S&P Global
Commodity Insights

Energy Storage Geographic Profile: Chile

Chile advances regulation to support ambitious storage goals

Henrique Ribeiro / Batteries and Energy Storage / Principal Analyst

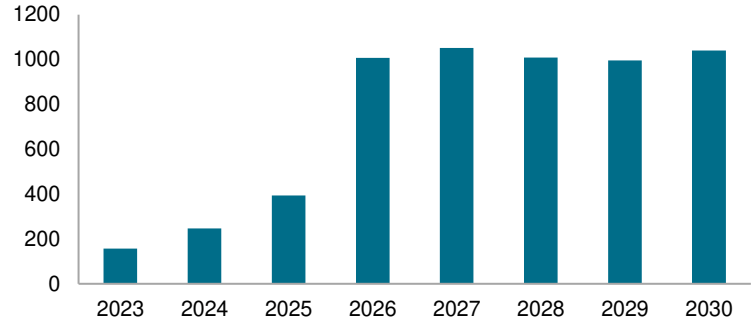
August 2023

Chile's administration supports storage and aims to tender 2 GW next year, in addition to new capacity rules that will drive BESS installations

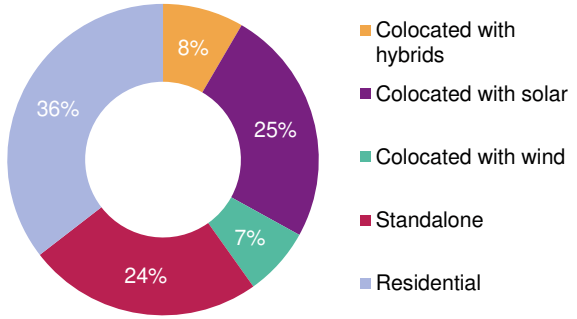
Between 2023 and 2030, **5.9 GW and 24.7 GWh** of energy storage is forecast to be installed:

- Chile's administration considers storage strategic for the country's goals (at least 60% of renewables by 2030, 100% by 2050). It proposed a law to allow the tender of 2 GW of BESS at a $2 billion cost. Also, the 5,400 GWh long-term energy tender announced in May will provide incentives for storage.
- A new ruling allows storage to receive revenue from power sufficiency and provides revenues for both BESS and the underlying renewables in colocated projects. It also increases the flexibility of project operators in their charge/discharge planning.
- Chile passed an Energy Storage Bill in late 2022 allowing standalone BESS to receive revenue both from arbitrage and from reserve capacity**.** The government promised to provide further clarity about revenue streams, as well as increased predictability about arbitrage opportunities, by early 2024.

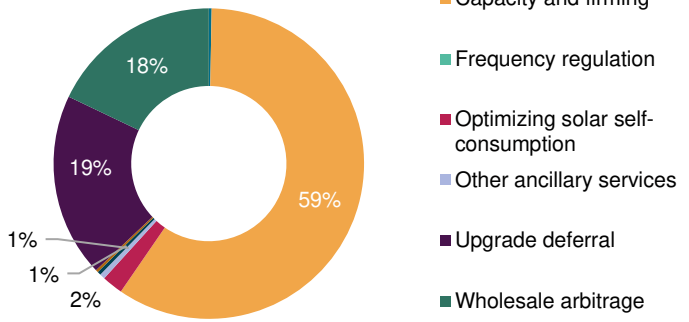
Energy storage capacity additions in Chile (MW)



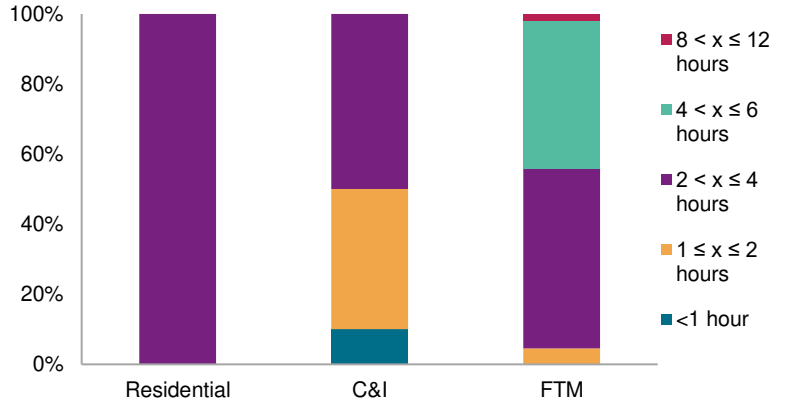
Capacity additions by siting (2023–30, % of MW)



Capacity additions by application (2023–30, % of MW)



Capacity additions by duration (2023–30, % of MW)



Data compiled June 2023
Source: S&P Global Commodity Insights.

S&P Global
Commodity Insights

The materialization of a supportive regulation will drive BESS capacity up beyond the 2 GW tender targeted by the local government for 2024

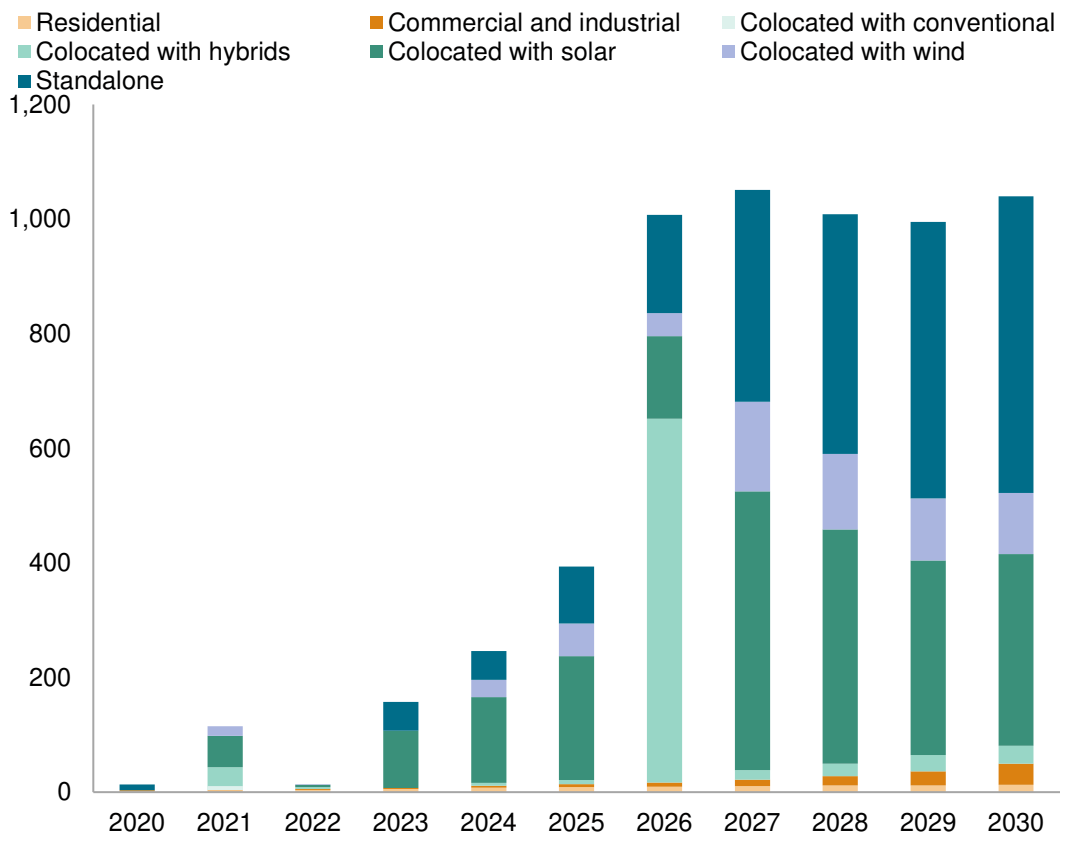
- Chile's strong commitment to renewables combined with the country's poor transmission system generates not only opportunities, but also the need for storage to support the grid by providing frequency regulation and minimizing renewables curtailment.
- The local government sees storage as a key part of Chile's decarbonization strategy, and the recent announcements aim to provide two separate (and predictable) main revenue streams: fixed payments for grid support and capacity reserve contracts.
- The authorities' intention is to run a $2 billion tender for 2 GW in the first half of 2024, targeting commissioning by mid-2026. Although the plan is unrealistic by this timeline and will require support from the Congress, the tender will kickstart the country's market development.
- Chile has also included storage in the new Power Sufficiency regulation, determining that renewables and storage will be allowed separate payments. These measures reduce the dependence on wholesale arbitrage as the main revenue stream — which is a barrier for BESS projects seeking funding owing to the uncertain nature of the income.
- Unlike the front-of-the-meter sector, Chile's behind-the-meter market is still not attracting significant investments. Despite the high solar irradiance in a significant portion of Chile's territory, neither residential nor commercial and industrial PV installations are expected to grow significantly, which will limit the potential for BTM storage.

Annual energy storage capacity additions by forecast vintage (MW)

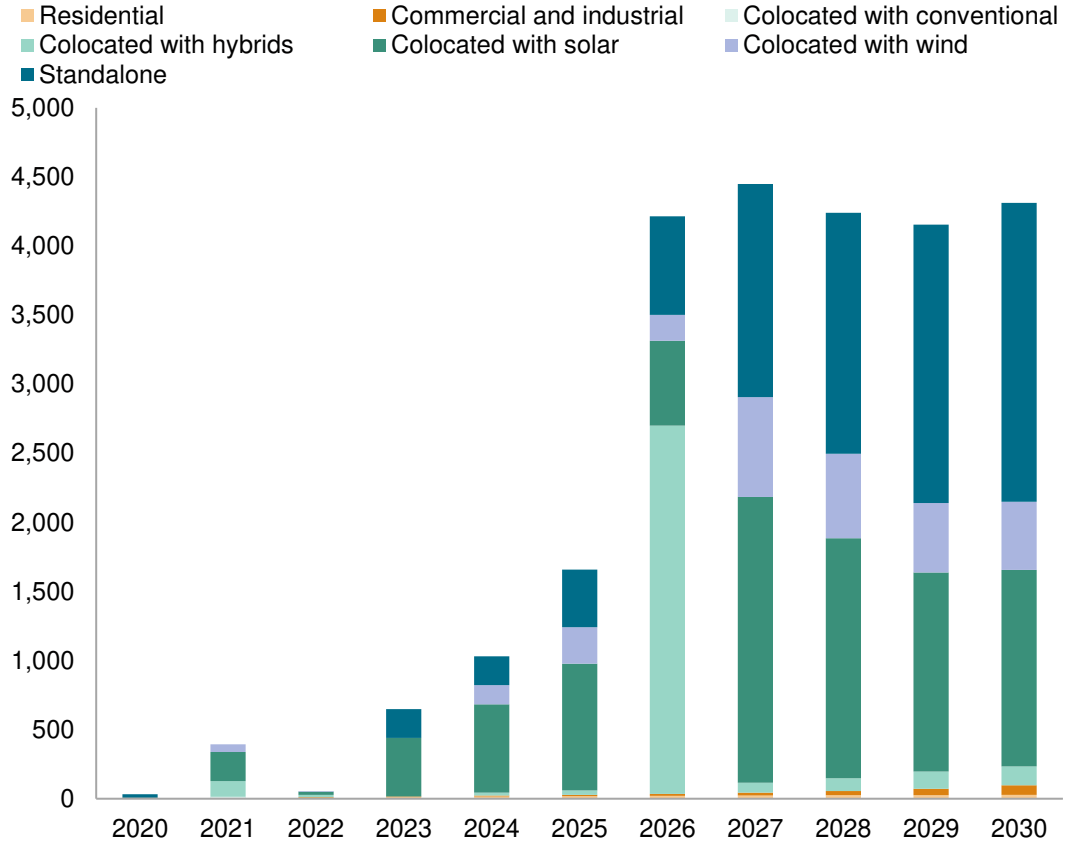
Data compiled June 2023
Sources: CEN; S&P Global Commodity Insights.

FTM gross capacity additions will keep growing steadily for the rest of the decade, BTM will have modest increase

Gross capacity additions by siting (MW)



Gross capacity additions by siting (MWh-n)



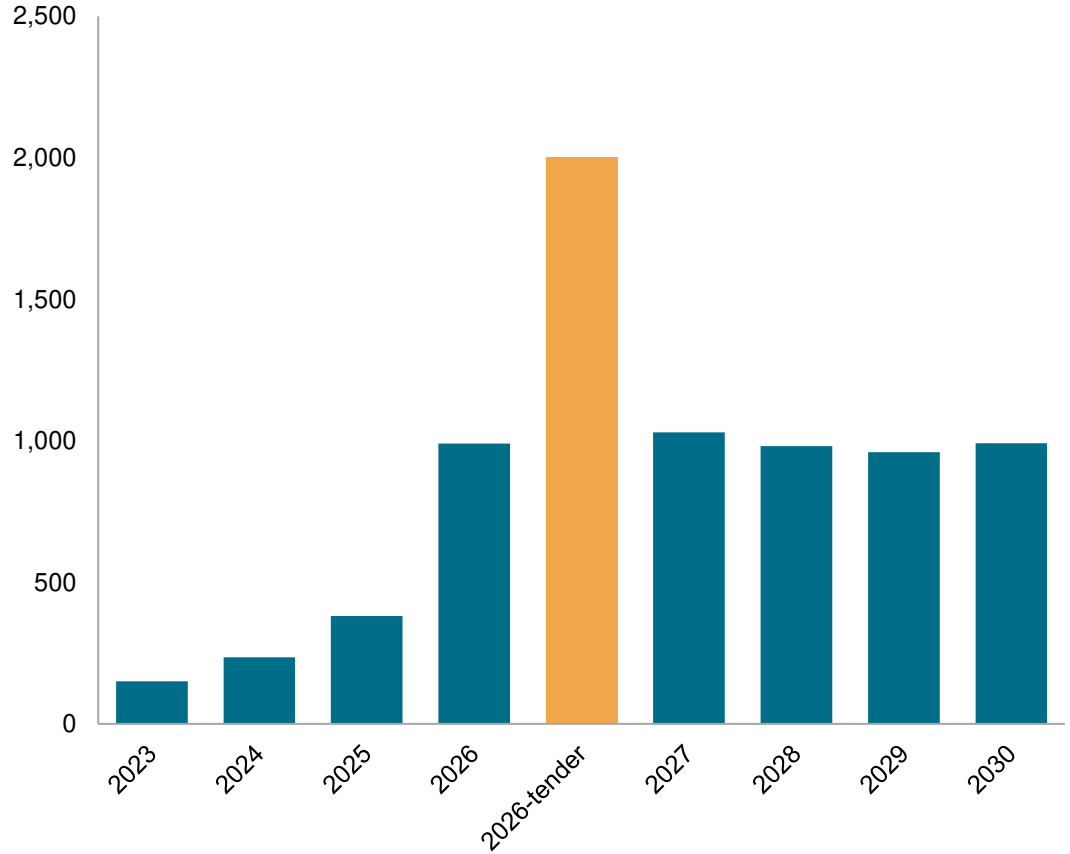
Data compiled June 2023
Source: S&P Global Commodity Insights.

S&P Global
Commodity Insights

The 2 GW tender planned by Chile's government is equivalent to 35% of the new FTM storage installations forecast for the 2023–30 period

- Chile's government plans to tender 2 GW of storage worth $2 billion next year for commissioning in mid-2026. To run the tender, the government needs first to approve its energy transition law in the congress. The poliical discussions about how to fund the $2 billion capital expenditure are likely to extend the time frame beyond the target.
- Although some aspects of the tender are still unclear, such as who will operate the projects, there is a consensus that the selected projects will be remunerated as transmission assets. The 2 GW size of the tender was determined based on a study from the National Electricity Coordinator (CEN) considering the grid's capex and operating expenditure (opex).
- Based on CEN's study, six different projects would be installed in the northern region with durations ranging from six to eight hours, totalling 13.2 GWh. There are several projects under the permitting stage in Chile, but few with those specifications. The re-design of projects is not simple and longer durations implicate in higher costs. The limited availability of connection points to the grid will favor the colocation with existing connected renewables projects.
- Although the tender is forecast to occur, it will not meet the announced scale and time frame given the political component and the complexity to adapt the existing pipeline to the tender's requirements. Historically, Chile creates frameworks for the private sector to invest instead of centralizing the development, but this is not certain for the tender.

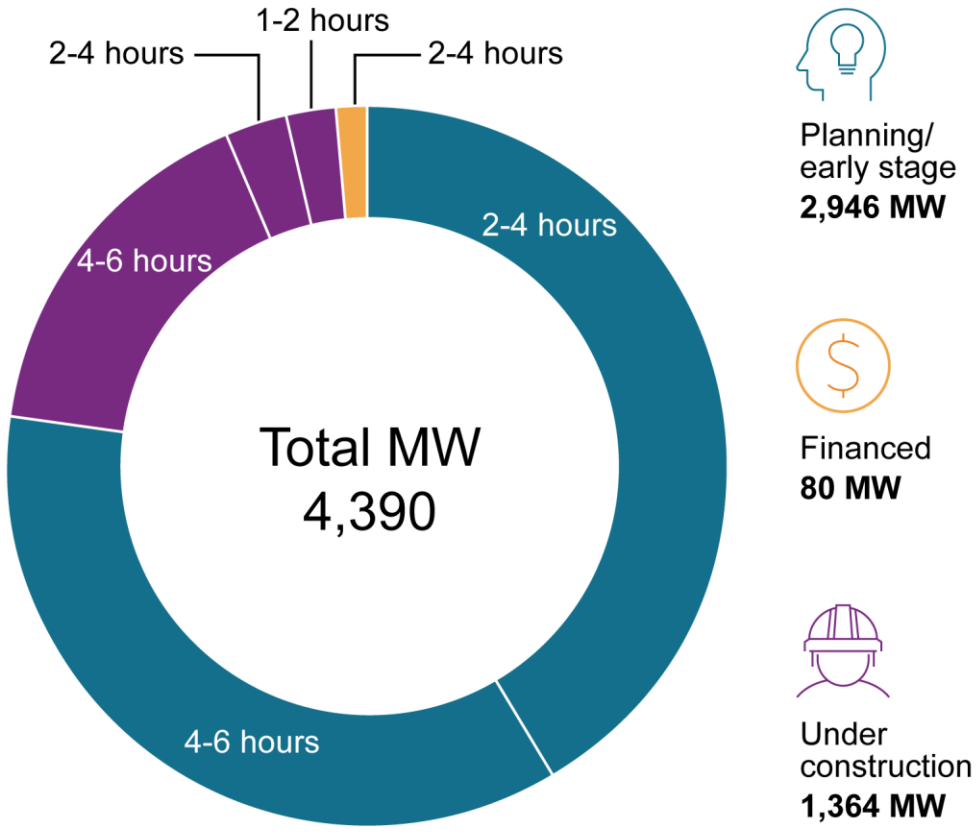
Chile's storage market outlook versus planned tender (MW)



Data compiled August 2023
Source: S&P Global Commodity Insights.

Most of the existing BESS pipeline still did not break ground and durations are shorter than CEN's target, which adds difficulties to achieve the tender's goals

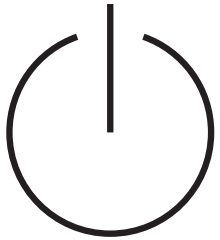
Chile's BESS project pipeline by status and duration



As of Aug. 9, 2023.
Source: S&P Global Commodity Insights.

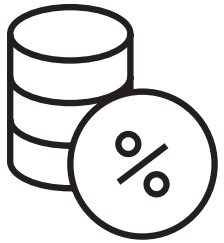
- In addition to the political difficulties to approve a tender of the intended magnitude, it will be challenging to meet the proposed timeline of having the additional 2 GW of BESS commissioned by 2026 considering that most of Chile's existing projects are still in the early stages.
- Even if the tender is completed in the first half of 2024 as intended by the government, it will be necessary to accelerate permitting as well as the provision of connection points to the selected projects. Some of them have submitted the required environmental impact assessments some years ago, but are still pending approval.
- Although the government did not specify the duration requirements for the tender, CEN advised that optimal results would be achieved if the 2 GW converted to 13.2 GWh. Not only does this target increase costs to project owners, but also it contradicts the original design of virtually all the capacity in the existing pipeline.
- The $2 billion tender budget is unlikely to afford 13.2 GWh — and given that getting approval for that value will be challenging enough, the most likely scenario is that the tendered energy capacity will be much less than 13.2 GWh. Durations will be more alligned with the predominant four-to-six hours of the existing pipeline than with the idealized six-to-eight hours.
- To achieve the 2026 goal, the selected projects will also face difficulties to procure the required batteries amid fierce competition, as demand from BESS and electric vehicles is expected to keep growing rapidly.

The new Sufficiency Power Regulation provides higher incentives for storage



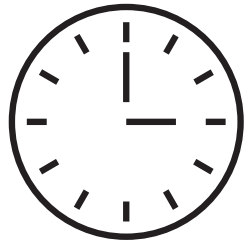
Higher flexibility for BESS operations

- Renewables plants that have colocated storage capacity will be allowed to charge from the grid, which increases the possibilities of different business strategies for operators.
- Although not extinghished, the Coordinator's role in the establishment of the charge/discharge plans is significantly reduced in the new regulation. Project operators will be allowed to integrate their plans into the Coordinator's general program, which will provide operators higher flexibility to design their business models, as well as to make changes along the way.



Remuneration will depend on the duration

System duration (hours)	BESS capacity remunerated (%)
< 1	0% of MW
1	50% of MW
2	70% of MW
3	85% of MW
4	95% of MW
≥ 5	100% of MW



New peak power definition

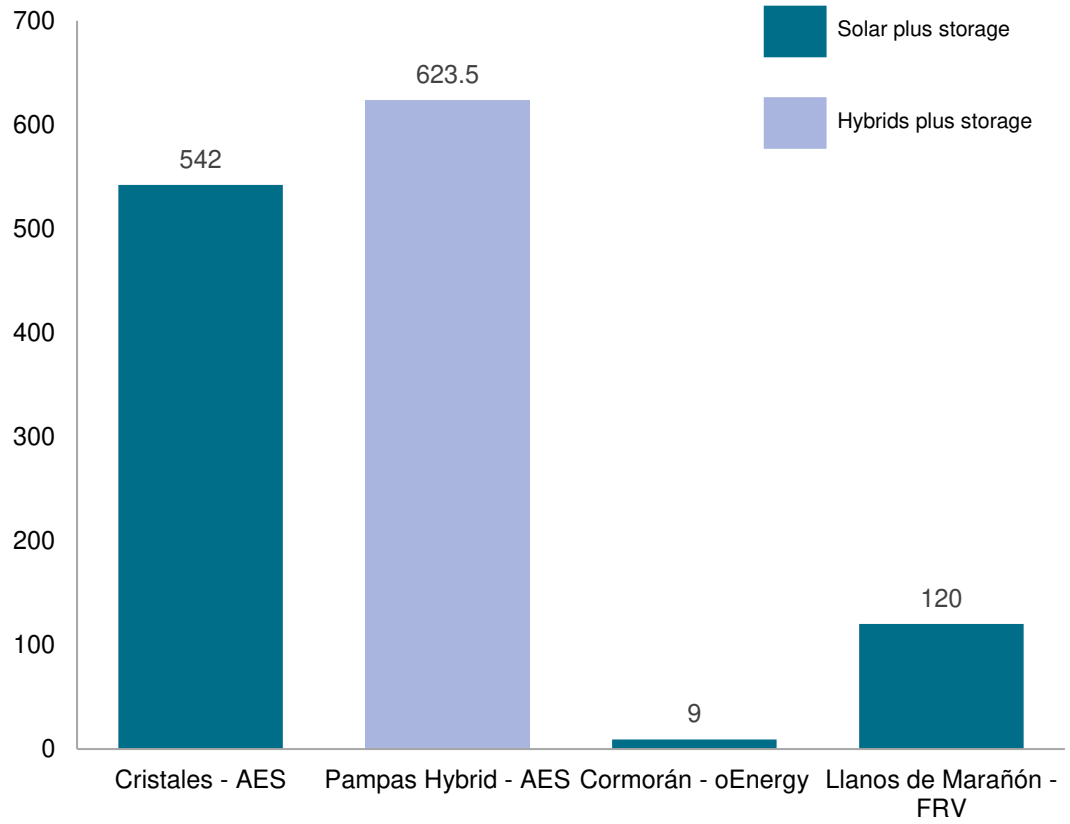
- The new definition of peak power will depend on the highest stress on the grid, measured by the ratio between supply and demand. This means that the peak power will not necessarily be the highest demand point as in the previous regulation.
- The CEN will do a study to measure the system's sufficiency to determine the peak hours. In practice, the changes in the "peak" definitions will favor the use of BESS to dispatch energy in night hours, when renewables generation (which is increasingly predominant in Chile) is low.

Source: S&P Global Commodity Insights.

Chile's Energy Storage and Electromobility Bill is still an incomplete work, but the signals provided in favor of storage incentivized new projects

- The Energy Storage and Electromobility Bill (approved in late 2022, but still pending a final text) equates standalone BESS to colocated projects as generation assets, providing the same revenue for dispatching energy and power to the system. In practice, however, standalone projects will still have difficulties with some customers who request 100% renewables content in their PPAs, since they charge from the grid.
- The changes in the Power Sufficiency rules are separate from the Storage Bill, which will be discussed along with a new regulation for coordination and operation of Chile's grid. The timeline to implement these changes, including the Storage Bill's final text, is by the third quarter of 2024. The Ministry's public goal is to provide certainties about how BESS can operate in Chile.
- Given that the Power Sufficiency regulation is focused on reserve capacity and the $2 billion tender will target to defer grid upgrades, the Storage Bill is likely to provide incentives for storage on frequency regulation and ancillary services. Although BESS is not forbidden to provide ancillary services, the existing regulation favors thermal plants.
- Although there are still pending aspects and unanswered questions regarding regulation, the government's public intention to favor storage is an incentive for project owners to move forward. However, clear ruling that favors the diversification of revenue streams will be crucial to keep the momentum.

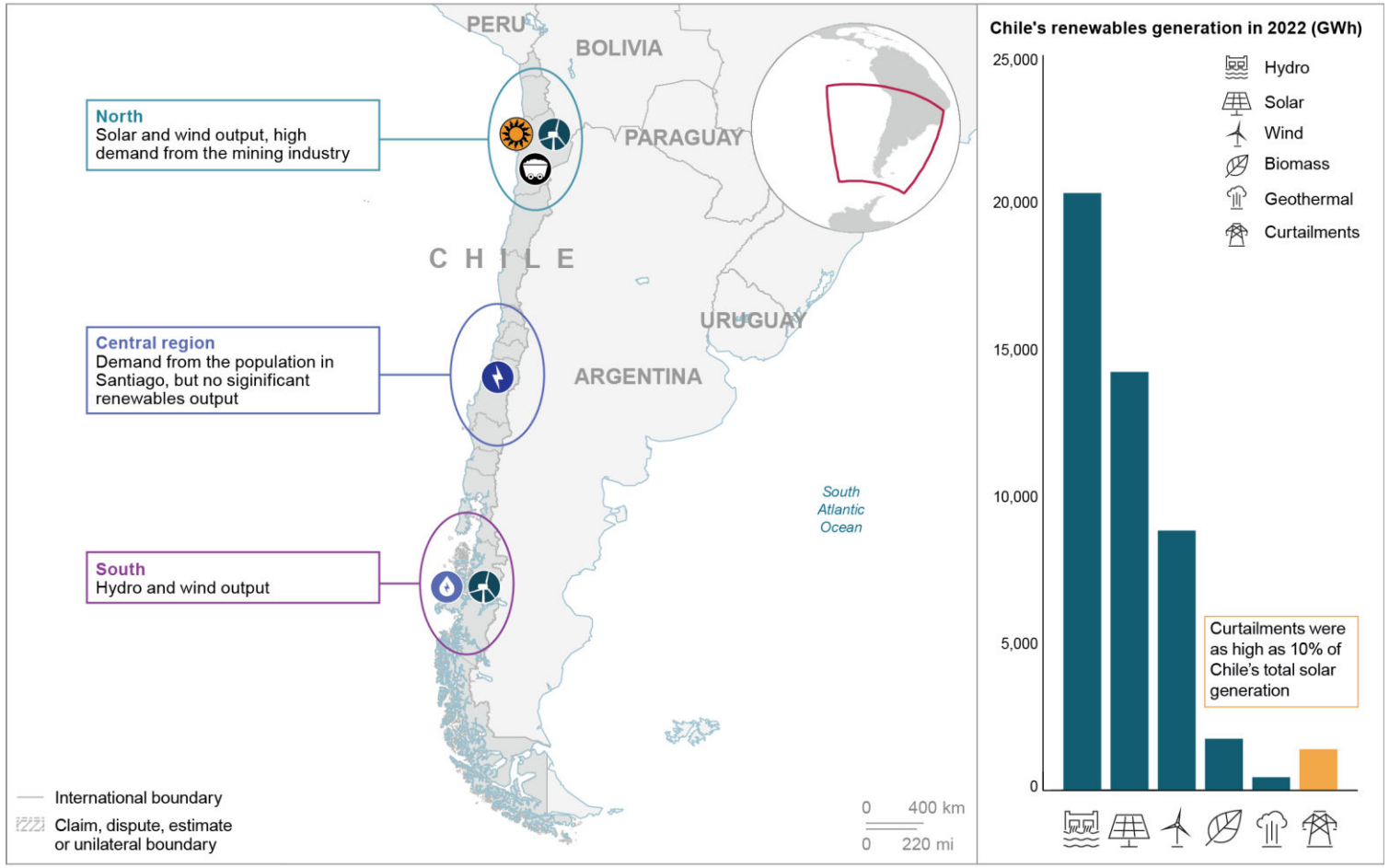
Chilean BESS projects that requested permitting after the Energy Storage Bill (MW)



Data compiled June 2023
Source: S&P Global Commodity Insights.

Transmission insufficiency increases Chile's need for storage

Chile's renewables generation is distant from consumption



Sources: Coordinador Electrico Nacional (CEN); S&P Global Commodity Insights: 2009879.

Poor transmission infrastructure is the main problem in Chile's energy system. Most of the generation is far away from the demand — and the country's geography does not favor connecting supply to demand.

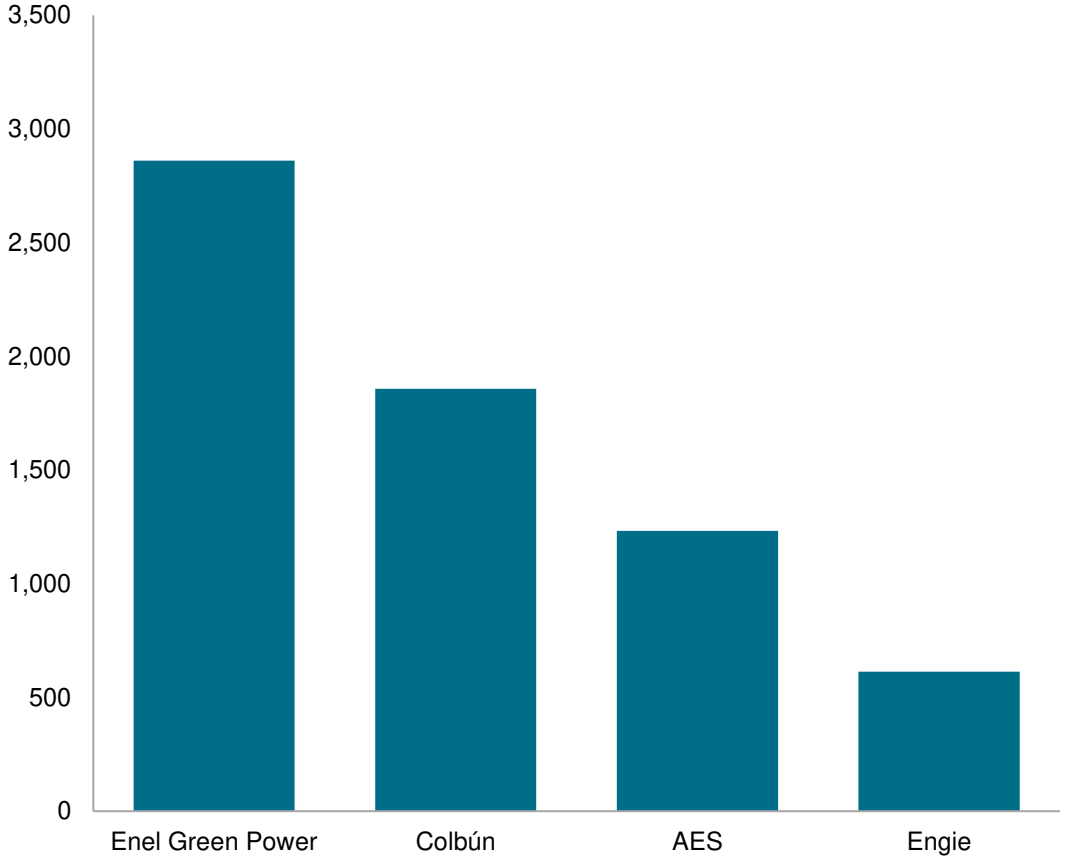
The increase in renewables energy has been challenging the grid's stability and leading to significant curtailments. Also, renewables are built faster than transmission, leading to the full commitment of new transmission assets even before they are built.

As a consequence, most of the future renewables projects will not be feasible without the colocation with storage. BESS will support transmission stations as well: in August 2023, there will be an auction for a 500 MVA/125 MWh BESS for the Parinas-Lo Aguirre line, and the 8 GWh tender planned by the government is intended to support transmission.

However, when categorized as a transmission asset, BESS is not allowed to access revenues from generation assets — capacity payment and wholesale arbitrage.

Chile’s four main utilities have been prioritizing investments in renewables

Chile's main utilities per renewables capacity (MW)



Data compiled June 2023
Source: S&P Global Commodity Insights.

Other key market participants

- **Coordinador Eléctrico Nacional (CEN):**
  - CEN is Chile’s independent transmission system operator. The local grid was reformed in 2017, when the Northern and Center-Southern systems were combined into the 3,100 km Sistema Eléctrico Nacional (SEN)
- **Comisión Nacional de Energía (CNE):**
  - Part of the Energy Ministry, CNE monitors energy prices and technical norms applicable to energy producers, transporters and distributors. All energy contracts’ prices have to be informed to CNE, who will determine the average market prices. Its is the closest in Chile to the concept of a Nominated Electricity Market Operator
- **Generadoras de Chile:**
  - Group that represents the main energy producers in Chile in policy and regulation discussions with the local government
- **ACERA:**
  - The Chilean Association of Renewables and Storage promotes the sector and is also involved in the conversations with the local government.

Siting definitions

Key terms and definitions

Term	Definition
Front of the meter (FTM)	**Storage systems that are connected directly to the grid, as opposed to directly to an end user.**
Colocated with solar	A storage system that is sited in the same location as an FTM solar generation asset. These can have different points of interconnection or share the same point of interconnection.
Colocated with wind	Same as above but colocated with wind.
Colocated with hybrids	When a storage system is sited in the same location as two or more utility-scale generation assets. This could include but is not limited to solar, wind, conventional asset, or a hydro generation asset.
Colocated with conventional	A storage system that is sited in the same location as a conventional generation asset. These can have different points of interconnection or share the same point of interconnection. This could include gas, coal, diesel, oil, or even hydro generation plants.
Stand-alone	An ESS sited on its own without any other generation system on the same site.
Behind the meter (BTM)	**Storage systems that are located in, or are connected directly to, metered points of electricity demand (i.e., homes or commercial sites).**
C&I	An ESS that is connected directly to or located in a commercial or industrial site. In the case of a home also operating as a premise of work, the origins of funding (company or personal funds) determine its siting.
Residential	An ESS that is connected directly to or located in a residential home. This may include multifamily dwellings and apartment buildings. This can include systems that provide value to a building with multiple homes but excludes community systems that are not connected to a specific building.
Off-grid	**Any system that is not connected to a major grid — microgrids or minigrids do not count as a major grid network. These are not included in this forecast. Any of the above systems could also be off-grid; if so, then the system would be excluded.**

Source: S&P Global Commodity Insights.

Application definitions

Key terms and definitions

Application	FTM or BTM	Definition
Backup power	BTM	An ESS is used to provide power in the event of an outage.
Capacity and firming	FTM	The monetary value of the contribution of an energy storage system to balancing supply and demand when generation is scarce. Typically, an offtaker secures the right to the ESS's output during certain hours only, leaving the ESS free to provide other services at all other times.
Conventional enhancement	FTM	An umbrella term describing all services in which an energy storage system is supporting a thermal asset, such as a coal or gas plant. These services could include providing ramp rate control or minimizing operating costs or long-term degradation of the asset. The asset must be installed while the conventional asset is still operable; i.e., located at sites of decommissioned assets are not included.
Frequency regulation	FTM or BTM	Operating reserves that are used to address intraminute (second-to-second) variations in net load to correct deviations in system frequency. May be deployed after a contingency event or during business-as-usual operations to maintain power quality.
Optimizing solar self-consumption	BTM	The coincident use of on-site generation by a colocated load. The term is commonly used to describe situations where customers use on-site solar PV to directly power on-site loads rather than exporting it to the grid. An ESS can allow customers with on-site generation to increase self-consumption by storing excess energy rather than exporting it and consuming it later to avoid retail purchases from the grid.
Other ancillary services	FTM or BTM	Includes all other ancillary services that a system could provide through a market mechanism; this typically includes black start, reactive power provision and other reserve products. In the future, this may include services for inertia or congestion management.
Peak shaving	BTM	The reduction in a customer's net load — generally via demand response or energy storage discharge — to reduce or avoid retail demand charges.
Time-of-use optimization	BTM	A type of arbitrage in which the customer uses an energy storage system to reduce their electricity bill by charging when time-of-use rates are low and discharging when time-of-use rates are high.
Upgrade deferral	FTM or BTM	The ESS is installed to supplement existing network infrastructure or defer investment into traditional solutions (i.e., wires and substations).
Wholesale arbitrage	FTM or BTM	The ESS is used to store electricity at times of low prices by purchasing from one of the many wholesale energy markets (day-ahead markets, real-time markets, and even imbalance markets) and discharge it during periods of high prices. BTM systems may participate directly or through an aggregator or "virtual power plant."

Source: S&P Global Commodity Insights.

Methodology

Energy storage forecast philosophy: S&P Global Commodity Insights aims to provide accurate and detailed statistics for the historical development of the market size as well as plausible and well-reasoned future projections. This includes combining dedicated primary data collection, insight gained from regular interviews with industry stakeholders, industry experience and modeling and analysis (including technology cost projections and business case evolution). Where assumptions are made around policy and regulation developments and other factors influencing market development, these will be clearly documented and shared with clients.

Inputs, considerations and method:

Historical	Near-term forecast (i.e., this year)	Medium-term forecast (i.e., next 2-3 years)	Long-term forecast (i.e., 5-10 years)

• Collection of primary data, including shipment data and lists of completed projects collected from:
  • Residential system suppliers
  • System integrators (commercial and industrial and FTM)
  • Power conversion system (PCS) suppliers
• Review of official statistics and public registries from government bodies and utilities
• Inventory level estimates (e.g., mismatch between shipments versus installations)
• Assessment of total completed commercial and industrial and FTM projects from S&P Global Commodity Insights energy storage project database.
	• Collection of primary data, including shipment data and lists of completed and planned projects
	• Review of official statistics and public registries from government bodies and utilities
	• Interviews with wide range of industry stakeholders to gather insight and gauge current market environment
	• Assessment of shipments/ installations completed so far that year
	• Assessment of amount of planned project pipeline likely to complete by end of year, including potential impact of supply chain constraints
	• Consideration of incentive deadlines and their impact on installation timelines.
		• Collection of primary data, including lists of planned projects from system integrators
		• Interviews with wide range of industry stakeholders to gather insight and gauge likely development of market environment
		• Assessment of the planned project pipeline, including estimating potentially unknown or not-yet-announced projects
		• Consideration of national energy storage (and wider renewable energy) development targets and associated incentive schemes
		• Projections for technology developments and cost outlook
		• Assessment of evolution of energy storage business cases and competitiveness in power markets Consideration of renewable energy outlooks, likely storage attach rates.
			• Consideration of market fundamentals, including working in collaboration with S&P Global Commodity Insights power market modeling teams to understand the fundamental need for energy storage in the future
			• Consideration of national energy storage (and wider renewable energy) development targets and associated incentive schemes
			• Projections for technology developments and cost outlook
			• Assessment of the evolution of energy storage business cases and competitiveness in power markets (taking into account cost/price projections)
			• Consideration of renewable energy outlooks and likely storage attach rates.

Source: S&P Global Commodity Insights.

Contact us

PRIMARY CONTACT(S)

Henrique Ribeiro

henrique.ribeiro@spglobal.com

CONTACT US

Americas	+1 800 597 1344
Asia-Pacific	+60 4 296 1125
Europe, Middle East, Africa	+44 (0) 203 367 0681

www.spglobal.com/en/enterprise/about/contact-us.html

www.spglobal.com/commodityinsights

S&P Global
Commodity Insights