ANDEG Conference 2026

Dispatchable capacity as the backbone of a reliable energy transition

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SPEAKER

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Eneva

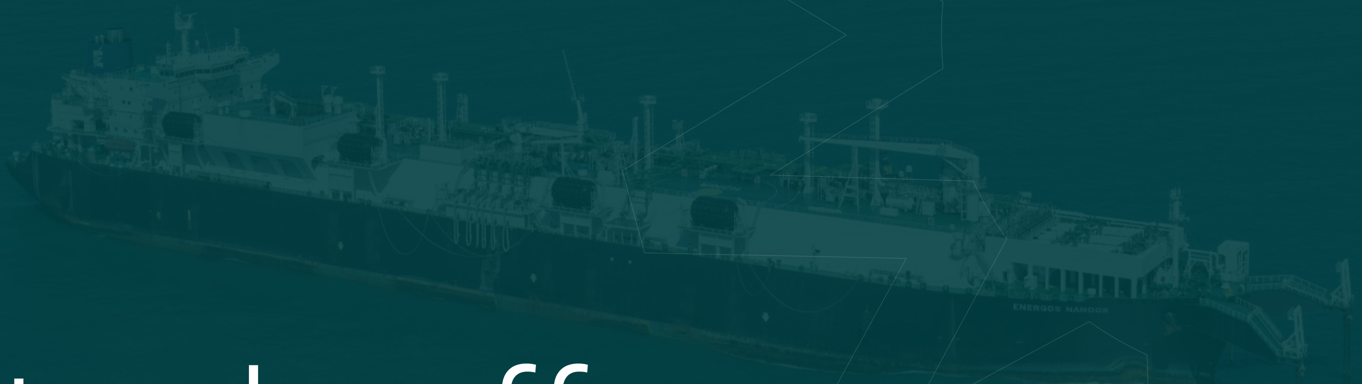
Agenda

The energy transition is not only changing how electricity is generated. It is changing what the power system needs to remain reliable.

Agenda

From energy transition complexity to system reliability solutions

01



Global trade-offs

Three structural shifts are reshaping the global power sector

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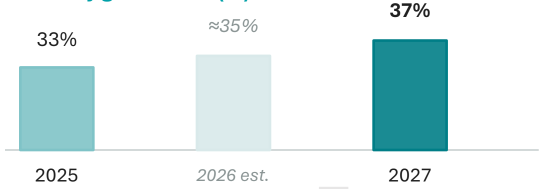
Demand growth, renewable expansion and flexibility requirements are defining the next investment cycle.

1

RENEWABLES EXPANSION

Renewables are becoming the leading source of global electricity generation

Share of renewables in global electricity generation (%)



37%

renewable share in global electricity generation by 2027

+8%

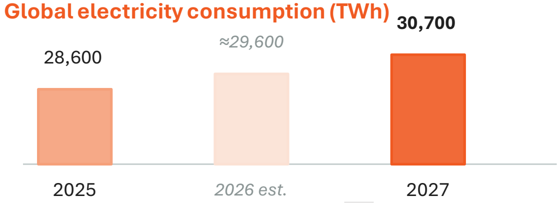
expected growth in renewable electricity generation in 2026

2

DEMAND ACCELERATION

Electrification, cooling, industry and data centres are driving sustained demand growth

Global electricity consumption (TWh)



+7.3%

projected increase in global electricity consumption from 2025 to 2027

30,700 TWh

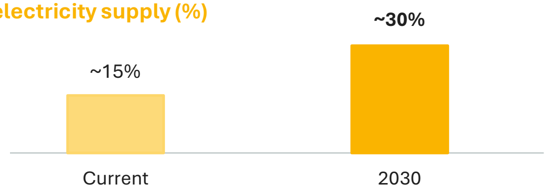
expected global electricity consumption in 2027

3

INCREASING SYSTEM VARIABILITY

Higher wind and solar penetration is increasing the need for flexibility and grid reinforcement

Variable renewable share in global electricity supply (%)



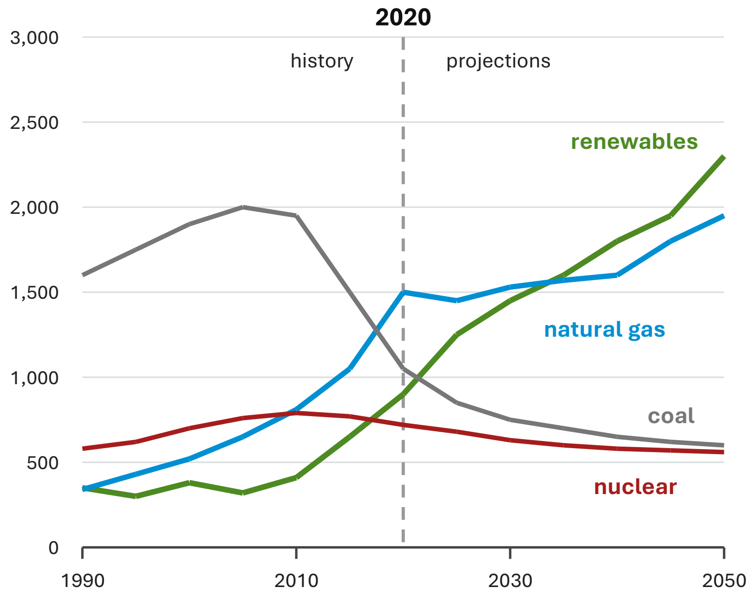
~30%

expected wind and solar share in global electricity supply by 2030

2×

approximately twice the current variable renewable share

Global primary energy consumption by source

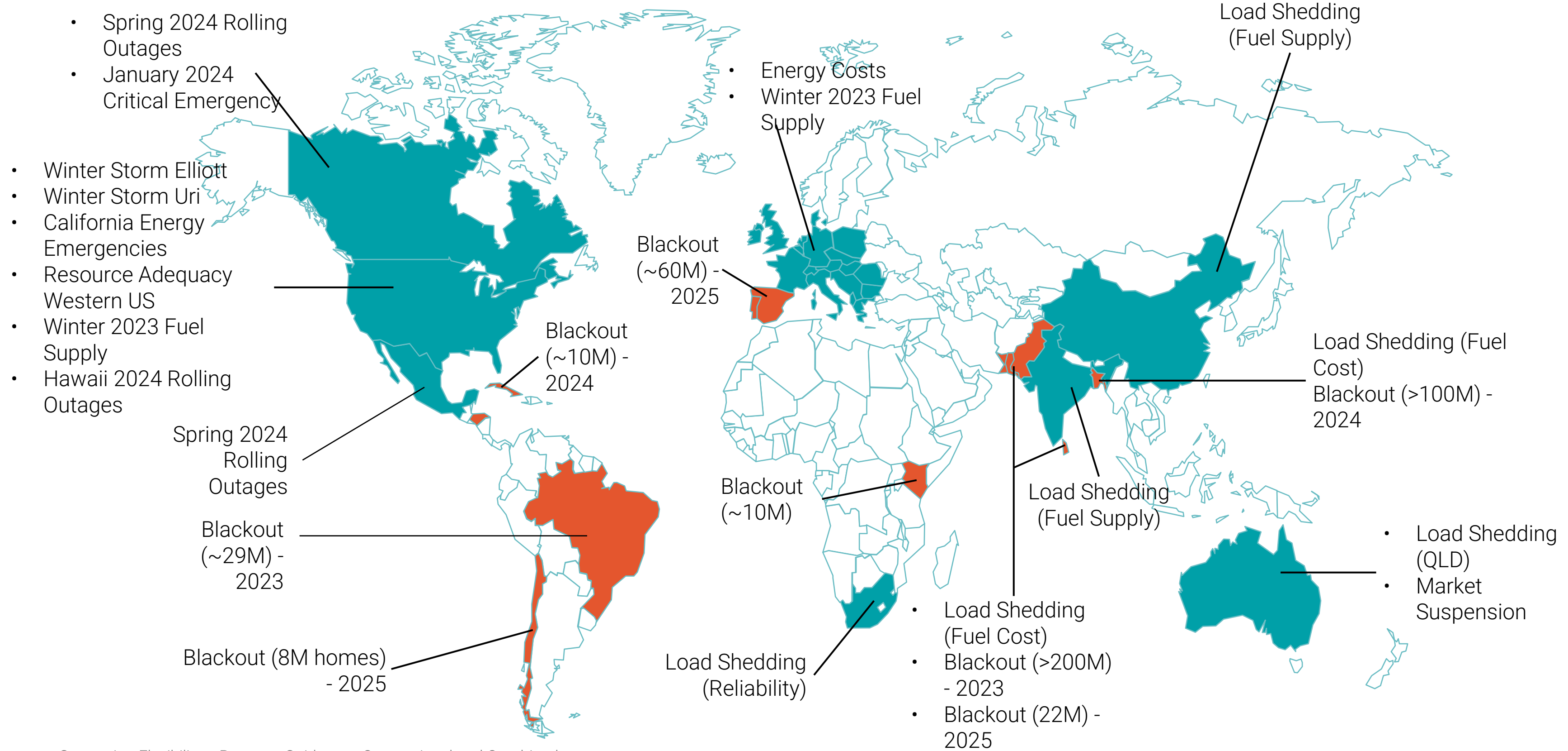


Source: "Annual Energy Outlook 2021," U.S. Energy Information Administration, February 2021
Editable recreation for presentation use

Source: IEA (iea.org). Note: 2026 electricity consumption is an estimate derived from the IEA's projected annual growth rate. Variable renewable energy comprises primarily wind and solar PV.

Global Challenges

The energy transition is exposing regional trade-offs between reliability, affordability, and sustainability.



Generation Flexibility - Program Guidance -Conventional and Combined Cycle Units _ EPRI

The Energy Trilemma

1 **SECURITY**

Middle East and North America rank strongest; Africa and Asia face the largest reliability gaps.

2 **EQUITY**

Africa has the greatest access and affordability challenge; high prices also weigh on Europe and Oceania.

3 **SUSTAINABILITY**

Europe, South America and Oceania lead; fossil dependence holds back the Middle East and Asia.

No region leads all three dimensions: the transition requires trade-offs among reliability, affordability and decarbonization.

Source: Generation Flexibility – Program Guidance – Convencional and Combined Cyble Units_EPRI

Case: Brazil August 2023 event

Prior conditions and event summary.

Norte		
Geração	Verificada	Programada
Hidráulica	2.493	2.514
Térmica	1.399	1.389
Eólica	210	304
Solar	3	0
Total	4.104	4.207

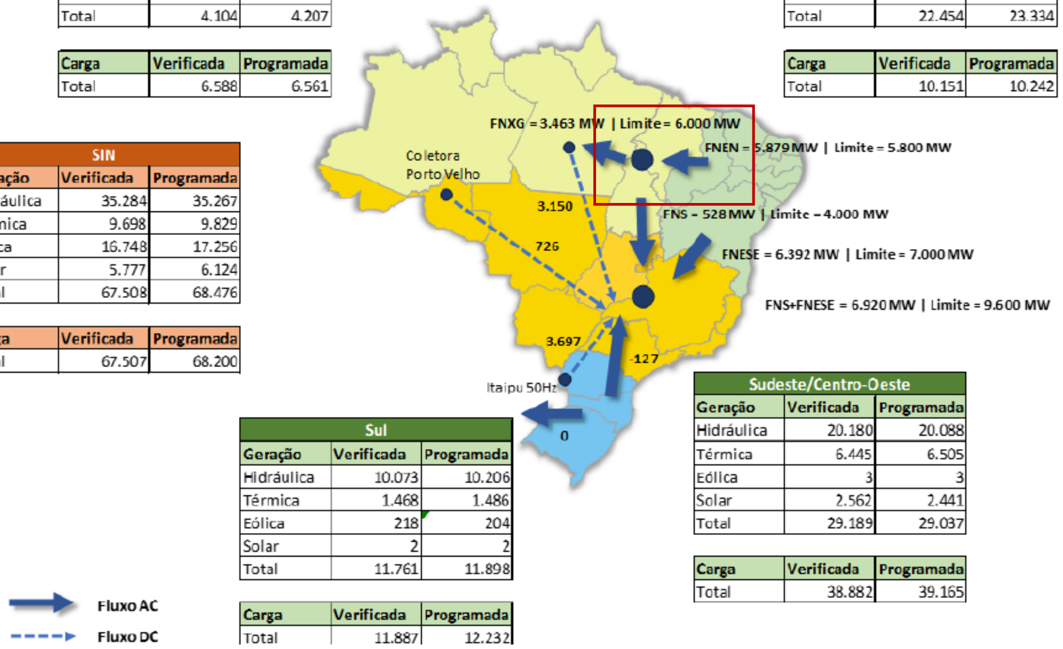
Carga	Verificada	Programada
Total	6.588	6.561

Nordeste		
Geração	Verificada	Programada
Hidráulica	2.539	2.459
Térmica	387	449
Eólica	16.317	16.745
Solar	3.211	3.681
Total	22.454	23.334

Carga	Verificada	Programada
Total	10.151	10.242

SIN		
Geração	Verificada	Programada
Hidráulica	35.284	35.267
Térmica	9.698	9.829
Eólica	16.748	17.256
Solar	5.777	6.124
Total	67.508	68.476

Carga	Verificada	Programada
Total	67.507	68.200

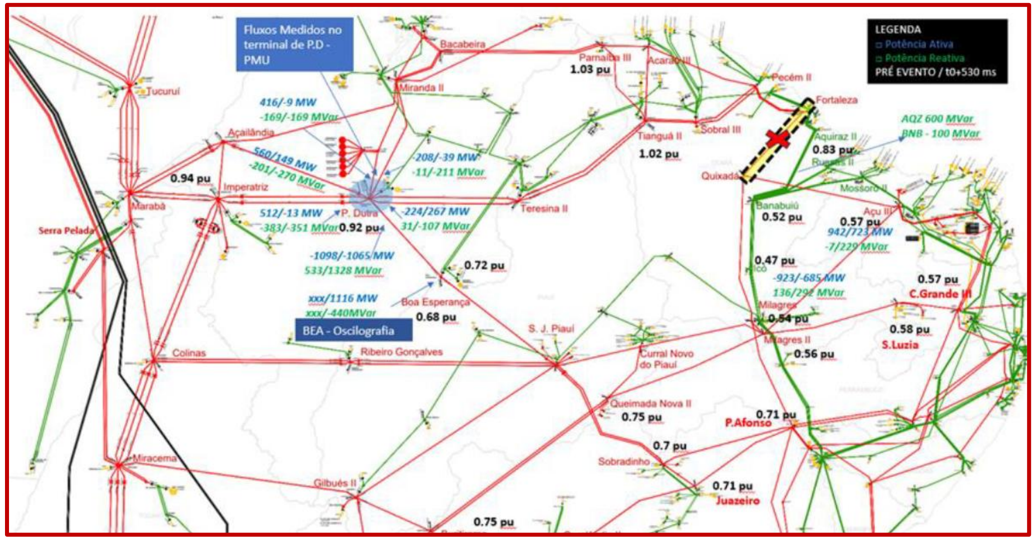


Sudeste/Centro-Oeste		
Geração	Verificada	Programada
Hidráulica	20.180	20.088
Térmica	6.445	6.505
Eólica	3	3
Solar	2.562	2.441
Total	29.189	29.037

Carga	Verificada	Programada
Total	38.882	39.165

Sul		
Geração	Verificada	Programada
Hidráulica	10.073	10.206
Térmica	1.468	1.486
Eólica	218	204
Solar	2	2
Total	11.761	11.898

Carga	Verificada	Programada
Total	11.887	12.232



Initial trigger:

Accidental shutdown of 500kV Quixadá – Fortaleza II TL

Cascading effect

Drastic voltage drop -> further shutdowns

Load shedding schemes (ERAC) activated

Key issues

System didn´t react as expected: model discrepancies

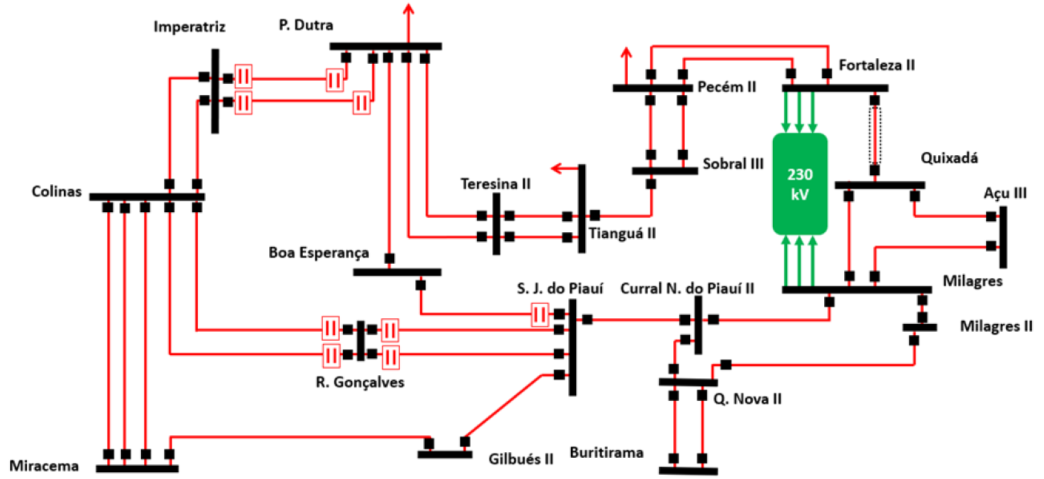
Result

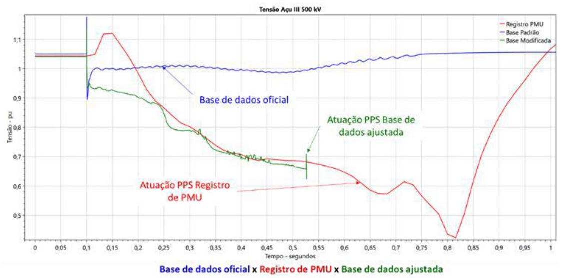
Approximately 23.4GW load drop (~1/3) -> 8 hours for total recovery

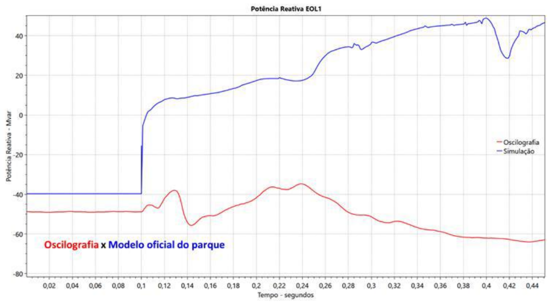
Source: RAP-ONS 00012/2023

Case: Brazil August 2023 event

Analysis.







Maximum recorded loading of 500kV Quixadá – Fortaleza II

- Higher solar generation
- Planned maintenances

Opening of Quixadá – Fortaleza II

- Switch onto fault (SOTF) erroneous actuation
- Flow redirected partially to 230kV sectorLimited reactive power support
- Several lines disconnected on distance protection
- Voltage collapse
- Frequency instability

Unexpected renewable performance

- Signficantive difference model and actual voltage response
- Instead of providing support or ride-through capability, units either tripped or drastically reduced output

Source: RAP-ONS 00012/2023

02

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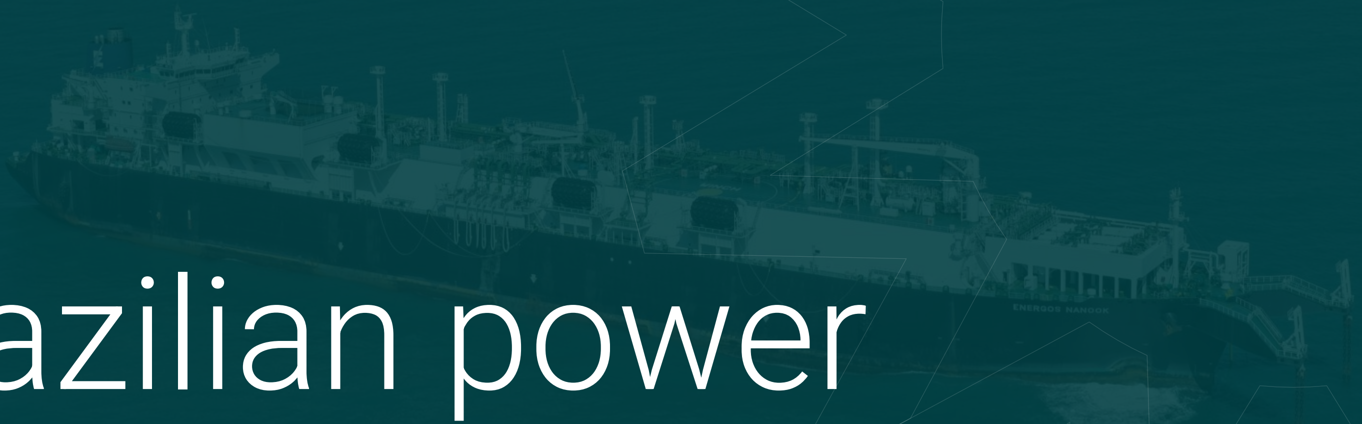
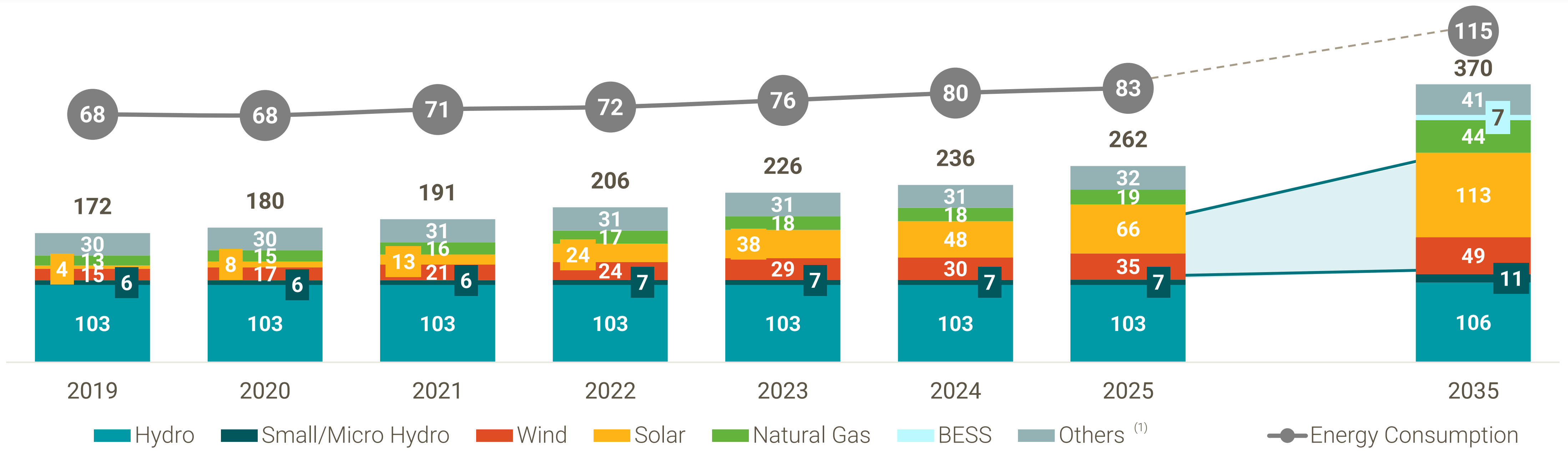


The Brazilian power system challenge

The Brazilian System is Highly Dependent on Intermittent Renewables and Natural Resources Availability to Meet an Increasing Demand

Brazilian Energy Matrix - Installed Capacity and Energy Load (GW; GWavg)



	2019	2020	2021	2022	2023	2024	2025		2035
Dispatchable[2]	77%	75%	72%	67%	61%	58%	54%	c. 3,3% CAGR	48%
Intermittent[3]	12%	14%	18%	23%	29%	33%	38%		44%

Increasing demand for thermal sources as a consequence of flat hydro installed capacity, higher share of renewables in the energy mix, and growth in energy consumption

Source: Years 2019 to 2024: data from EPE's yearly "Anuário Estatístico 2025"; Year 2025: data from ANEEL's Dynamic Dashboard; 2035: data from EPE's Preliminary "PDE 2035" (Changes in Installed Capacity from 2025 to 2035).
Notes: (1) Includes Oil, Coal, Nuclear, Biomass fuel and Demand Response; (2) Considers hydro and thermal excluding biomass and nuclear, as well as battery storage; (3) Considers solar and wind sources.

Renewable Expansion Increases the Need for Flexibility in the Brazilian Power System

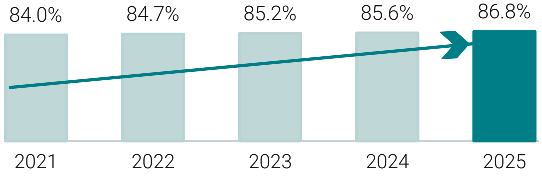
As renewable generation and electricity demand continue to grow, flexible capacity becomes increasingly critical to maintain system reliability, security, and supply-demand balance.

1

RENEWABLES GROWTH

Renewables continue to reshape Brazil's power mix

Share of renewable sources in electricity supply (%)



86.8%

renewable share in electricity supply in 2025

26.4%

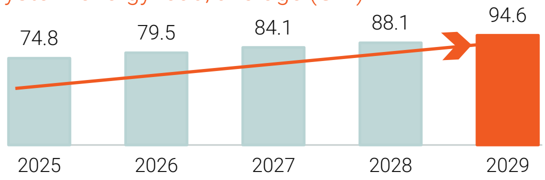
combined wind and solar share

2

DEMAND EXPANSION

Electricity demand is expected to grow steadily over the next years

System energy load, average (GW)



+14.1%

projected growth in system energy load, 2025 to 2029

94.6 GW

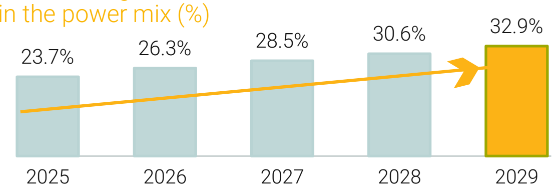
projected load in 2029

3

INCREASING SYSTEM VARIABILITY

More solar and distributed generation drive wider and faster net demand variations

Distributed generation + solar share in the power mix (%)

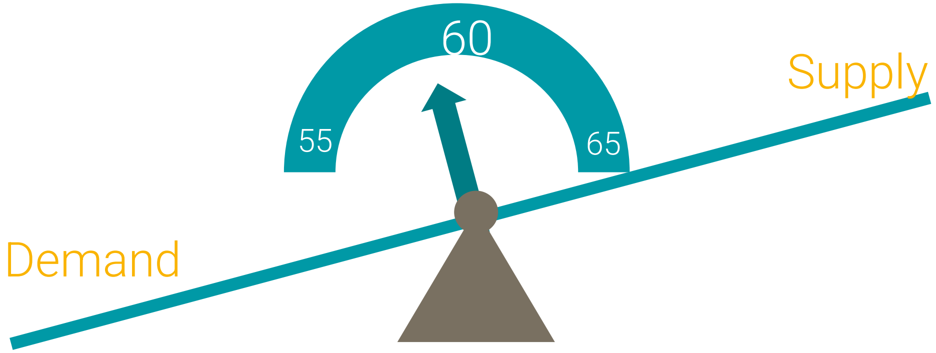


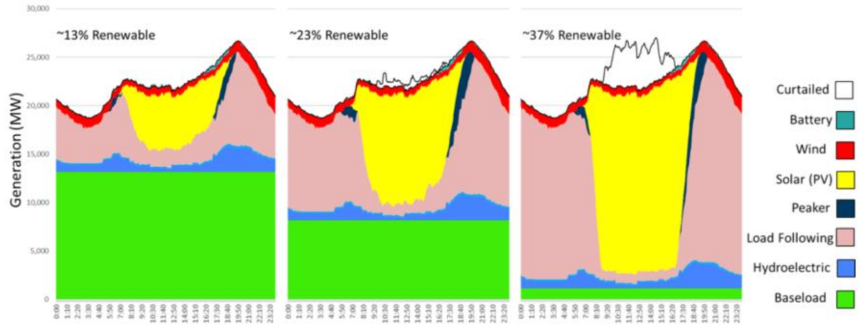
32.9%

expected solar and distributed generation share in 2029

>50 GW

expected future daily flexibility





Source: ONS, Energy Operation Plan 2025. 2 EPE, Brazilian Electricity Statistical Yearbook 2026. 3 EPE, Ten Year Energy Expansion Plan 2035. 4 U.S. EIA, Annual Energy Outlook 2021.

The Brazilian power system challenge:

Intermittency, dry-season constraints and peak demand dynamics

Three structural dynamics converge during critical periods, increasing the need for firm and flexible capacity.

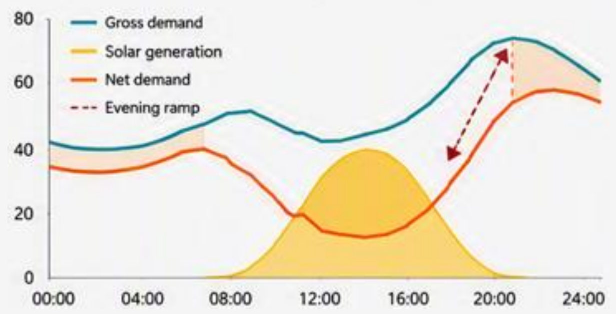
1 INTERMITTENCY & INTRADAY RAMPS

Variable generation is increasing balancing requirements

44.1 GW
Maximum daily hydropower modulation observed through Apr/2025[1]

>50 GW
Expected future daily flexibility requirement[1]

TYPICAL SUMMER DAY – NET LOAD CURVE (GWavg)



Higher solar penetration creates deeper midday valleys and steeper evening ramps, requiring dispatchable resources to respond faster and across wider ranges.

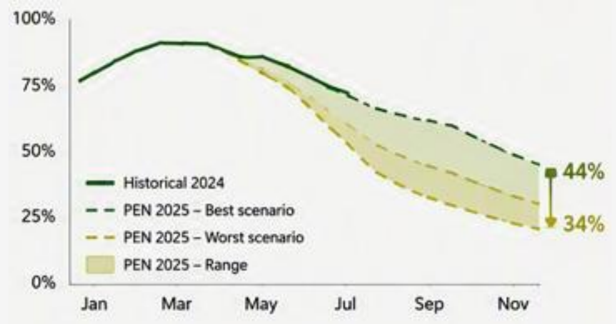
2 DRY SEASON & HYDROLOGICAL CONSTRAINTS

Hydrological uncertainty reduces operating margin during critical periods

34%–44%
SE/CO storage at the end of Nov/2025 (EARmax)[1]

~14 GW
Thermal dispatch indicated for the final months of the 2026 dry season in most scenarios[1]

SE/CO RESERVOIR STORAGE TRAJECTORY (% EARmax)



Lower inflows and declining reservoirs limit hydropower flexibility, requiring thermal generation to preserve stored water and ensure security of supply.

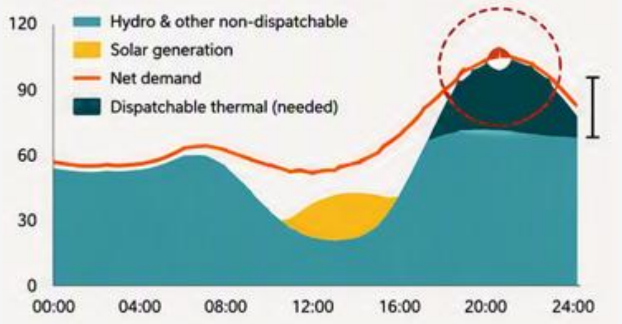
3 PEAK DEMAND DYNAMICS

Demand is growing and increasingly concentrated in evening hours

108 → 125 GW
Maximum instantaneous demand: 2025 to 2029[1]

+1.9 GW
Average increase vs. PEN 2024[1]

TYPICAL WINTER EVENING – SUPPLY & DEMAND (GW)



Peak demand continues to rise and shifts to the evening, when solar is unavailable, increasing reliance on firm, dispatchable capacity.

REDUCED SYSTEM MARGIN: Increasing need for firm, flexible, and available capacity to support reliability and reserve requirements.

Source: ONS – Energy Operation Plan 2025 to 2029 (PEN 2025) – Executive Summary.

03

The role of thermal power plants

Why firm and flexible capacity remains essential

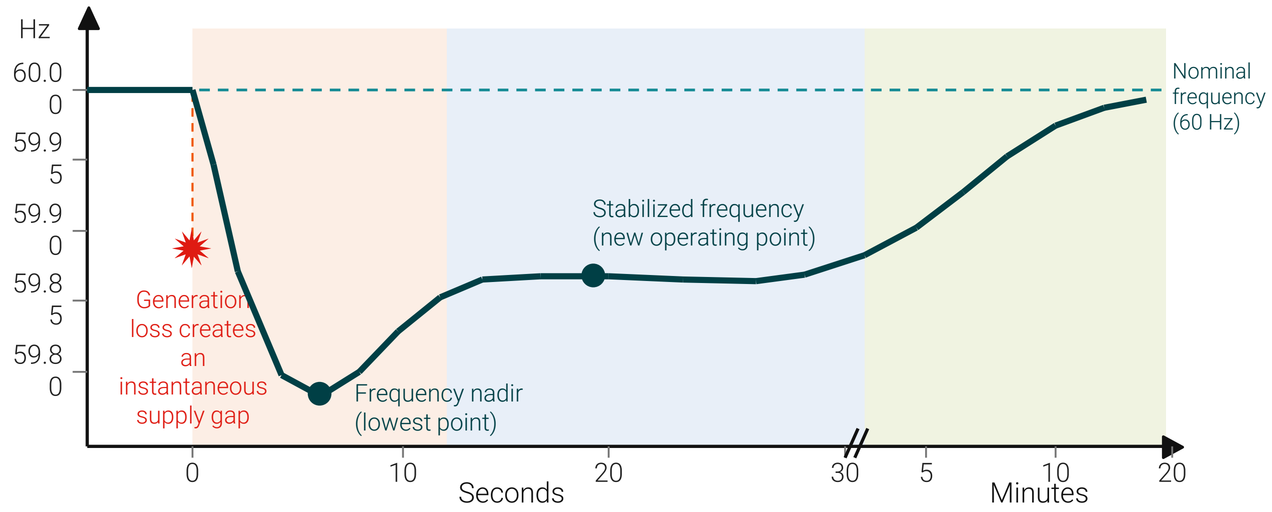
Power system reliability depends on resources that can arrest, stabilize and restore frequency after a sudden supply, demand imbalance.

The frequency response cycle after a generation loss

1. ARREST
Limit the speed and depth of the frequency decline

2. STABILIZE
Contain the disturbance and establish a stable operating point

3. RESTORE
Recover frequency and rebuild the system's operating margin



Arresting period
Inertial and fast response limit the initial rate of decline, creating time for other resources to act.

Rebound period
Primary response increases generation output, arrests the frequency drop around the nadir and stabilizes the system.

Recovery period
Secondary and tertiary responses restore frequency to nominal and replenish the operating reserves used.

RELIABILITY IS DELIVERED ACROSS MULTIPLE TIMESCALES

IMMEDIATE
Inertial and fast frequency response
Limits the initial rate of frequency decline.

SECONDS
Primary frequency response
Arrests the frequency drop and stabilizes the system.

MINUTES
Secondary and tertiary response
Restores frequency to nominal and rebalances the system.

CONTINUOUS AVAILABILITY
Firm capacity and operating reserves
Ensure that sufficient controllable power is available when the disturbance occurs.

Advanced Dynamic Analysis: Synchronous Machines vs. Inverters

Reliability depends on how each technology arrests frequency, supports voltage and feeds protection systems after grid disturbances.

Dynamic behavior across key system needs

	SYNCHRONOUS MACHINES	INVERTER-BASED RESOURCES
Frequency & inertia	Intrinsic rotating mass delivers immediate inertial response and physically limits RoCoF. The swing equation ($M \cdot d^2\delta/dt^2 = Pm - Pe$) governs the response.	Grid-following units have no physical inertia and track grid frequency through PLLs. Grid-forming controls can emulate virtual inertia in software.
Voltage dynamics	Flux-linkage continuity plus automatic voltage regulation provide immediate voltage support through the exciter and magnetic field.	Reactive-current loops regulate voltage quickly, but performance depends on PLL tracking speed, control tuning and processing delay.
Fault contribution	High short-circuit current, often 5–10× In over subtransient to steady-state stages, preserves relay selectivity.	Current is typically limited to about 1.1–1.5× In to protect semiconductors, increasing the risk of protection blindness.

SYSTEM EFFECT Replacing synchronous machines with inverter-based generation changes the physical source of inertia, voltage stiffness and fault current — so protection and controls must be engineered as part of the resource mix.

ENGINEERING IMPLICATIONS FOR A LOW-SCR GRID

1. **GRID STRENGTH**
   Lower short-circuit ratio makes the network more sensitive to fast control interactions and disturbances.

2. **PROTECTION**
   Relay philosophy must adapt when fault-current magnitude, phase and duration are no longer synchronous-machine-like.

3. **CONTROL MODE**
   Grid-forming inverters can mitigate stiffness loss, but only with validated tuning, ride-through logic and coordination.

4. **PLANNING**
   Firm synchronous and flexible resources remain the reference for fast inertial, voltage and fault support.

Translated and standardized to the Slide 16 visual system.

04

Eneva’s contribution to system reliability

In this context, thermal and hydropower plants play a central role in capacity auctions

As the Brazilian interconnected system becomes more complex, the market increasingly values attributes that only thermal and hydropower assets can provide consistently.

As operational variability increases across Brazil's interconnected power system, resource adequacy can no longer be secured solely by expanding energy supply; it increasingly depends on procuring system attributes. Capacity auctions have therefore become the primary mechanism for securing firm capacity, operational responsiveness and reliability, making hydropower and thermal plants essential to system security.

System Variability	Capacity Requirement	Thermal / Hydropower
Non-dispatchable generation sources	Higher risks of hourly deficits, preventive curtailment and emergency dispatch	Dispatchable Asset
Rapid changes in net load	Lower system reliability	Predictable Supply
Lower intraday predictability	Need for rapid response	System Reliability Resource

Integrated Energy Company with a Strategy Centered on Natural Gas and E&P, Midstream and Power Generation

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Upstream

Natural Gas, Oil and Gas Liquids

1.7 tcf
(47.5 bcm)
2P Gas Reserves [1]

+ 51,800 km²
Concession Area

Midstream

LNG

Current: 45.9 mm cf/d
(1.3 mm m³/d)
Expansion: 10.6 mm cf/d (0.3 mm m³/d)
Small Scale Off-grid Liquefaction Capacity

Current: 0.7 bcf/d
(21.0 mm m³/d)
Expansion: 1.2 bcf/d (35.0 mm m³/d)
On-grid Regas Terminal for Imported LNG

Downstream

Power Plants

10.9 GW
Contracted and Constructed Capacity [2]

+10 GW
Project Pipeline [3]

Largest Onshore 2P Gas Reserves in Brazil

Brazil's largest LNG Producer

Brazil's largest thermal generator

Notes: (1) Source: Gaffney Cline & Associates ("GCA") Report as of 12/31/2023 for Amazonas Basin, excluding the production history of 2024 and 2025, and GCA Report as of 12/31/2025 for Parnaíba Basin; (2) Includes, in addition to operational assets, Azulão I and Azulão II, currently under construction, as well as all of Futura 1 Solar complex's and CGTF's capacity and the projects awarded in the latest Auction (LRCAP 2026).

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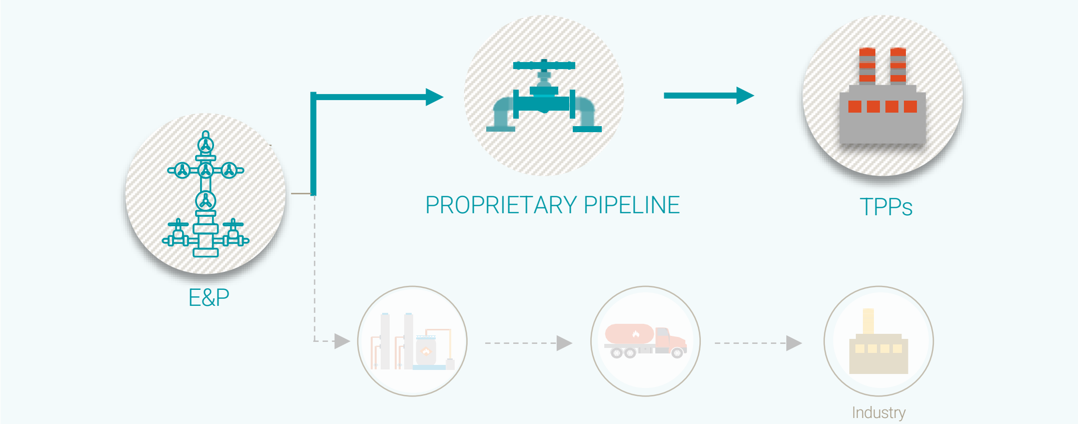
Eneva Provides Reliable and Competitive Energy Solutions, Addressing Grid Challenges and Enabling Growth in Renewables

R2W

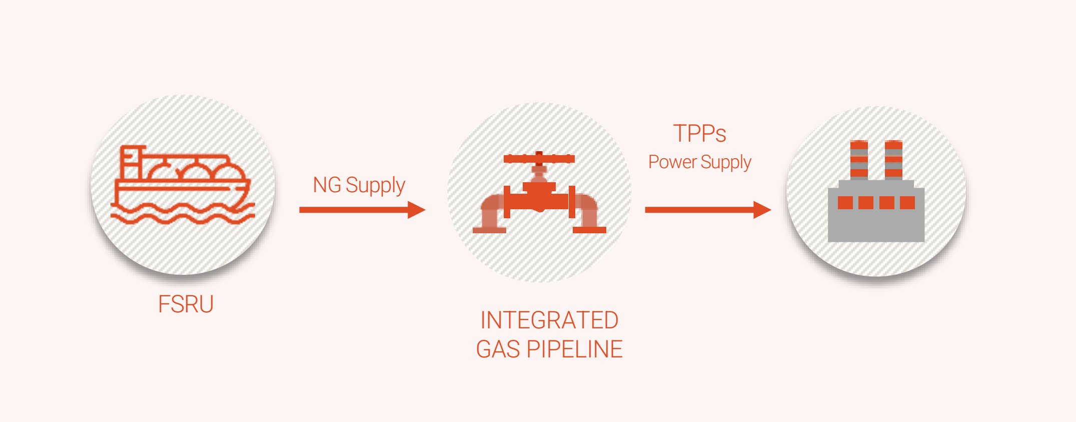
Most Cost Competitive TPP Operator, with a Verticalized Model



TPPs located close to Eneva's natural gas fields, connected by proprietary pipelines

G2P

TPPs fueled by imported LNG regasified at FSRUs connected to the natural gas grid



Power production from natural gas in thermal power plants with significant dispatch upside

Robust thermal portfolio providing capacity, reliability, and flexibility to the power system, supporting the growth of renewables

1st

Brazil's largest thermal generator with 10.1 GW[1] of total capacity

AFFORDABILITY

RELIABILITY

SUSTAINABILITY

Notes: (1) Includes, in addition to the installed thermal capacity, TPPs Azulão I, Azulão II and all projects contracted in the 2026 Capacity Auction.

Eneva's Unique Reservoir-to-Wire (R2W) Model Effectively Integrates Onshore Natural Gas E&P and Power Generation

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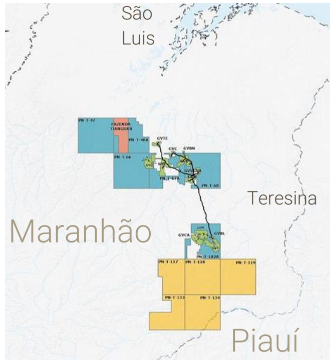
R2W Parnaíba

TPPs located close to gas production units, connected by proprietary pipelines

E&P → PROPRIETARY PIPELINE → TPPs

E&P → Gas Liquefaction → LNG Road Transport → Industry



R2W Amazonas

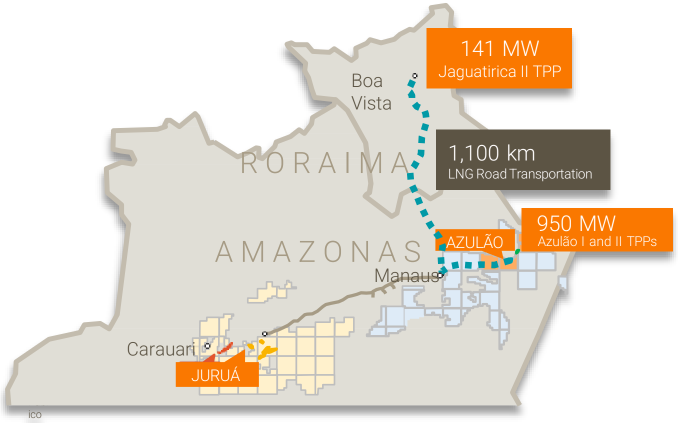
Azulão Complex: TPPs located close to gas production units, connected by proprietary pipelines

R2W with Virtual Pipeline Roraima

Azulão-Jaguatirica Project: Gas produced is liquefied and transported by road to TPP

E&P → PROPRIETARY PIPELINE → Azulão I & II TPPs

E&P → Virtual Pipeline: Gas Liquefaction → LNG Road Transport → Gas Regasification → Jaguatirica II TPP



R2W Business Model Strenghts:

CAPACITY

RELIABILITY

FLEXIBILITY

- Lowest TPP cost operator
- Verticalized model

The scale built over the last decade sustains a new cycle of contracted growth

From the integrated gas and energy model to leadership in the largest capacity auction in the country.

TRANSFORMATION TRAJECTORY

Selected Milestones

2013	Gas and generation integration	First commercial gas production and start-up of Itaqui, Pecém II and Parnaíba UTEs.
2016–17	Restructuring and resumption	Merger with PGN, closure of judicial reorganization and IPO of R$ 0.9 billion.
2021–22	Extended Platform	Victories in capacity auctions, incorporation of Focus and acquisition of Celse and UTE Fortaleza.
2024–25	Diversification and execution	Azulão 950 under construction, new acquisitions, Parnaíba VI in operation and 100% contracted liquefaction plant.
2026	Scale Jump	LRCAP consolidates national expansion, with existing assets recontracted and new hubs.

Values on a real basis and according to the company's disclosure in March and May 2026.

LRCAP 2026 | TRANSFORMATIONAL FRAMEWORK

Biggest winner of the auction

5.4 GW
contracted capacity
1.70 GW existing + 3.65 GW new

R$ 161 billion
Contracted fixed revenue
R$ 30.1 billion rehiring + R$ 131.1 billion new UTEs

31%
of thermal demand
captured at auction

R$ 18.2 billion
CAPEX Program
to make contracts viable

STRATEGIC IMPLICATION

More scale, cash predictability and geographic presence, with execution as a critical value driver.

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