) volume rather than fraction. (3) Available data for 2025 IAs may be lagging in some regions. (4) Not all requests executing IAs will ultimately come online – see slide 38 for detail on post-IA completion rates.

Across 4 regions with available data, 34% of interconnection requests ultimately execute IAs¹; ERCOT has higher share of requests reaching IA than other regions

Fraction of annual interconnection request volume that have executed interconnection agreements by the end of 2025

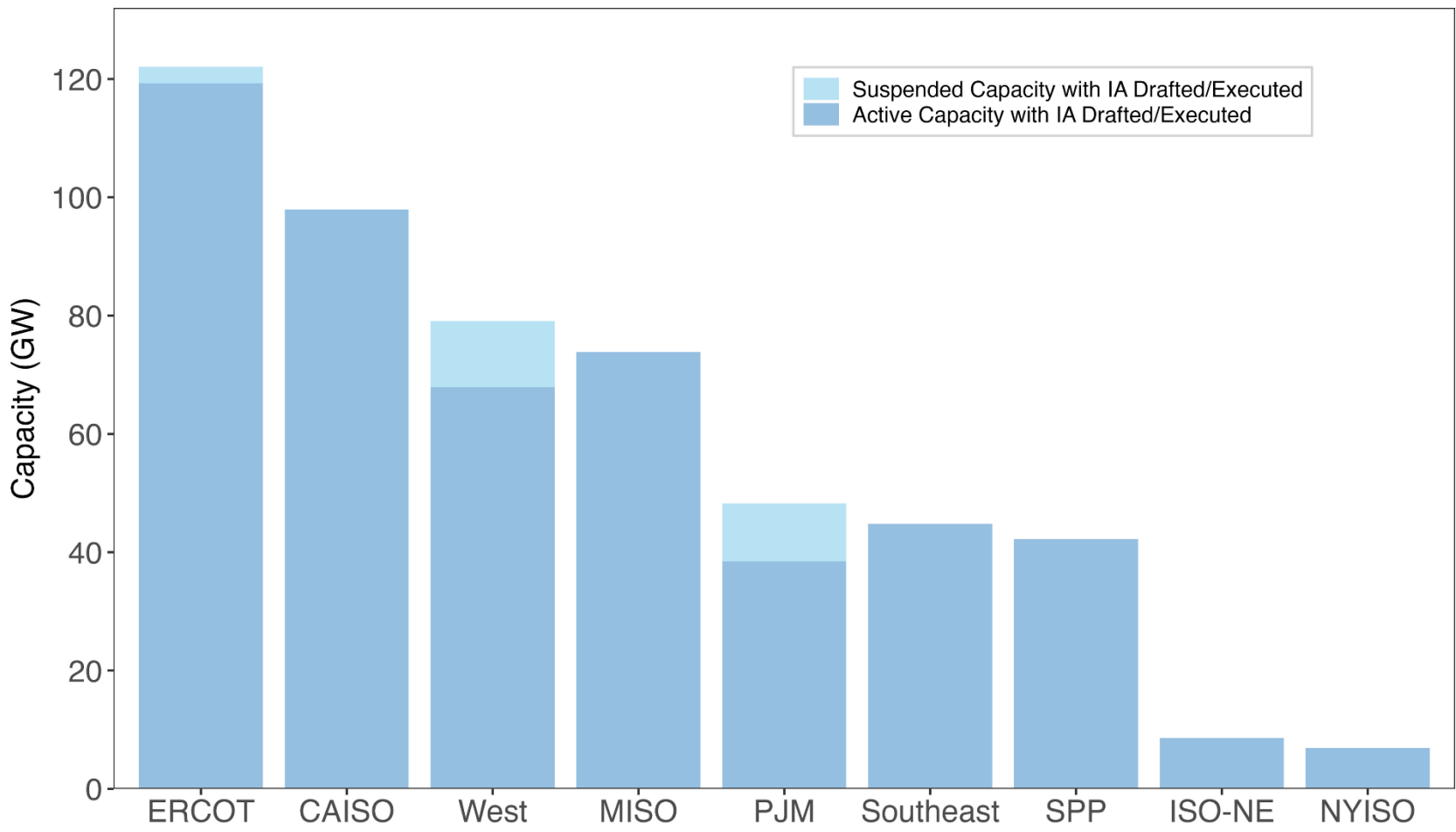


This metric refers to the fraction of all interconnection requests submitted in a given year that have *signed interconnection agreements*, regardless of the final outcome of those requests. This is related to but distinct from our “completion rate” metrics (see slides 35-38), which calculate the fraction of requests that reach commercial operations. Not all requests executing IAs will ultimately come online; see slide 38 for detail on post-IA completion rates. More recently submitted requests are less likely to have signed IAs because of the time required to complete studies (see, e.g., slide 43).

Generators do not pay for network upgrades under ERCOT’s “connect and manage” approach to interconnection. This approach differs from other regions, and is likely one reason for the higher IA rates seen in ERCOT.

Notes: (1) Overall percentage is calculated as the fraction of all interconnection requests submitted from 2000-2024 that had signed IAs by the end of 2025. (2) Chart shows same calculation by request year. (3) Chart limited to regions with complete information on interconnection phase / agreement status, as well as complete data on total annual requests.

ERCOT has the most capacity with draft or executed IAs (119 GW active; 3 GW suspended), followed by CAISO (98 GW active) and the West (69 GW active; 11 GW suspended)



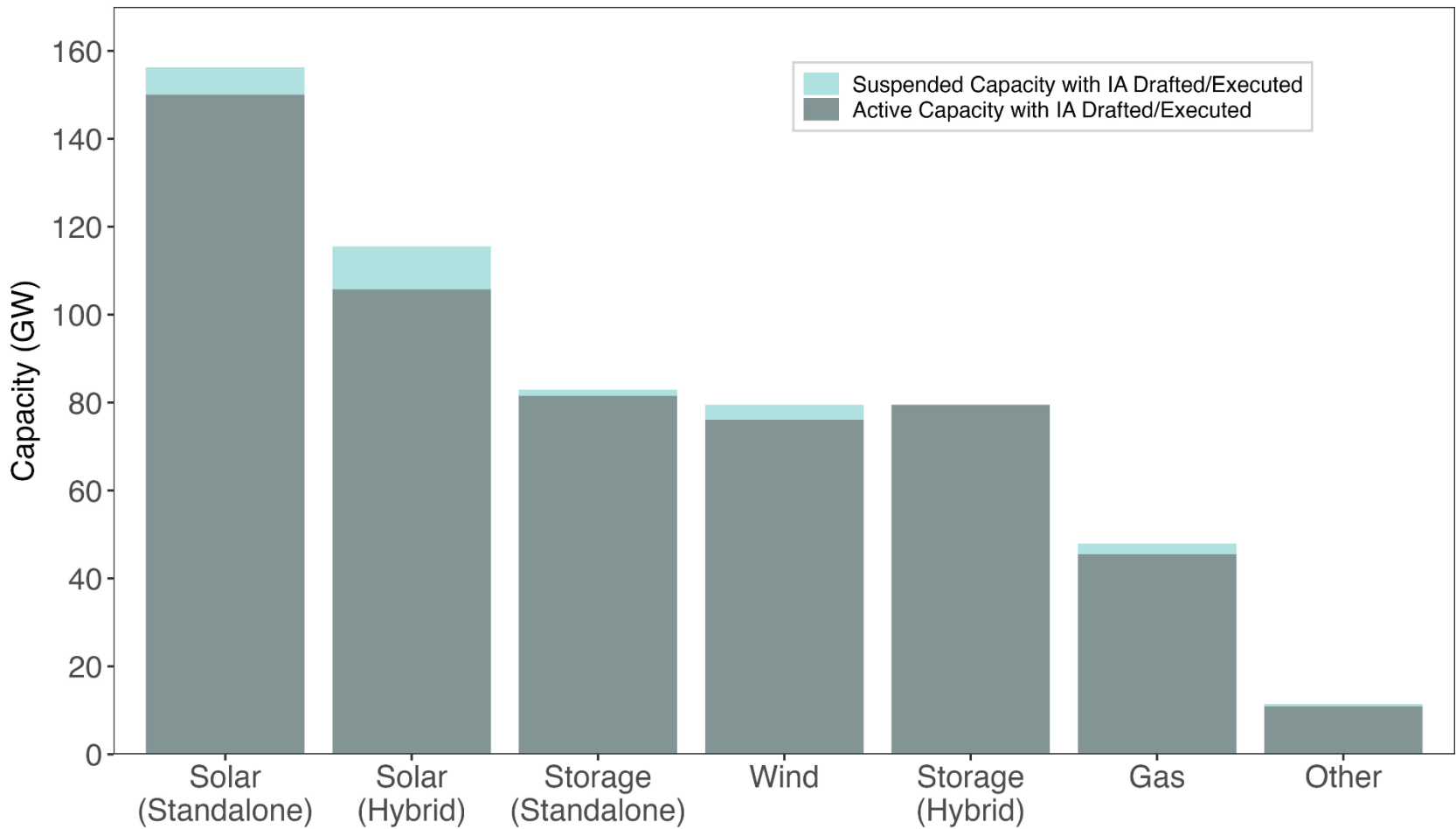
Note: Not all of these plants will be built.

Signed interconnection agreements can provide a useful signal about the nearer-term pipeline of proposed power plants, but many other factors influence whether a proposed power plant is ultimately built or not. Many requests with signed IAs have historically withdrawn (*see slide 38*).

Capacity shown is the *nameplate* capacity for these interconnection requests, which is not necessarily deliverable at all times and may be lower during peak or critical load hours.

Notes: (1) IA capacity bars include capacity in the queues that has either a draft or fully executed interconnection agreement but has not yet reached commercial operations. (2) The darker blue portion of the bar includes only active capacity; light blue portion includes suspended queue requests with an executed/drafted IA. (3) The implication of “Suspended” queue status differs by ISO. e.g., in PJM it is voluntary and elected by the developer; in MISO it requires a force majeure event to suspend a project.

256 GW of active solar requests (including hybrids) have draft or executed IAs, compared with 161 GW of active storage, 76 GW of active wind, and 45 GW of active gas



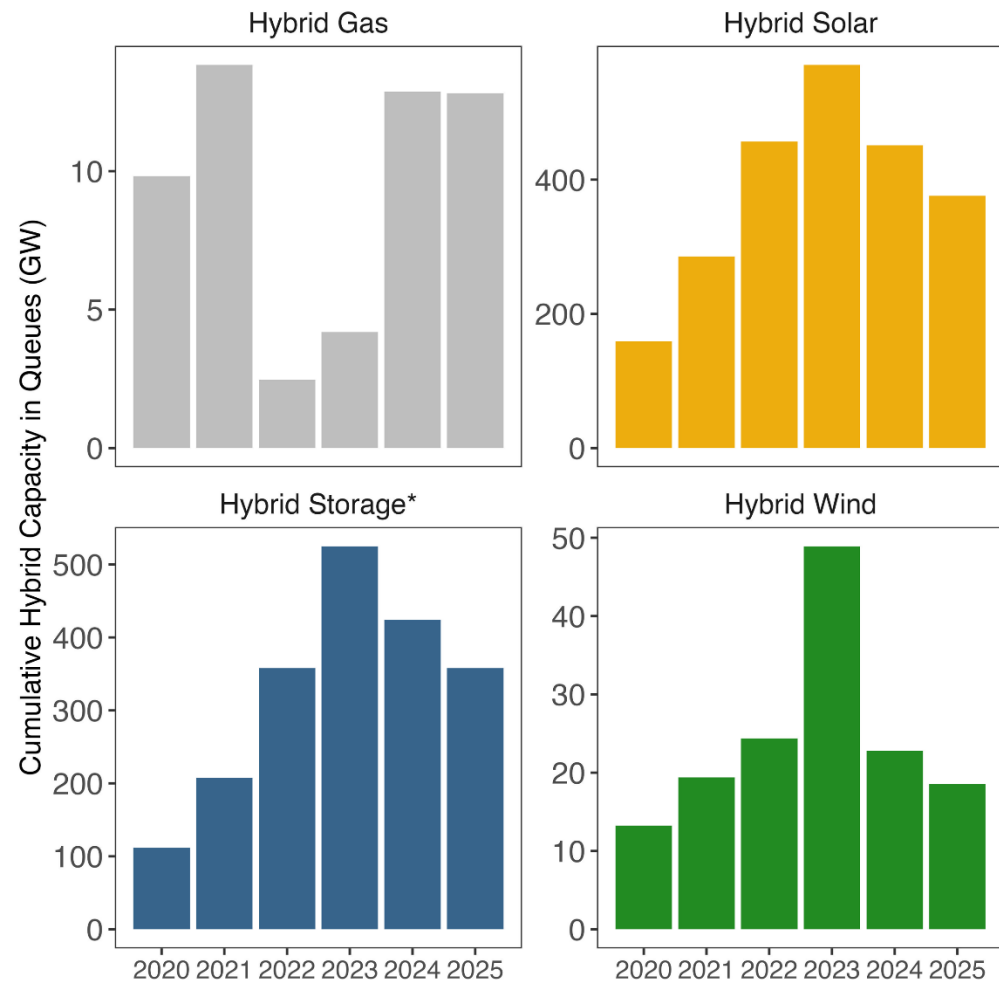
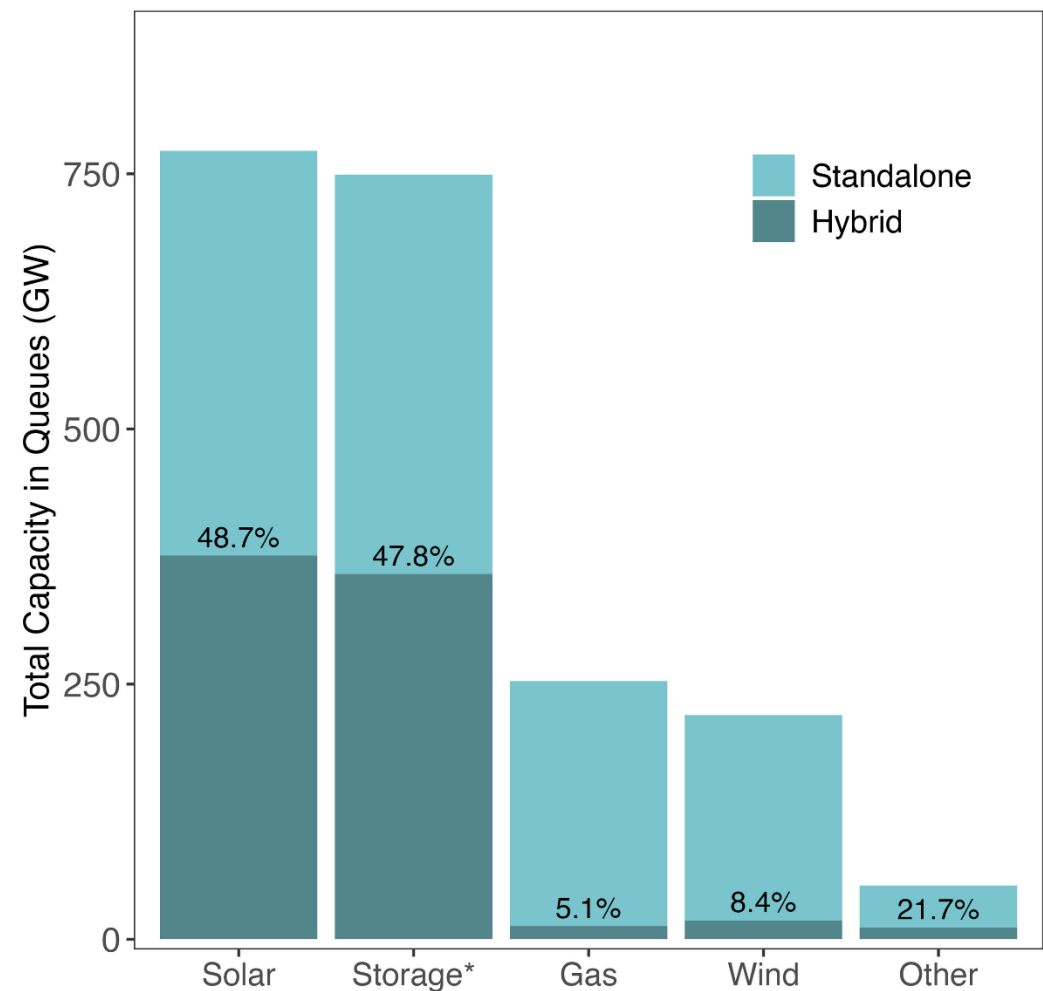
Note: Not all of these plants will be built.

Signed interconnection agreements can provide a useful signal about the nearer-term pipeline of proposed power plants, but many other factors influence whether a proposed power plant is ultimately built or not. Many requests with signed IAs have historically withdrawn (see slide 38).

Capacity shown is the *nameplate* capacity for these interconnection requests, which is not necessarily deliverable at all times and may be lower during peak or critical load hours.

Notes: (1) IA capacity bars include capacity in the queues that has either a draft or fully executed interconnection agreement but has not yet reached commercial operations. (2) The darker portion of the bar includes only active capacity; lighter portion includes suspended queue requests with an executed/drafted IA. (3) Hybrid storage capacity was imputed for some requests where it was missing in the source data (4) The implication of “Suspended” queue status differs by ISO. e.g., in PJM it is voluntary and elected by the developer; in MISO it requires a force majeure event to suspend a project.

Requests for hybrid plants are common: Hybrids comprise 49% of active solar (376 GW), 48% of storage (358 GW), and <10% of wind (19 GW) and gas (13 GW)



**Hybrid storage capacity is estimated when missing in source data using storage:generator ratios from requests that provide separate capacity data*

Notes: (1) Some hybrids shown may represent storage capacity added to existing generation; only the net increase in capacity is shown; (2) Capacity for hybrid plants (e.g., Wind+Solar+Storage) is included separately in each resource category (i.e., the solar component shows up in hybrid solar, storage in hybrid storage), presuming the capacity is known for each type. "Hybrid Storage" therefore represents only the storage portion of generator+storage hybrid plants. (3) Hybrid storage is unlikely to be dispatched synchronously with hybrid generation.

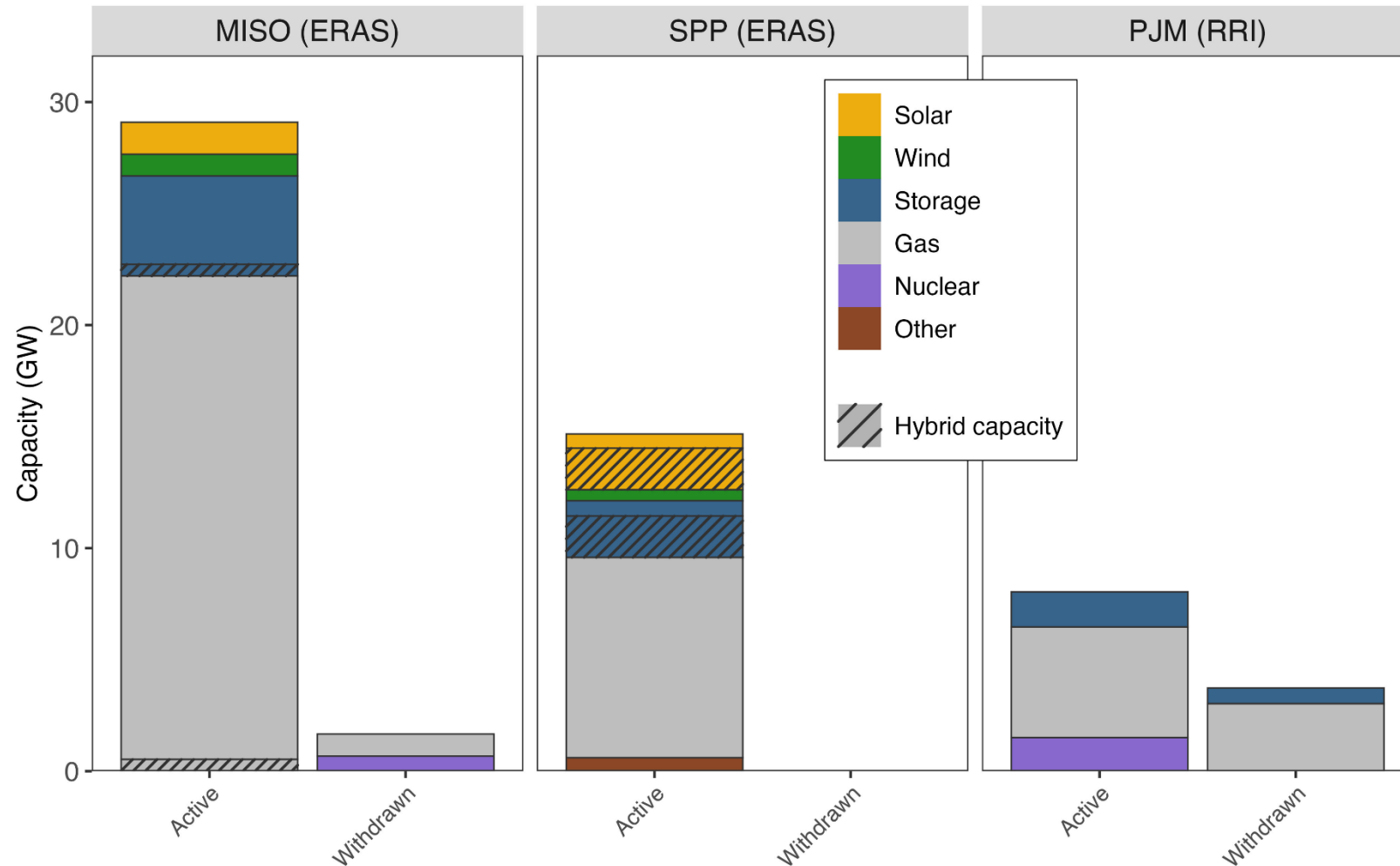
Hybrids comprise a sizable fraction of all proposed solar plants in multiple regions; gas and wind hybrids are less common overall but still a large proportion in CAISO

% of Active Capacity in Hybrid Configurations				
Region	Solar	Wind	Gas	Storage*
CAISO	91%	49%	70%	56%
ERCOT	46%	5%	0%	27%
ISO-NE	10%	0%	0%	2%
MISO	20%	9%	8%	37%
NYISO	24%	0%	0%	16%
PJM	20%	0%	0%	32%
SPP	33%	2%	5%	39%
Southeast	17%	0%	1%	34%
West	85%	14%	12%	71%
TOTAL	49%	8%	5%	48%

**Hybrid storage capacity is estimated when missing in source data using storage:generator ratios from requests that provide separate capacity data*

- Hybrid configurations are especially common in CAISO and the non-ISO West
- **Solar** hybridization has been steady around 45-50% overall in recent years, with CAISO consistently having >90% of solar capacity in hybrids
- **Gas** hybridization decreased to 5% from 9% last year, with new gas requests predominantly standalone
- **Wind** (including offshore) hybridization remained steady at 8% since last year.

Gas dominates new resource-adequacy focused fast track interconnection processes in MISO, SPP, and PJM



- Fast track interconnection processes differ in name across ISOs but share common goals
 - **ERAS**: Expedited Resource Addition Study (MISO, SPP)
 - **RRI**: Reliability Resource Initiative (PJM)
 - These processes promise timelines as short as three months from request to IA
- MISO has 29 GW of active ERAS capacity compared to 15 GW in SPP and 8 GW of RRI in PJM
- PJM had significant withdrawals from RRI projects

Notes: ERAS and RRI projects were identified using publicly available sources from the ISOs (in PJM and MISO) or from "ERAS" in the queue ID (in SPP). ERAS and RRI requests that are broken out on this slide are also included as requests throughout this report.

Operational & Withdrawn Projects: Volume and Completion Rates

Operational project data were available from all 7 ISO/RTOs and 36 non-ISO balancing areas, totaling 4,789 projects.

Region	<i>n</i> (Operational)	Capacity (GW)
CAISO	235	37.8
ERCOT	613	95.3
ISO-NE	228	16.5
MISO	515	73.3
NYISO	215	24.8
PJM	1,192	97.6
SPP	299	45.1
Southeast (non-ISO)	529	112.4
West (non-ISO)	963	64.7

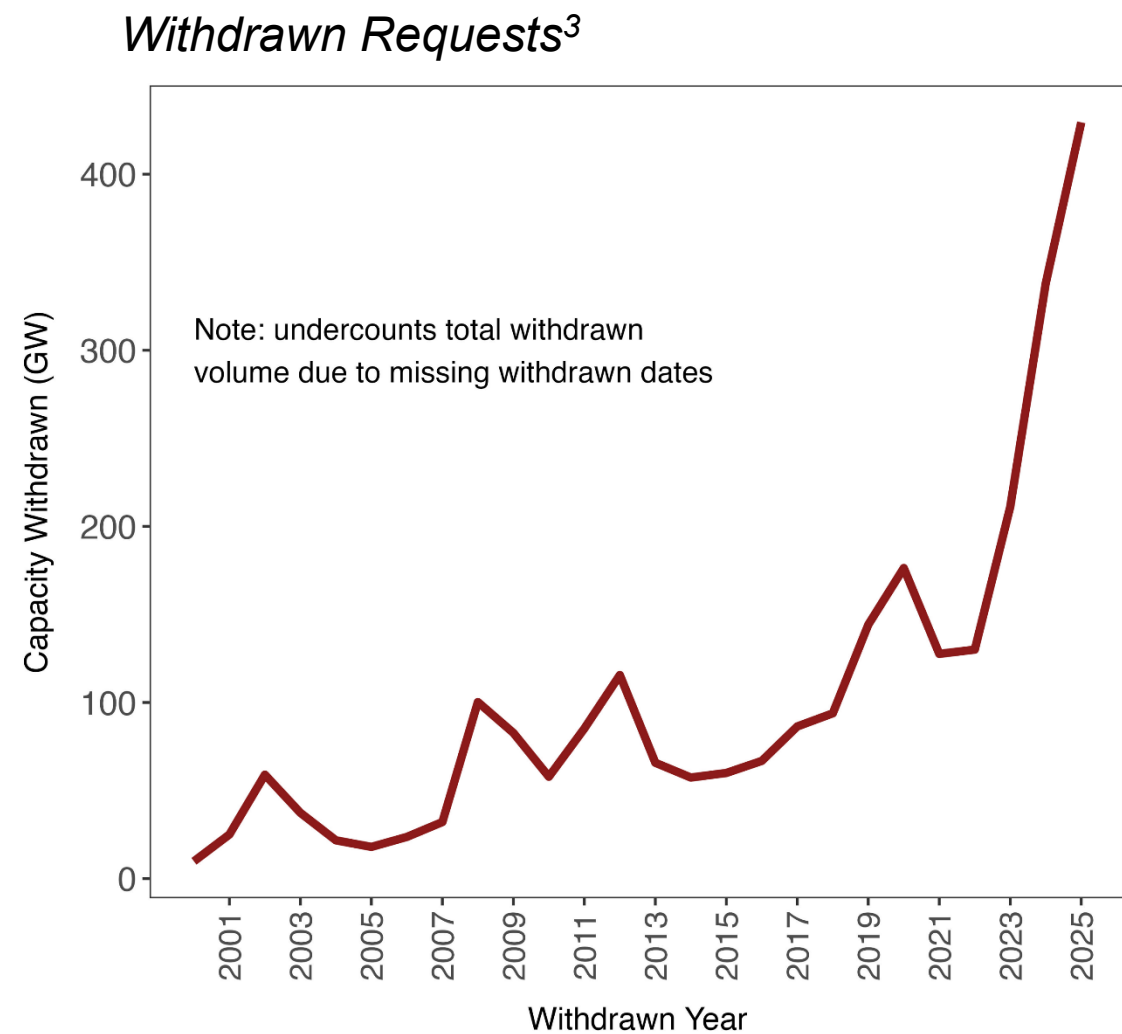
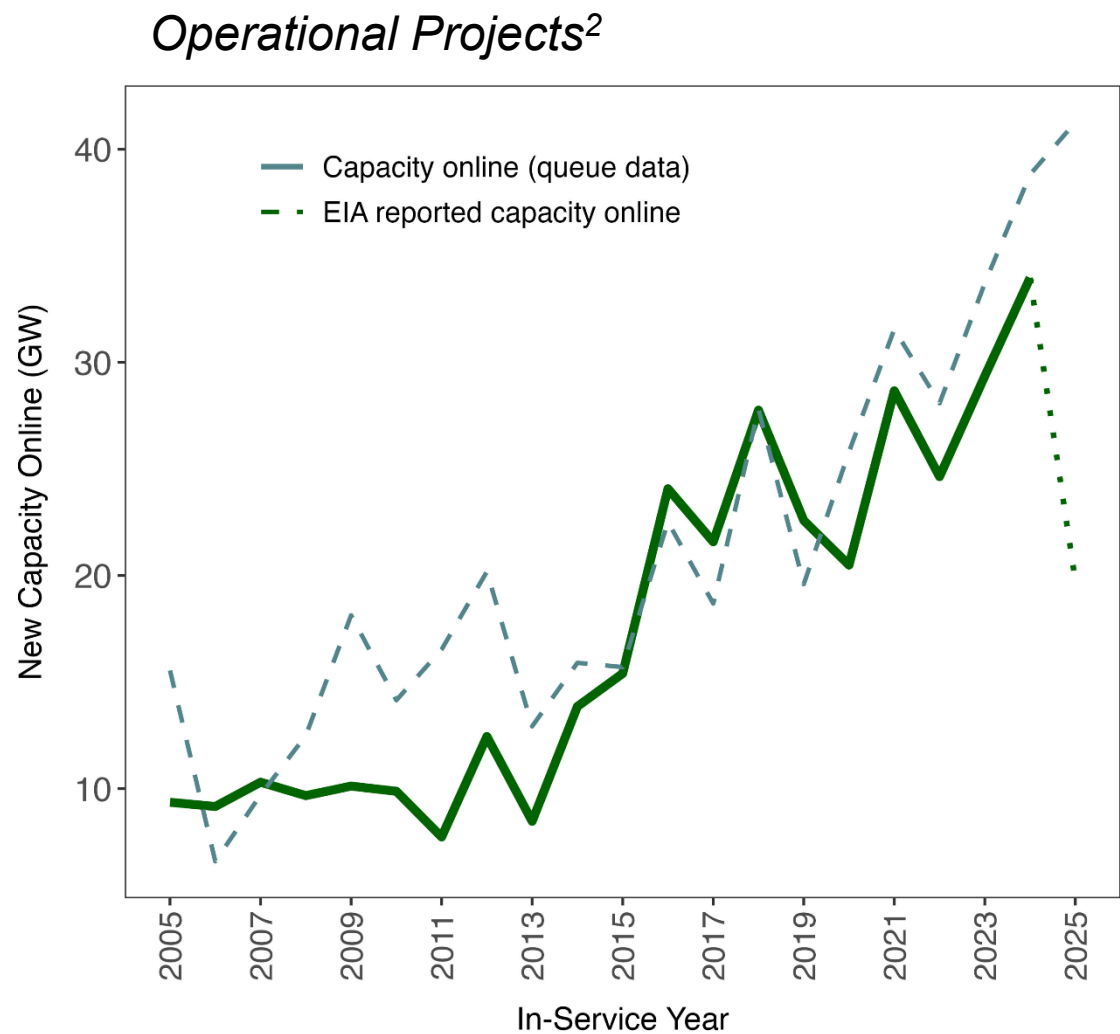
Withdrawn request data were available from all 7 ISO/RTOs and 45 non-ISO balancing areas, totaling 24,221 requests.

Region	<i>n</i> (Withdrawn)	Capacity (GW)
CAISO ⁴	2,200	631.2
ERCOT	1,158	262.0
ISO-NE	982	118.1
MISO	3,263	622.9
NYISO	1,531	324.1
PJM	5,226	638.1
SPP	1,846	382.9
Southeast (non-ISO)	2,738	603.3
West (non-ISO)	5,277	949.5

Notes: (1) The volume of operational and withdrawn projects with available data from interconnection queues may be smaller than the total volume of operational or withdrawn projects in each balancing area. (2) Some regions only report the current status of a request (i.e., operational or withdrawn), but not an associated date for that status. Requests with missing dates are excluded from some subsequent analyses. (2) Data were sought from 7 ISOs and 50 non-ISO BAs; operational and withdrawn project data may be delayed or unavailable. (3) Capacity (GW) shown in these tables does **not** include estimates for missing hybrid storage capacity. (4) Withdrawn includes CAISO cluster 15 requests that were not resubmitted in 2024 (as required by CAISO to continue).

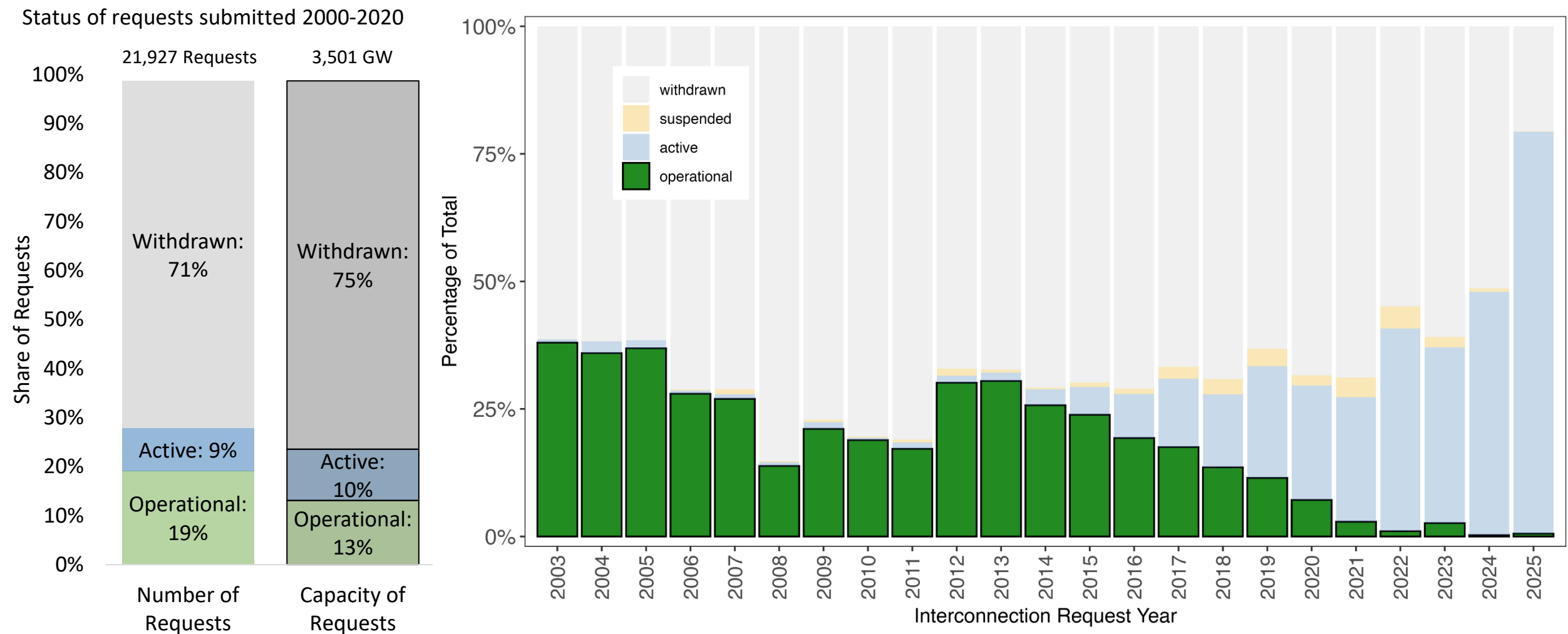
Volume (capacity) of operational and withdrawn projects is trending upward.

Over 750 GW¹ of capacity was withdrawn in 2025



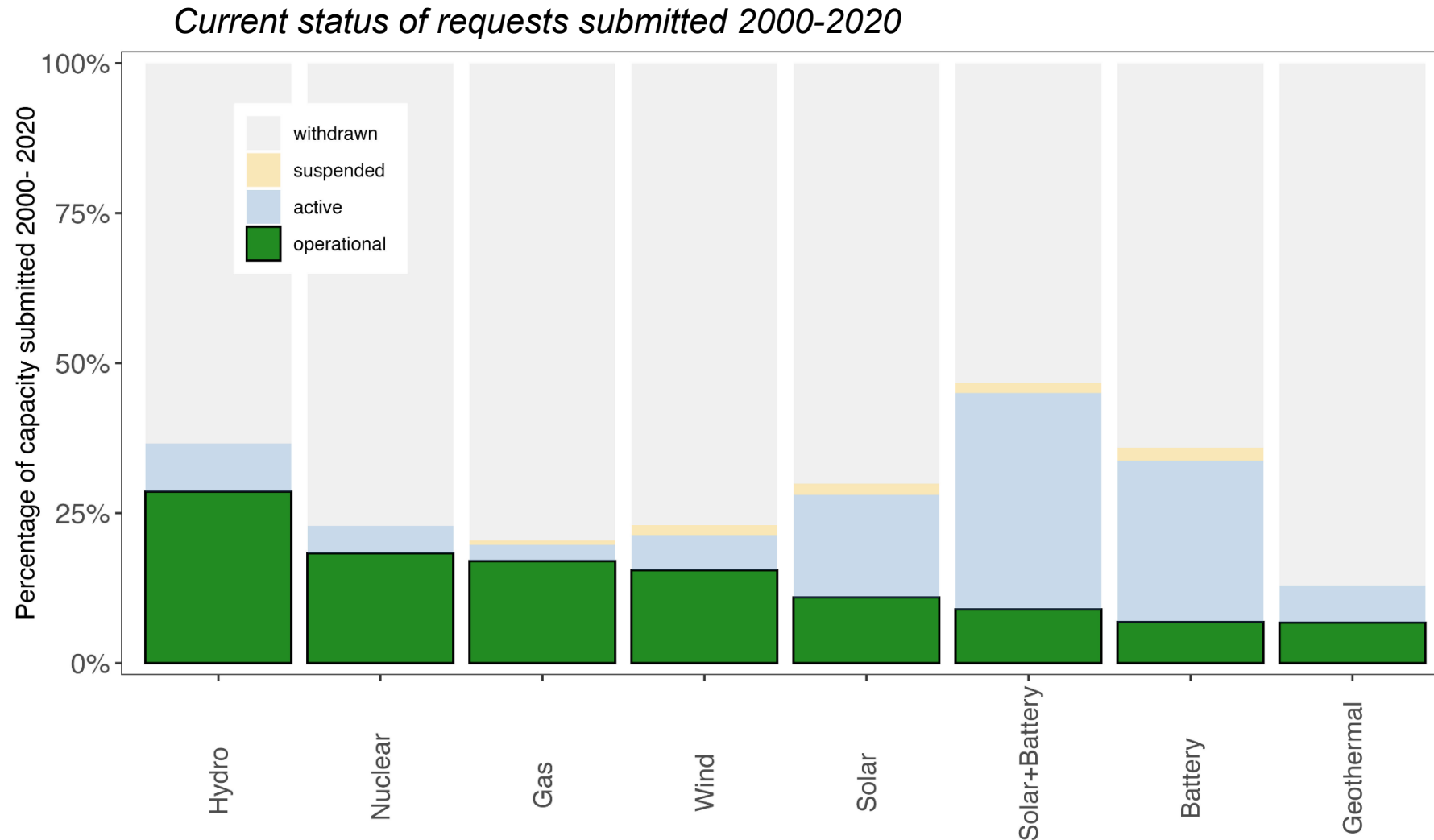
Note: (1) Valid in-service year only available for 73% of the “operational” project sample; withdrawn year only available for 63% of the “withdrawn” project sample. These figures therefore only include a subset of total data. (2) The discrepancy between queue capacity and EIA capacity is primarily due to missing in-service dates and lags or gaps in reporting in the queue data. EIA data are filtered to only include balancing areas for which we have queue data with COD dates, and only include transmission-interconnected plants. (3) Withdrawn capacity includes CAISO Cluster 15 (2023) requests that were not resubmitted in 2024 (as required by CAISO to continue).

The majority (>70%) of interconnection requests are withdrawn. Just 13% of capacity submitted into queues from 2000-2020 had come online as of the end of 2025



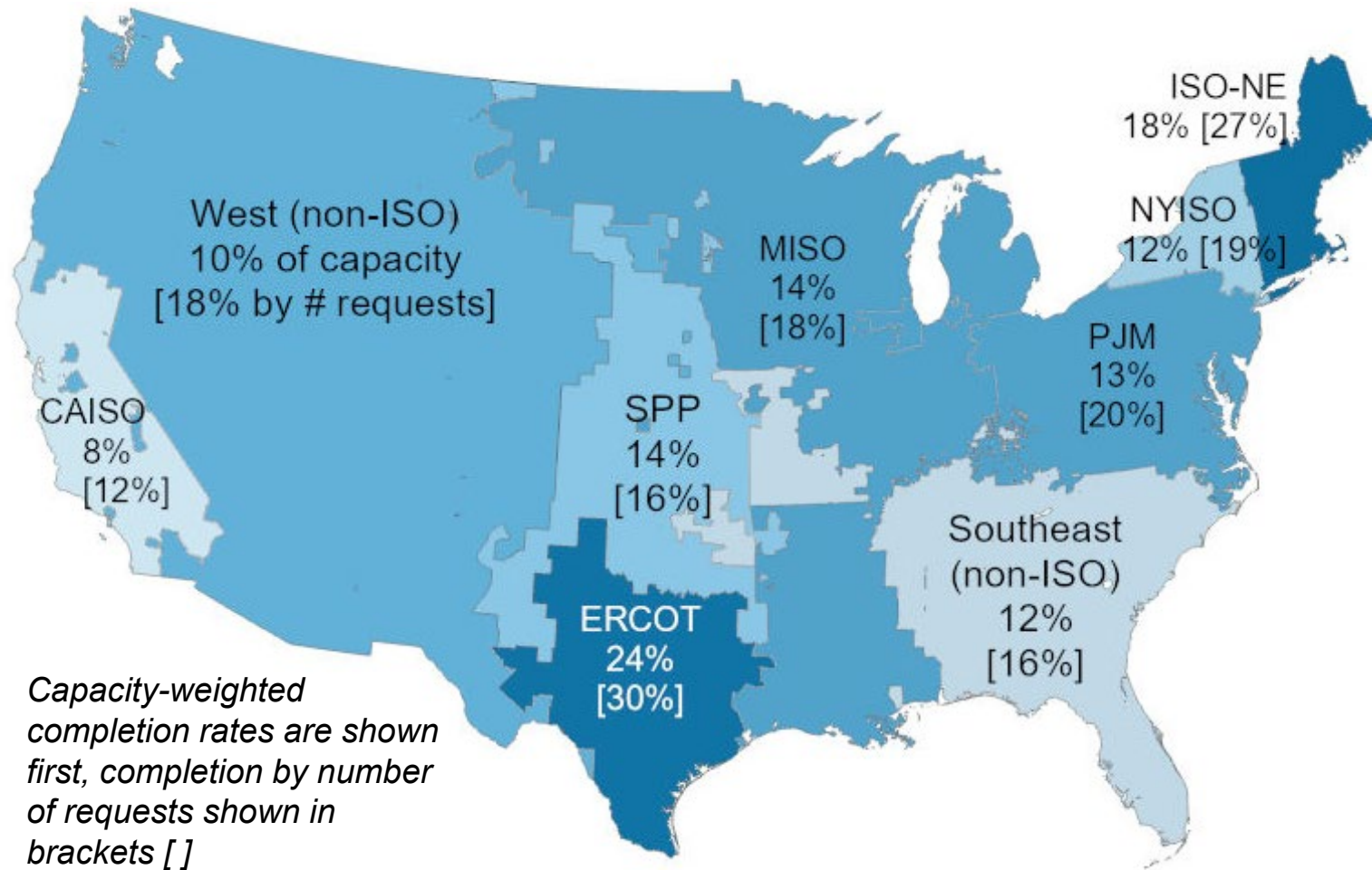
Notes: (1) Final outcome for projects entering the queues in recent years may not yet be determined; some take 5 or more years from request to COD. (2) Status shown represents a snapshot of all available data as of the end of 2025. (3) Completion rate shown in chart on right is calculated by number of projects, not capacity. (4) Includes data from 7 ISO/RTOs and 33 non-ISO balancing areas that provide comprehensive status information (since online date is not required for this analysis, data are roughly complete for these regions). (5) Left chart only includes requests submitted through 2020 (22,061 requests).

There is considerable variation in completion rates across generator types; In terms of capacity, Hydro (29%), Nuclear (18%), and Gas (17%) have highest average completion rates



Notes: (1) Calculated as number of projects operational as of EOY 2025 divided by the total number of requests from 2000-2020. (2) Percentages only include projects requesting interconnection from 2000-2020. (3) Includes 21,927 requests submitted 2000-2020, from 7 ISO/RTOs and 33 non-ISO balancing areas that provide comprehensive status information.

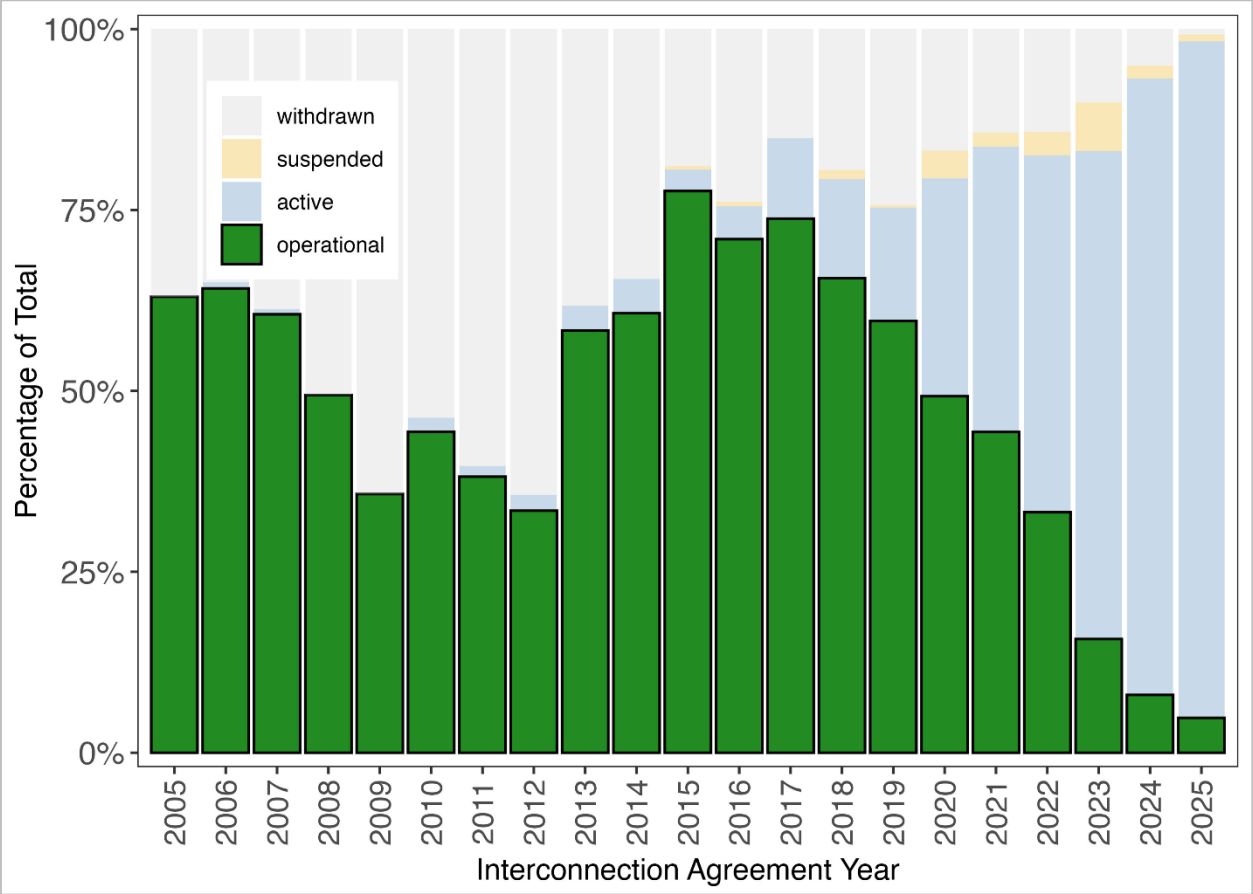
The share of projects requesting interconnection from 2000-2020 that have reached COD is relatively low across regions: Only ERCOT completes more than 20% of requested capacity



- Completion rates by number of requests are slightly higher overall (in brackets [%])
 - Still, only ERCOT and ISO-NE exceed 25% completion by number of requests
- For interconnection requests from 2000-2020, ERCOT (24%) and ISO-NE (18%) had the highest project completion percentages, with CAISO (8%) and the West (10%) lower on average
- These rates are variable over time, and trends may be shifting as queue volumes and reforms evolve
- Completion rates are a factor of the amount of developer interest in a given market alongside various factors that enable or disable project completion
 - Although not assessed here, comparing annual built capacity to forecasted need in each region could be a useful metric

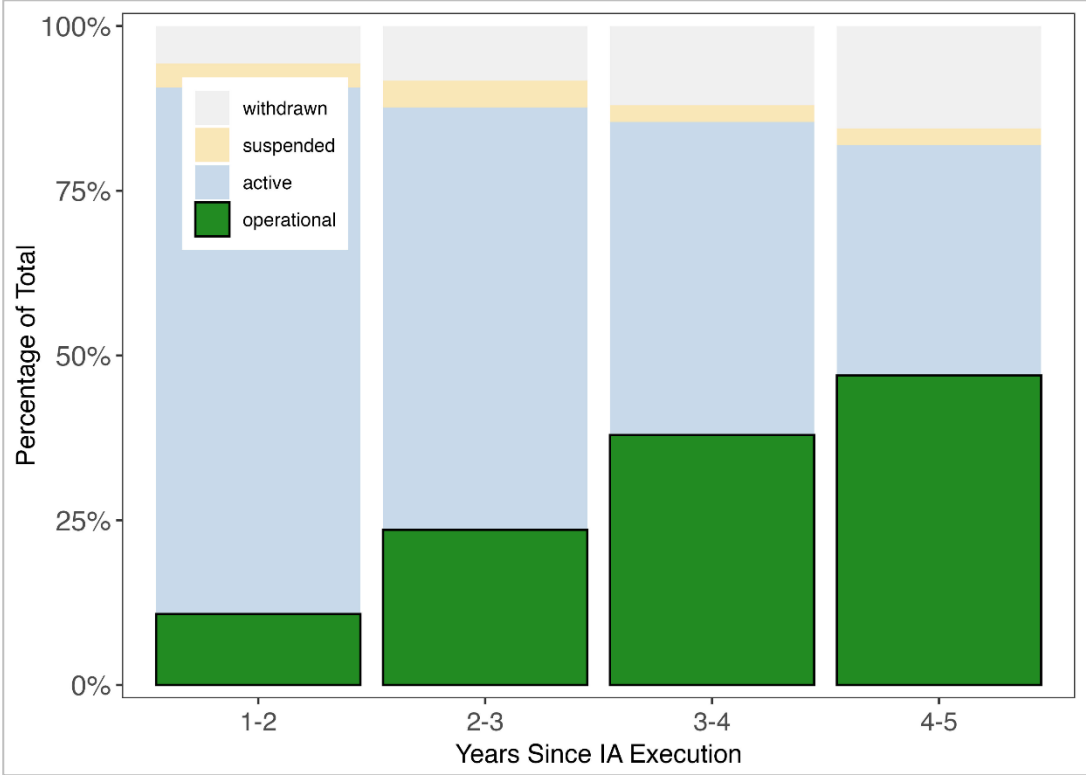
Even after signing an interconnection agreement (IA), many requests withdraw. 41% of capacity that signed IAs 2000-2022 had withdrawn by the end of 2025

Current (2025) status for requests with executed IAs, by IA year



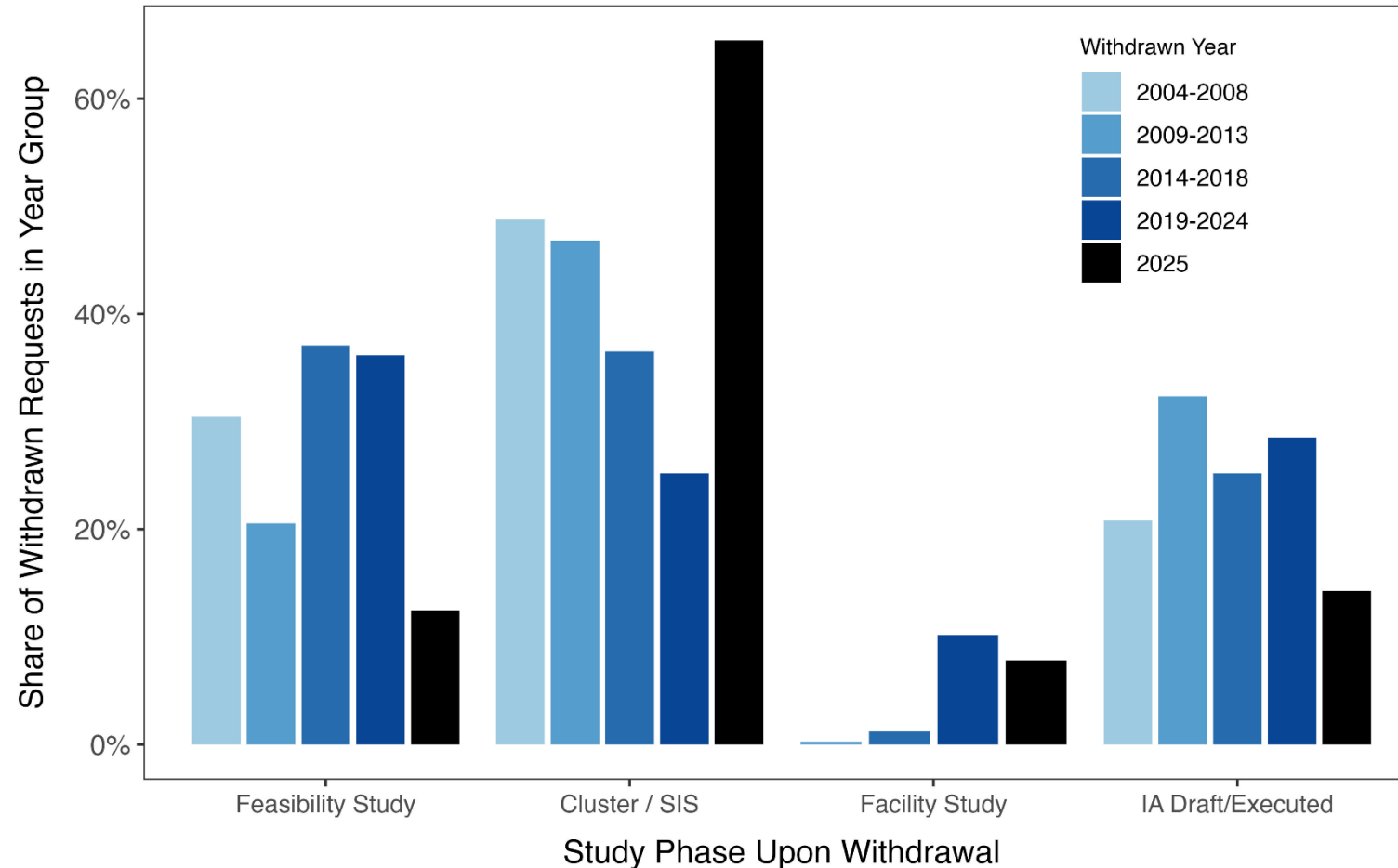
Notes: (1) Table and charts only include requests with executed interconnection agreements and for which the IA date was available. (2) Includes data from 7 ISOs and 7 non-ISO BAs for which IA dates could be identified. (3) Overall this data sample is dominated by requests in MISO (31%) and ERCOT (22%), but MISO requests particularly dominate the earlier years. (4) Right-hand chart compiles data from LBNL's historical annual interconnection queue datasets - not just the most recent data year.

Status by number of years after IA execution



Status of IAs signed 2000-2022, by capacity (GW)				
EOY 2025 status	Operational	Active	Suspended	Withdrawn
Cap. (GW)	309	105	6	296
Percentage	43%	15%	1%	41%

The majority of 2025 withdrawals occurred in the system impact study (or cluster study) phase, with fewer late-stage withdrawals



Later-stage withdrawals can be more costly for developers (sunk costs, deposits) and can trigger re-studies for other projects in the queue, increasing delays.

Note: Only includes data for entities that provide study phase for withdrawn requests (n = 11,503; 47% of all withdrawn requests).

Duration Trends: How Long Do Projects Spend In the Queues?

Withdrawn Requests:

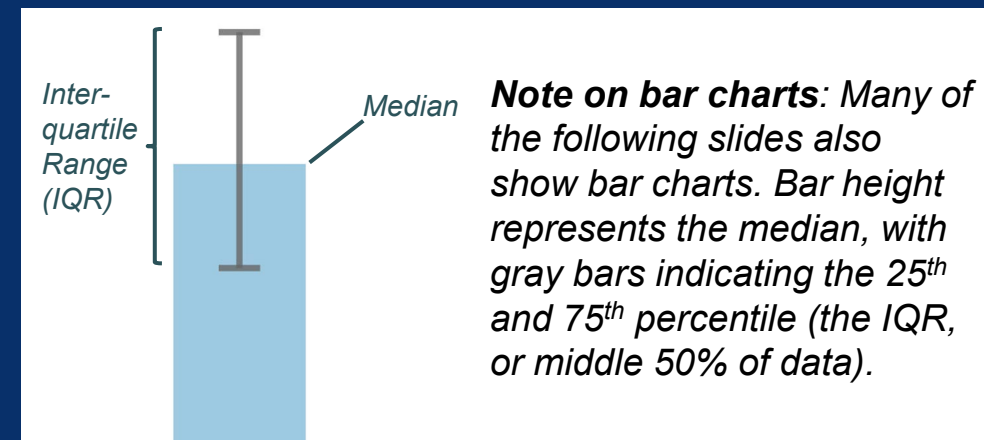
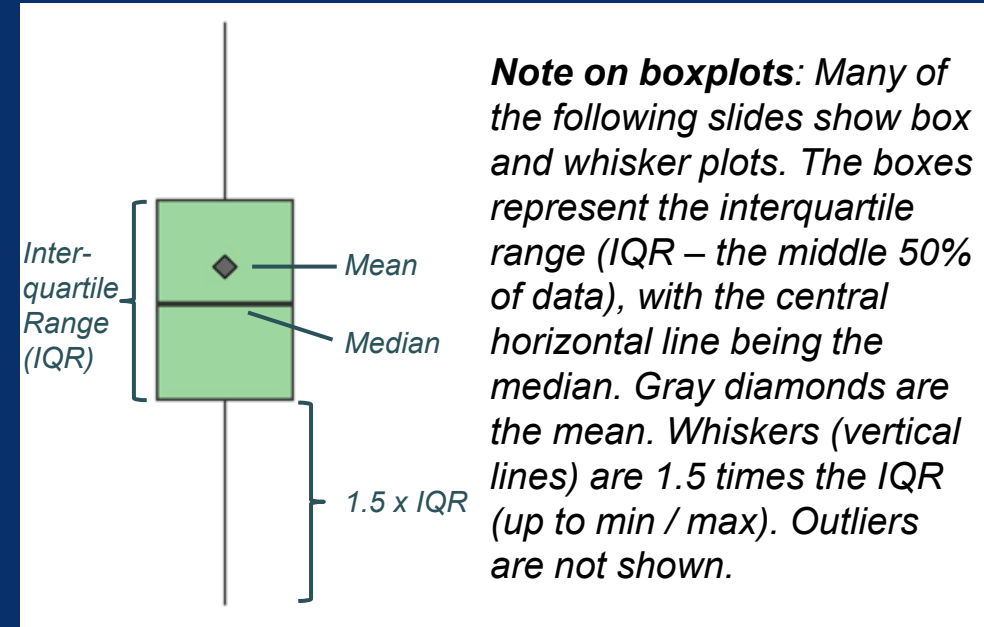
- Duration from Interconnection Request (IR) to Withdrawn Date
 - By region and generator type

Requests with Signed Interconnection Agreements (IA):

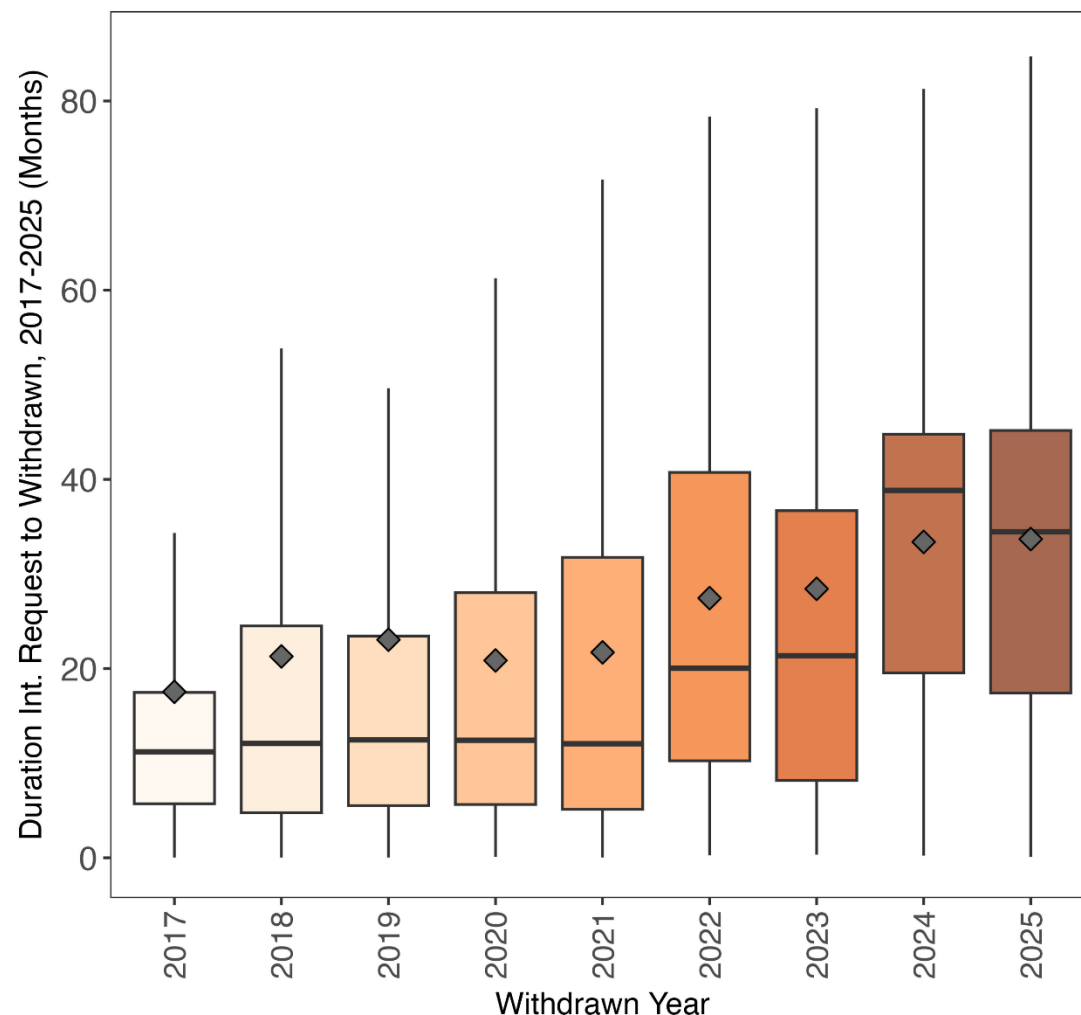
- Duration from IR to IA
 - By region, generator type, size, and service type

Operational Projects:

- Duration from IA to Commercial Operations Date (COD)
 - By region and generator type
- Duration from IR to COD
 - By region, generator type, and size



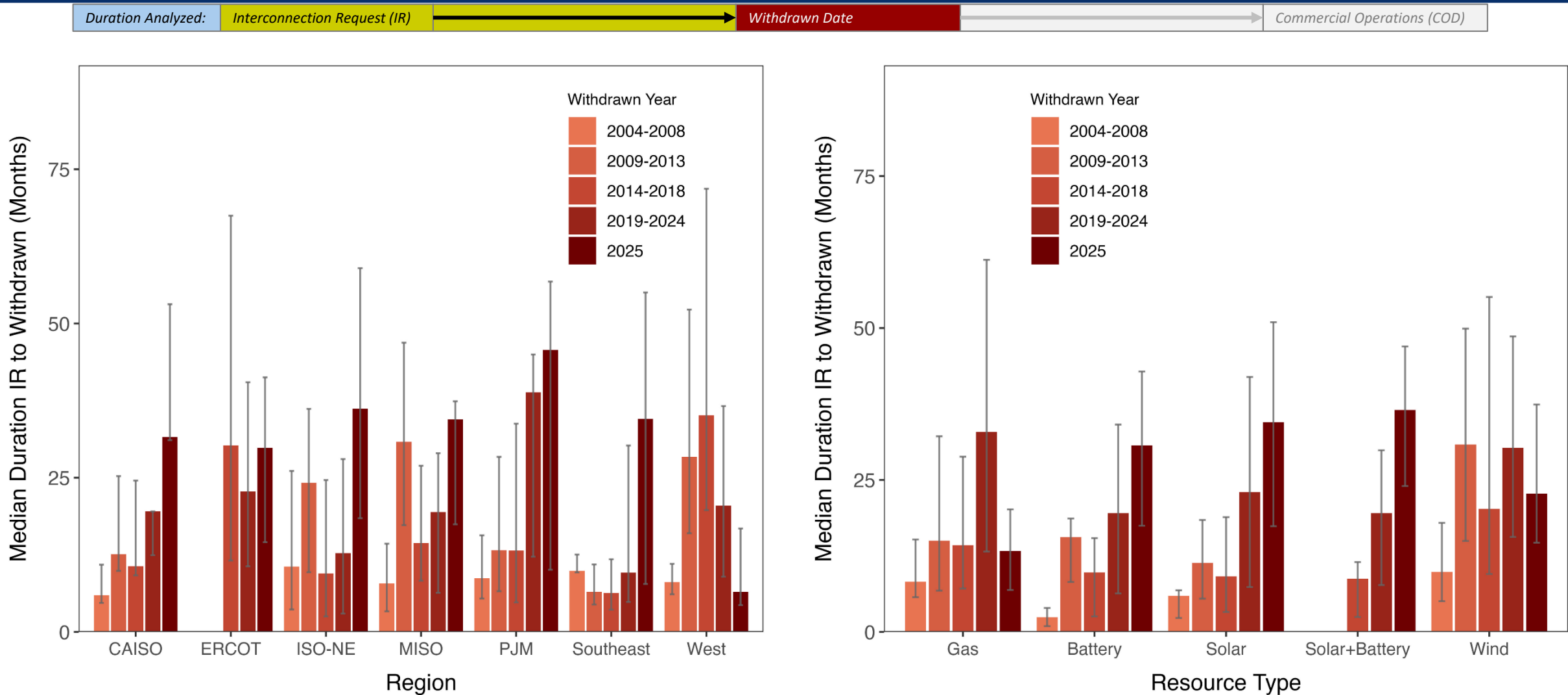
The average duration from interconnection request to withdrawal date has increased in recent years; 2025 median below 2024, but remains high



- This trend implies that some recently-withdrawn projects have waited longer in the queues before making the determination to withdraw
- The average (mean) has shifted from being greater than the median, indicating mostly shorter duration with a few outliers, to slightly below it in 2024 and 2025.
 - ▣ This change indicates that long duration times have become more common across the board, and may be related to increasing adoption of cluster studies in which many projects go through studies at the same time.
- FERC Order 2023 and other reforms may have motivated some older requests to withdraw in 2024 and 2025
- Later stage withdrawals can be costly for developers and can disrupt assumptions built into other projects' interconnection studies, necessitating re-studies in some cases and lengthening study durations

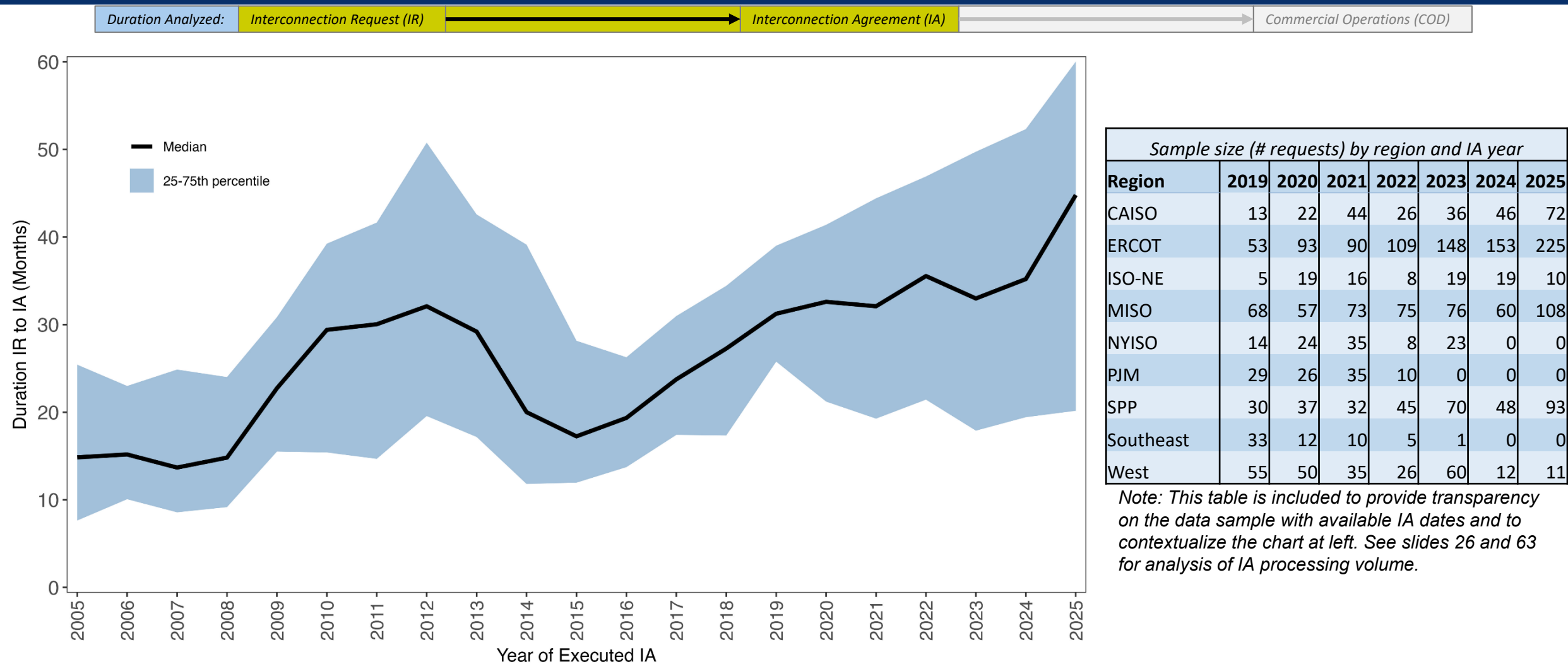
Notes: (1) Withdrawn date was available for 15,248 requests from 7 ISOs and 10 non-ISO balancing areas. (2) Duration is calculated as the number of months from the queue entry date to the date the project was withdrawn from queues. (3) For CAISO Cluster 15 projects that failed to resubmit, the resubmittal deadline is used as the withdrawal date.

Time from request to withdrawal is trending upward in several regions and across most resource types



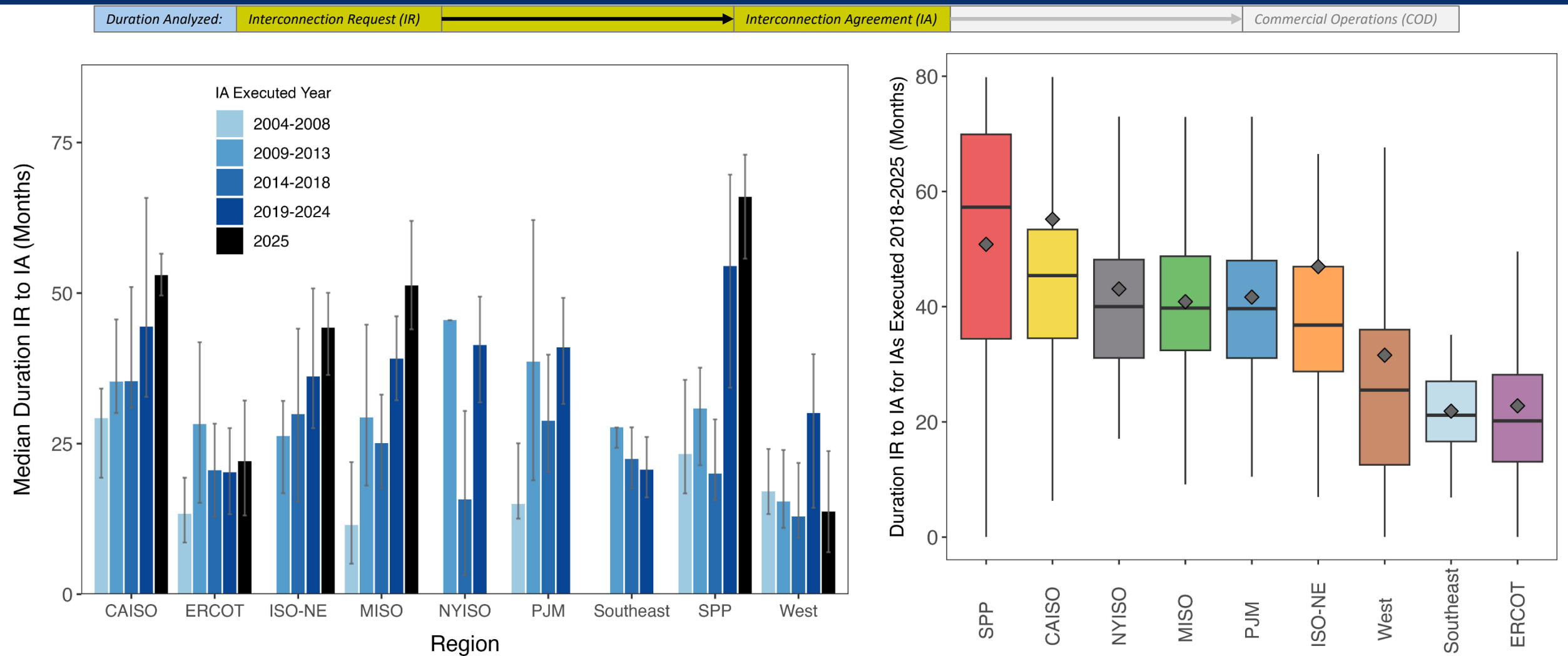
Notes: (1) Withdrawn date was available for 15,248 requests withdrawn since 2004 from 7 ISOs and 10 non-ISO balancing areas. (2) Duration is calculated as the number of months from the queue entry date to the date the project was withdrawn from queues. (3) For CAISO Cluster 15 projects that failed to resubmit, the resubmittal deadline is used as the withdrawal date. (4) See appendix slide 61 for sample size by generator type. The sample size in 2025 for some regions is small.

Duration from interconnection request to interconnection agreement sustaining high values over the past several years, with median time of nearly four years (45 months)



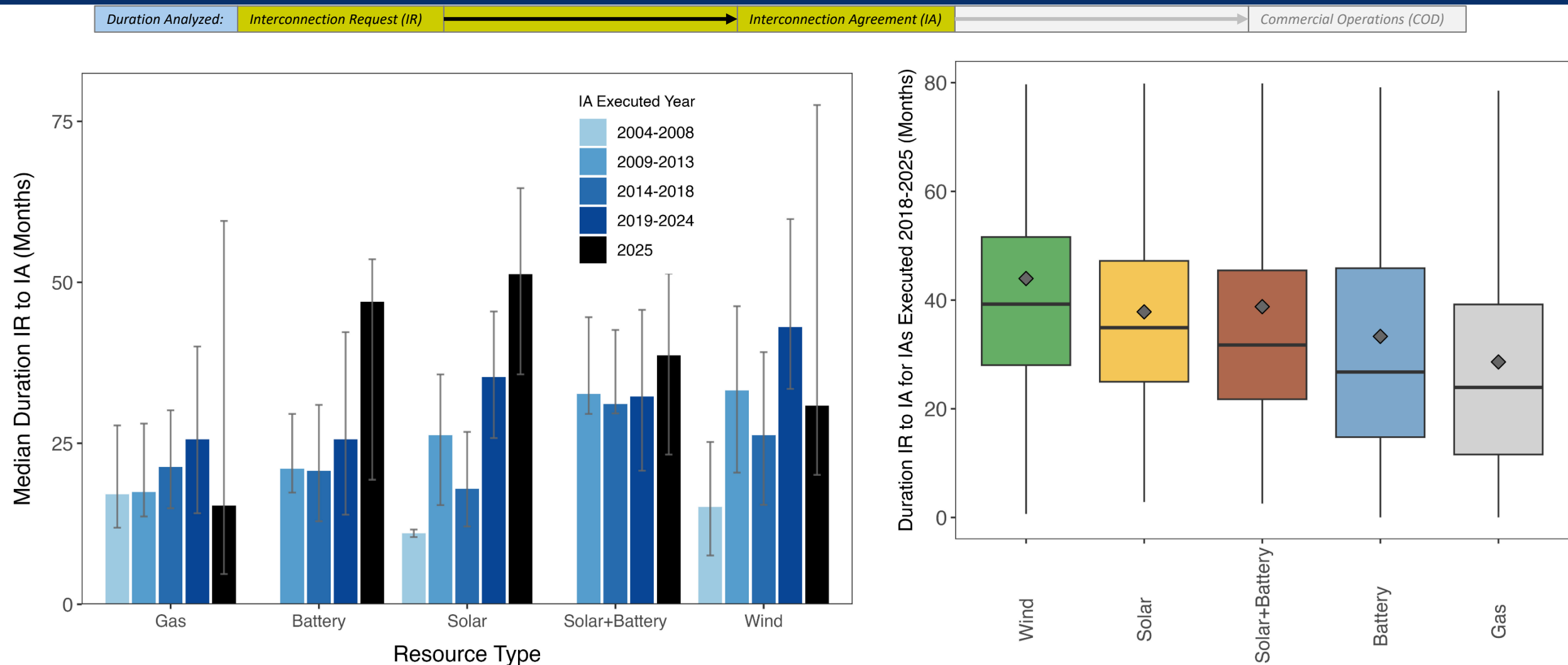
Notes: (1) A large portion of the 2024 and 2025 data sample for this analysis came from ERCOT, which typically has relatively shorter durations (see next slide); date of IA execution for projects with IA agreement completed in 2023-2025 was not accessible in database format from several regions. (2) Sample includes 4,929 requests from 7 ISO/RTOs and 7 non-ISO balancing areas with executed interconnection agreements since 2004. (3) Not all data used in this analysis are publicly available.

ERCOT and the non-ISO regions (Southeast and West) typically have faster IR to IA processing times compared to the FERC-jurisdictional ISOs



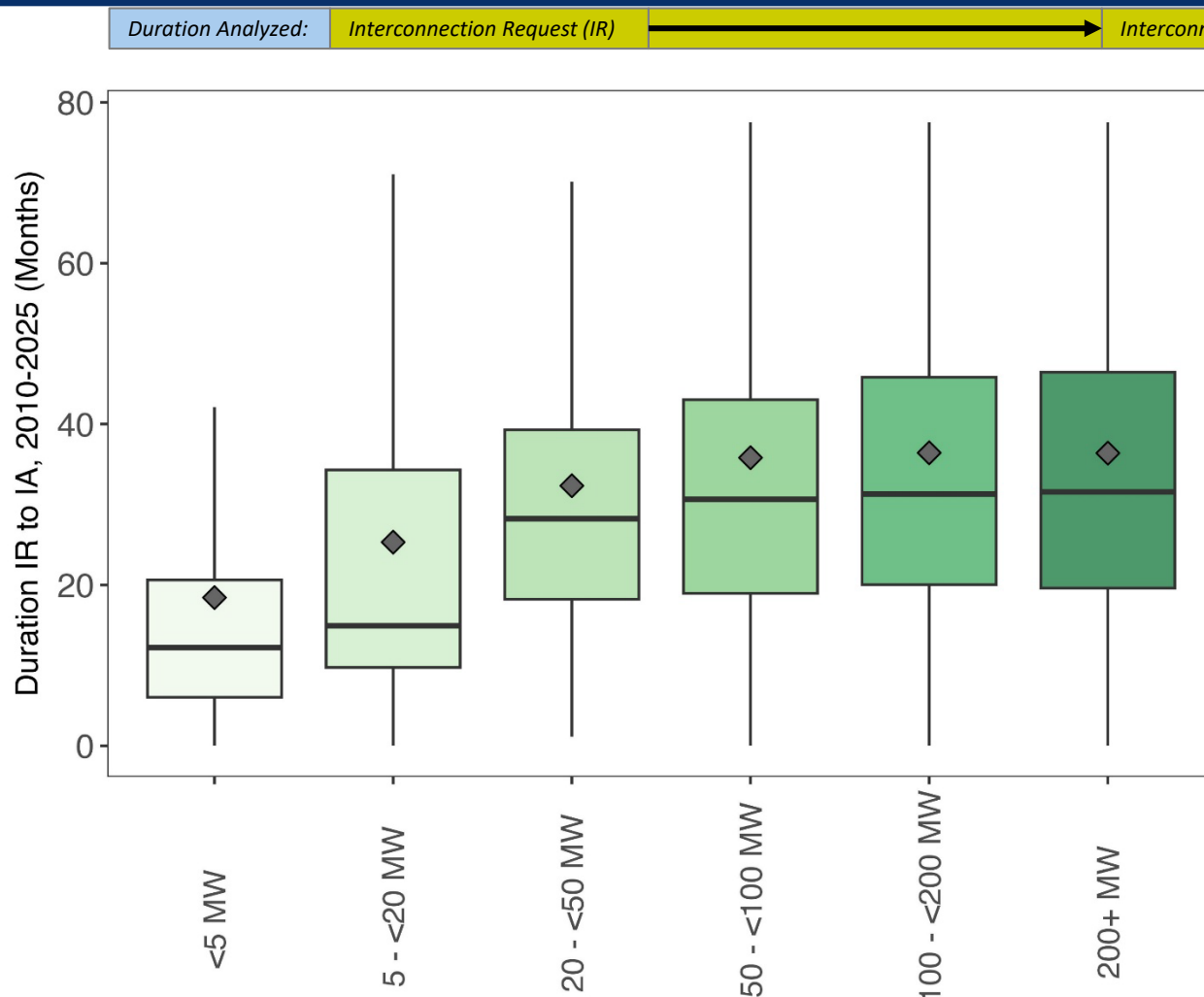
Notes: (1) Sample includes 4,929 requests from 7 ISO/RTOs and 7 non-ISO balancing areas with executed interconnection agreements since 2004. (2) See prior slide for sample size by region. (3) A large portion of the 2024-2025 data in this analysis are from ERCOT. (4) Not all data used in this analysis are publicly available. (5) Date of IA execution for projects with IA agreement completed in 2023-2025 was not accessible in database format from several regions.

Wind projects have faced longer interconnection study timelines overall, but recent solar and battery requests are trending up. Recent gas requests have been processed more quickly



Notes: (1) Sample includes 4,317 requests for the 5 resource types shown, from 7 ISO/RTOs and 7 non-ISO balancing areas with executed interconnection agreements since 2004. (2) See slide 43 for sample size by region; see appendix for sample size by generator type. (3) A large portion of the 2024-2025 data this analysis are from ERCOT. (4) Not all data used in this analysis are publicly available.

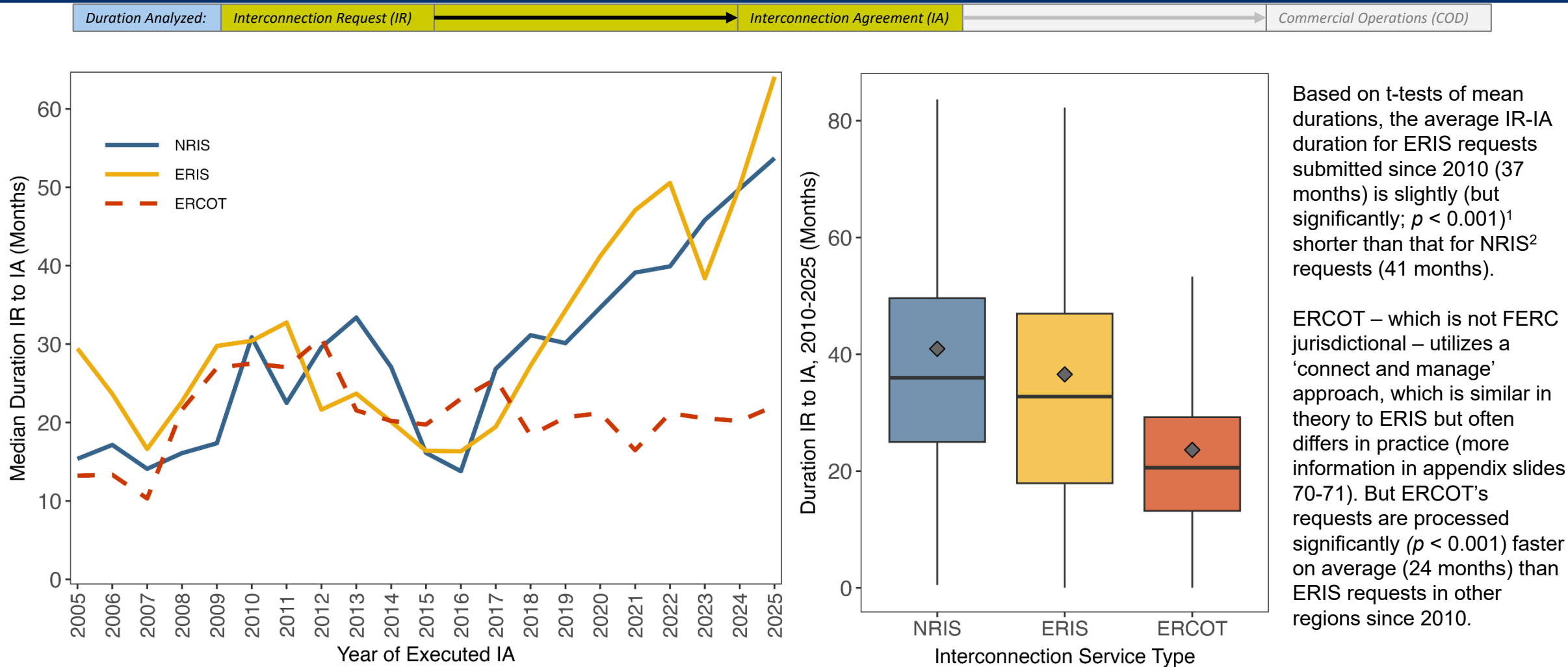
There is a clear step change in IR to IA duration between “small” (<20 MW) and “large” (>20 MW) generator interconnection procedures



- Projects with rated capacity <20 MW typically complete studies and execute interconnection agreements much faster than larger projects
 - Median is 12 months for projects <5 MW
 - Median is 15 months for projects 5 - <20 MW
- The median duration for projects 20 MW or larger hovers around 30 months across the four larger project groups analyzed
- 20 MW is the threshold between the FERC “large” and “small” generator interconnection procedures (LGIP / SGIP)
 - The median LGIP duration is twice the median SGIP duration for projects in our sample

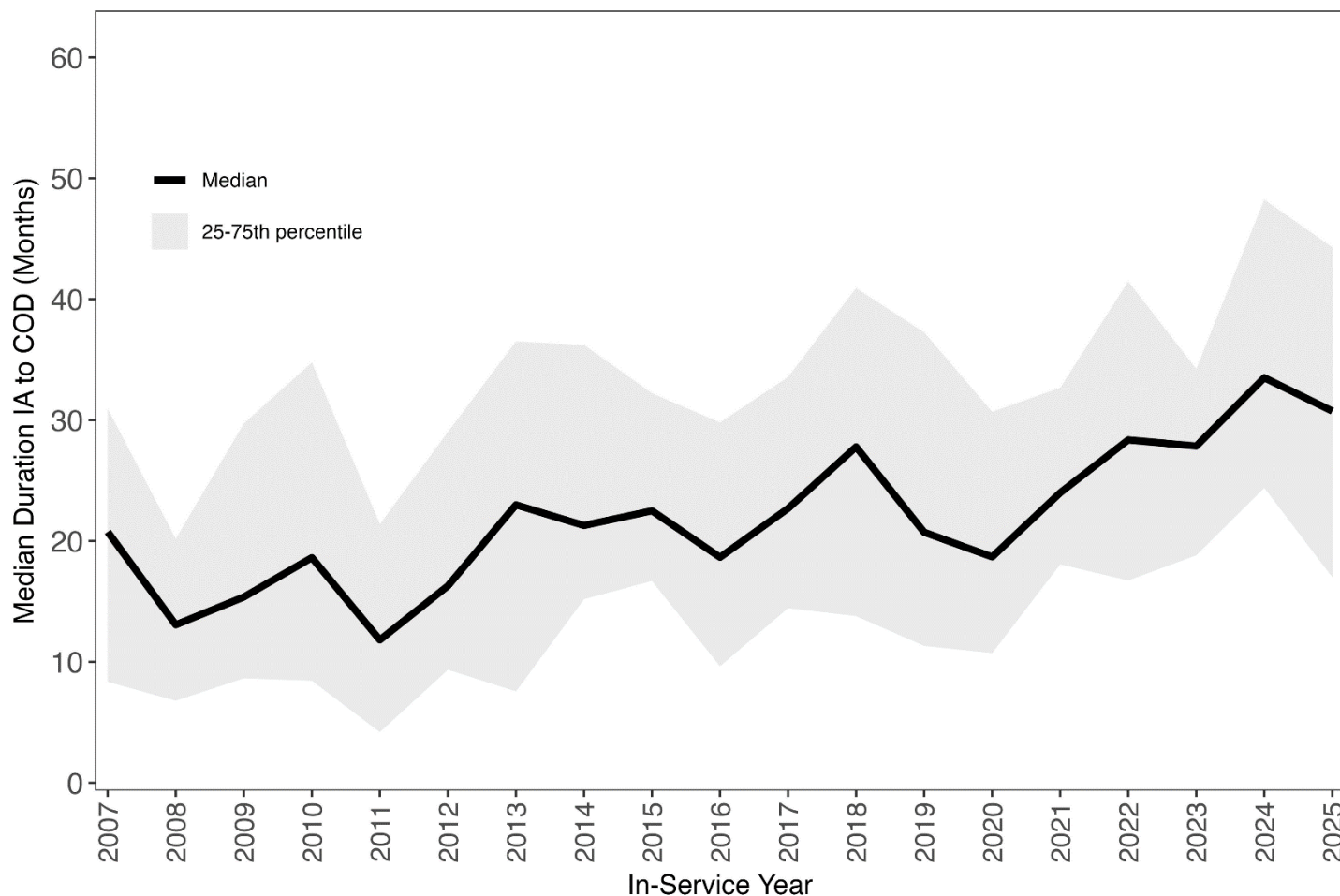
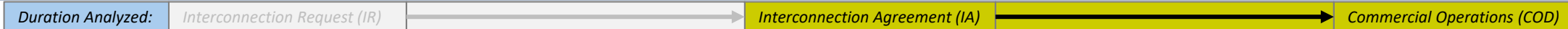
Notes: (1) Sample includes 4,205 projects from 7 ISO/RTOs and 7 non-ISO balancing areas with executed interconnection agreements since 2010. (2) See slide 43 for sample size by region; see appendix slide 61 for sample size by generator type. (3) A large portion of the 2024-2025 data used for this analysis are from ERCOT. (4) Not all data used in this analysis are publicly available.

Energy Resource Interconnection Service (ERIS) requests are slightly faster to process than Network Resource Interconnection Service (NRIS), but ERCOT requests are faster than both



Notes: (1) T-tests were used to determine whether there is a statistically significant difference between the mean duration of groups. We consider a p-value less than 0.05 to be statistically significant. (2) “NRIS” here includes projects choosing the NRIS/ERIS study option at time of request. (3) Sample includes 3,720 requests from 6 ISO/RTOs and 7 non-ISO balancing areas with executed interconnection agreements since 2005 that also provided service type information. (4) Not all data used in this analysis are publicly available.

Projects can face substantial delays *after* securing an interconnection agreement (IA). The median duration from IA to commercial operations date (COD) has increased over time

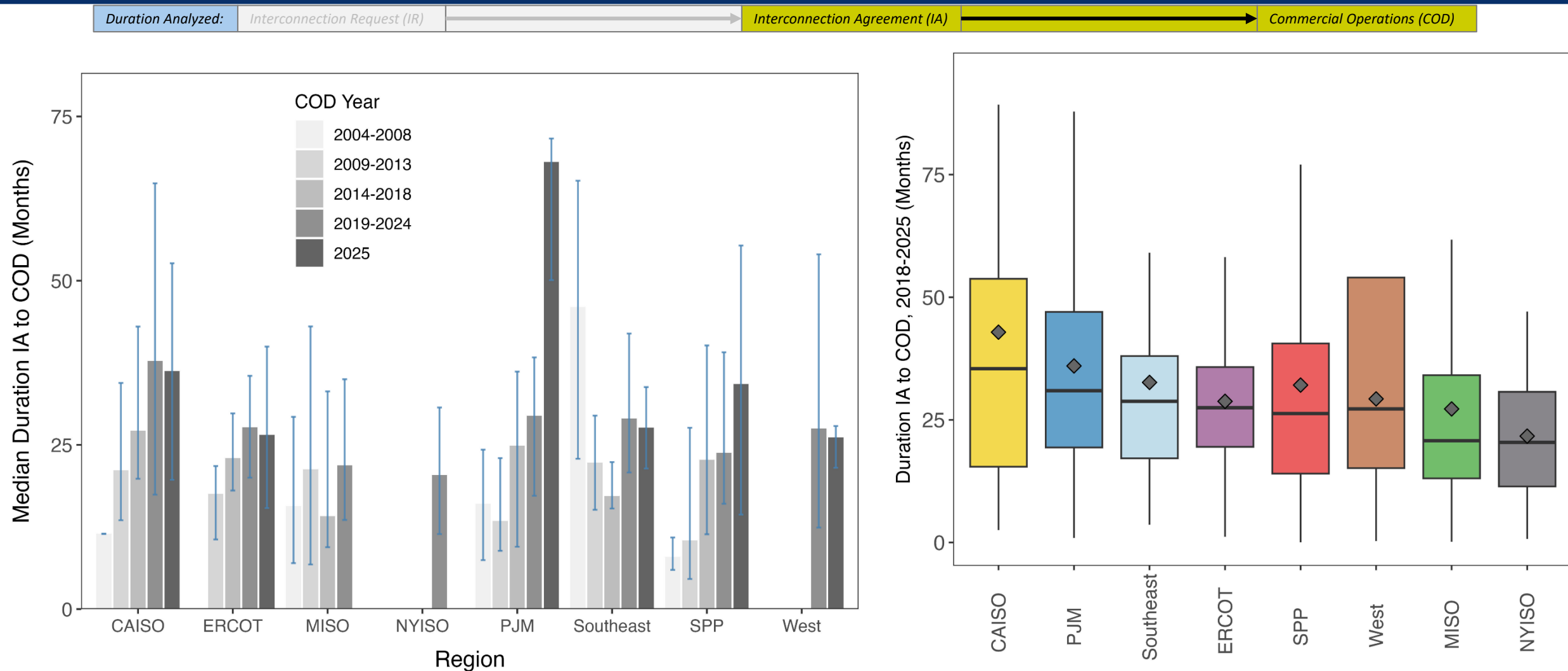


- Limited data were available to analyze typical durations from interconnection agreement to commercial operations
- The median IA to COD duration has trended upwards
 - The median was 21 months in 2008
 - The median was 31 months in 2025
- Long timelines from IA to COD are largely due to factors outside of the interconnection process, such as procurement / offtake, permitting, and transmission completion

Sample size (# requests) by region and COD year							
Region	2019	2020	2021	2022	2023	2024	2025
CAISO	11	8	13	13	11	12	12
ERCOT	18	16	49	35	59	72	66
MISO	19	33	20	22	22	36	0
NYISO	8	1	4	9	4	0	0
PJM	8	15	12	6	10	13	9
SPP	10	40	16	11	16	27	50
Southeast	3	8	4	3	6	14	2
West	0	0	0	8	6	2	3

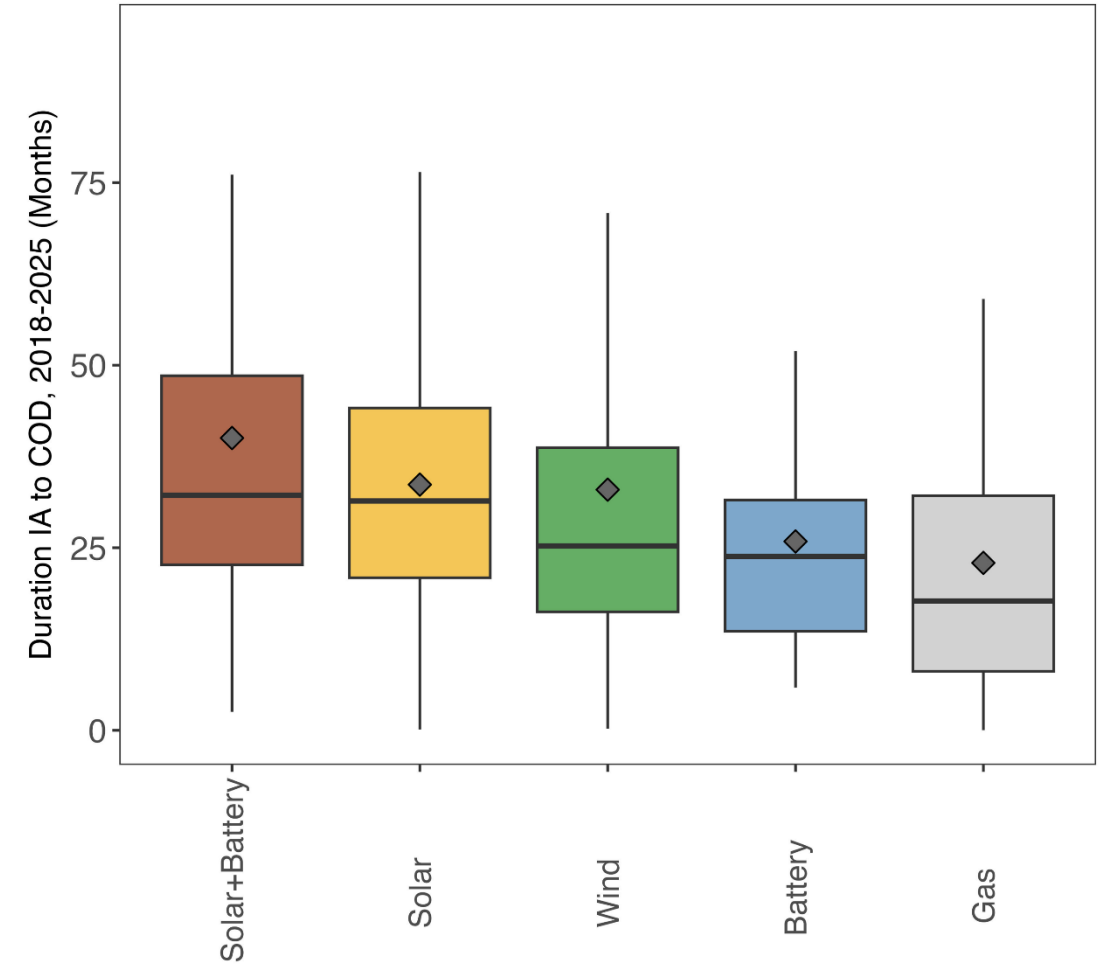
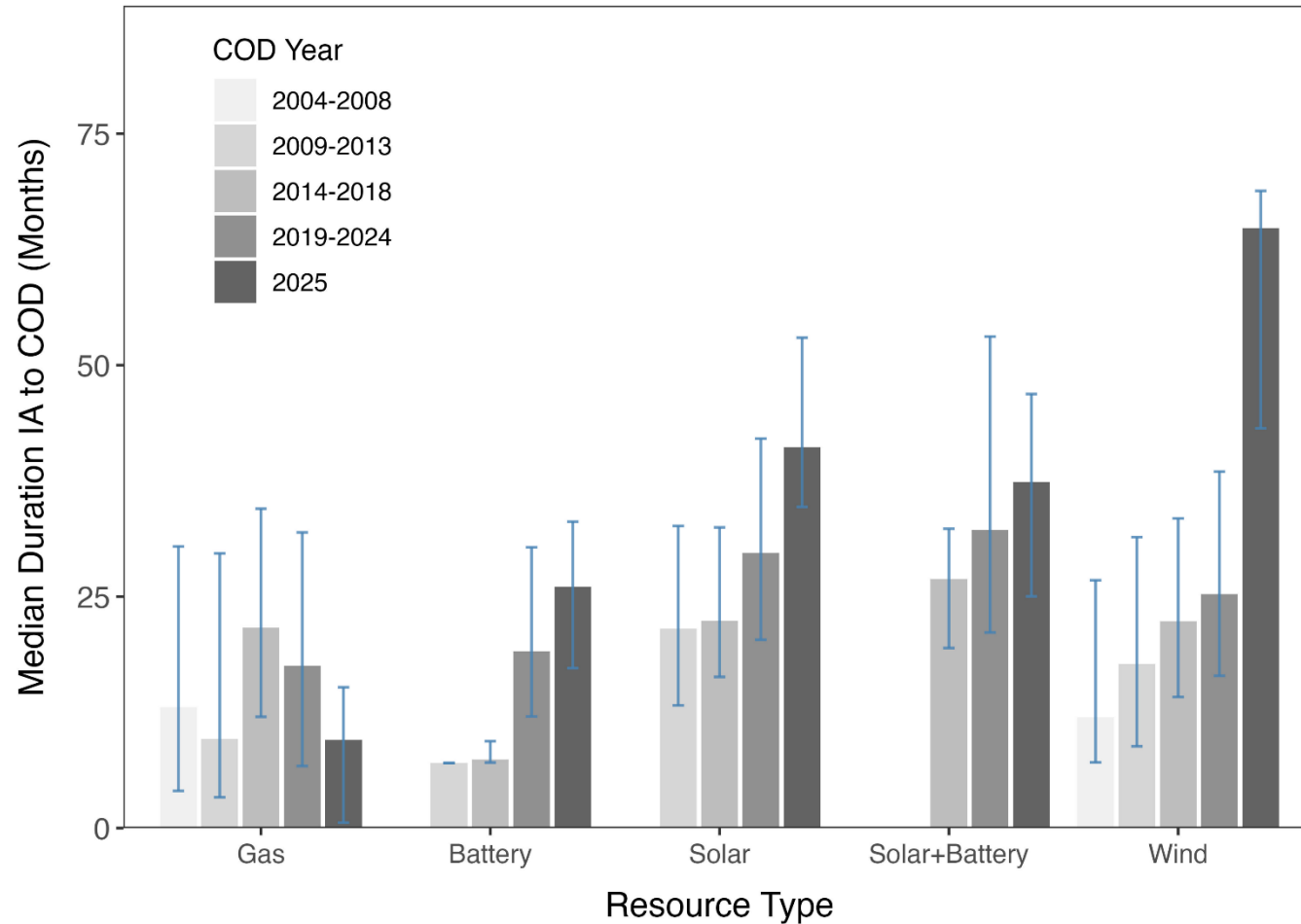
Notes: (1) Data were only available for 1,492 projects across 6 ISO/RTOs and two utilities that came online since 2007. (2) Not all data used in this analysis are publicly available.

The timeline from IA to COD is increasing across regions; this period is typically longest in CAISO, though PJM had very long timelines in 2025



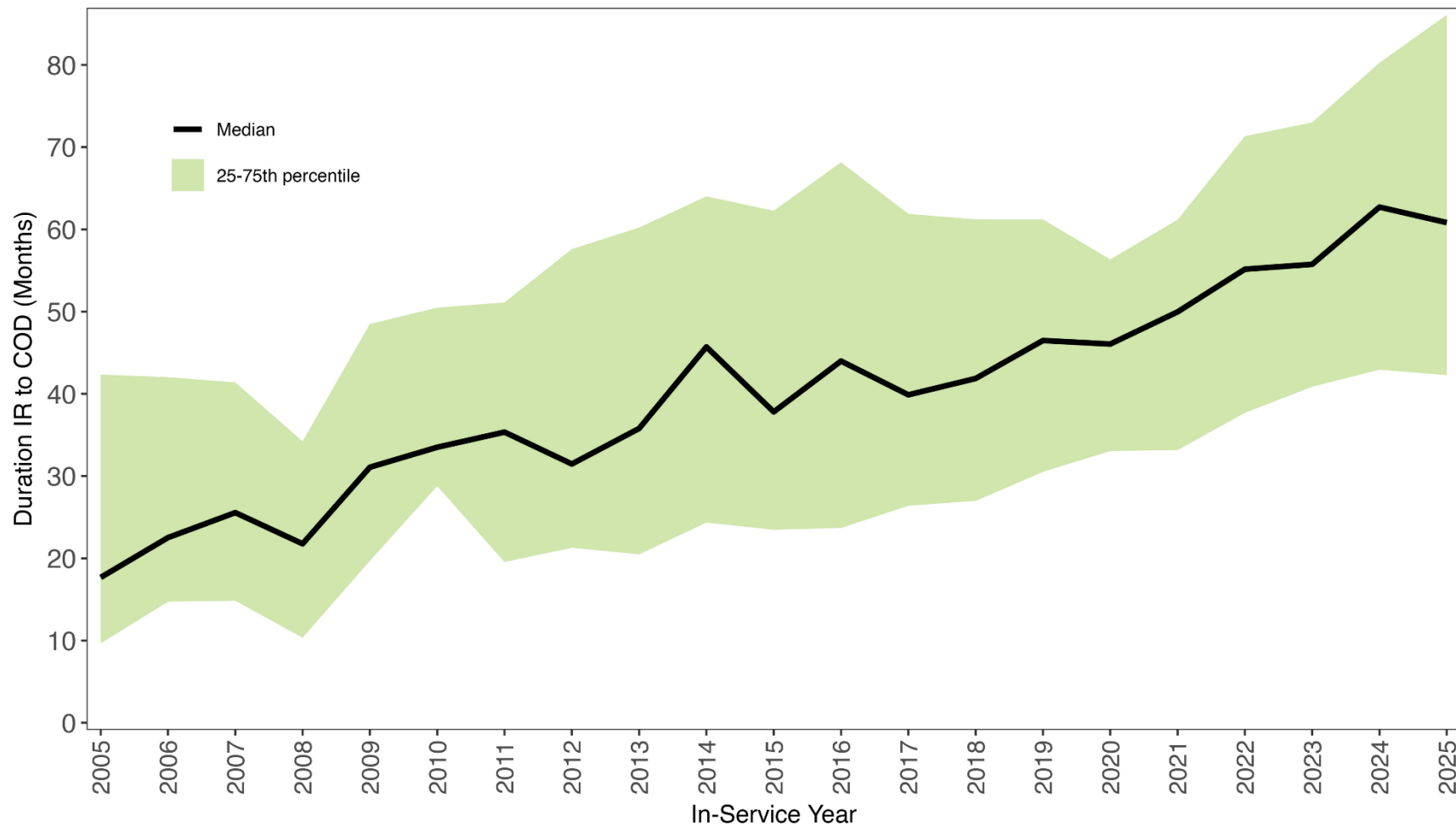
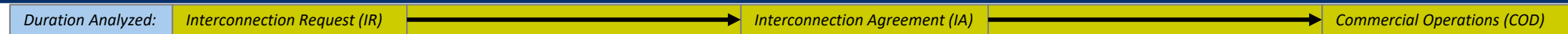
Notes: (1) Data were only available for 1,541 projects across 6 ISO/RTOs and two utilities that came online since 2004. (2) See prior slide for sample size by region. (3) Not all data used in this analysis are publicly available.

IA to COD duration is increasing across resource types, except for gas plants, which have seen a decline over time and now have the fastest timeline across resource types²



Notes: (1) Data were only available for 1,541 projects across 6 ISO/RTOs and two utilities that came online since 2004. (2) Our sample for this analysis only includes 9 gas plants that reached COD in 2025, at least 5 of which appear to be simple uprates (<100 MW). (3) See slide 48 for sample size by region; see appendix slide 61 for sample size by generator type. (4) The sample of Solar+Battery plants in this analysis are predominantly from CAISO. (5) Not all data used in this analysis are publicly available.

The median duration from interconnection request (IR) to commercial operations date (COD) has trended up, but declined slightly in 2025: 61 mo. for projects completed in 2025

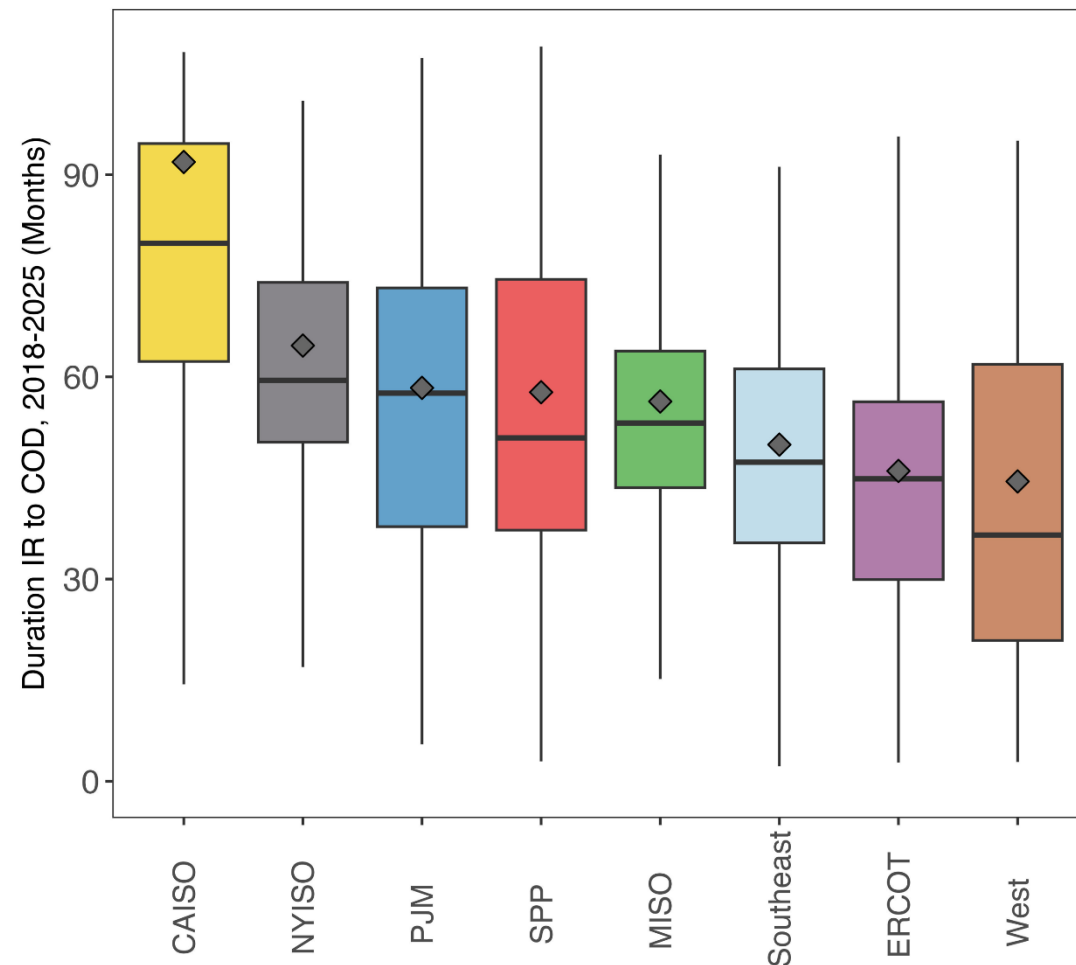
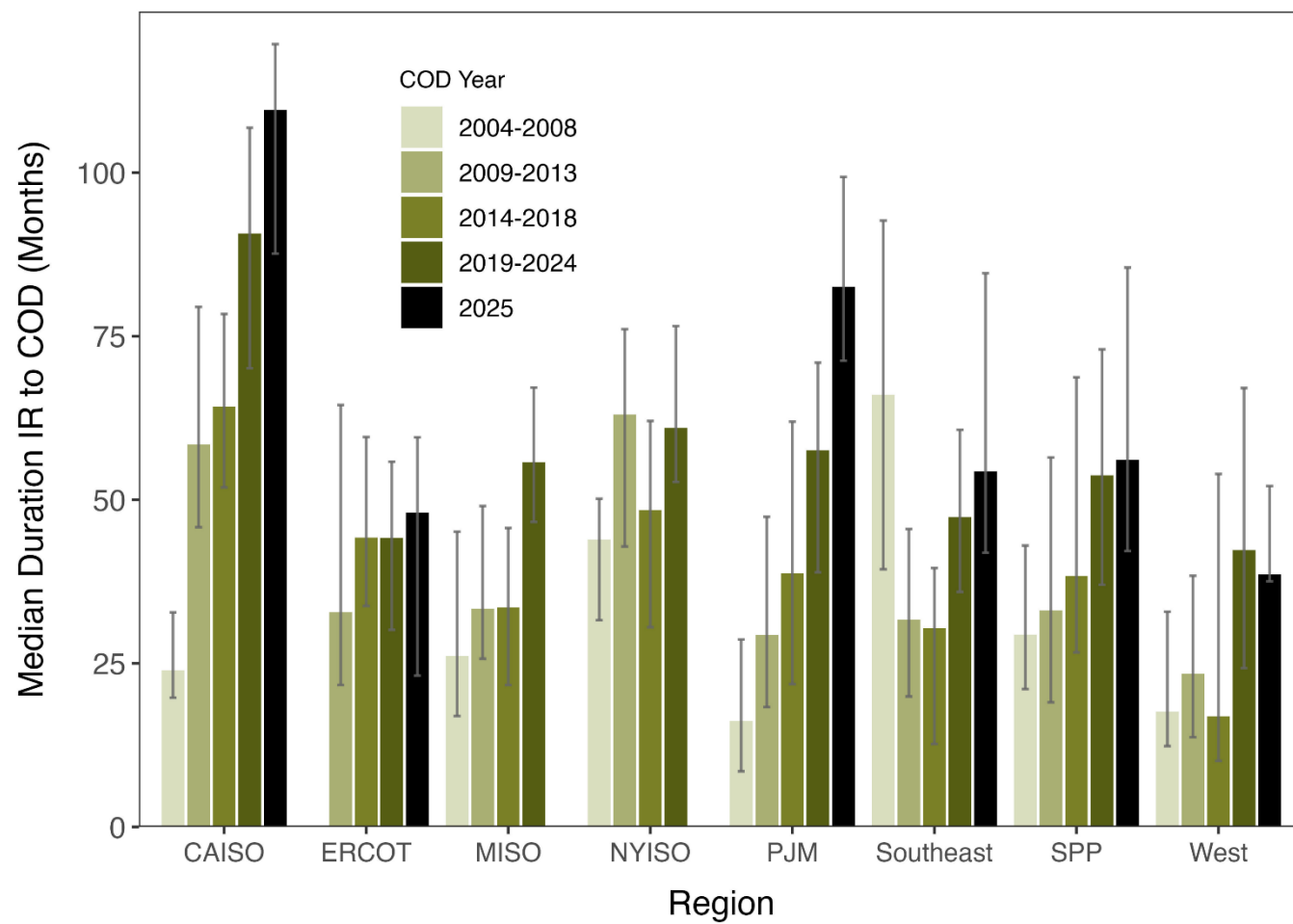
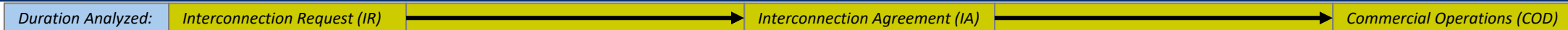


Sample size (# requests) by region and COD year							
Region	2019	2020	2021	2022	2023	2024	2025
CAISO	12	8	19	14	12	15	14
ERCOT	21	19	54	44	63	95	74
MISO	29	36	21	26	27	45	0
NYISO	10	1	4	9	5	0	0
PJM	51	78	42	32	64	60	47
SPP	12	55	25	18	44	56	139
Southeast	15	25	23	24	37	55	19
West	5	6	13	13	13	10	3

Note: This table is included to provide transparency on the data sample with available COD dates and to contextualize the chart at left.

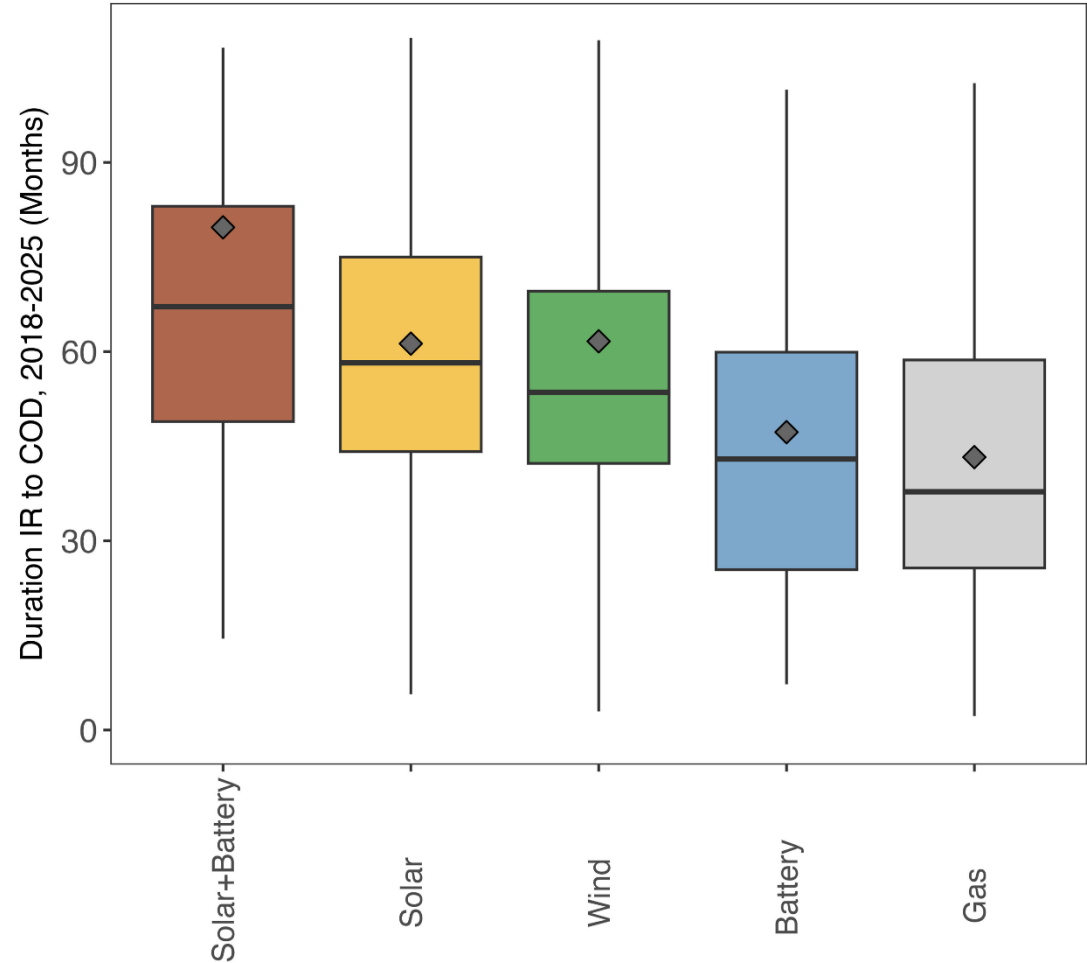
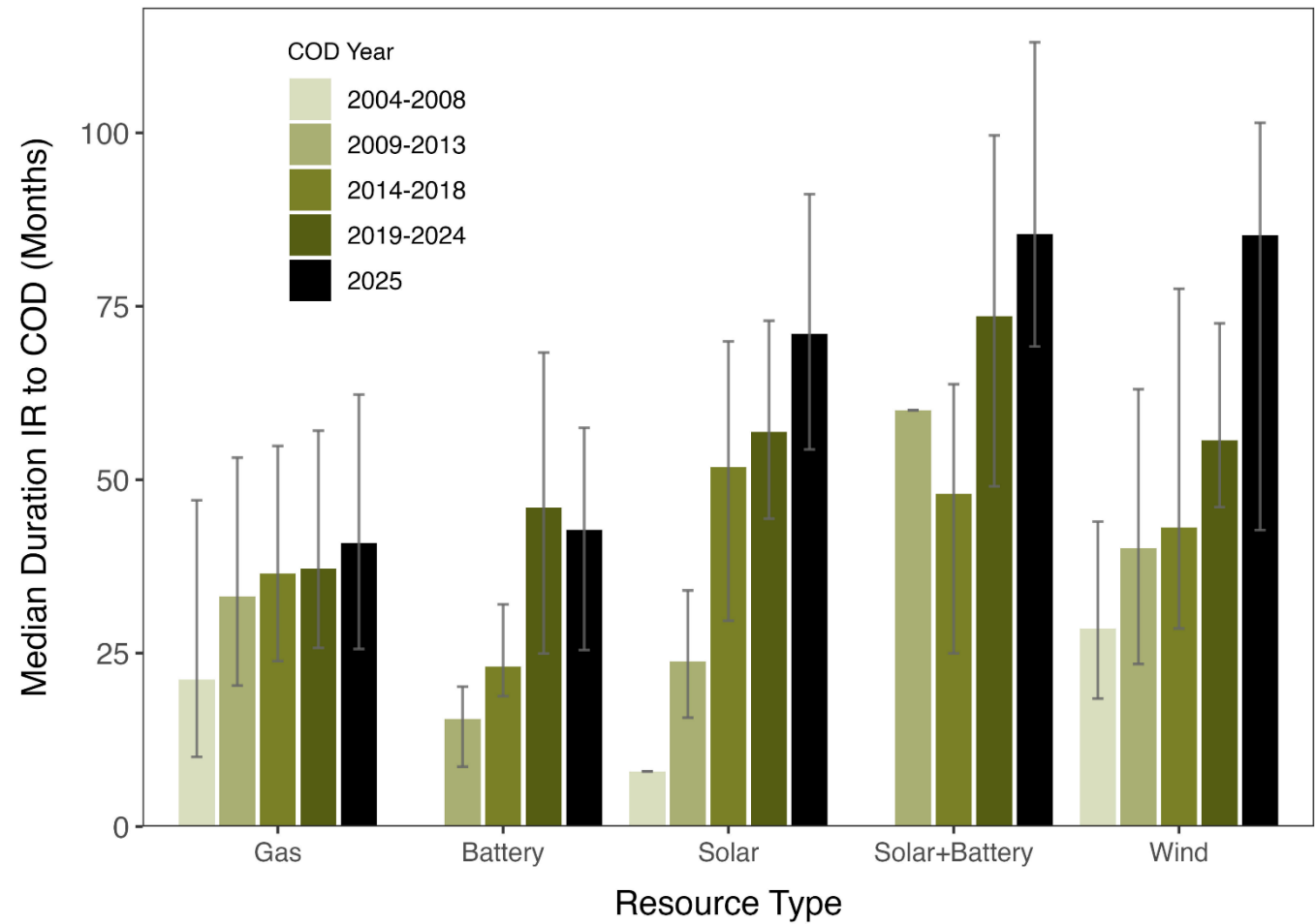
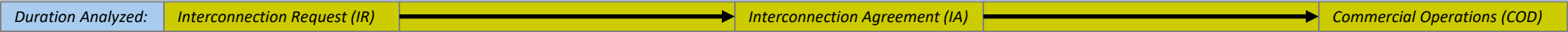
Notes: (1) Sample includes 3,310 projects from 6 ISOs and 19 non-ISO BAs that came online since 2005. (2) Duration is calculated as the number of months from the queue entry date to the commercial operations date.

The request to operational timeline has increased in many regions; median duration since 2018 is longer in FERC-jurisdictional ISOs



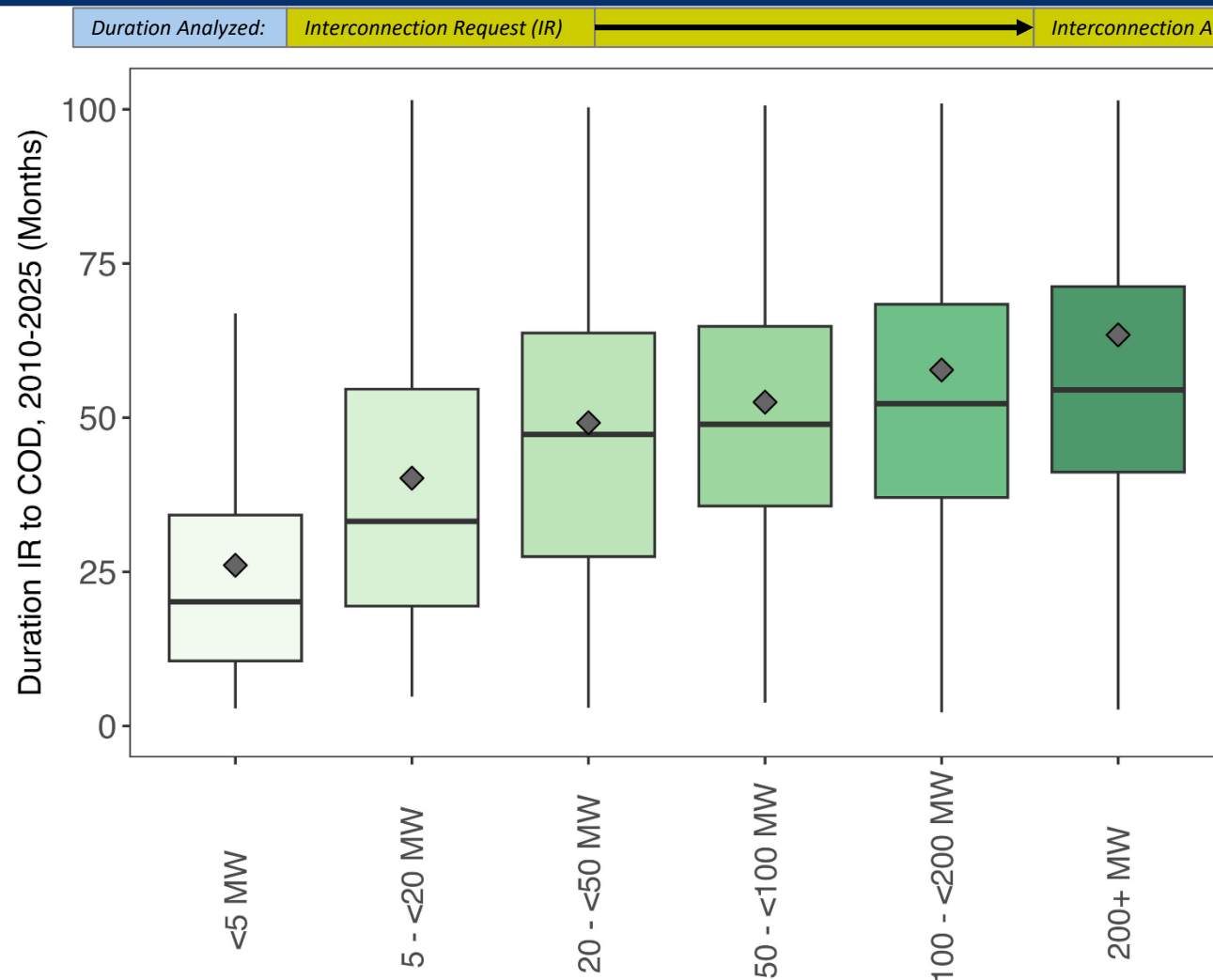
Notes: (1) Sample includes 3,359 projects from 6 ISOs and 19 non-ISO BAs that came online since 2004. (2) Duration is calculated as the number of months from the queue entry date to the commercial operations date. (3) See prior slide for sample size by region.

Duration from request to COD is also increasing across resource types. Solar+battery, solar, and wind projects typically take longer than battery or gas.



Notes: (1) Sample includes 2,760 projects for the 5 resource types shown, from 6 ISOs and 19 non-ISO Bas and that came online since 2004. (2) Duration is calculated as the number of months from the queue entry date to the commercial operations date. (3) See slide 51 for sample size by region; see appendix slide 61 for sample size by generator type.

Larger projects have longer development timelines: The average IR to COD duration increases by project size (MW) – especially up to the 20 MW LGIP limit



- For the smallest projects in our sample (<5 MW), the median project came online less than 2 years (20 months) after the interconnection request
- The median 5 - <20 MW project takes nearly 3 years (34 months) from IR to COD
- Larger projects spend even more time in the interconnection and development process, with the median 100 - <200 MW project taking >4 years (54 months) and the median 200+ MW project taking nearly 5 years (59 months) from IR to COD

Notes: (1) Sample includes 2,864 projects from 6 ISOs and 19 non-ISO BAs that came online since 2010. (2) Duration is calculated as the number of months from the queue entry date to the commercial operations date. (3) See slide 51 for sample size by region; see appendix for sample size by generator type.

As of the end of 2025, there were >8,200 proposed plants actively seeking grid interconnection across the U.S., representing 1,312 GW of generation and approximately 749 GW of storage.

- High withdrawal volume alongside relatively stable new requests resulted in a 10% decrease in total active queue volume in 2025.
- Active natural gas capacity (253 GW, +86%) increased in 2025, while solar (773 GW, -19%), storage (749 GW, -16%) and wind (220 GW, -19%) capacity decreased.
- Capacity in queues is widespread across the U.S., but some states dominate: Texas has 21% of all active solar capacity in the queues, 20% of gas, 22% of storage, and 22% of wind; California has 15% of storage and 8% of solar.
- There is a modest but growing amount of nuclear (~10 GW) and geothermal (~5 GW) capacity active in the queues.
- Hybrid power plants comprise a large share of proposed projects, particularly in CAISO and the West. 418 GW of hybrids (excluding storage) are active. Nearly half of all active solar and storage capacity is in hybrid plant configurations¹.
- 549 GW of capacity already has a draft or executed interconnection agreement (IA) but has not yet reached commercial operations, including 256 GW of solar, 161 GW of storage, 76 GW of wind, and 45 GW of gas.
- The time projects spend in queues before reaching COD is increasing. For the regions with available data², the median duration from IR to COD was <2 years for projects built in 2004-2008, >4 years for those built in 2019-2024, and 5 years for those built in 2025.
 - The full interconnection process timeline (from IR to IA) has also increased to a median of 45 months in 2025.
 - Larger projects have longer development timelines; interconnection study duration increases notably for projects >20 MW.
 - Generally, timelines are increasing across resource types and regions, though ERCOT and the non-ISO regions tend to be faster.
- Ultimately, most of this proposed capacity will not be built. Only 13% of capacity that submitted interconnection requests from 2000-2020 had reached commercial operations by the end of 2025; 75% of that capacity had been withdrawn and 10% was still active.
- FERC Order 2023 and other regional reforms are being implemented. These are important measures to reduce interconnection bottlenecks and enhance grid system reliability, but it is too early to measure and assess their full impact.

Related i2X Programs and Resources



The Interconnection Innovation e-Xchange (i2X) is a U.S. Department of Energy (DOE) initiative supported by the Office of Critical Minerals and Energy Innovation to enable simple, fast, and affordable interconnection while enhancing the reliability and security of our electric grid.

Collecting and analyzing generator interconnection costs to the transmission system

- ▣ Analysis of [interconnection cost](#) data for requests in MISO, PJM, SPP, ISO-NE, NYISO, CAISO, and five non-ISO balancing areas. Technical briefs and cleaned interconnection cost data files are available for download.

Support interconnection standard adoption and study harmonization (in partnership with ESIG)

- ▣ [i2X FIRST](#) facilitates the adoption of new and recently updated standards relevant for interconnected energy resources.
- ▣ [i2X STITCH](#) explores interconnection study methods to identify ways where harmonization and automation can improve the speed and reliability of new generation resource interconnections.

Distributed Energy Resource (DER) interconnection analysis and stakeholder engagement

- ▣ [Analysis and resources on DER interconnection](#) queues, timelines, and costs; automated interconnection processes; cost allocation; and innovative technologies to improve interconnection procedures.
- ▣ Technical workshops and trainings also cover topics such as IEEE's 1547-2018 standard and data transparency.

Visit <https://www.energy.gov/eere/i2x/> or join [i2X Connect](#) to find additional resources and get engaged

Contact:

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More Information:

- Visit <https://emp.lbl.gov/queues> to download the data used for this analysis and access an interactive data visualization tool
- Visit https://emp.lbl.gov/interconnection_costs for related research on interconnection costs

Acknowledgements:

This work was funded by the U.S. Department of Energy's Office of Critical Minerals and Energy Innovation (CMEI), in particular via the Interconnection Innovation eXchange (i2X). In addition, we thank our Technical Advisory Committee (TAC) for their helpful feedback on a draft of this report. The TAC includes representatives from 5 ISO/RTOs and 4 non-ISO utilities.

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Appendix

Balancing areas included in data:

ISO/RTOs	Southeast (non-ISO)	
CAISO	Associated Electric Coop.	LG&E & KU Energy
ERCOT	Dominion	Orlando Utilities Commission
ISO-NE	Duke Carolinas	Santee Cooper
MISO	Duke Florida	Seminole Electric Coop.
NYISO	Duke Progress	Southern Company
PJM	Florida Power & Light	Tampa Electric Co.
SPP	Georgia Transmission Corp.	Tennessee Valley Authority
	Jacksonville Electric Authority	
West (non-ISO)		
Arizona Public Service	Idaho Power	Portland General Electric
Avista	Imperial Irrigation District	Public Service Co. of CO / Public Service Co. of NM
Black Hills Power / Black Hills CO	L.A. Dept. Water & Power	Puget Sound Energy
Bonneville Power Admin.	Minnkota Power Cooperative	Sacramento Municipal Utility District
Chelan PUD	Navajo-Crystal	Salt River Projects (5 entities)
Cheyenne Light Fuel & Power	NorthWestern	Tacoma Public Utilities
Colorado Springs Utilities	NV Energy	Tri-State G&T
El Paso Electric	PacifiCorp	Tucson Electric Power
Grant PUD	Platte River Power Authority	WAPA (5 entities)

Number of active interconnection requests by capacity

Count of Active Requests by Capacity and Type						
Capacity	Gas	Solar	Storage	Solar+Battery	Wind	Other
<5 MW	9	67	14	10	10	37
5 - <20 MW	78	170	74	27	25	49
20 - <50 MW	65	272	84	84	29	85
50 - <100 MW	65	633	265	171	57	74
100 - <200 MW	75	805	747	416	190	95
200+ MW	330	795	909	746	463	219

Count of Active Requests by Capacity and Region									
Capacity	CAISO	ERCOT	ISO-NE	MISO	NYISO	PJM	SPP	Southeast	West
<5 MW	3	14	4	19	0	27	1	39	40
5 - <20 MW	3	79	12	17	6	157	5	90	53
20 - <50 MW	16	32	9	60	43	256	18	74	112
50 - <100 MW	37	106	5	164	34	257	80	401	179
100 - <200 MW	66	476	17	638	64	259	246	167	397
200+ MW	307	820	25	748	43	178	333	186	822

Sample size (number of requests) by generator type

IR to withdrawn date by withdrawn year group

Generator Type	2004-2008	2009-2013	2014-2018	2019-2024	2025
Gas	184	270	354	255	54
Battery	4	16	191	1496	642
Solar	90	883	1332	2985	1080
Solar+Battery	0	0	49	916	416
Wind	303	913	595	701	192

IR to COD by commercial operations year group

Generator Type	2004-2008	2009-2013	2014-2018	2019-2024	2025
Gas	103	113	209	184	16
Battery	0	8	23	67	75
Solar	1	69	197	594	127
Solar+Battery	0	1	12	69	16
Wind	151	172	221	290	42

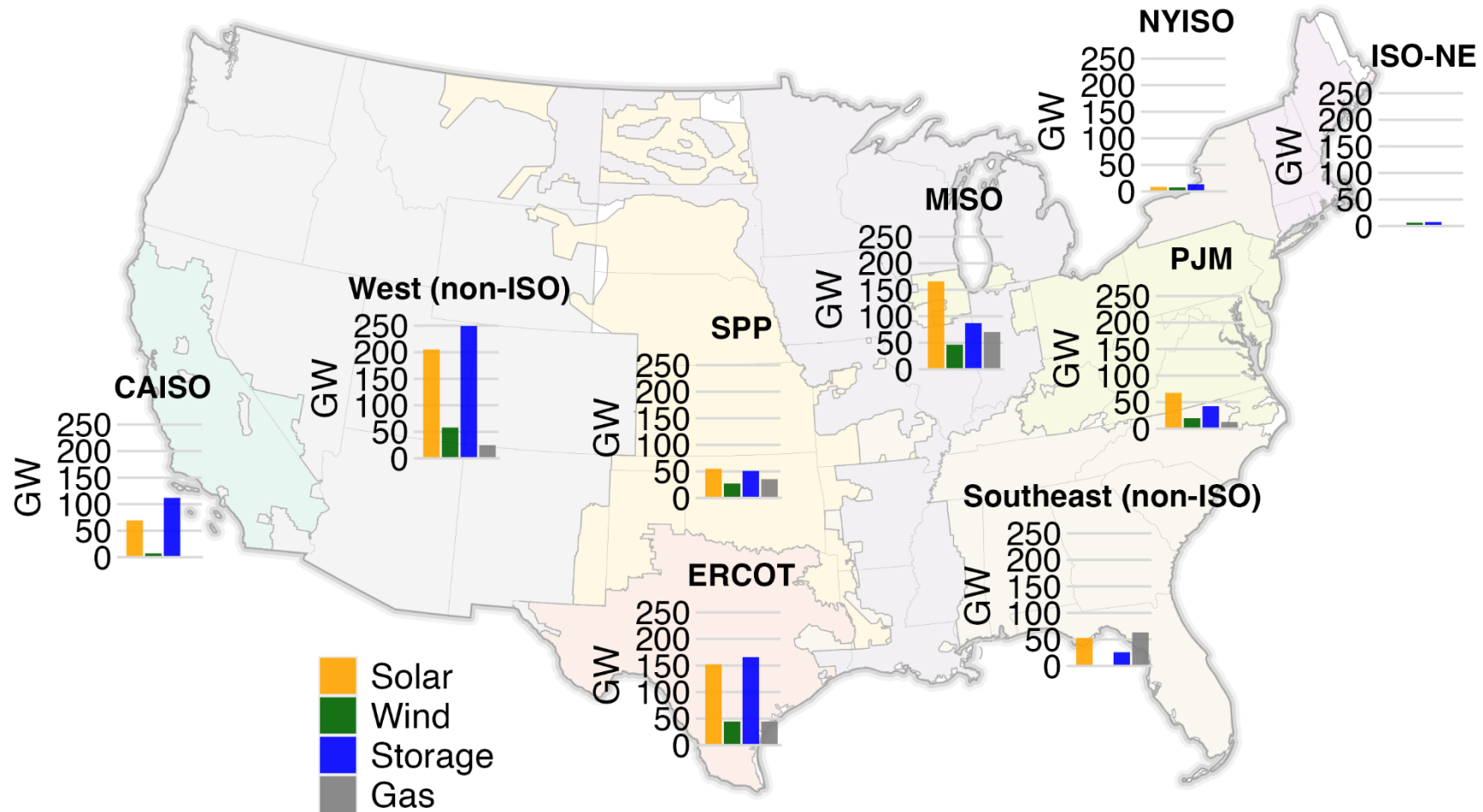
IR to IA date by IA executed year group

Generator Type	2004-2008	2009-2013	2014-2018	2019-2024	2025
Gas	78	83	129	91	35
Battery	0	3	22	316	130
Solar	2	104	277	816	153
Solar+Battery	0	10	32	270	115
Wind	332	691	285	301	41

IA to COD by commercial operations year group

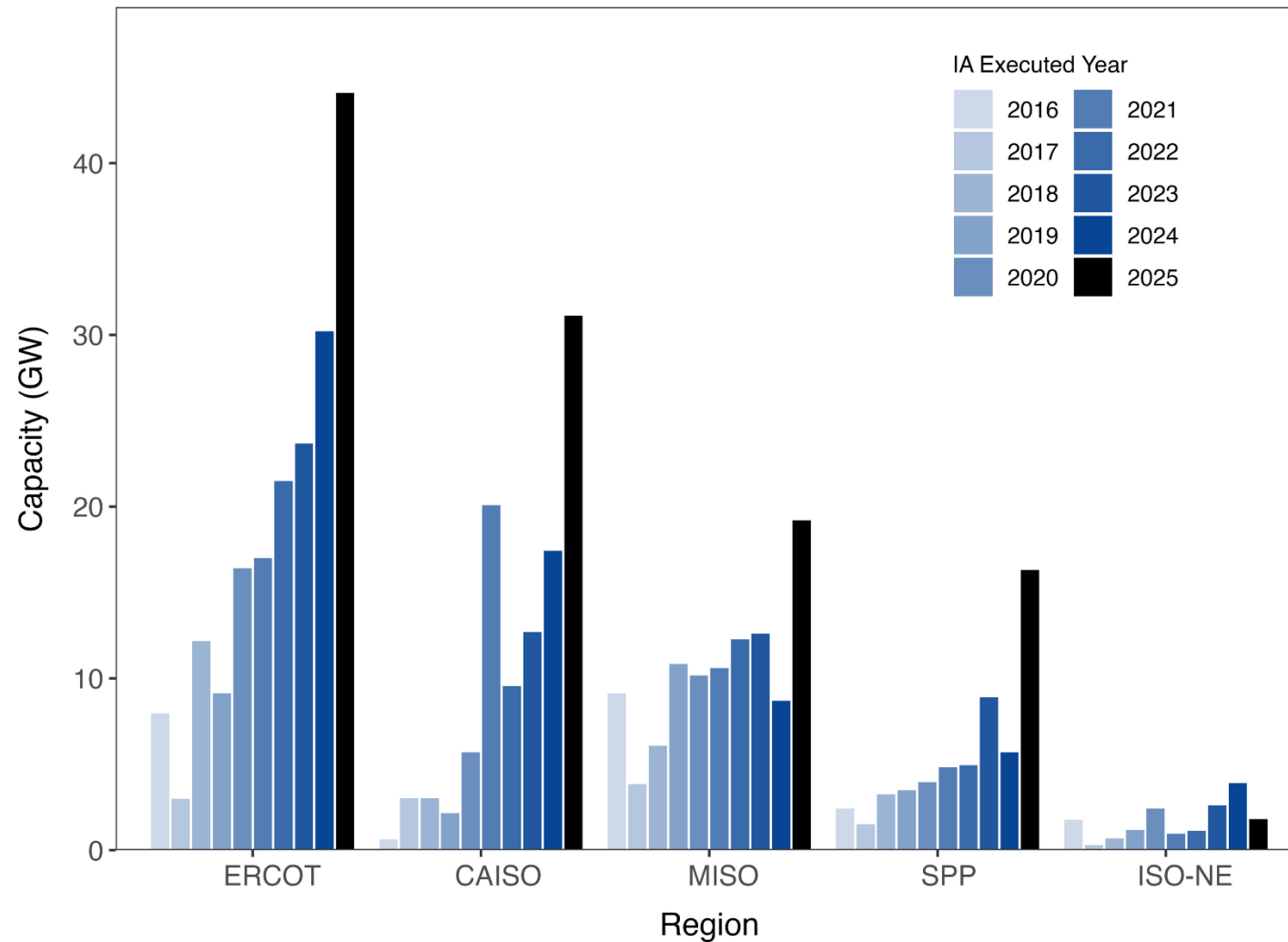
Generator Type	2004-2008	2009-2013	2014-2018	2019-2024	2025
Gas	27	38	69	59	9
Battery	0	1	6	30	52
Solar	0	16	99	282	37
Solar+Battery	0	0	7	45	10
Wind	51	76	167	220	18

Active solar, storage, wind, and gas capacity by region



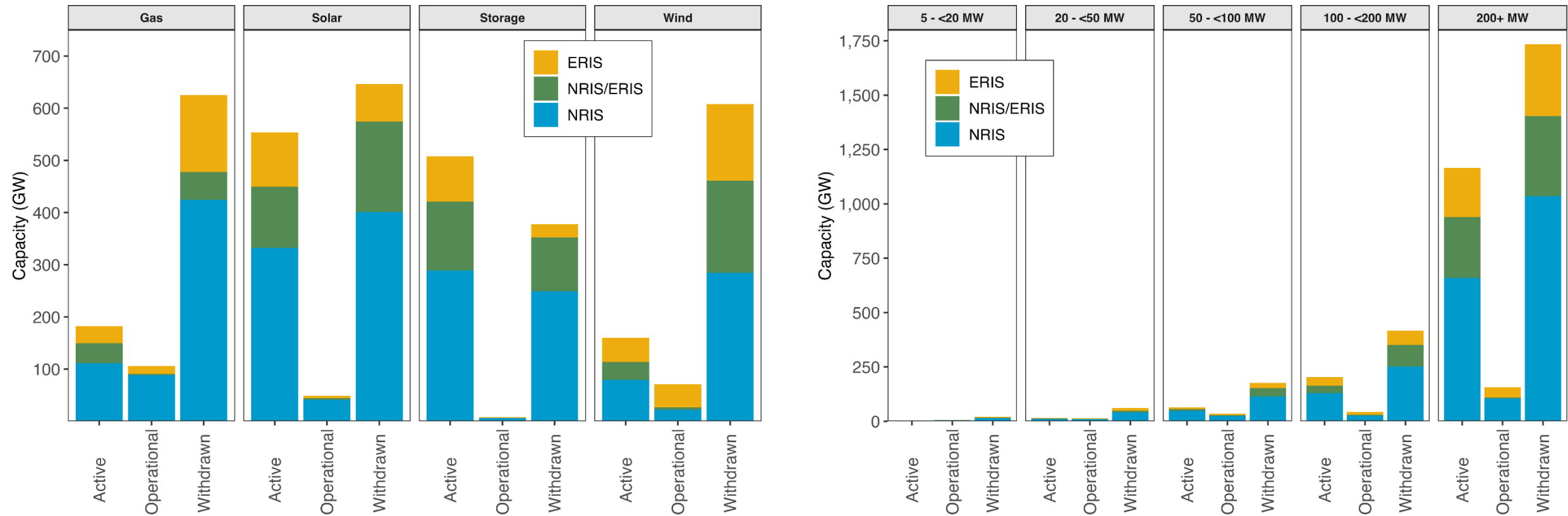
Note: "Active" requests include those that are actively requesting or undergoing grid interconnection studies, as well as those that have already executed interconnection agreements but have not yet reached commercial operations.

Annual volume (GW) of interconnection agreements executed by region



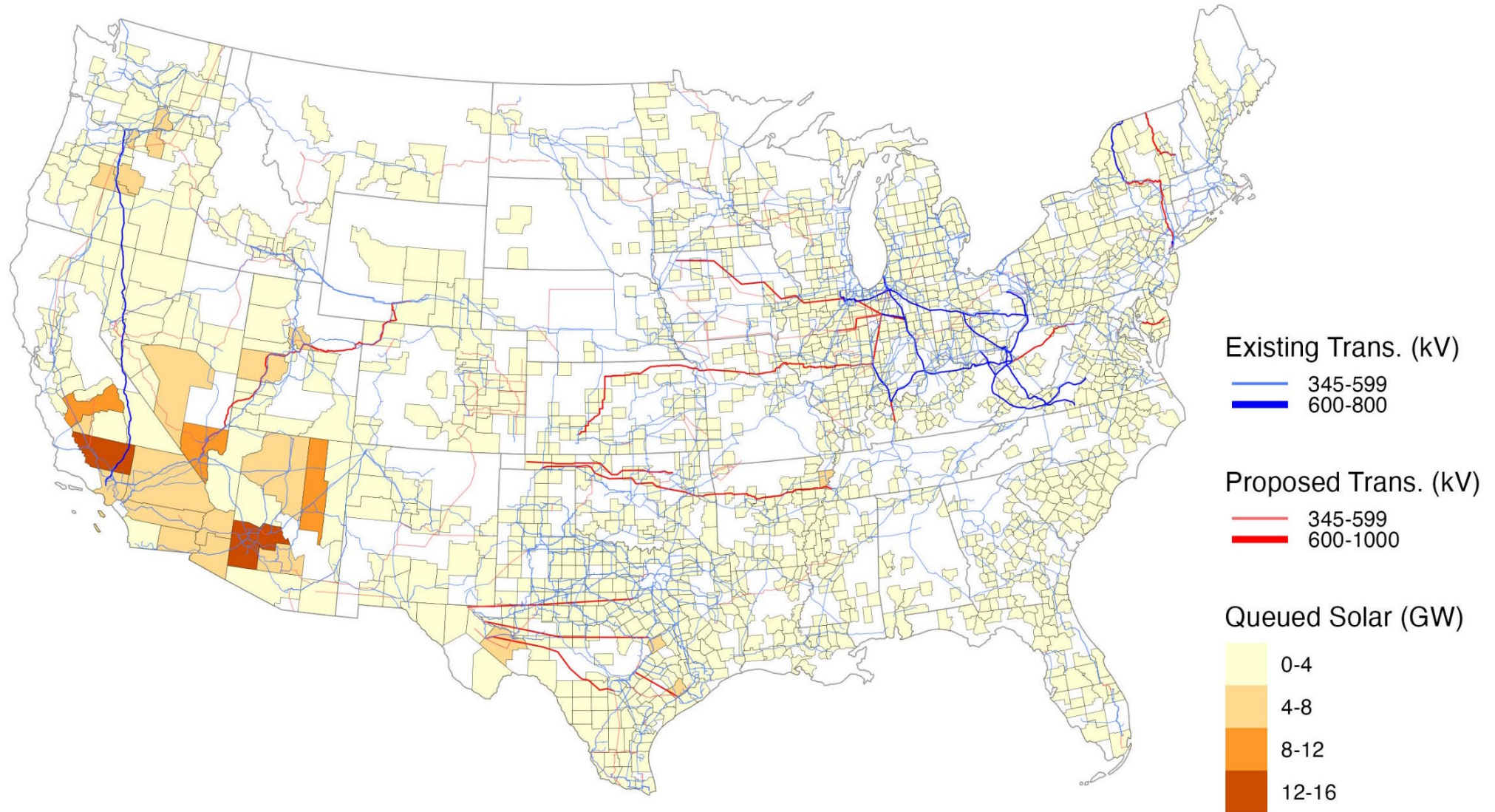
Notes: (1) Chart limited to regions where “IA date” is at least 70% populated (see table on slide 9). See slide 26 to see IA executed volume as a fraction of each region’s 2025 peak load. Available data for 2025 IAs may be lagging in some regions.

Interconnection service type (ERIS / NRIS) by status, resource type, and project size



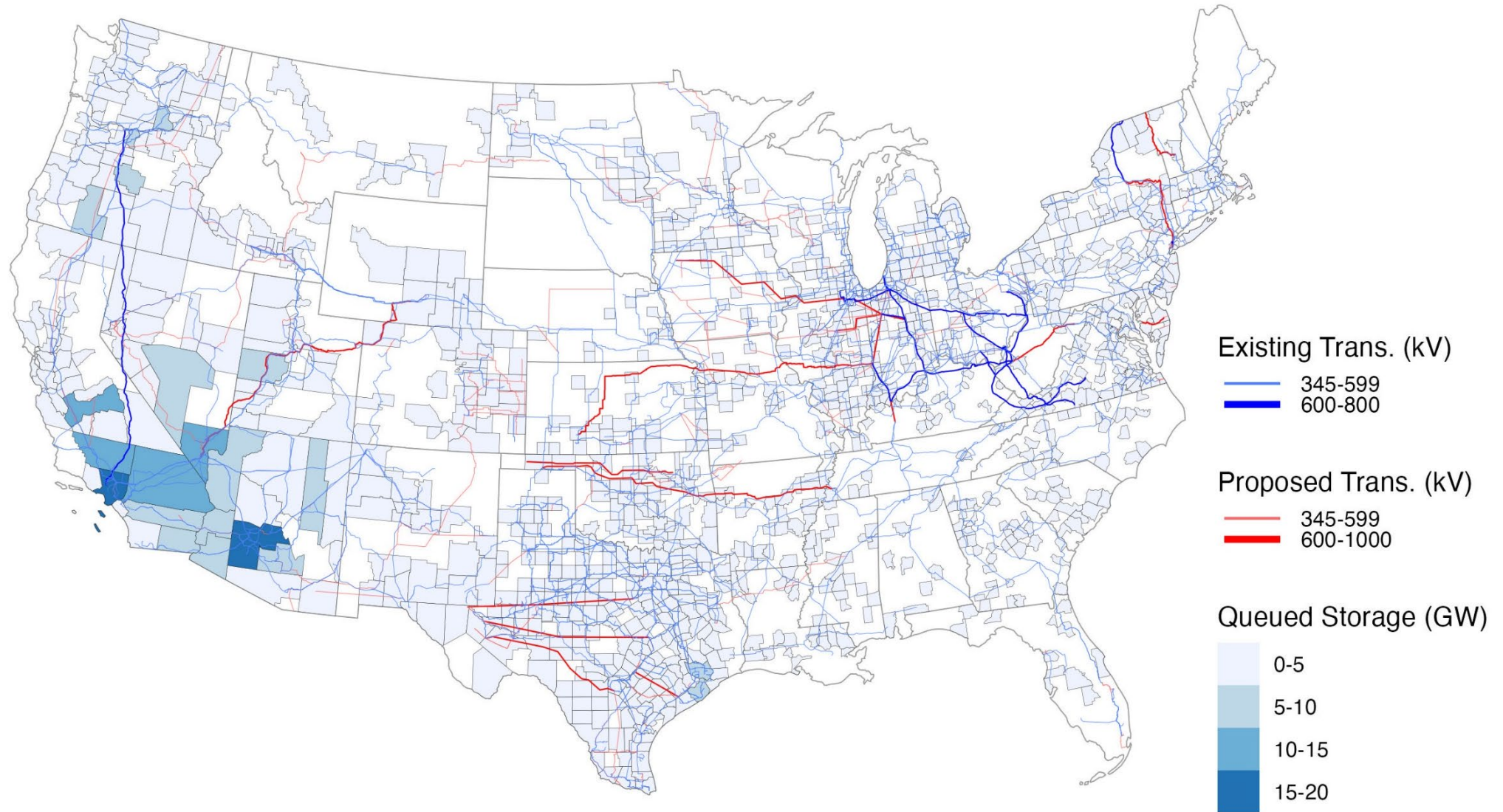
Notes: (1) NRIS and ERIS were developed under FERC Order 2003, and apply to FERC-jurisdictional transmission providers. (2) These charts exclude ERCOT.

Active solar capacity in queues at the end of 2025, by county



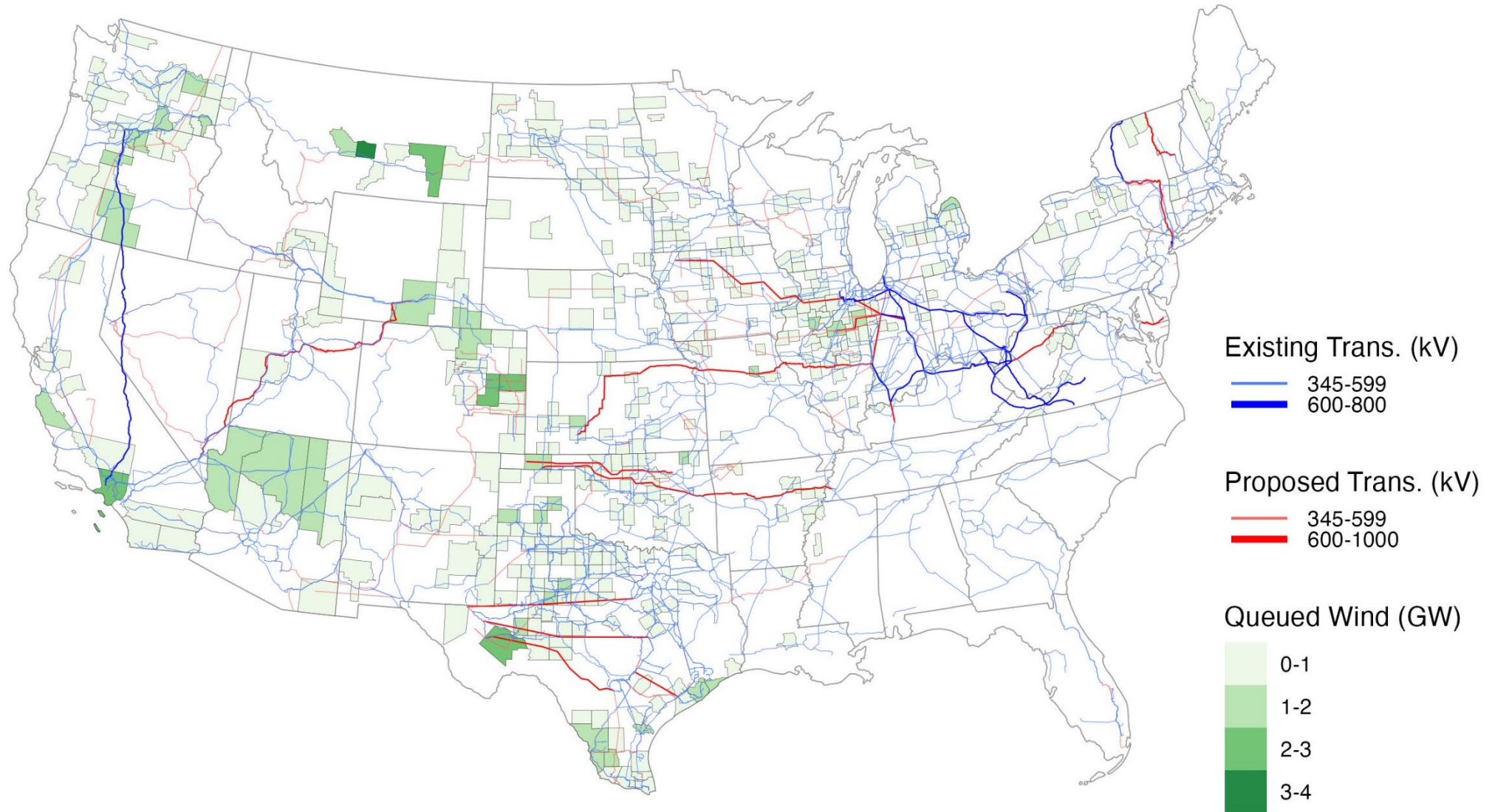
Notes: (1) Includes “active” interconnection requests only. (2) County was missing or could not be determined for 0.8% of active solar requests. (3) Transmission line data from Hitachi Velocity Suite as of March, 2026. (4) See <https://emp.lbl.gov/queues> to access an interactive data visualization of these maps

Active storage capacity in queues at the end of 2025, by county



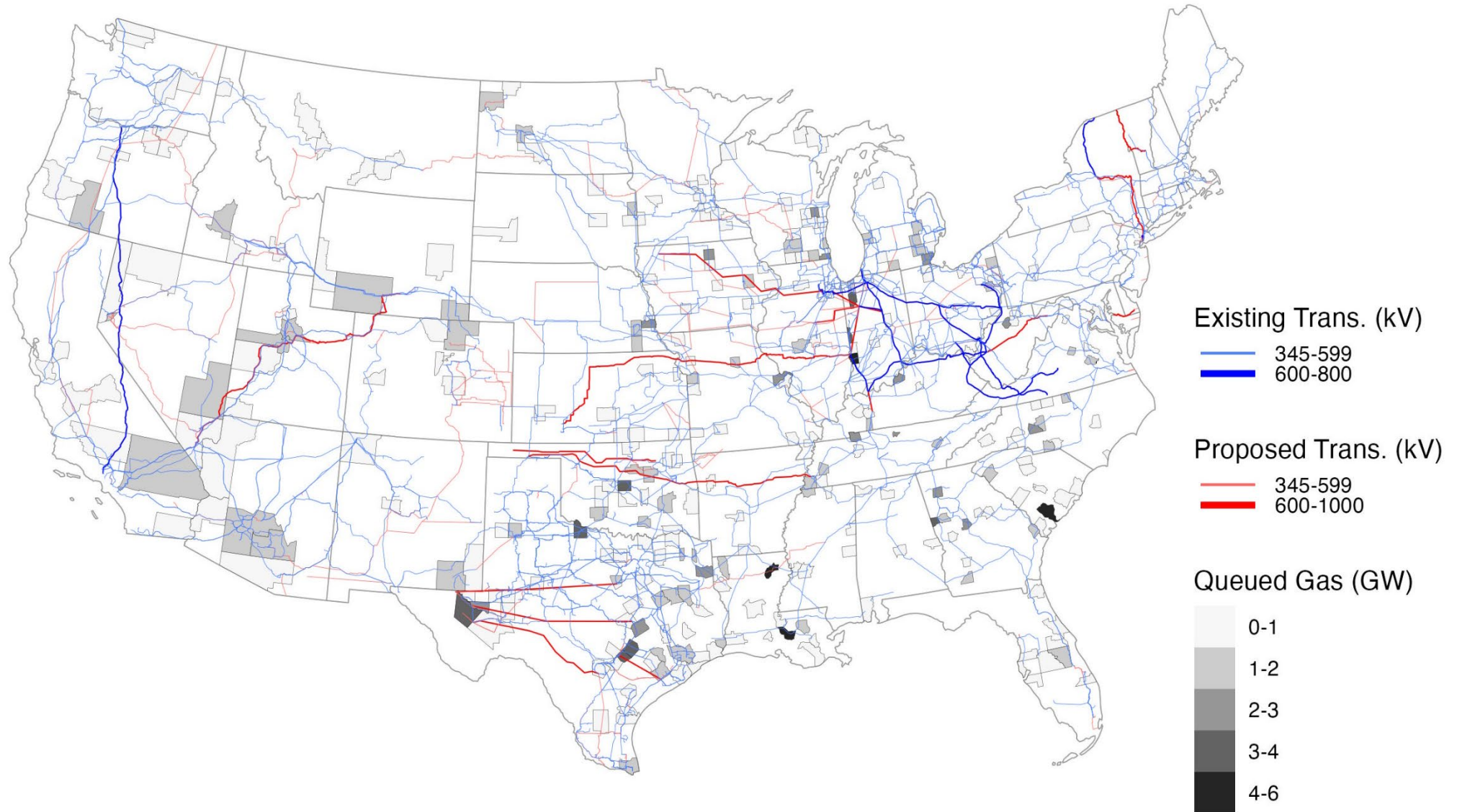
Notes: (1) Includes “active” interconnection requests only. (2) County was missing or could not be determined for 0.4% of active storage requests. (3) Transmission line data from Hitachi Velocity Suite as of March, 2026. (4) See <https://emp.lbl.gov/queues> to access an interactive data visualization of these maps

Active wind capacity in queues at the end of 2025, by county



Notes: (1) Includes “active” interconnection requests only. (2) County was missing or could not be determined for 4.7% of wind requests. (3) Transmission line data from Hitachi Velocity Suite as of March, 2026. (4) See <https://emp.lbl.gov/queues> to access an interactive data visualization of these maps

Active gas capacity in queues at the end of 2025, by county



Notes: (1) Includes “active” interconnection requests only. (2) County was missing or could not be determined for 0.4% of active gas requests. (3) Transmission line data from Hitachi Velocity Suite as of March, 2026. (4) See <https://emp.lbl.gov/queues> to access an interactive data visualization of these maps

Summary of key reforms in FERC Order 2023

- **Cluster studies** replace serial processing with an annual, **first-ready, first-served** cluster study, where projects in the same area are studied together, reducing delays caused by interdependent projects
- Higher at-risk **deposits and escalating withdrawal penalties** for projects in the queue
- **Stricter readiness** criteria for developers before submitting an interconnection request; requires 90% site control at the time of the interconnection request and 100% by the time of the facilities study
- **Timeline, process, and reporting** requirements for transmission providers; **financial penalties** for delays
- Visual representation (**heatmaps**) of **available transmission capacity** at various points of interconnection
- Improved and standardized process for **affected system studies** (studying impacts on neighboring transmission systems)
- Improved procedures and **flexibility for storage and hybrid resources**; allows co-located resources to share a single point of interconnection and permits earlier access to surplus service
- Requires grid operators to evaluate **alternative transmission technologies (a.k.a. Grid Enhancing Technologies [GETs])** as alternatives to traditional upgrades
- Compliance filing deadline: **May 2024**

Notes: (1) FERC Order 2023 - RM22-14-000. <https://www.ferc.gov/media/e-1-order-2023-rm22-14-000>. (2) The effects of Order 2023 and other recent reforms will not be immediate; most data presented in this report pre-date these reforms.

Four thematic areas summarizing ERS implementation in ISOs/RTOs

ERS and transmission service

Link between ERS and transmission service is not consistent across ISOs

- In 4 of 6 FERC-jurisdictional ISOs, interconnection customers must select NRIS equivalent to receive RA eligibility
- In MISO, ERS projects can be counted toward local RA if they apply for and receive firm transmission service
- In SPP, ERS projects can obtain RA eligibility through a NITS study

ERS Interconnection process

Most ISOs have converged on similar study processes and rules for ERS, with small but important differences:

- Timing of ERS and deliverability studies
- Process for applying for NRIS equivalent at a later point
- Additional options for provisional service beyond the pro forma minimum requirements
 - CAISO allows NRIS (full or partial deliverability) projects to come online as ERS (no operating limits) while upgrades are being completed
 - MISO and SPP offer conditional service in cluster studies

ERS Network upgrade cost allocation

Approaches to network upgrade cost allocation differ in two main respects: (1) Cost allocation rule and (2) Cost allocation methods

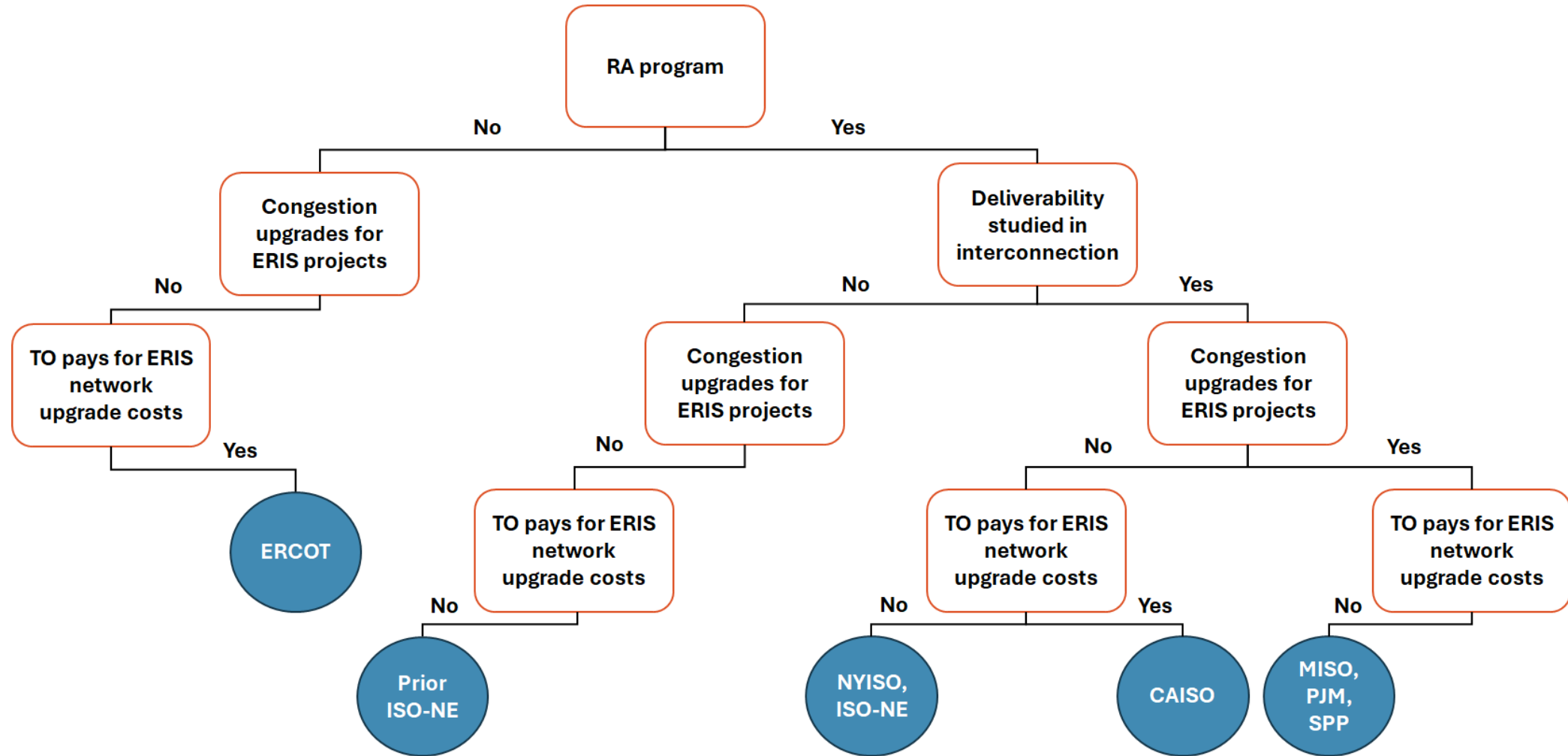
- Generator pays in ISO-NE, MISO, NYISO, PJM, SPP; CAISO uses FERC pro forma crediting approach
- Methods for calculating cost allocation for ERS projects across ISOs are mostly impact-based (e.g., DFAX), with exceptions
 - CAISO uses proportional capacity method for network upgrades that are not short circuit related
 - SPP uses solution-based DFAX, potentially for most upgrades

ERS Interconnection study methods

Three main categories of approaches to ERS study methods among ISOs

- Minimum interconnection (i.e. no congestion upgrades for ERS) in CAISO, NYISO, ISO-NE
- Case study stringency (identifies some congestion-related upgrades) in PJM
- Flow-based trigger thresholds (identifies the most congestion-related ERS upgrades) in MISO, SPP

Key differences in ERS implementation across ISOs/RTOs



Notes: RA refers to Resource Adequacy and TO refers to transmission owner