PLEXOS Presentation
Brazilian Market

Rio de Janeiro, Brazil
11th November 2025

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Agenda

1 What is PLEXOS?

2 13 Business Cases & Typical Applications

3 PLEXOS Cloud Demo (Short-term & Long-term)

4 Q&A

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Global Energy Market Context

1. **Rapid renewable growth.** Is transforming generation portfolios through record solar, wind, and storage.
2. **Grid congestion and infrastructure limits.** are key barriers to efficiently integrating new clean capacity.
3. **Energy storage and flexibility solutions.** are vital to balancing variability and maintaining system reliability.
4. **Sector coupling.** across electricity, gas, hydrogen, and water is redefining long-term planning and resilience.
5. **Advanced analytics.** and integrated modelling enable data-driven decisions balancing cost, carbon, and reliability.

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What is PLEXOS?

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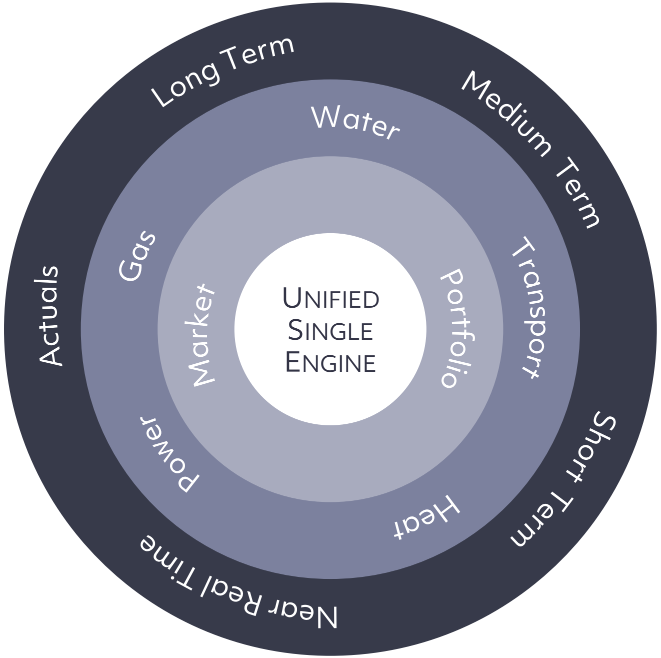
What is PLEXOS?

- Developed by Energy Exemplar, PLEXOS is an Integrated simulation platform for electricity, gas, hydrogen and water markets.
- Uses mathematical optimization (MILP) to find least-cost dispatch and investment.
- Solves from minutes to decades – short term operation to long term planning.
- Trusted by regulators, system operators and private investors worldwide.



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Integrated Simulation Workflow

- Long-term plans feed into medium- and short-term simulations automatically.
- Decisions and constraints propagate forward through the simulation chain.
- Hourly or sub-hourly operational detail enables realistic modelling.

LT

P) Min Investments + operational costs:
Subject to:
Energy balance
…

MT

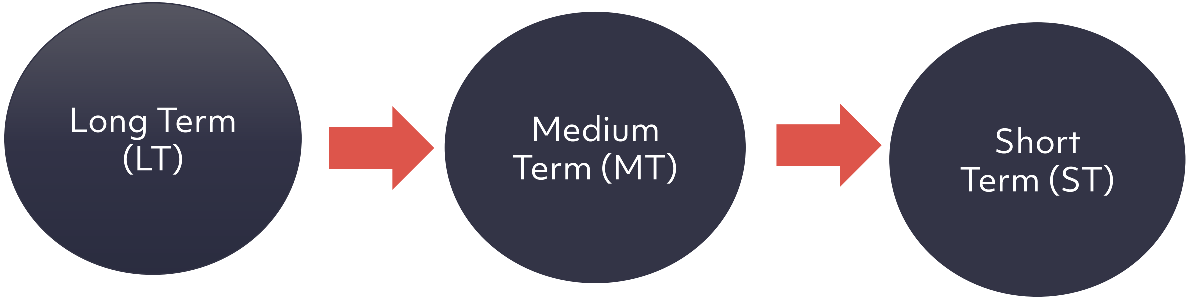
P) Min operational costs:
Subject to:
Energy balance
…

Lower resolution (granularity)

ST

P) Min operational costs:
Subject to:
Energy balance
…

Higher resolution (granularity)



Results:

a) Generation expansion plan

b) Transmission expansion plan

Results:

a) Marginal cost forecast

b) Dispatch forecast

c) Water usage:
  - Water values
  - Targets

Unit commitments. Results:

a) Hourly marginal costs

b) Hourly dispatch

Receives water values or targets as inputs to represent border conditions.

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Key differentiators

1. **Solve optimization problem using MILP.** It can ensure certain levels of optimality.
2. **Co-optimization.** It can include generation/transmission/reserve and multicommodity.
3. **Granularity.** enables modelling at the level of blocks of hours, individual hours, or sub-hourly intervals.
4. **Reserve modelling.** Allow to model detailed types of reserves and also include them in LT plan.
5. **Single engine.** Single optimization engine across all horizons.
6. **Supports nodal, zonal, or regional** modelling, with a single switch to toggle between them.
7. **Stochastic optimization**. It allows scenario analysis, Montecarlo and stochastic optimization (2 and multistage).
8. **Mixed temporal resolution**. It allows to include this for long and short term.
9. **Transparency and auditability.** Generates diagnostic files detailing the complete optimization model.

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PLEXOS Cloud

- Centralized Storage in web
- Map reporting and congestion analysis
- Change management and versioning process
- Power BI and comparison reporting
- Simulation machine selection
- Excel Add-in

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Optimal Simulation Machines

Choose the Perfect Fit	A wide range of hardware options for simulations.
Unrestricted Usage	Use multiple machines as needed with Usage-based pricing.
Personalized Performance	Exclusive machine reservation ensures dedicated resources.
Smart Recommendations	Leverage our Recommendation Engine for VM suggestions based on past runs.
Customizable Solutions	Additional machines available upon request.

Cores (Virtual CPU's)	Memory (GB)
2	16
4	32
8	64
16	128
32	256
48	384
64	512

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Business Cases and Typical Applications

13 illustrative uses cases

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1/13. Expansion Planning

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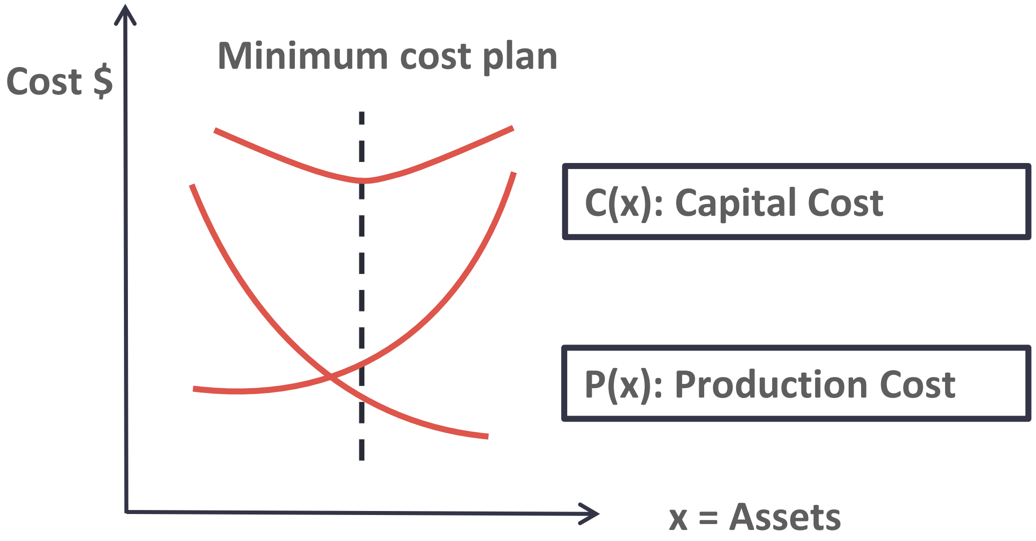
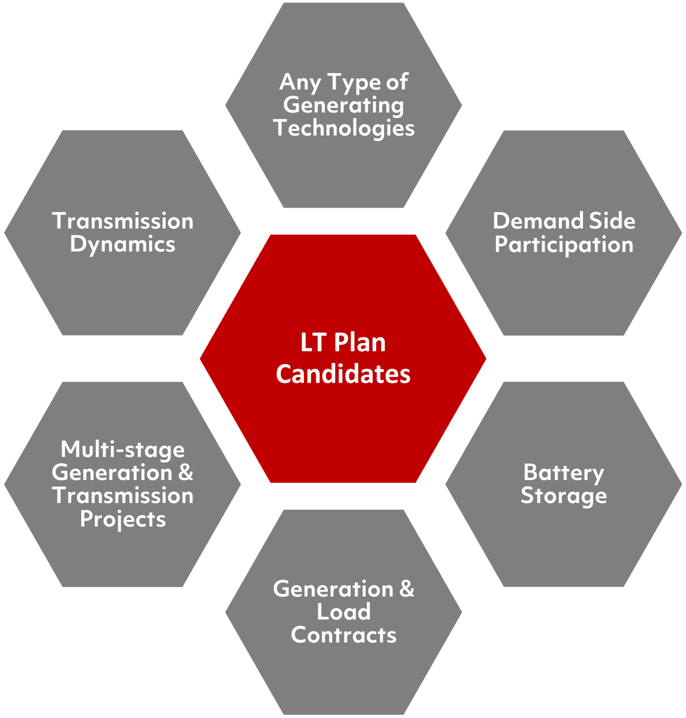
Expansion Planning

Finds the optimal combination of generation and transmission new builds and retirements



MIP Objective: Minimise NPV of capital & production

C(x) + P(x) = Total Cost



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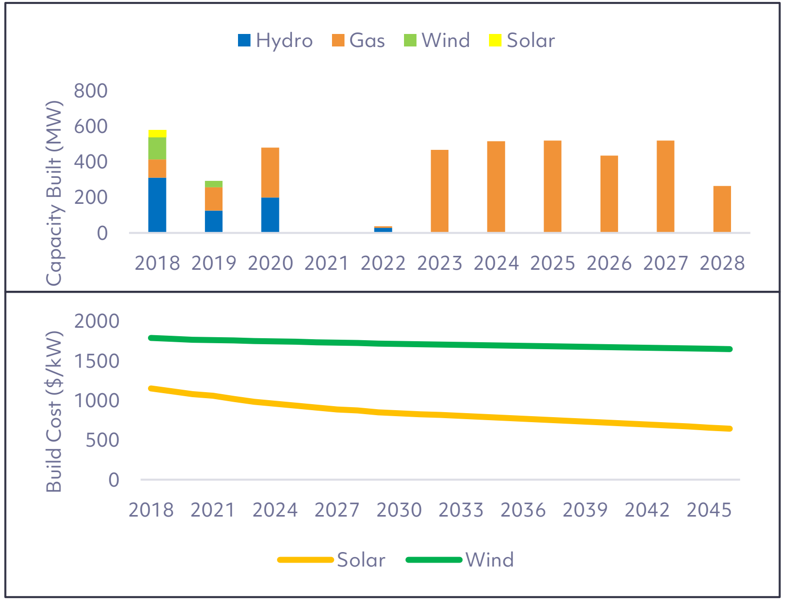
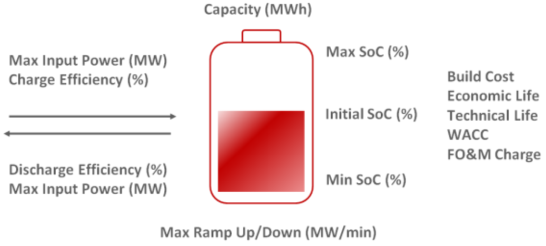
Expansion Planning





- It produces a generation and transmission expansion plan, answering what, when, and where to build.
- The simulator can account for declining build costs over time to represent emerging technologies such as wind and solar.
- The simulator can model battery storage and analyze, for example, when a solar + battery or wind + battery combination is beneficial for the system.

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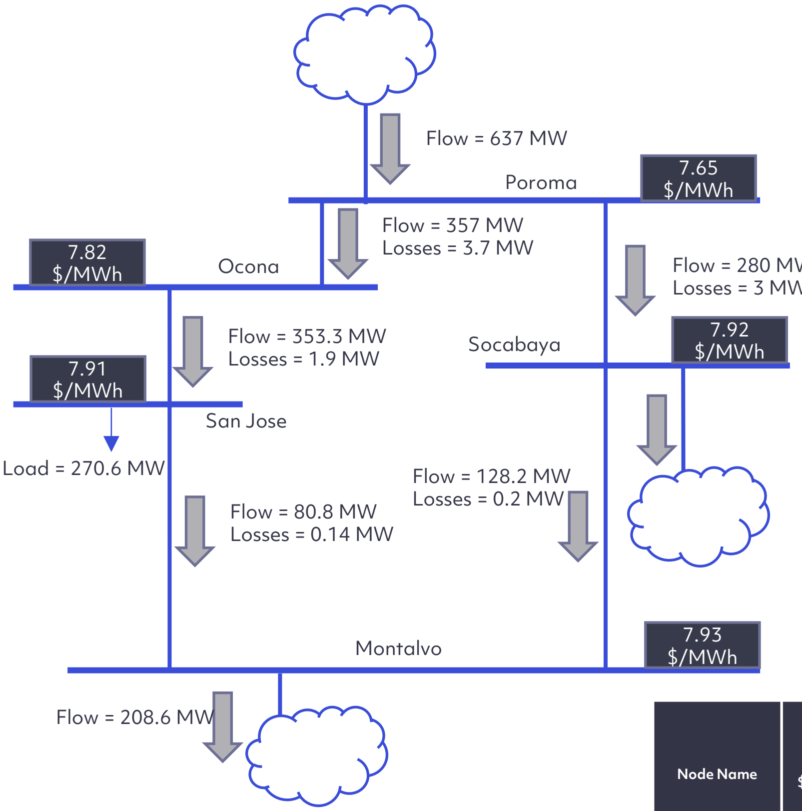
2/13. Transmission

Transmission

- PLEXOS includes a optimal DC power flow to solve economical dispatch.
- It can include security constraints N-X.
- There are several methods to include transmission losses and to formulate the OPF equations.
- It decompose locational marginal price in 3 components: Energy, congestion and losses.



Node Name	Price $/MWh	Energy Charge $/MWh	Congestion Charge $/MWh	Marginal Loss Charge $/MWh
Poroma	7.65	7.91	0	-0.26
Ocona	7.82	7.91	0	-0.09
Socabaya	7.92	7.91	0	0
San Jose	7.91	7.91	0	0
Montalvo	7.93	7.91	0	0.02

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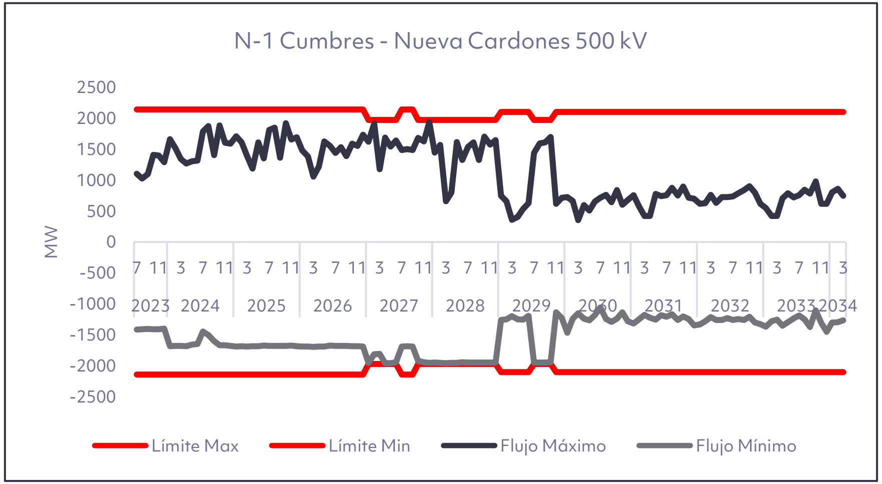
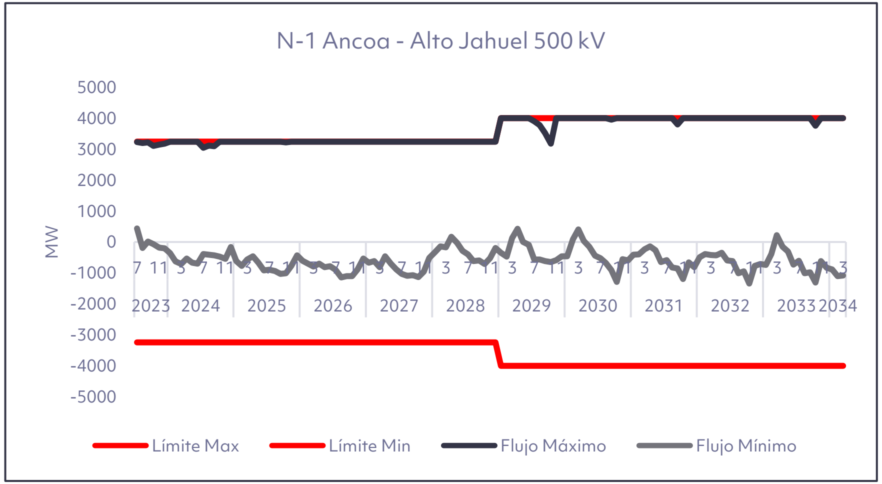
Transmission system

North



Center

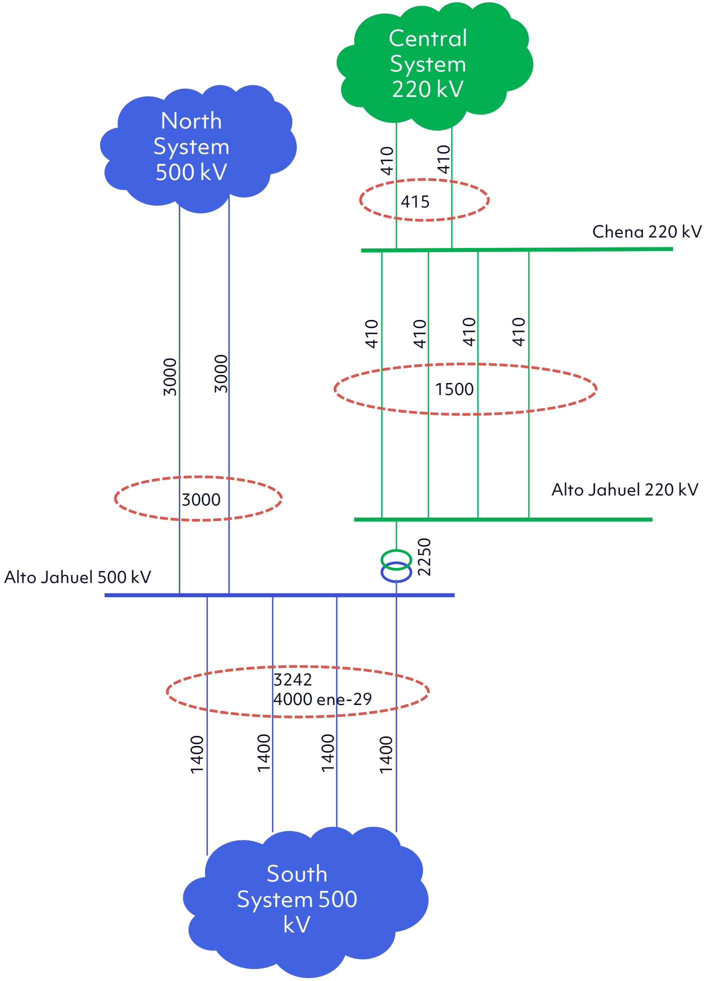


Transmission Security Constraints

- N-1 security constraints can be modelled using interface class.
- Represents aggregated transmission paths or interconnectors between zones or regions.

Can be assigned:

- Transfer limits (MW).
- Flow directions (uni- or bi-directional).



3/13. Hydro Thermal Coordination

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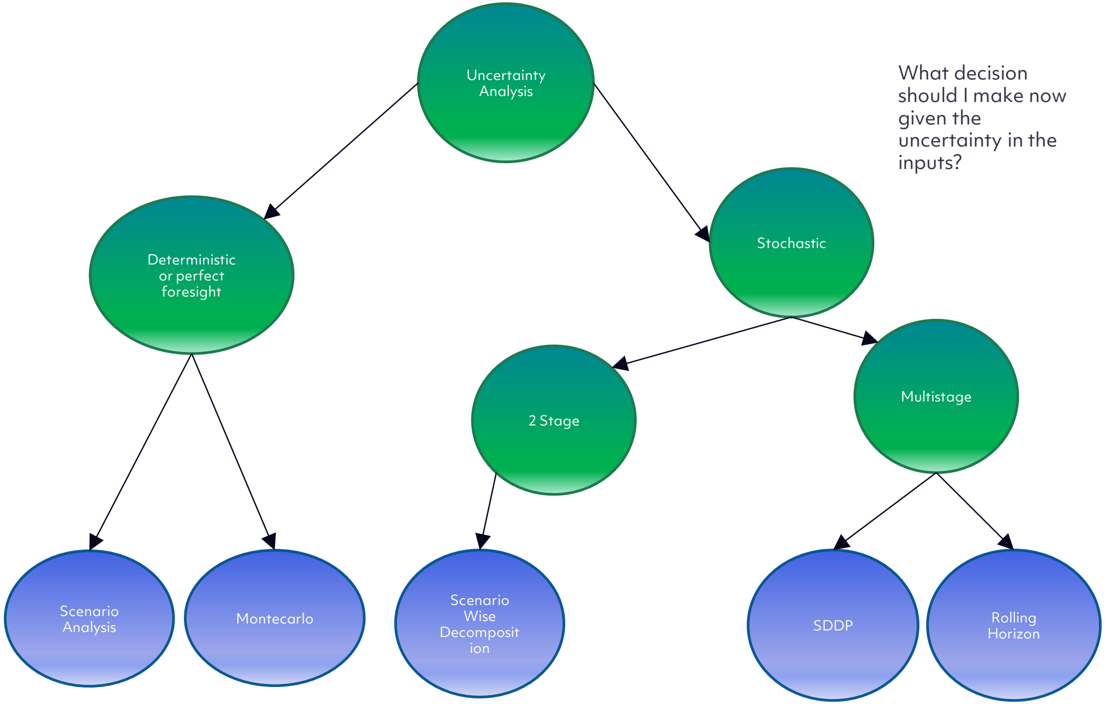
Hydro-Thermal Coordination

- Simple modelling representing hydro with capacity factors vs more complex modelling cascade system
- Cascaded reservoir modelling represents upstream–downstream interactions and energy value of stored water.
- Stochastic optimization captures inflow uncertainty across multiple hydrological scenarios.



What decision should I make now given the uncertainty in the inputs?

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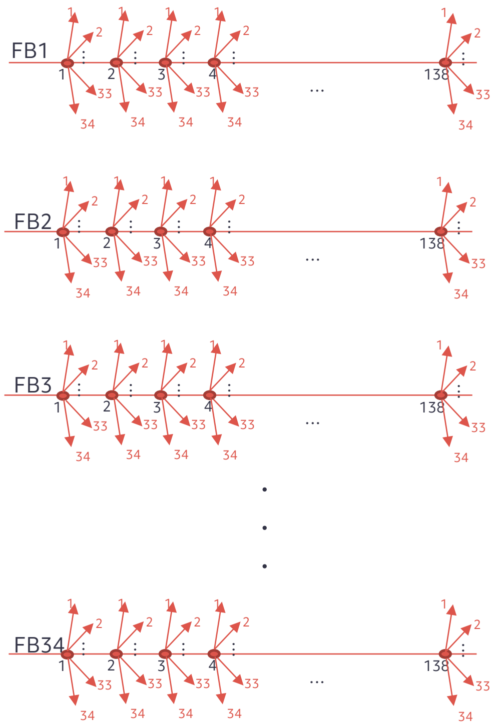
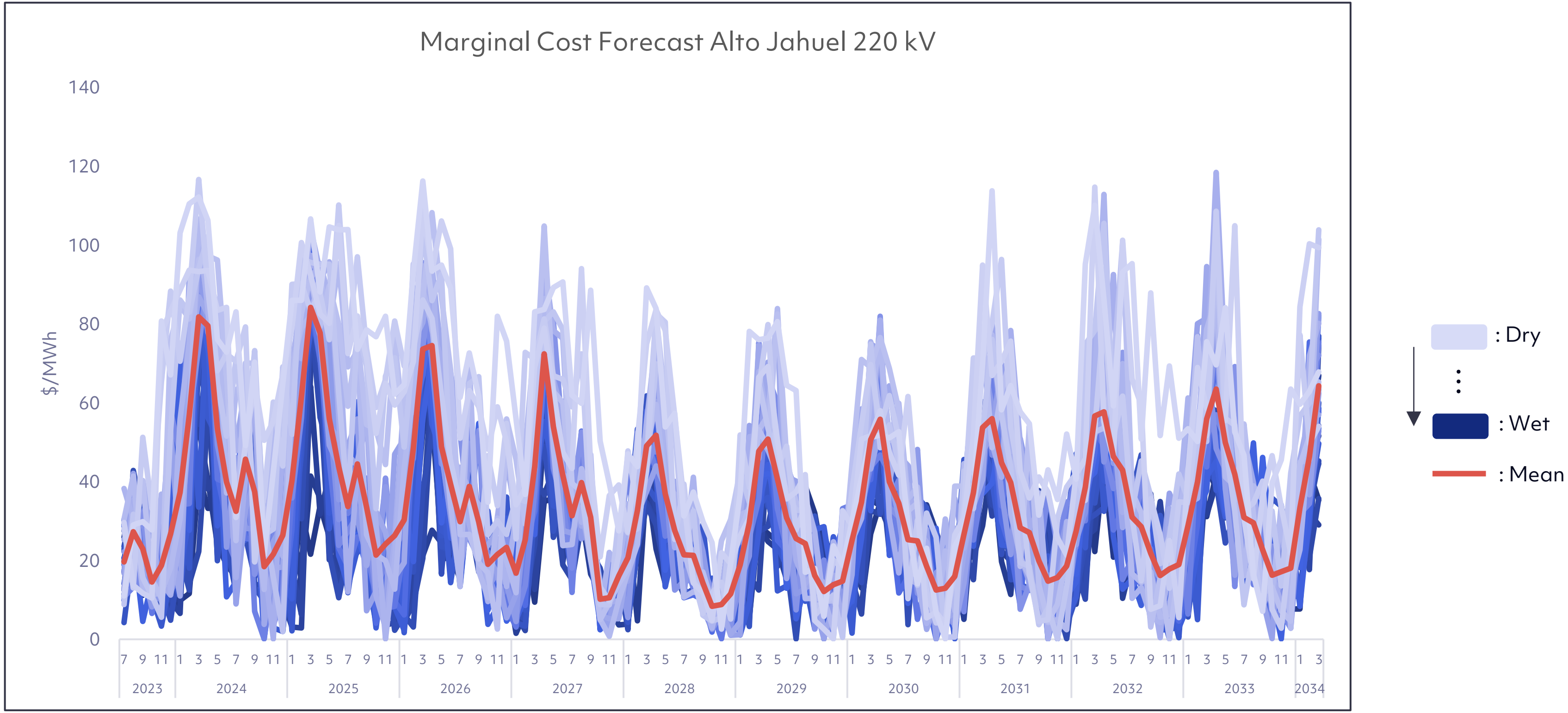
Example: Chile Power system

	# objects
Storages	11
Thermal Generators	291
Hydro Generators	193
Wind Generators	95
Solar Generators	908
Batteries	43
Nodes	227
Lines	533
Phase Shifters	3
Interfaces	132
Constraints	27
Natural Inflows	186
Wind profile	95
Solar profile	908

	Value
Horizon	10 years
Stages	Monthly
Number of stages	129
Block number per stage	24
Full branches	34
Hanging branches	34



Example: Price Forecasting



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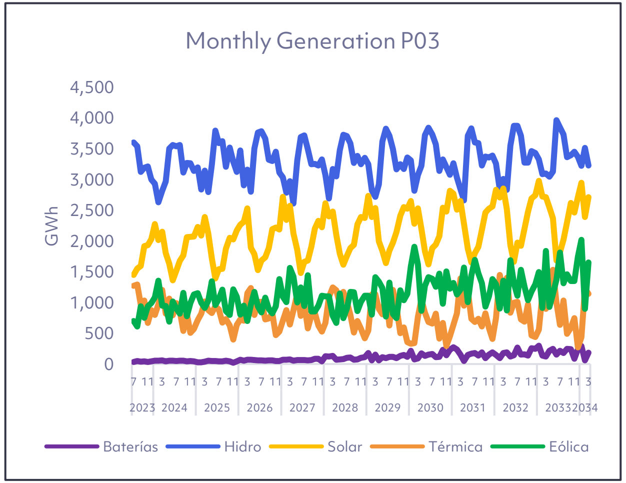
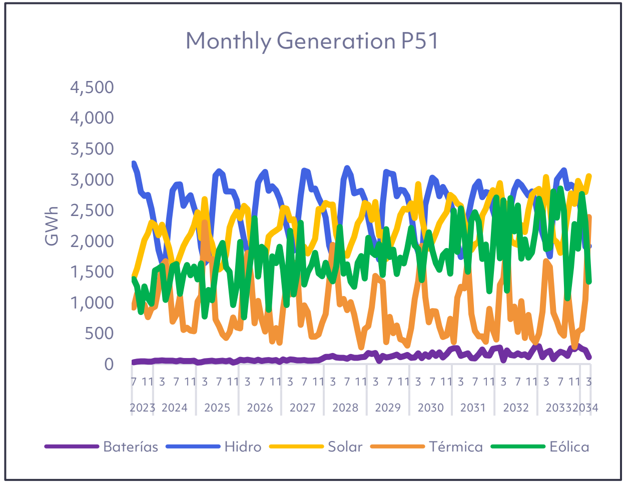
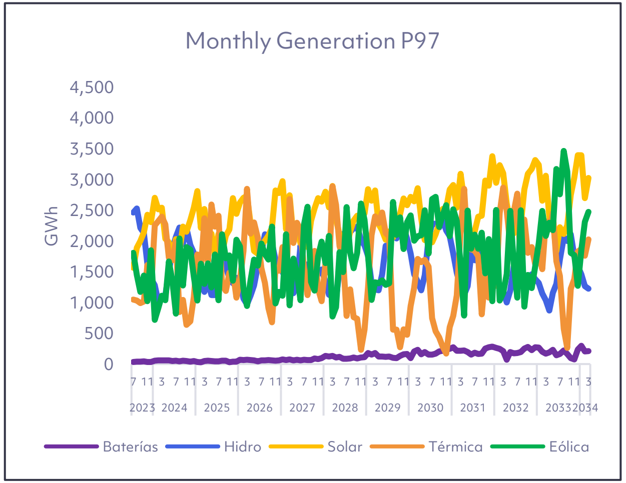
Example: Dispatch forecasting







Dry Condition

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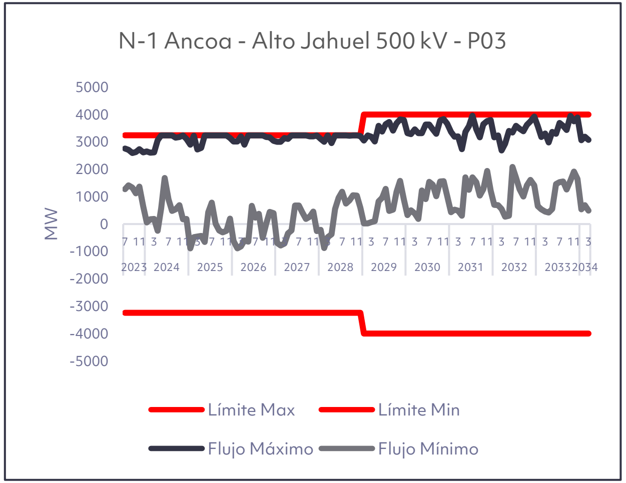
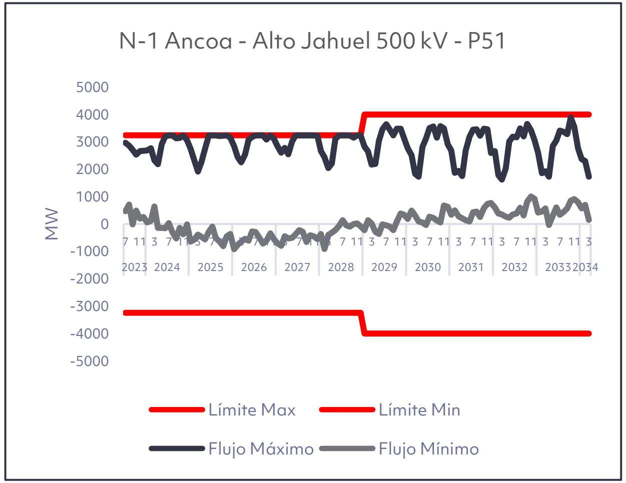
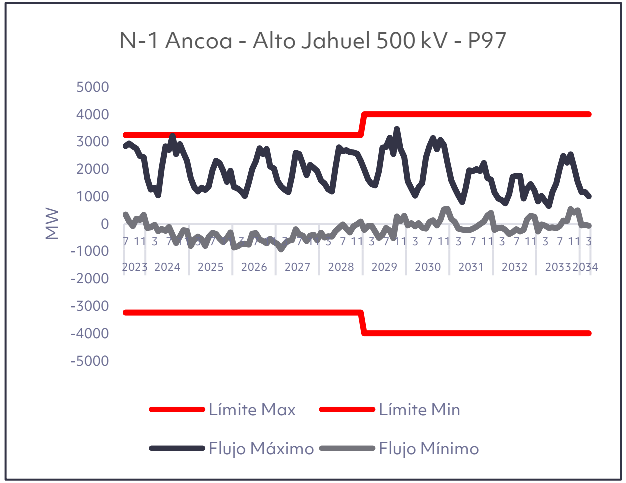
Example: Congestion Analysis







Dry Condition

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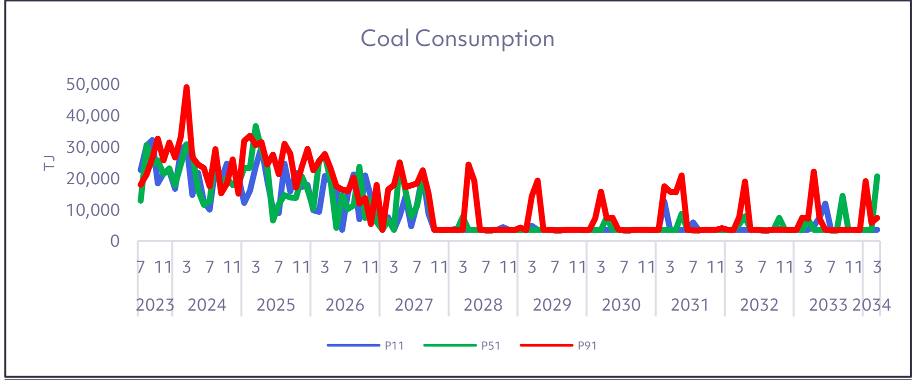
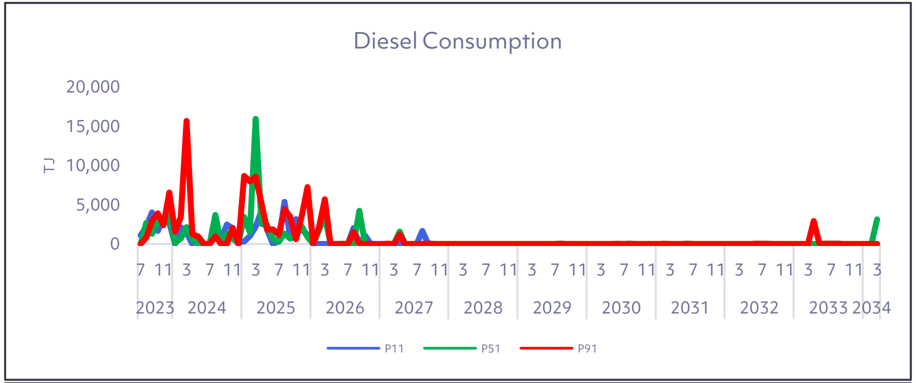
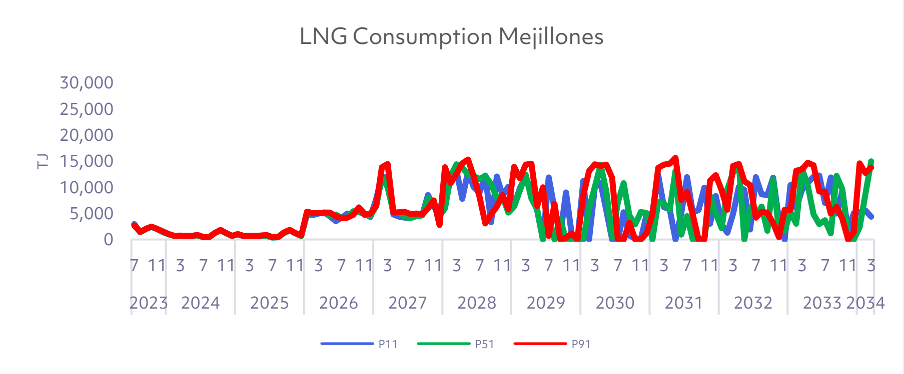
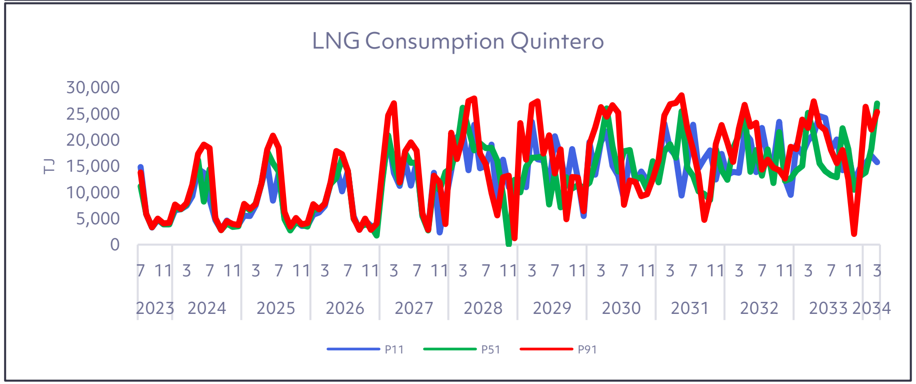
Example: Fuel Consumption









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4/13. Renewable Integration

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Renewable Integration

- Models solar, wind, and hybrid systems with chronological and stochastic variability.
- Captures forecast uncertainty and curtailment under network and market constraints
- Co-optimizes generation, storage, and transmission for least-cost operation.
- Evaluates flexibility and reserve requirements for variable renewables.

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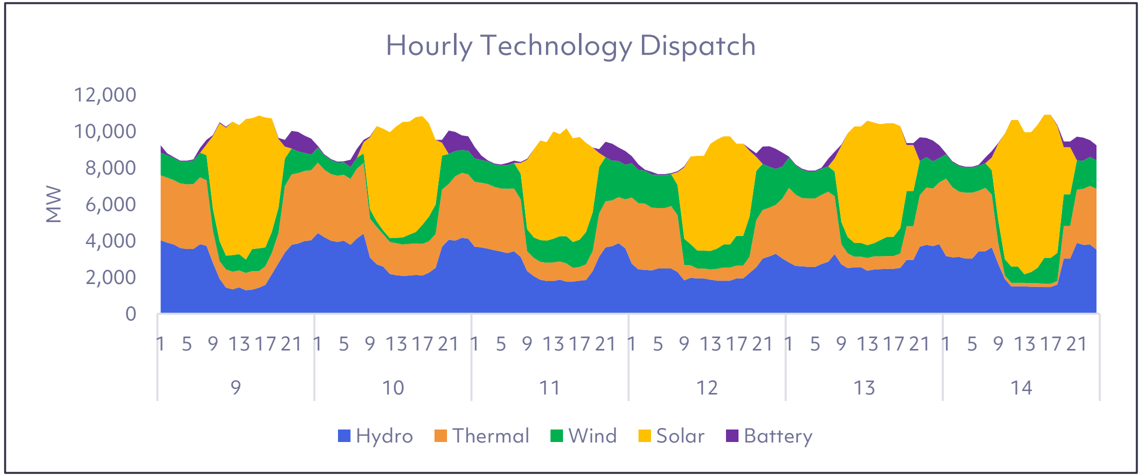
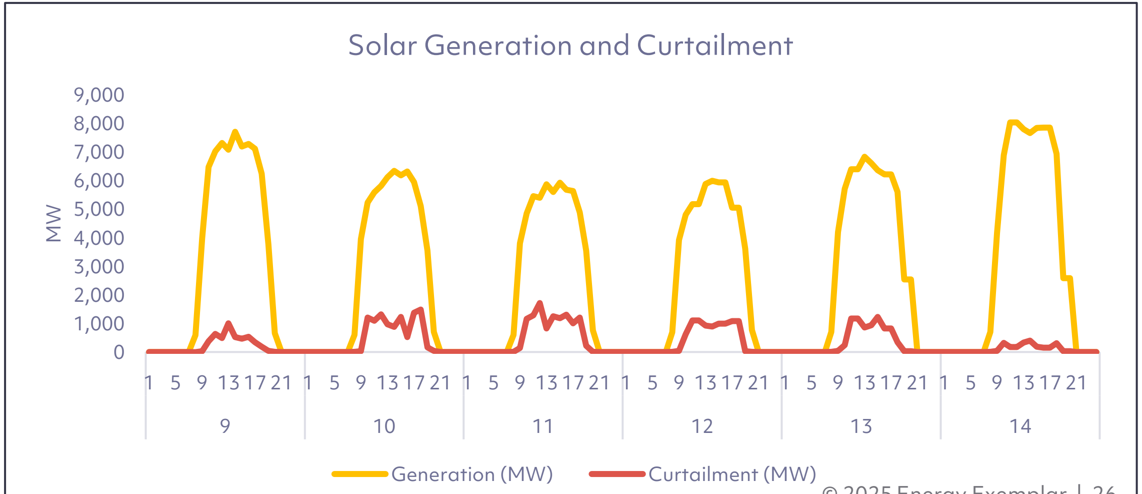
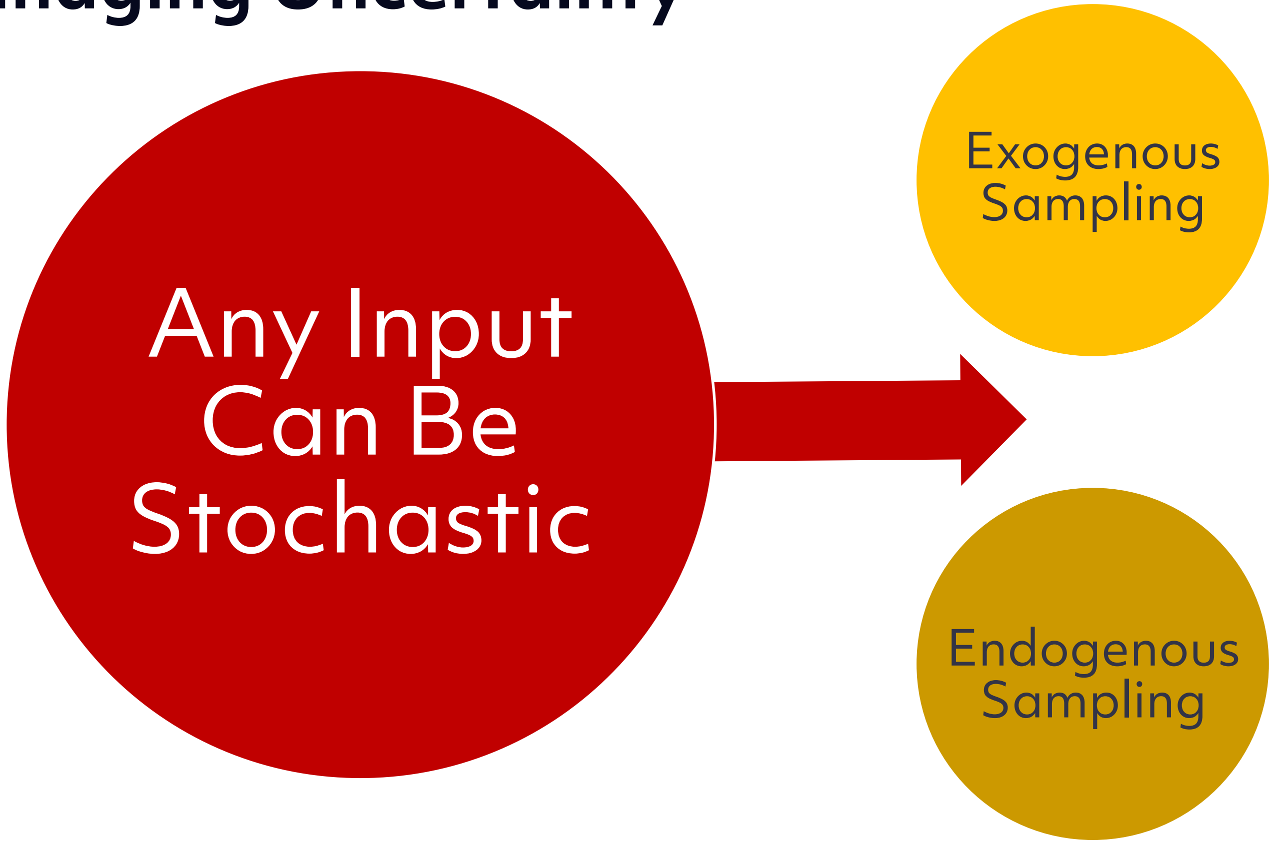
Example: Chile 9-14 October 2025





Managing Uncertainty

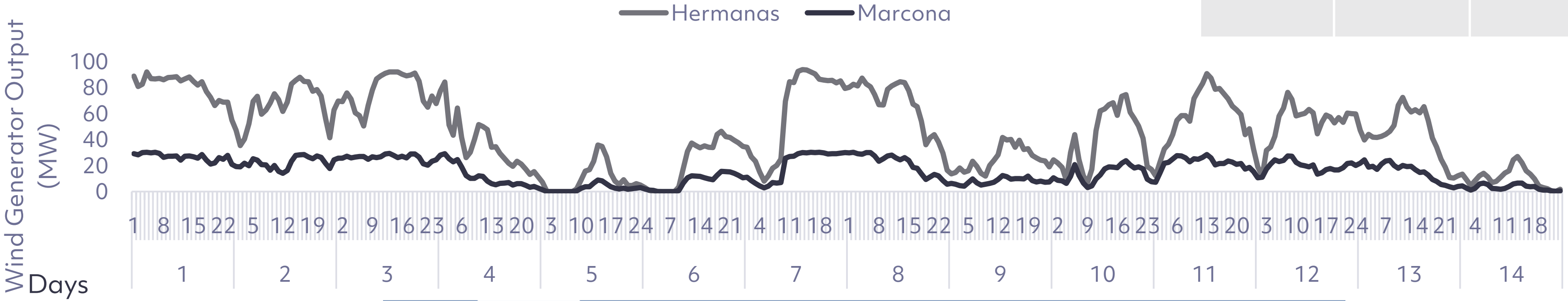


Example: Time series forecasting for Wind

Correlation Matrix:

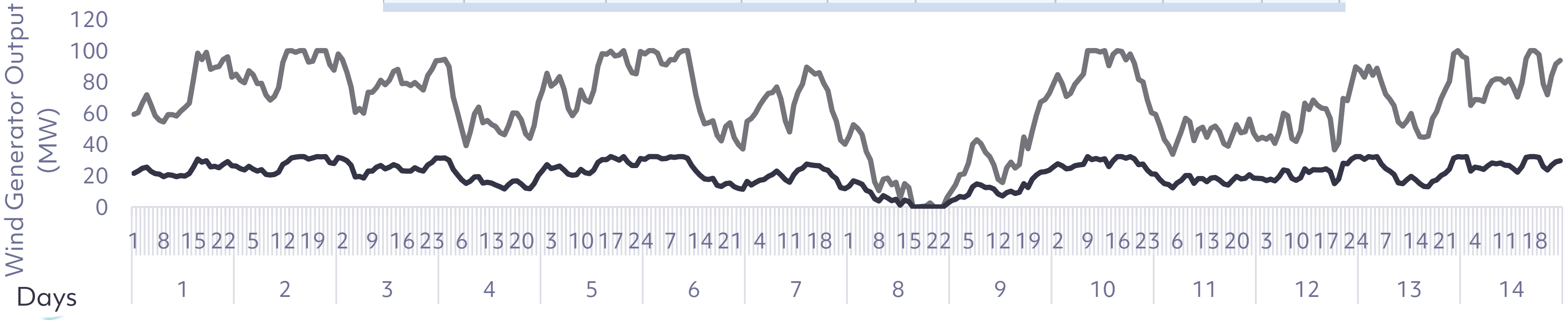
	Hermanas	Marcona
Hermanas	1	96.3
Marcona	96.3	1

Historical Wind Generator Output



Variable	Sampling Method	Distribution Type	Min Value	Max Value	Abs Error Std Dev	ARIMA alpha	ARIMA beta	ARIMA d
Hermanas	Auto	Normal	0	100	7.570997	0.9461	0.3157	0
Marcona	Auto	Normal	0	32.2	2.643483	0.9485	0.2325	0

Modelled Time Series



5/13. Storage Optimization

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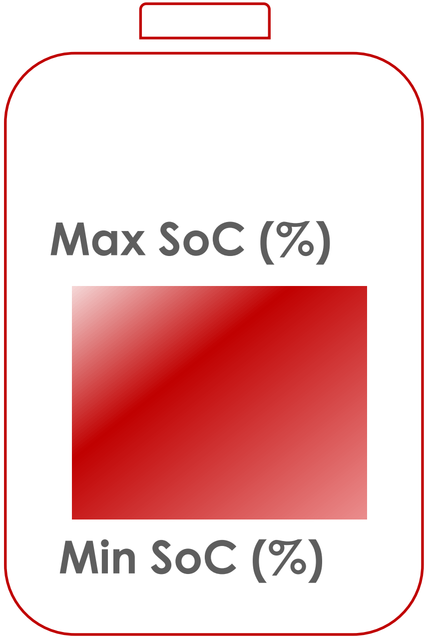
Battery

- Simulates electrochemical storage with full charge–discharge dynamics.
- Models state of charge, cycling limits, and degradation.
- Enables arbitrage, frequency regulation, and peak shaving.
- Supports renewable integration and grid flexibility.
- Integrated with LT Plan for sizing, duration, and technology selection.

Capacity (MWh)



- Max Input Power (MW)
- Max Ramp Up/Down (MW/min)
- Charge Efficiency (%)
- Discharge Efficiency (%)
- Max Cycles: Hour/Day/Week/Month/Year
- Capacity Degradation

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Hydro Storage

- Simulates reservoir and pumped hydro operations.
- Manages inflows, spillage, and storage levels.
- Supports time-shifting and grid flexibility.
- Co-optimizes with other assets and investment planning.

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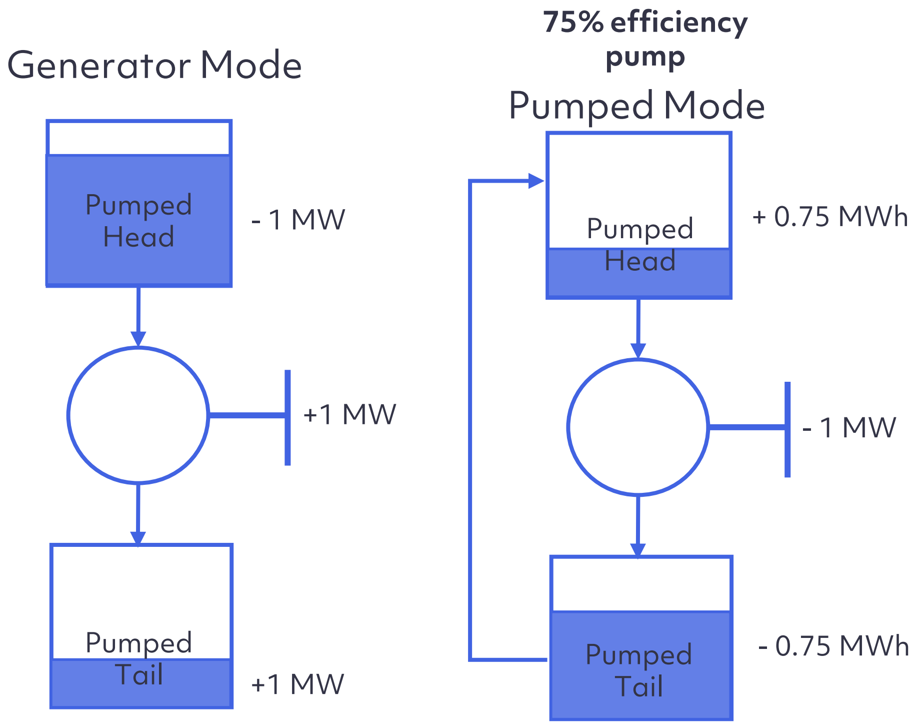
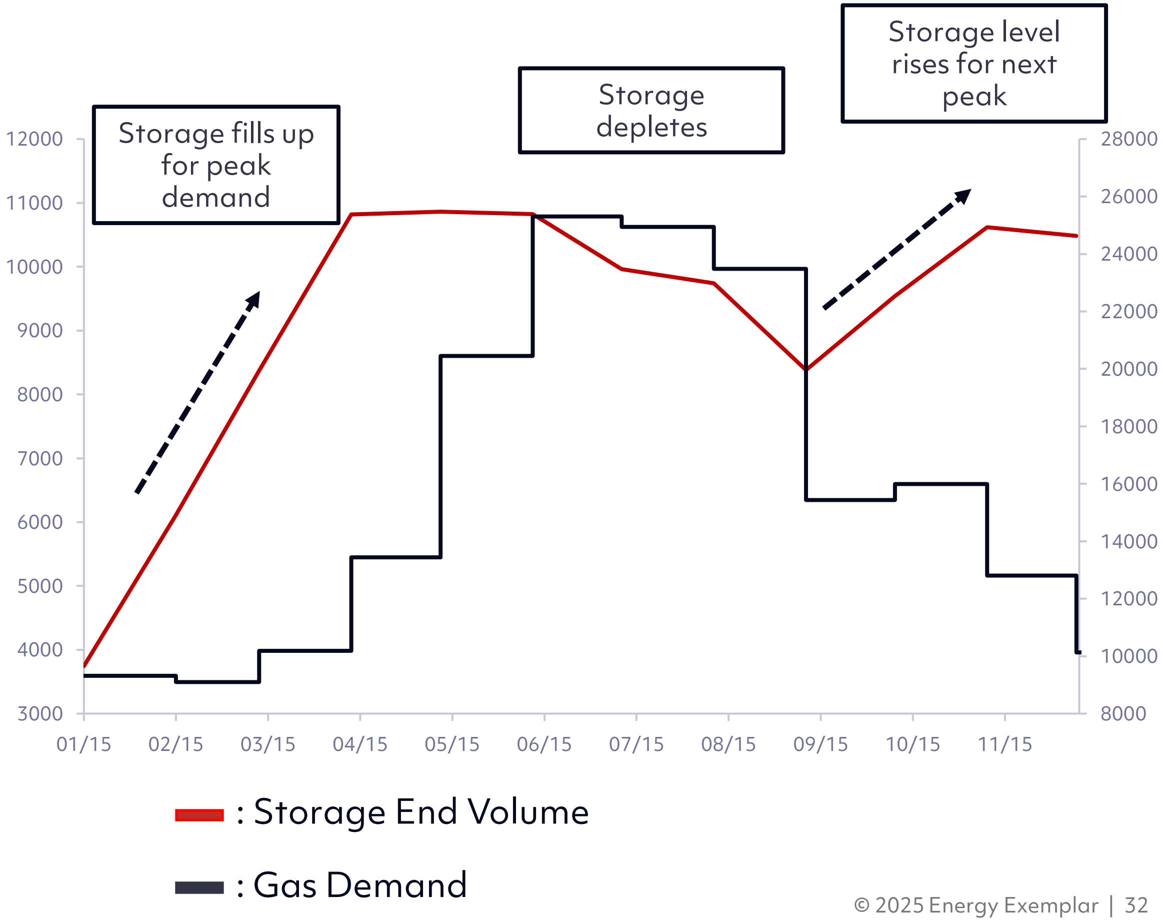
Example Pumped Storage



Gas Storage

- Models injection, withdrawal, and inventory of gas storage.
- Tracks flows, levels, and losses for operational accuracy.
- Enables load shifting and seasonal balancing to cut costs.
- Improves reliability under network constraints.
- Integrated with LT Plan for optimal sizing and siting.
- Supports long-duration gas supply.



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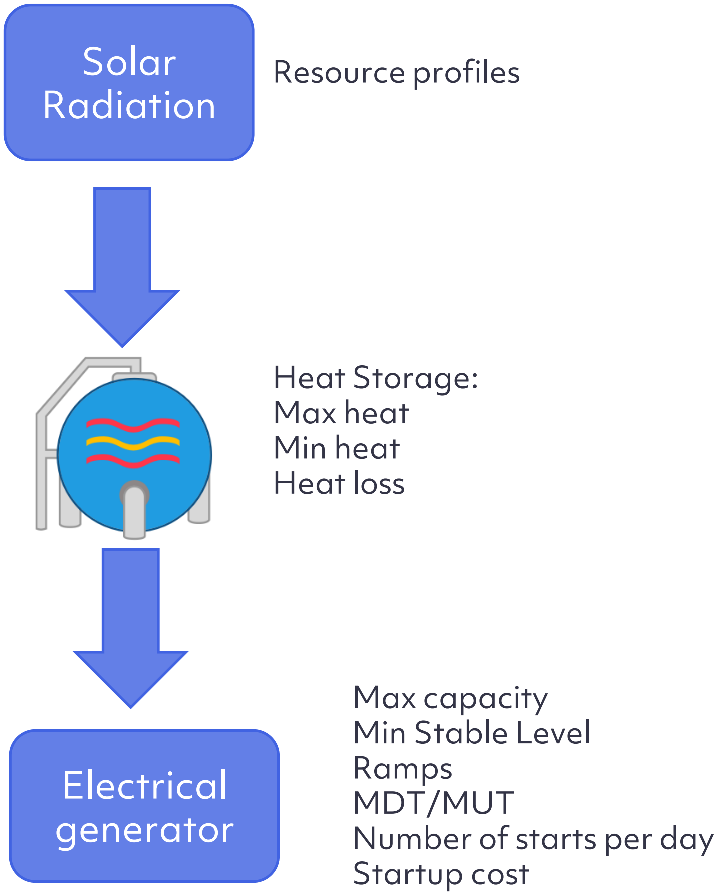
Heat Storage

- Simulates charging, discharging, and thermal storage dynamics.
- Tracks state of charge, losses, and constraints.
- Enables heat time-shifting: store when cheap or unused, release during peak needs.
- Integrated with LT Plan for optimal sizing, siting, and valuation.

Example: CSP



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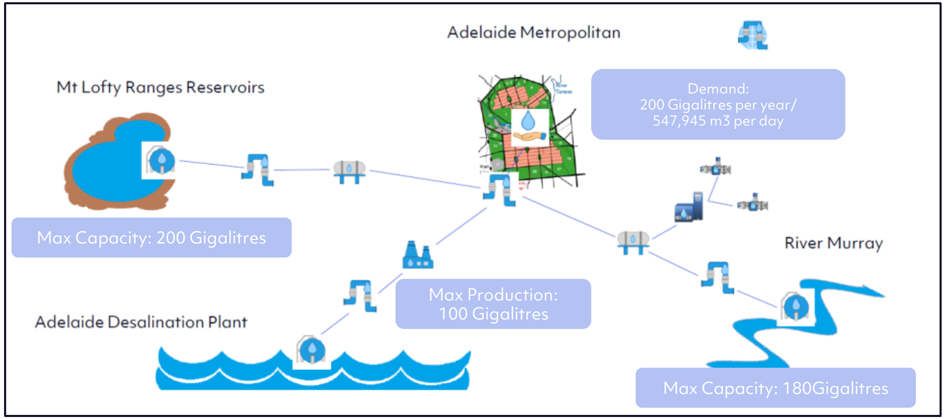
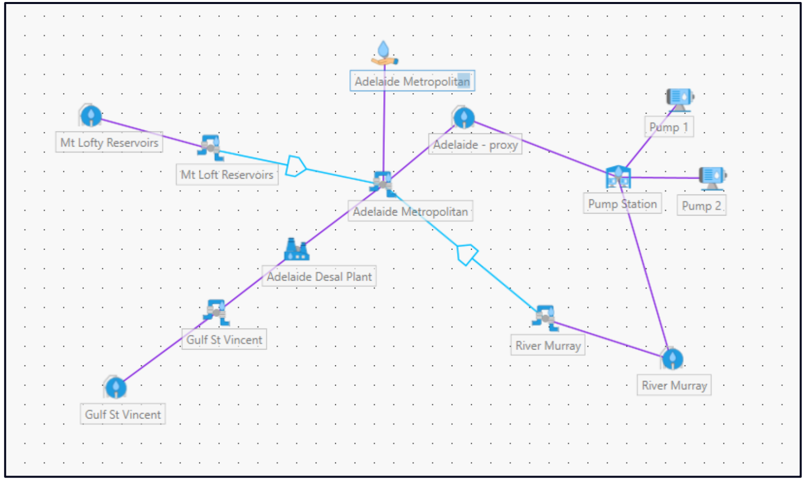
Water Storage

- Simulates water storage and release in reservoirs and tanks.
- Tracks flows, constraints, and losses over time.
- Enables intertemporal water management across sectors.
- Integrated with LT Plan for optimal sizing and planning.





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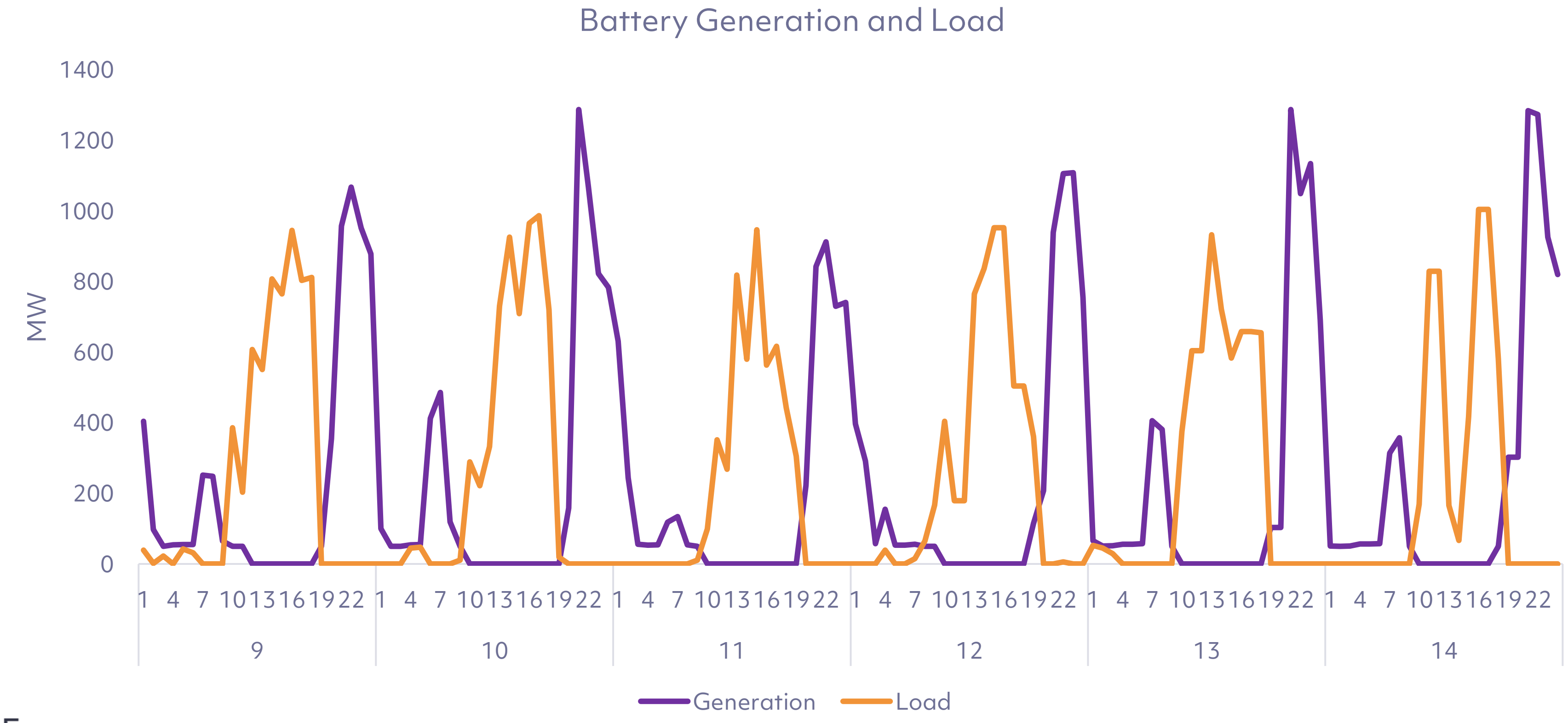
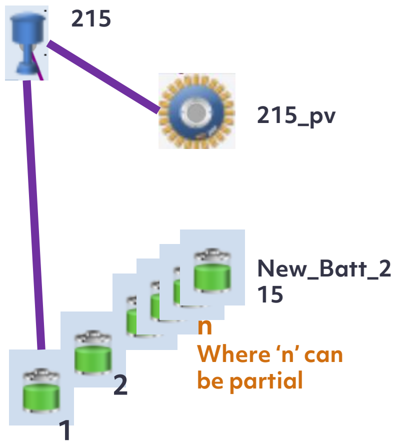
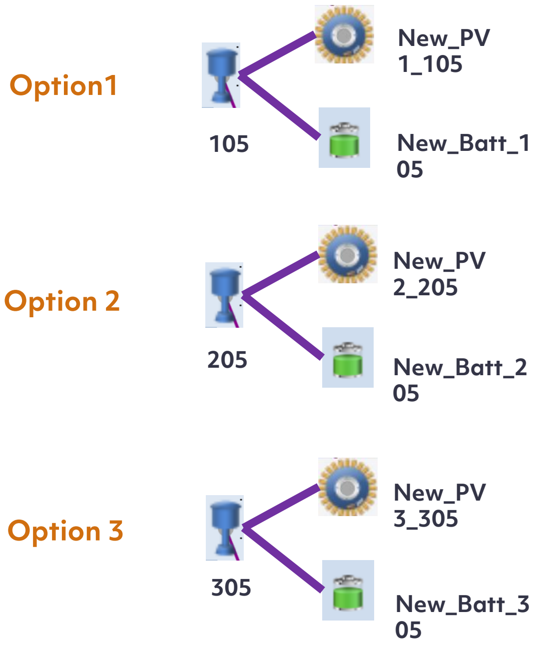
Example: Battery dispatch



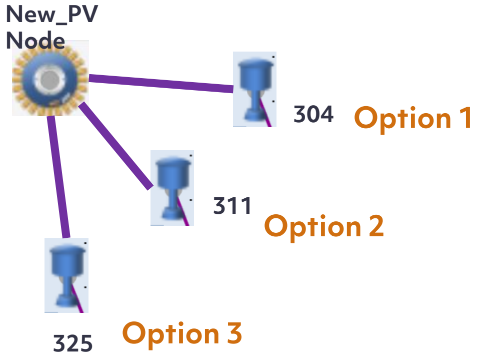
Example: Battery + PV Location



Optimized energy storage sizes when pairing with Solar PV



Location and siting optimization of PV + storage



PV Siting Optimization

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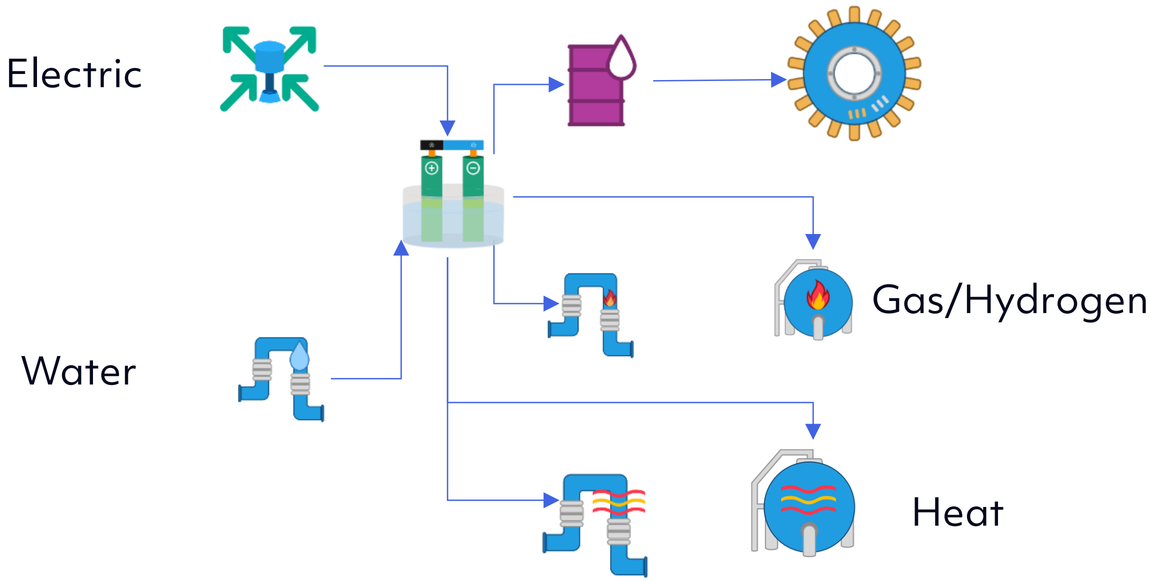
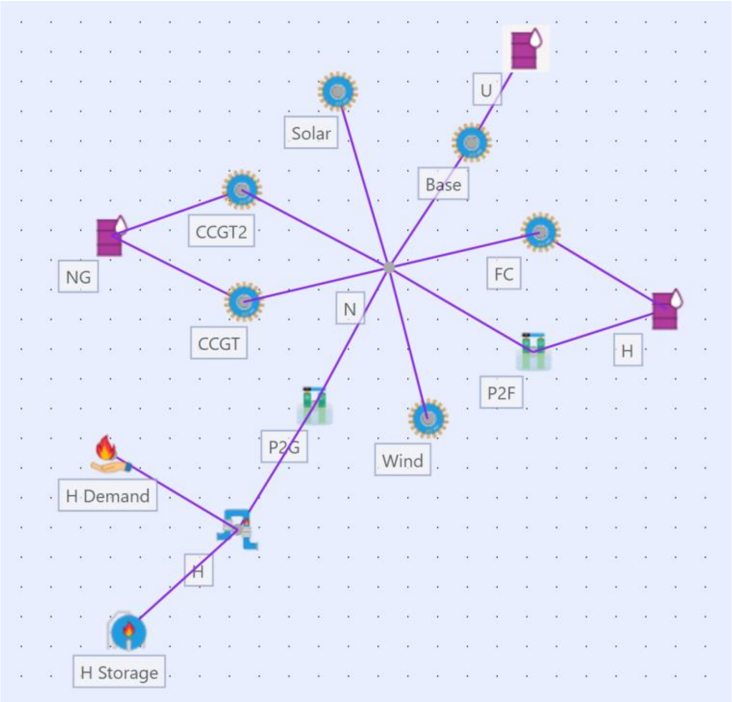
6/13. Hydrogen

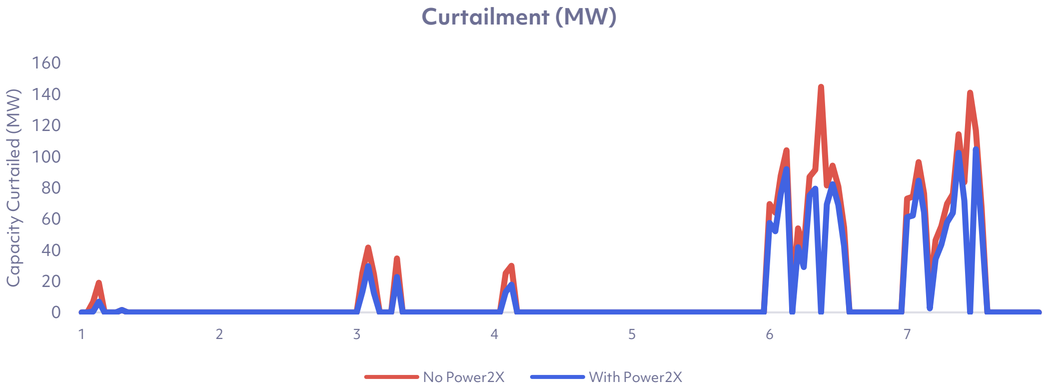
Power2X

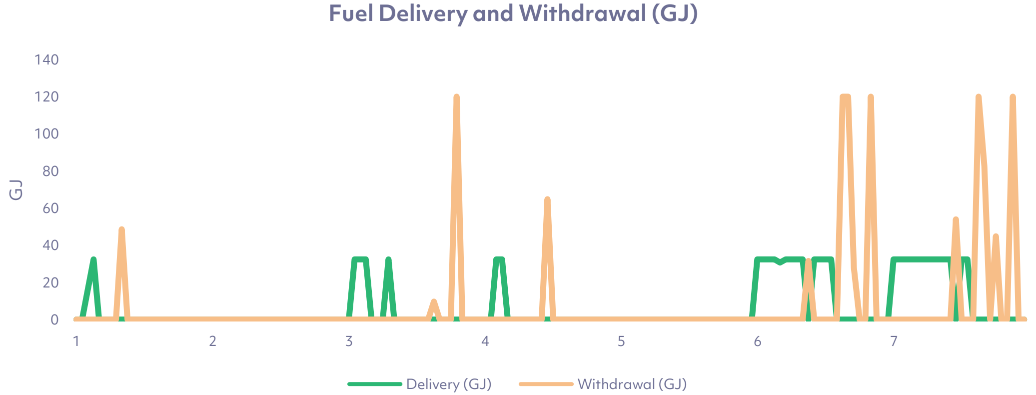
- Converts electrical power to other products such as hydrogen.
- Power2X acts as a load on the electric system.
- Power2X connects the electric, gas water and heat systems



Power2X: Example







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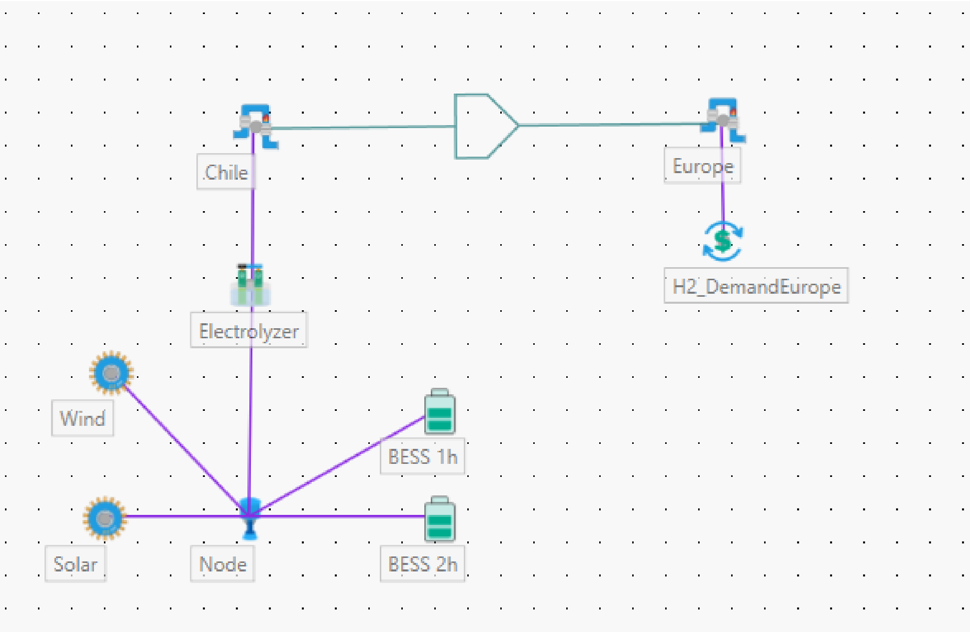
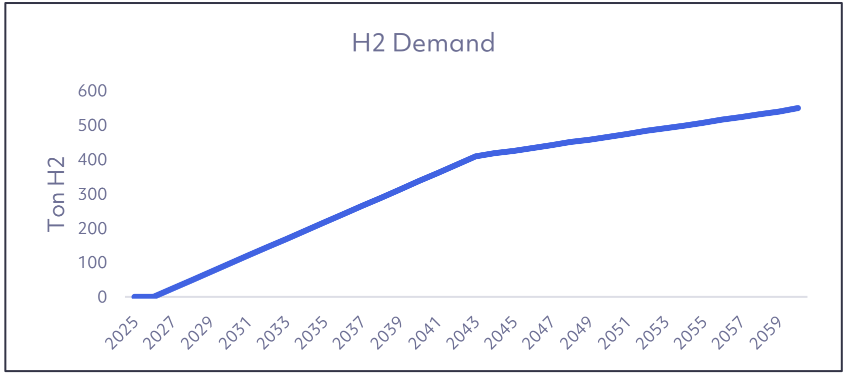
Investment Case – Optimal H2 Production Size:



Candidates. Find when to invest and optimal size of:

- BESS 1 and 2 hours
- Solar and wind power plants
- Electrolyser

With the aim to supply a growing H2 demand



Price range of 2 – 3 $/kg H2

Case Study Input Parameters

Wind and solar:

- Renewable Profiles
- Power degradation
- Build Cost
- Economic Life
- WACC
- Max Units Built in Year

Batteries:

- Capacity (MWh)
- Max Power (MW)
- Max/Min State of Charge (%)
- Charge/Discharge eff (%)
- Build Cost
- Economic Life
- WACC
- Max Units Built in Year

Electrolyser:

- Max Load (MW)
- FO&M Charge
- Efficiency (%)
- Build Cost
- Economic Life
- WACC
- Max Units Built in Year

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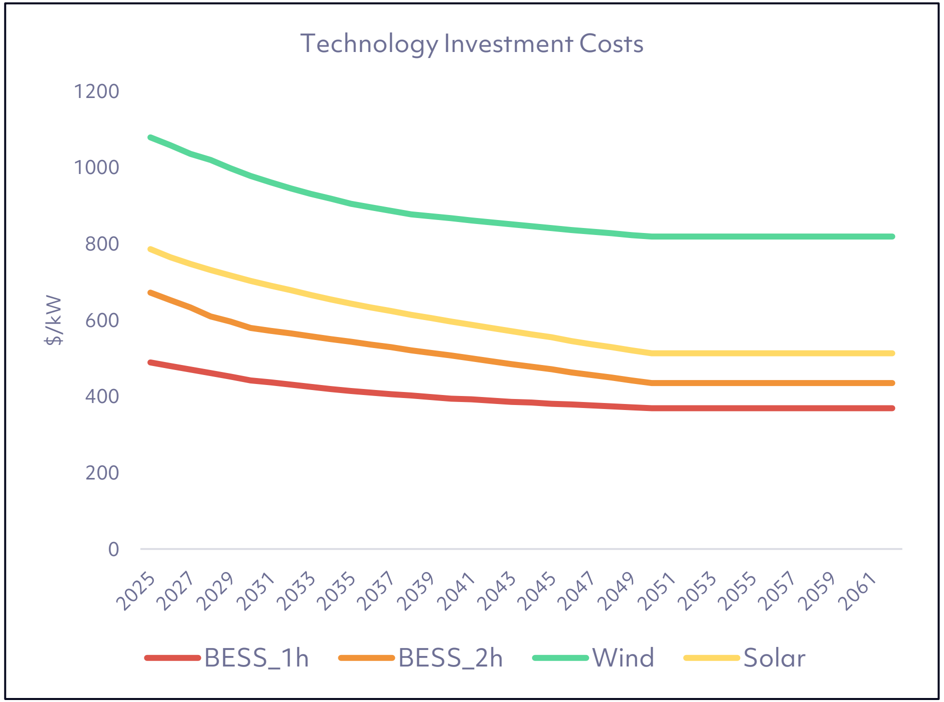
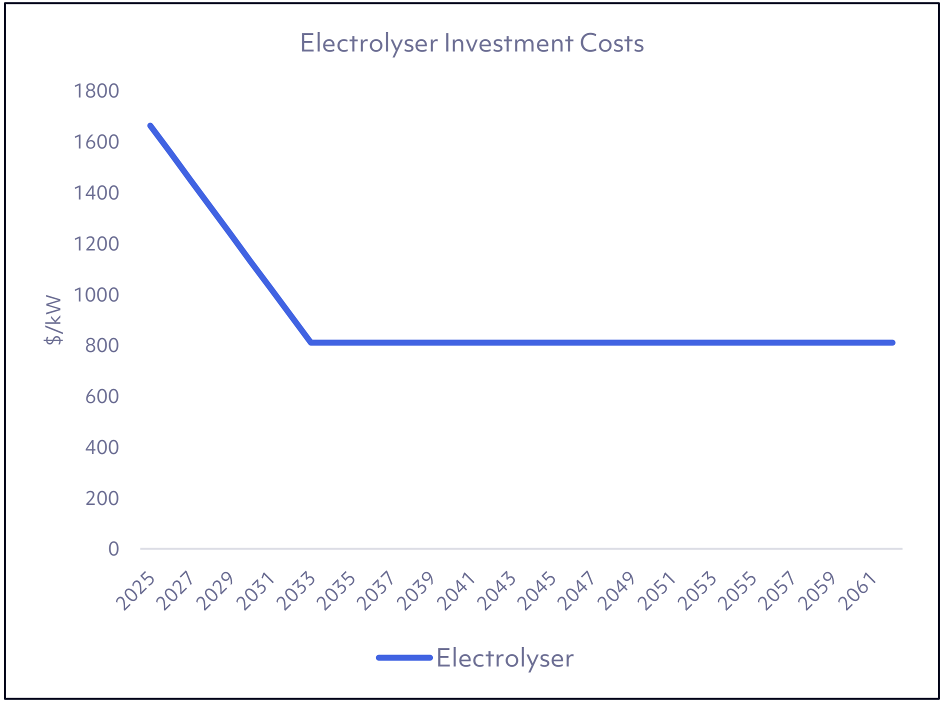
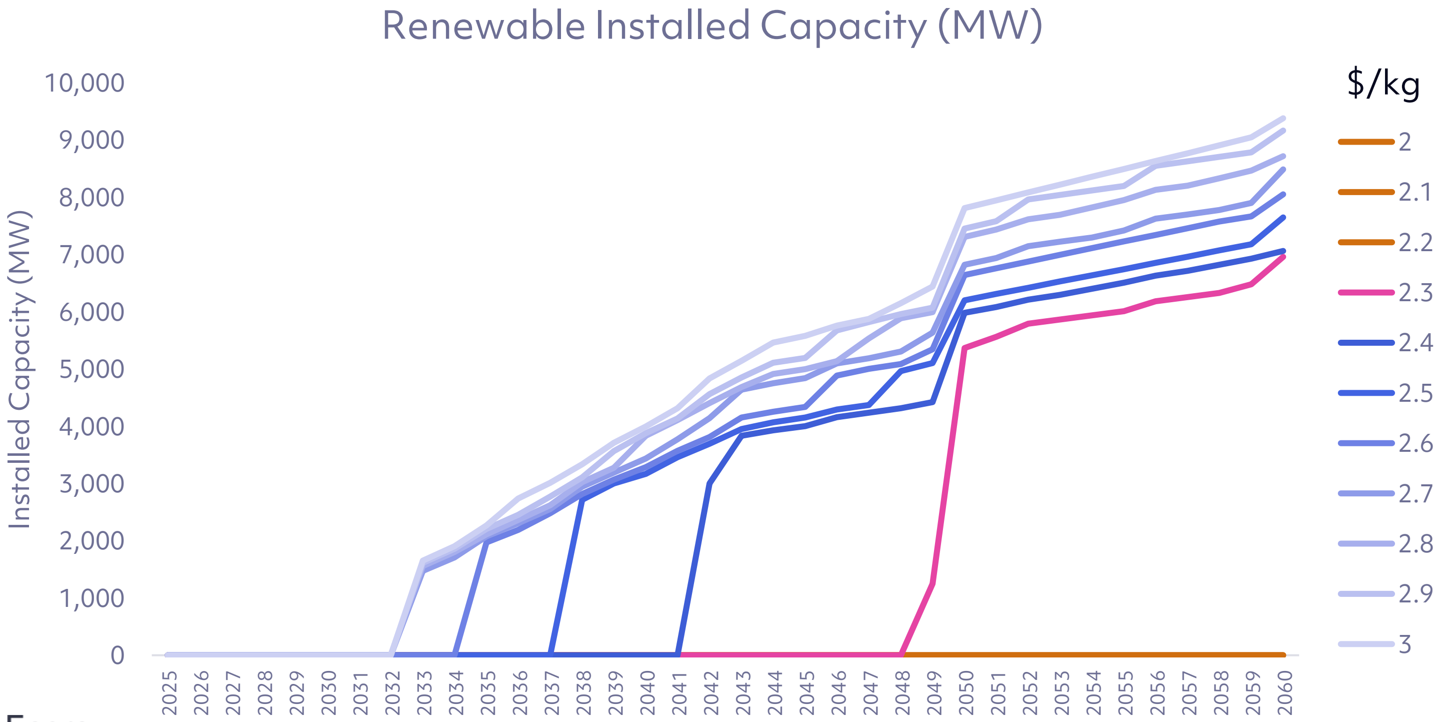
Assumptions: Investment Costs





Results:

Under the described assumptions, it is profitable to start investing from $2.3/kg H2



$/kg	$/GJ
2	16.68
2.1	17.51
2.2	18.34
2.3	19.18
2.4	20.01
2.5	20.85
2.6	21.68
2.7	22.51
2.8	23.35
2.9	24.18
3	25.01

Hydrogen (LHV): 119.93 GJ/Ton

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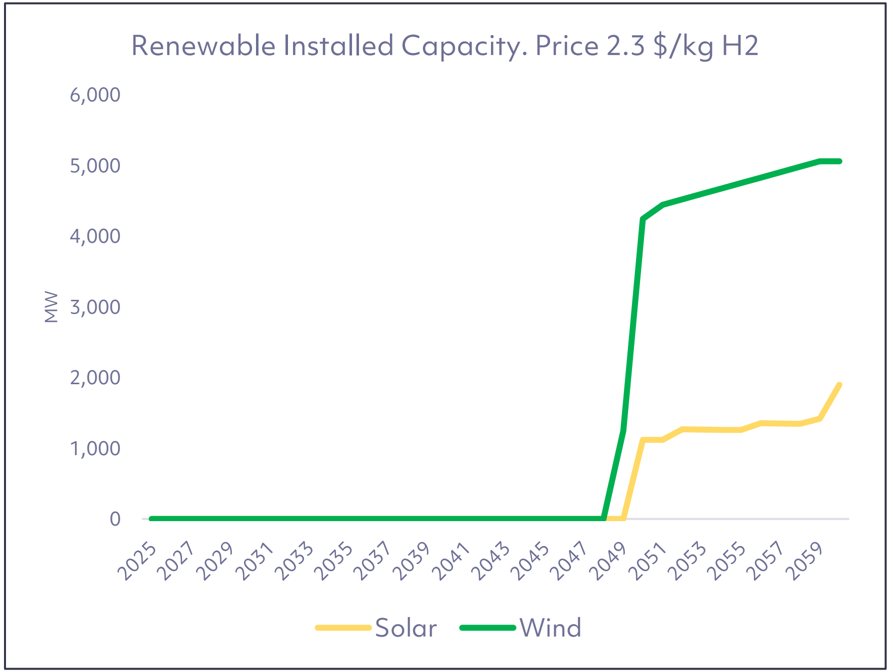
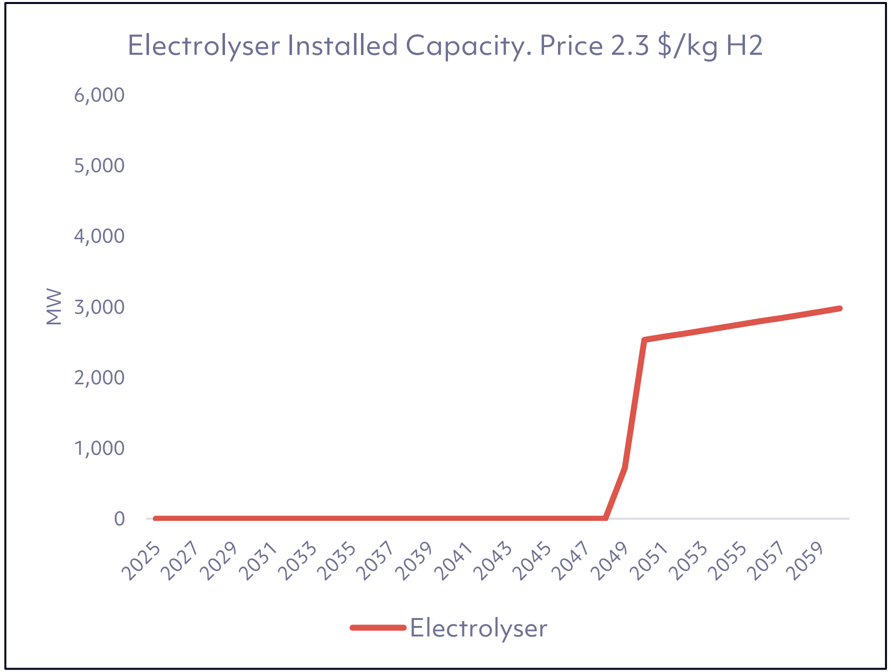
Results:





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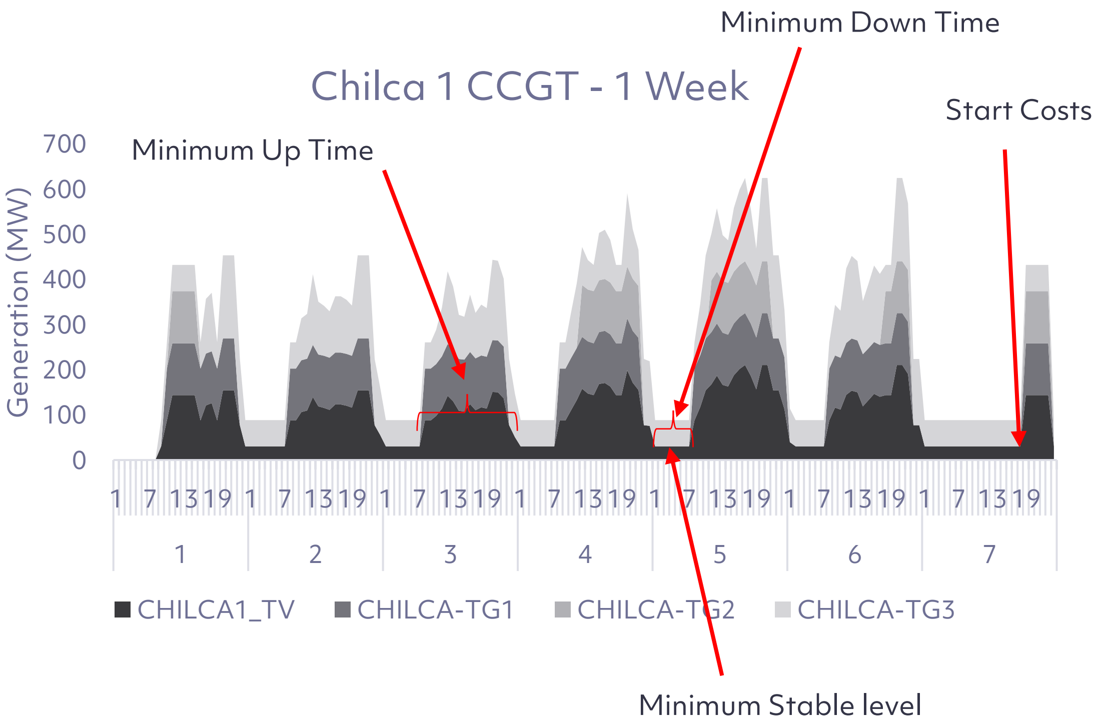
7/13. Short Term Bidding & Short Term Dispatch

Energy Exemplar

Market Bidding & Short Term Dispatch

- Simulates day-ahead and real-time market operations with chronological precision.
- Models unit commitment, economic dispatch, and price formation at nodal or zonal levels.
- Allows cost-based, bid-based, or hybrid market representations
- Enables strategic bidding analysis for generators and portfolio optimization.
- Captures forecast uncertainty in demand, renewables, and prices for risk assessment.



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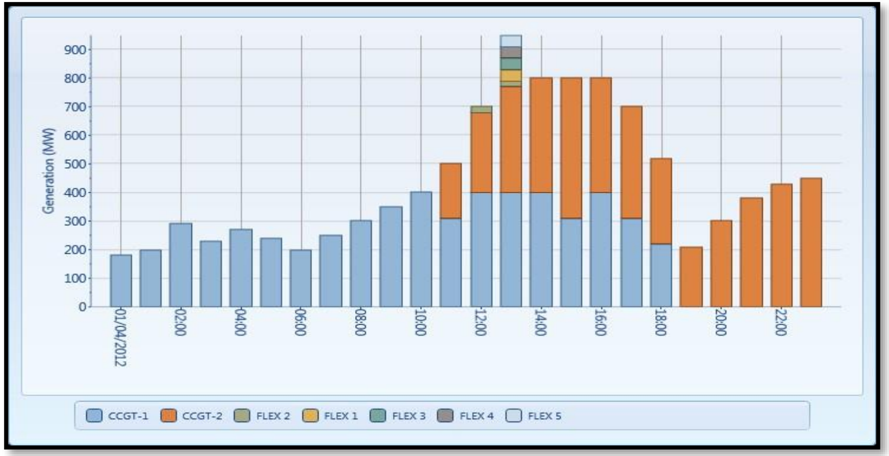
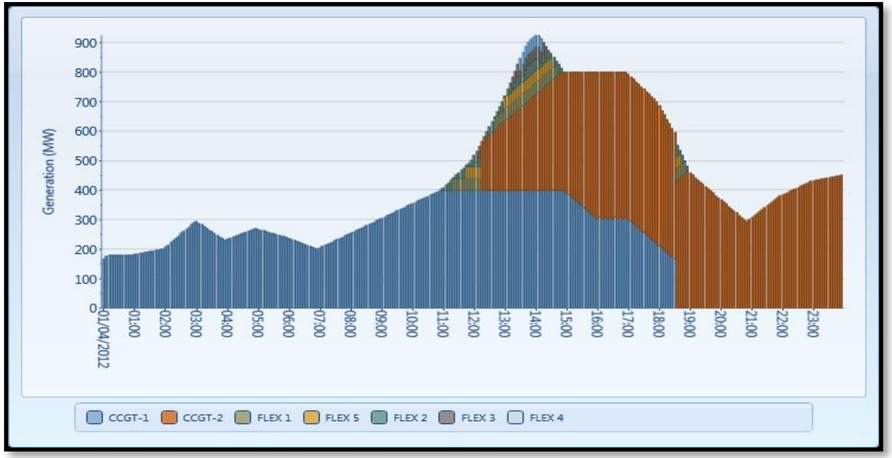
Case Studies. Sub Hourly Modelling

How to evaluate impact in sudden changes that can only be covered by flexible units?

Generation Dispatch: Hourly



Generation Dispatch: 5 Minute Basis



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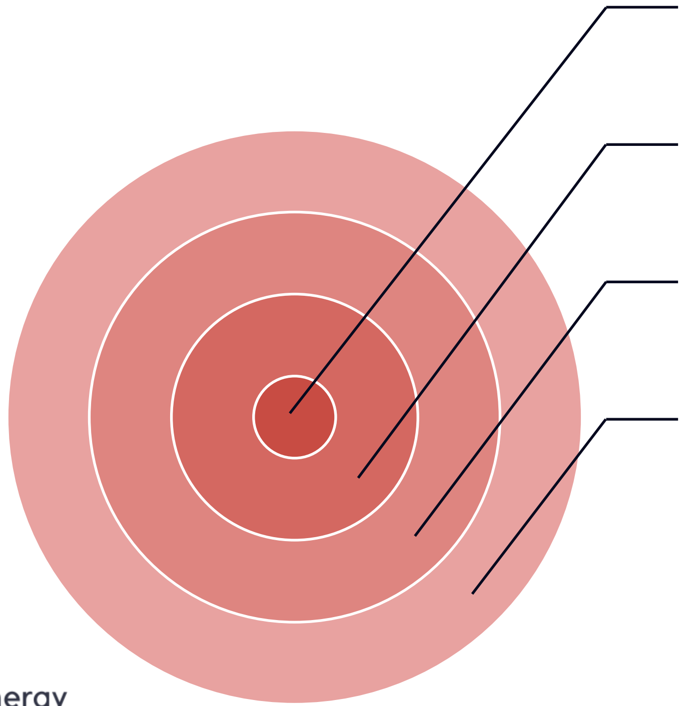
Ancillary Services Modelling



Type
- Regulation
- Spinning
- Non-spinning

**Timefra
me**

Duration

Risk
- Static
- Dynamic

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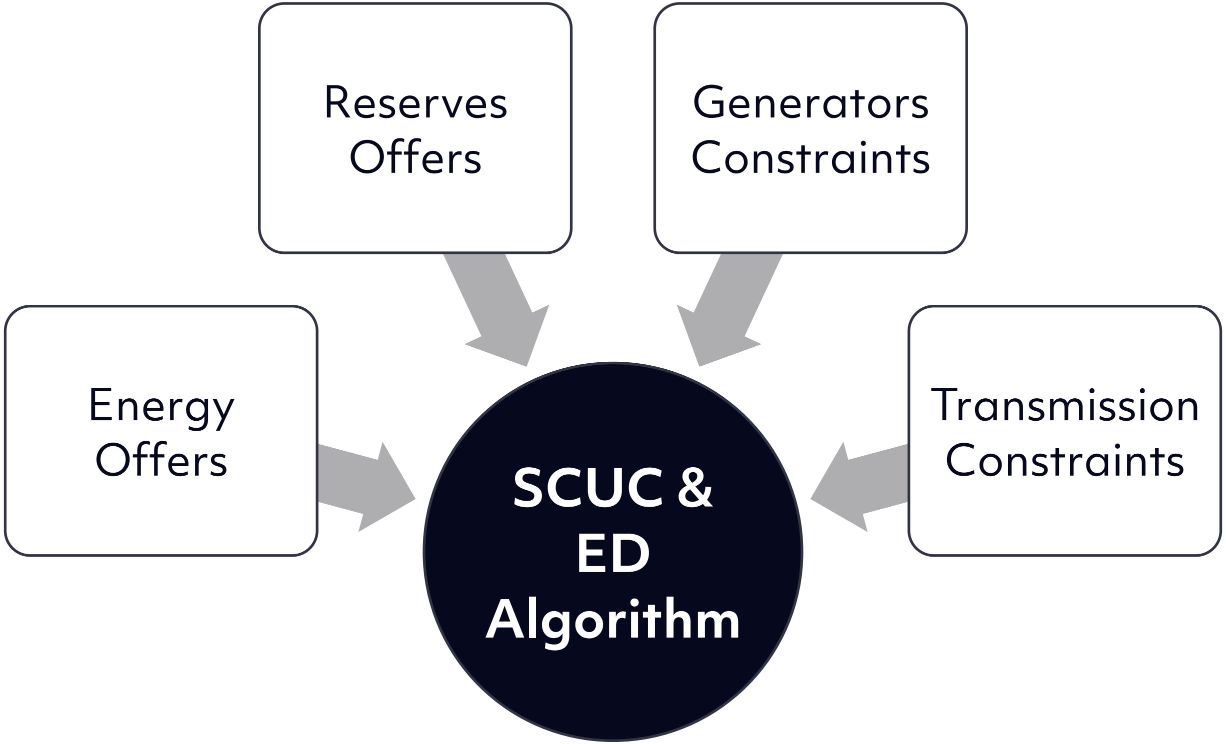
Energy & Reserves Co-optimisation

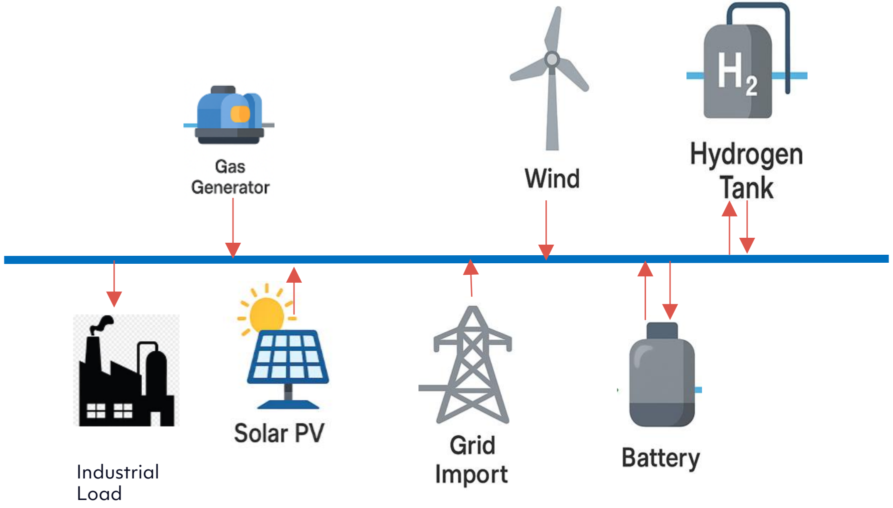


Energy and Reserves Dispatch Example

8/13. Behind the meter: Microgrids

Microgrids Modelling

- Co-optimizes distributed assets for cost, reliability, and resilience.
- Integrates renewables, storage, and hydrogen to cut emissions and costs.
- Balances energy independence with grid interaction.



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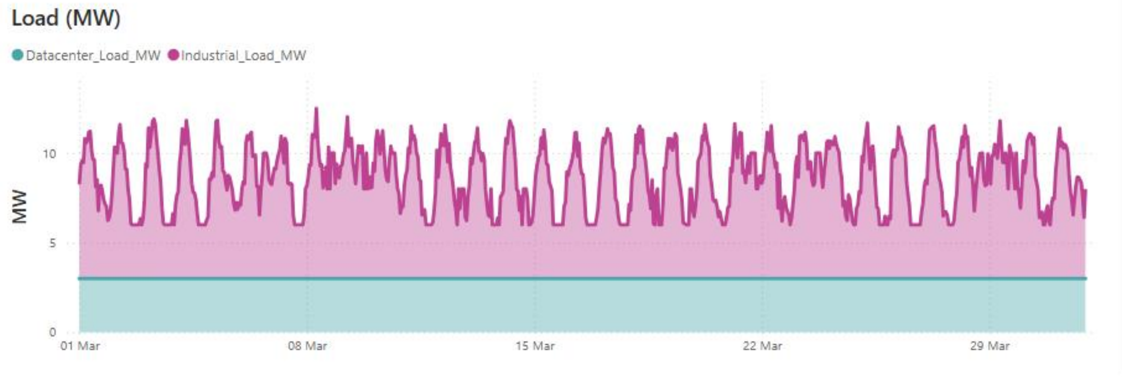
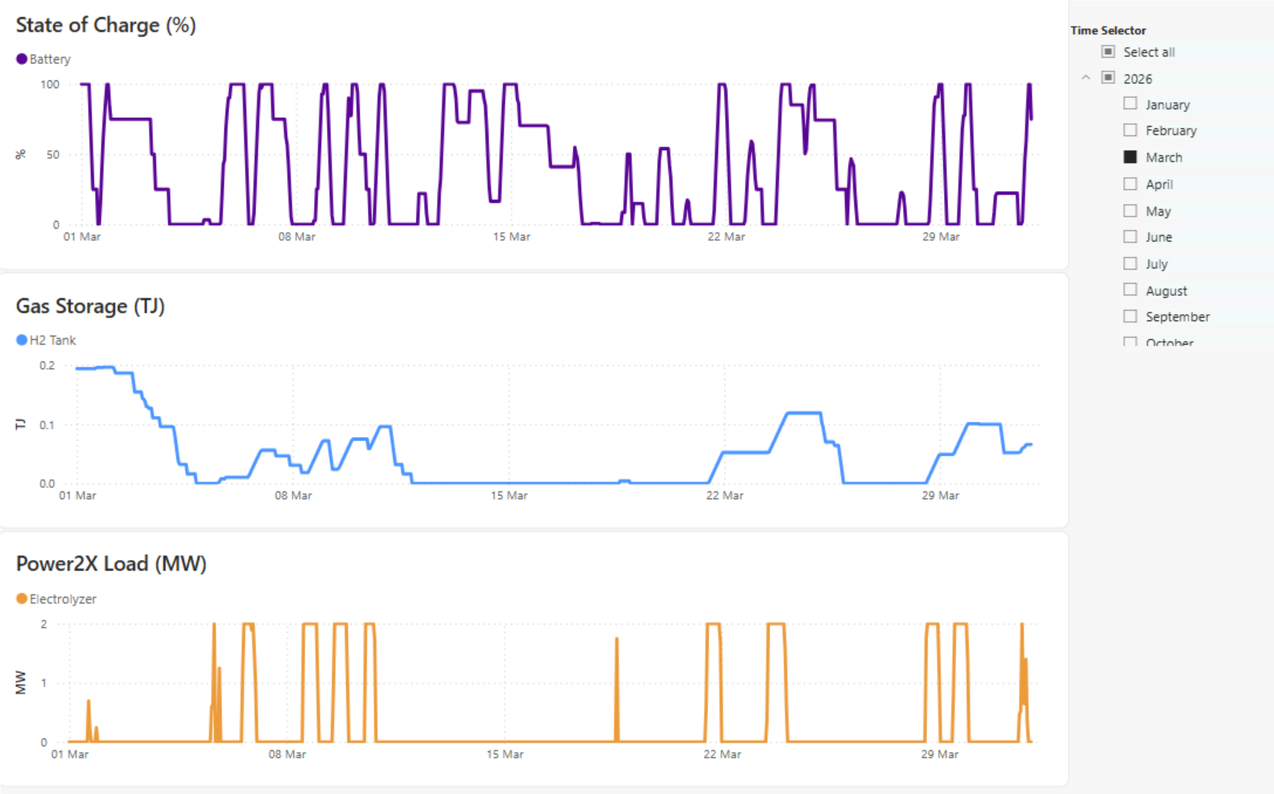
Results full Hybrid – Hydrogen



Time Selector

- Select all
- 2026
  - January
  - February
  - March
  - April
  - May
  - June
  - July
  - August
  - September
  - October

Results full hybrid - hydrogen



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9/13. Portfolio Optimization

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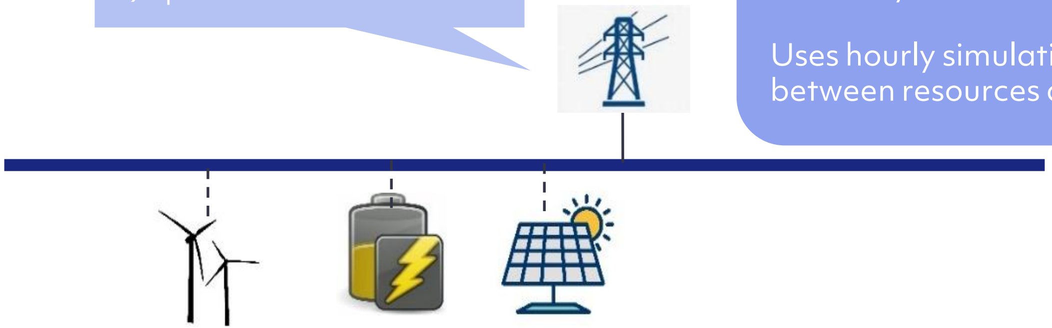
Portfolio Optimization

Objective Function:

$$Max: \sum I_{energy} + \sum I_{AS} + \sum I_{Capacity} - \sum C_{Investment} - \sum C_{Operational} - \sum C_{AS}$$

For energy incomes 2 inputs:
1) Forecasted grid capacity
2) Spot Price



PLEXOS can identify the best combination of solar, wind, and battery capacities to maximize overall project efficiency.

Uses hourly simulations to capture complementarity between resources and improve system utilization.

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Portfolio Optimization

Inputs required:

1) Hourly solar and wind profiles	→	Satellite information
2) Hourly forecasted grid capacity.	→	GATC concept
3) Hourly Spot Price Forecast.	→	Nodal Price for each node
4) Ancillary Services incomes.	→	Depends on market regulations
5) Capacity payments incomes.	→	Depends on market regulations
6) Capital and operational costs.	→	Project information

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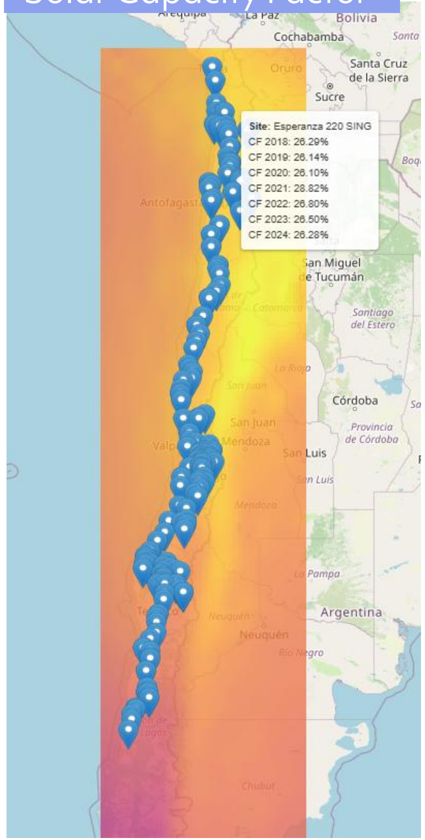
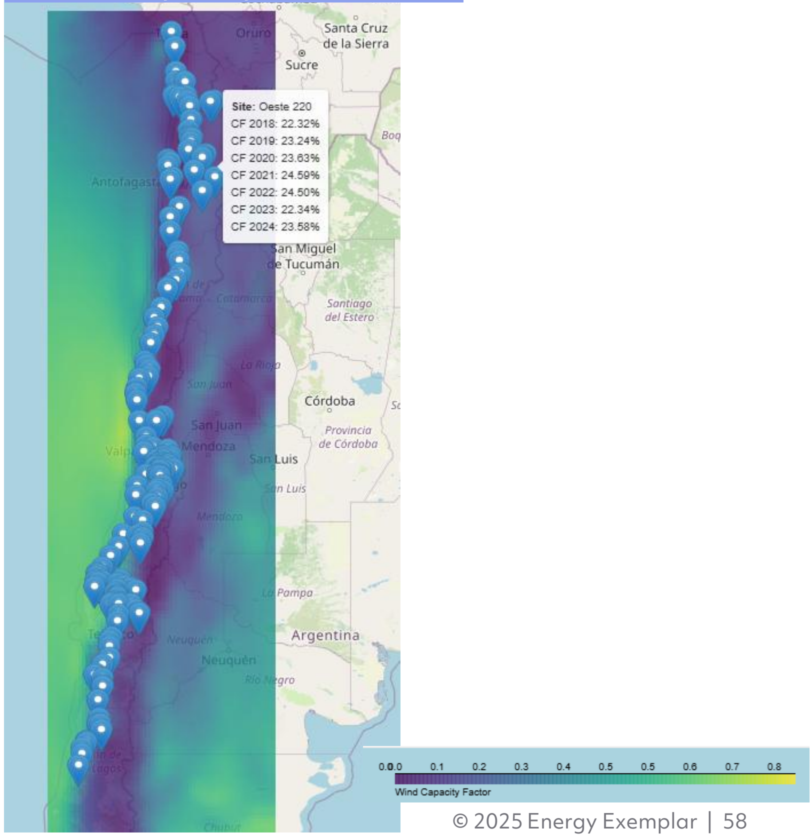
Yearly Capacity Factors

Solar Capacity Factor



Source: Merra-2 raw data

Wind Capacity Factor



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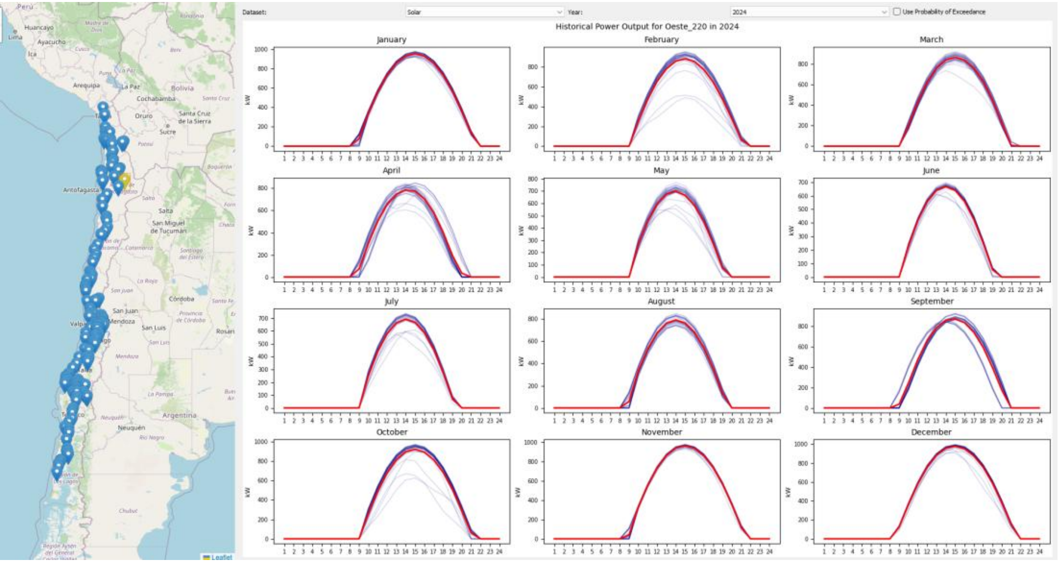
Renewables profiles

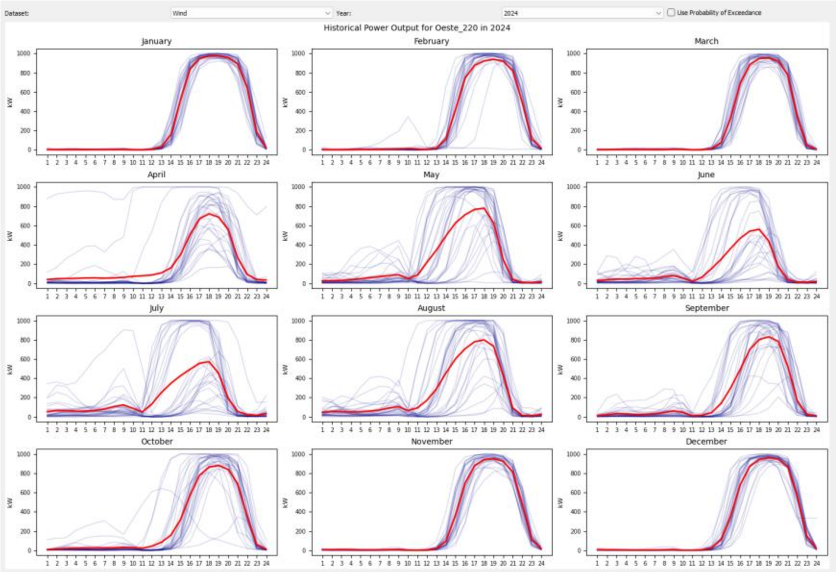
If non in situ measurements are available. It can be used historical satellite data.

Example: Oeste 220 kV

Solar 2024



Wind 2024



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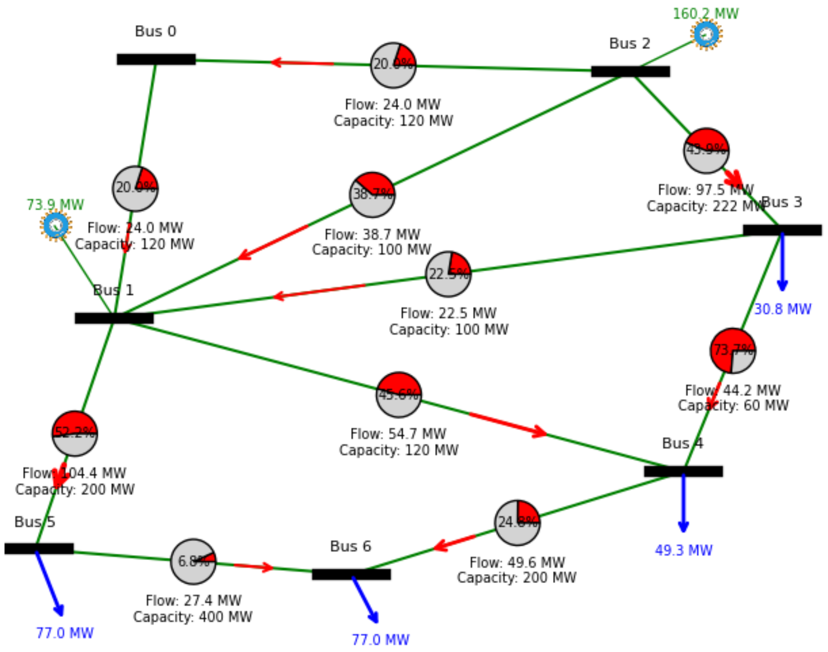
ATC Concept

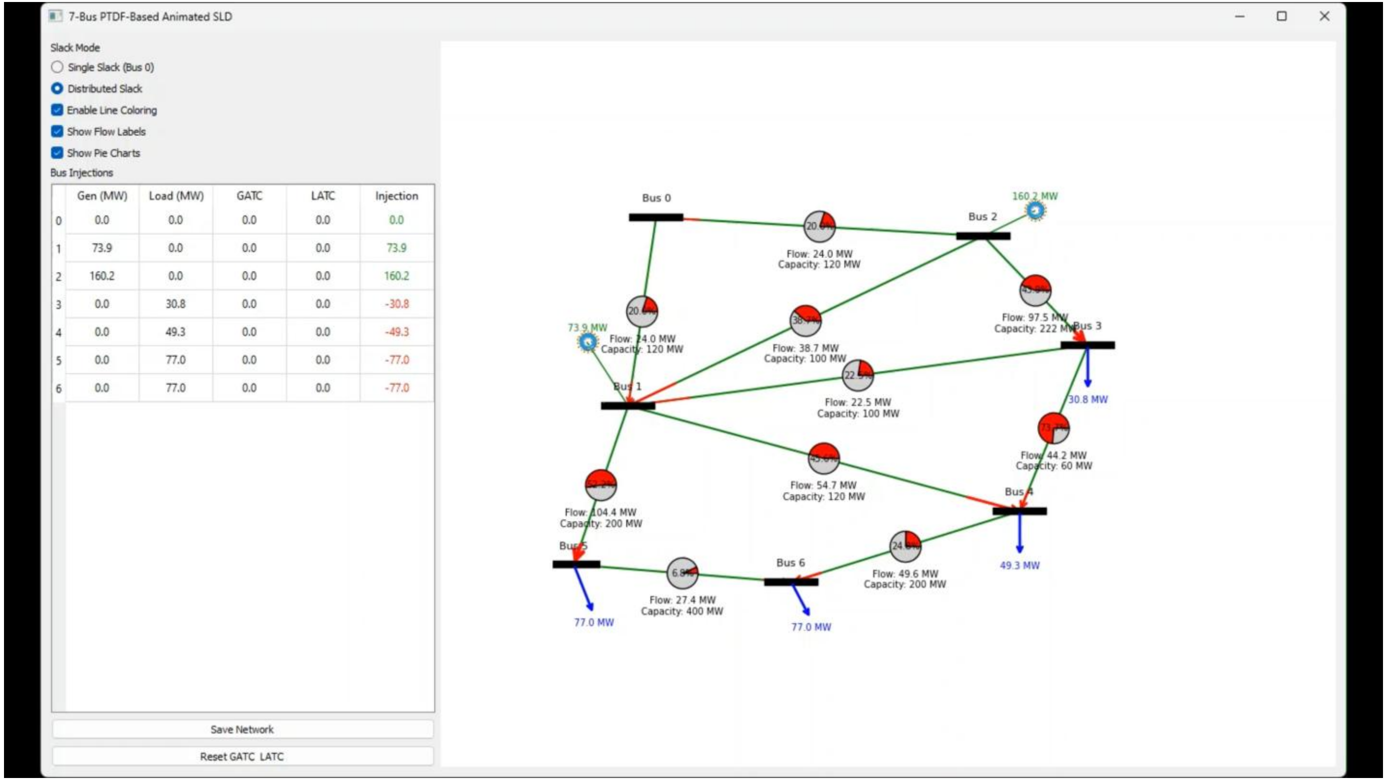
- **ATC** (Available Transfer Capability) measures how much extra power can be injected or withdrawn at a node without violating line limits.
- GATC (Generation ATC) is the maximum additional generation a node can inject, accounting for slack distribution and current flows.
- LATC (Load ATC) is the maximum additional load a node can draw, also considering slack compensation and congestion limits.
- Both use PTDF-based calculations to assess how node-level changes affect line flows across the network.
- GATC and LATC support grid planning, congestion management, and optimal siting of new generation or load.

Energy Exemplar

GATC Example on bus 1. IEEE 7 busbar



GATC Example on bus 1. IEEE 7 busbar



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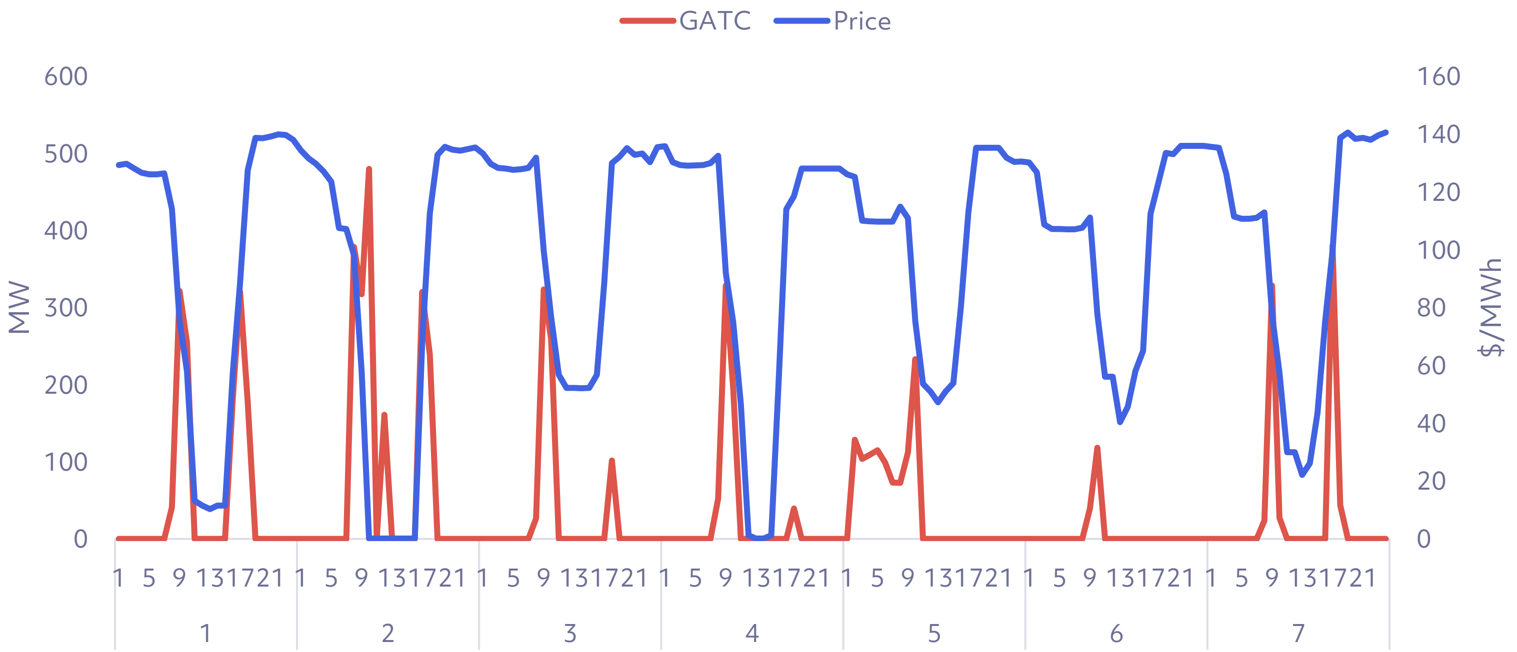
Example of forecasted GATC and price for node OESTE



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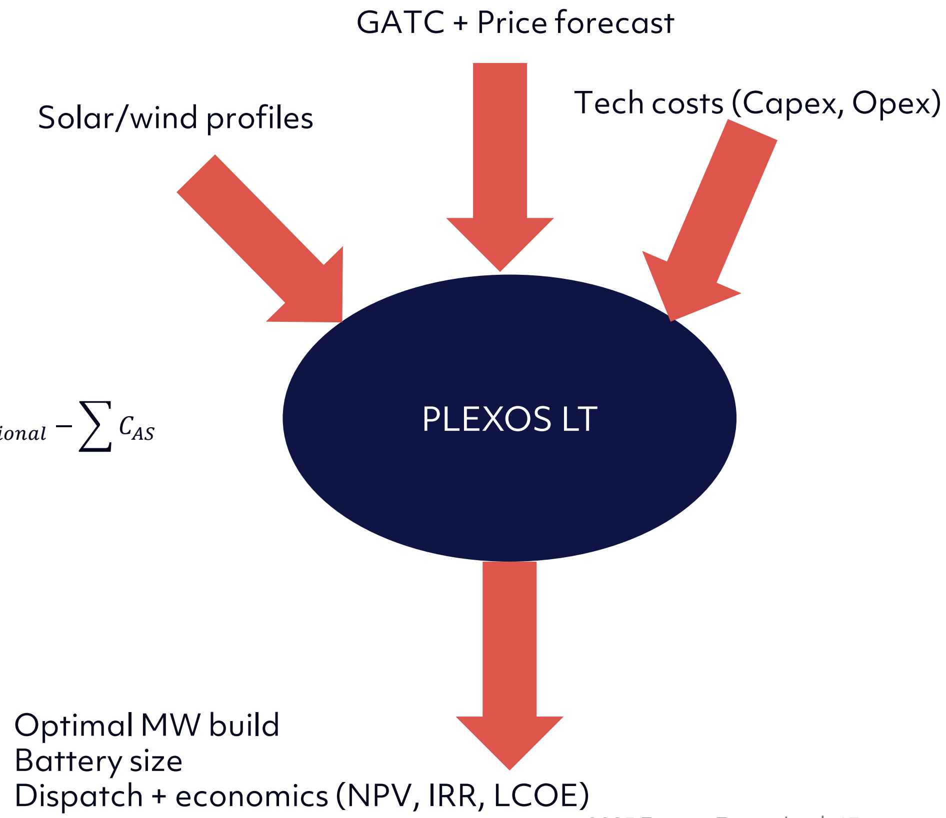
Using PLEXOS at selected nodes

Goal: Find optimal build size at best node

Objective Function:

$$Max\colon \sum I_{energy} + \sum I_{AS} + \sum I_{Capacity} - \sum C_{Investment} - \sum C_{Operational} - \sum C_{AS}$$



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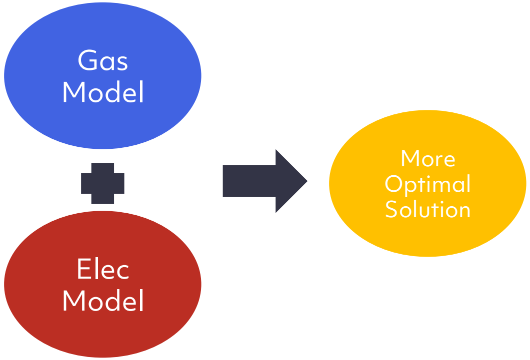
10/13. Integrated Power-Gas Modelling

Energy Exemplar

10. Power - Gas

- Joint optimization of electricity and gas for least-cost, reliable operation.
- Captures physical and economic coupling between fuel supply and power output.
- Maximizes infrastructure efficiency, lowering system costs and improving reliability.
- Models full gas network dynamics alongside power flows.
- Enables cross-sector energy exchange, including hydrogen and power-to-gas pathways.



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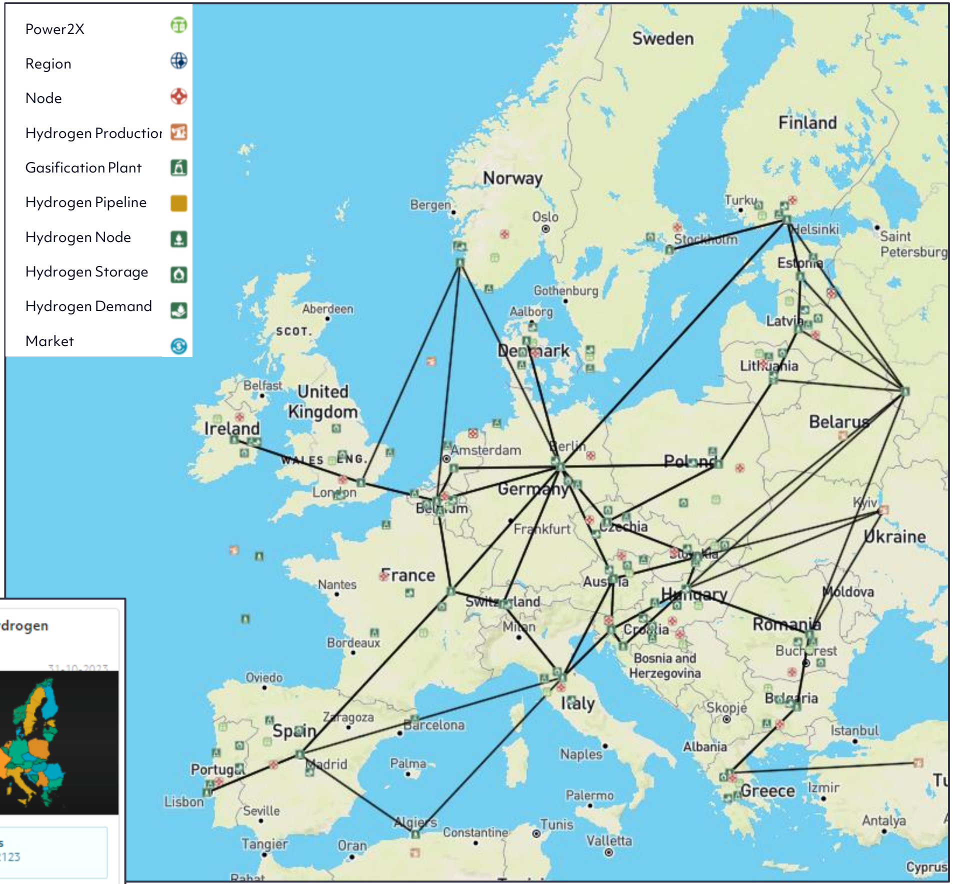
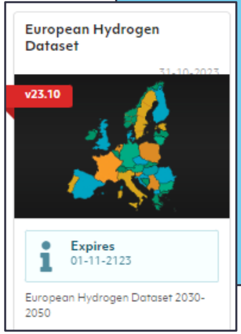
European Hydrogen Dataset (23.10)

- Energy Exemplar's first stand-alone Pan-European Hydrogen PLEXOS Dataset
- Study Horizon 2030 – 2050
- Calibrated against ENTSOG TYNDP
- Available for download from the Portal (for licensed users)





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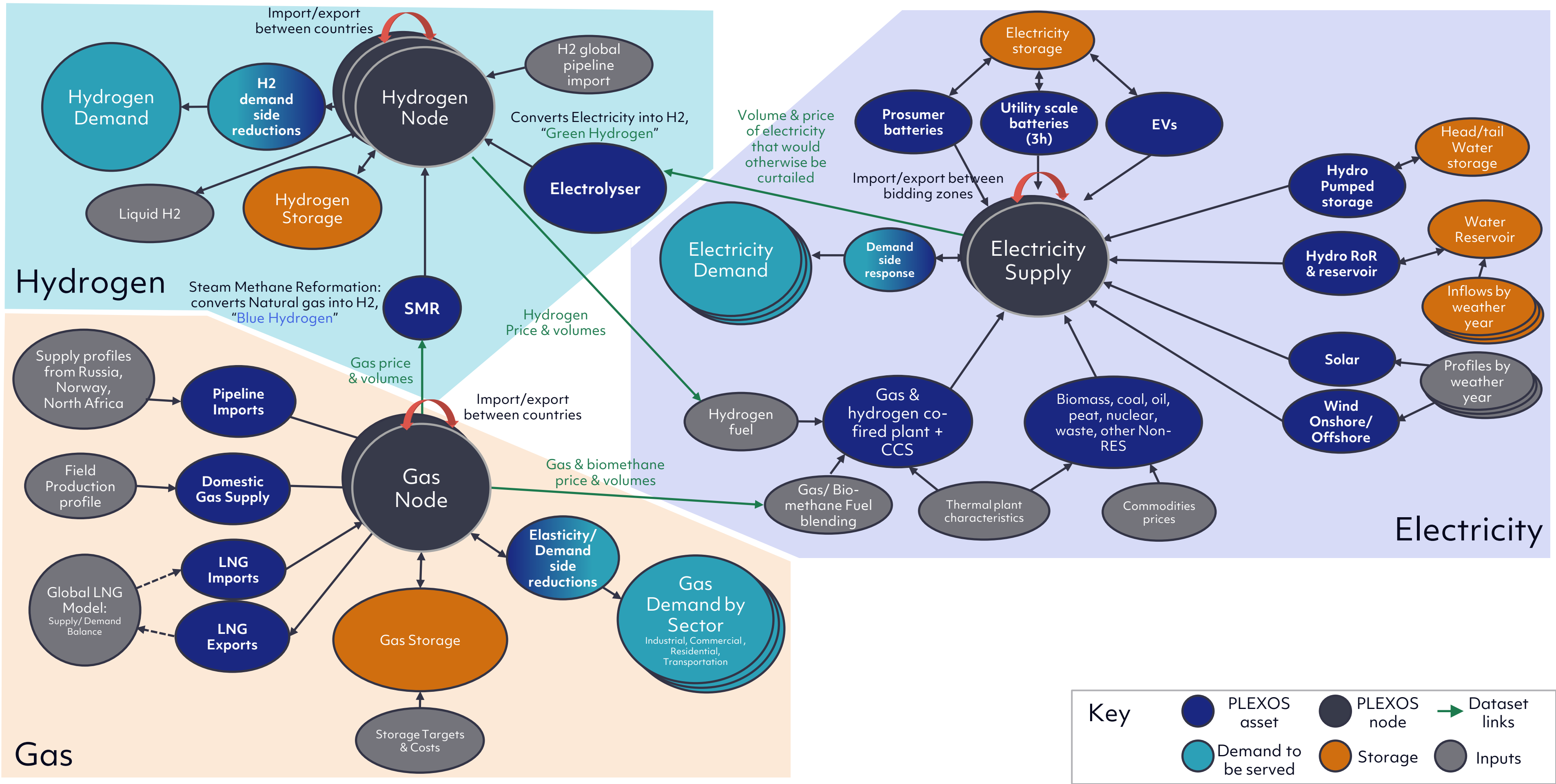
Linkages co-optimised across coupled energy sectors



11/13. Reliability & Resource Management

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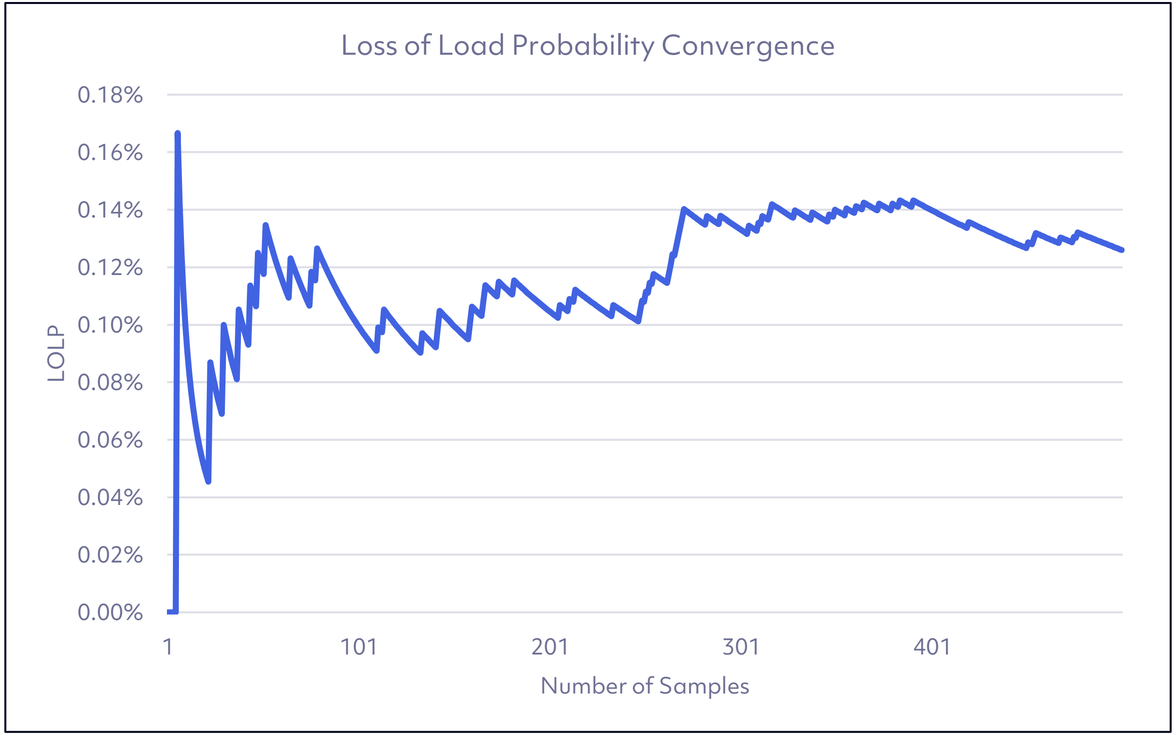
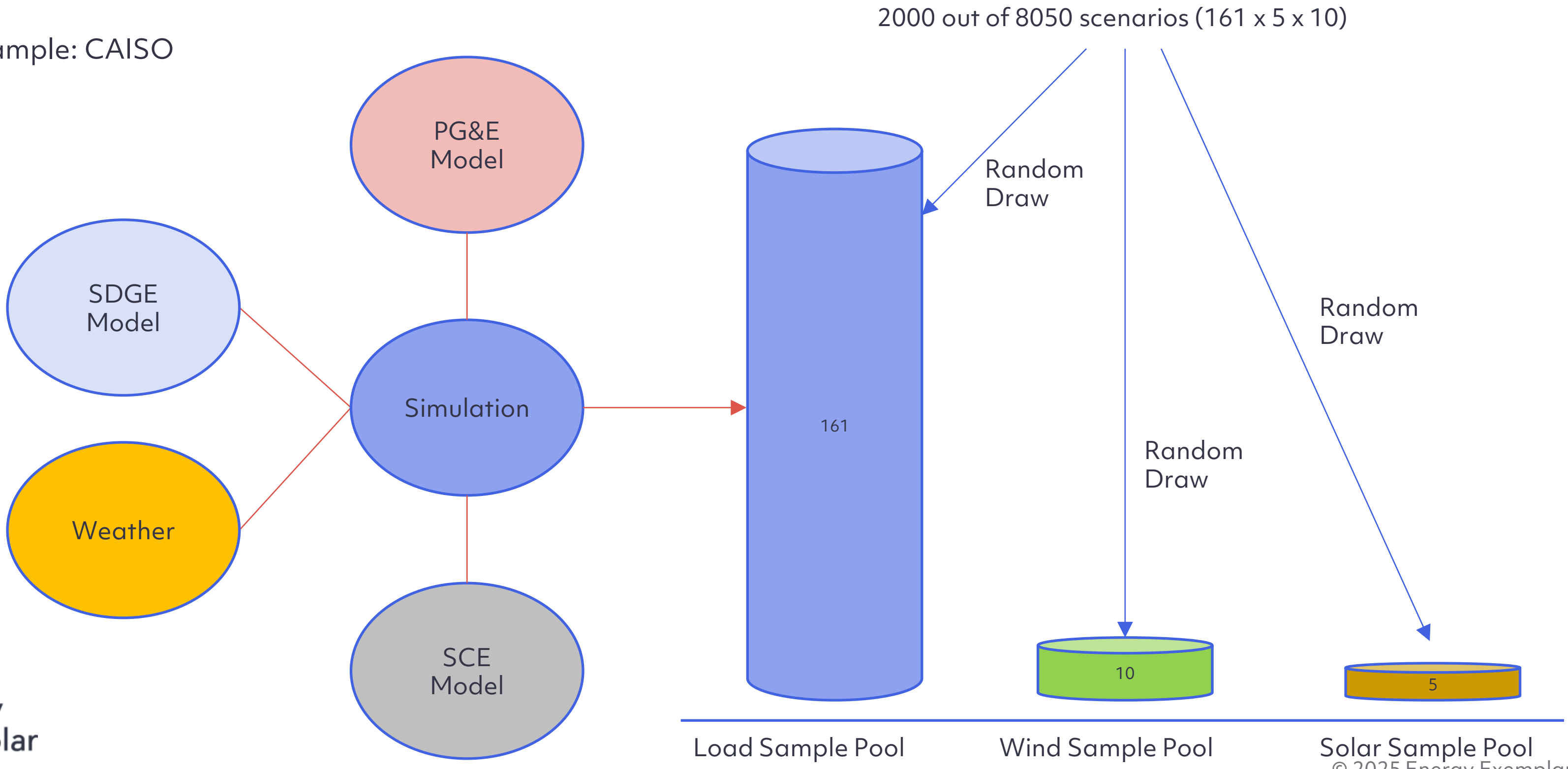
Reliability & Resource Management

- PLEXOS calculates reliability metrics such as LOLP, LOLE, and EENS using both convolution and Monte Carlo simulation methods.
- Convolution provides fast analytical reliability estimates.
- Monte Carlo simulation captures chronological and correlated uncertainties for more detailed system adequacy analysis.



Reliability & Resource Management

Example: CAISO



12/13. Interleaved

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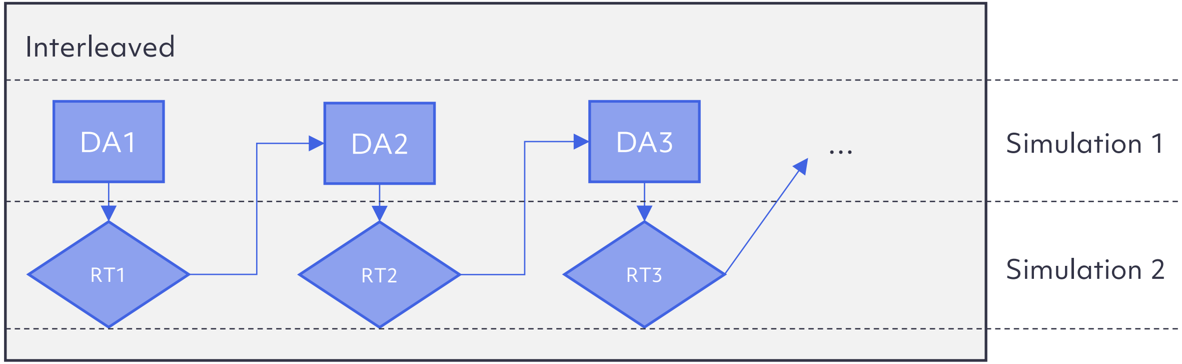
PLEXOS: Interleaved feature

Traditional

Simultaneous planning over the entire horizon.

The model anticipates unexpected Events.

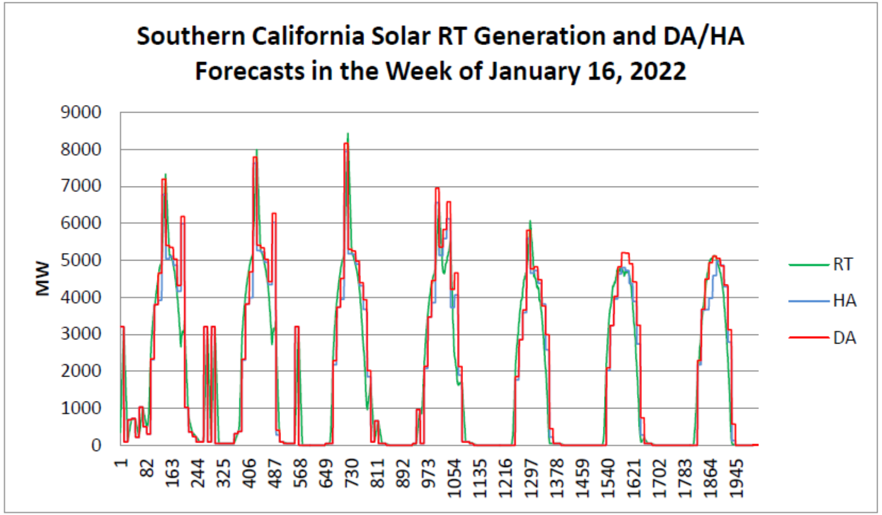
➔ Optimistic Simulation

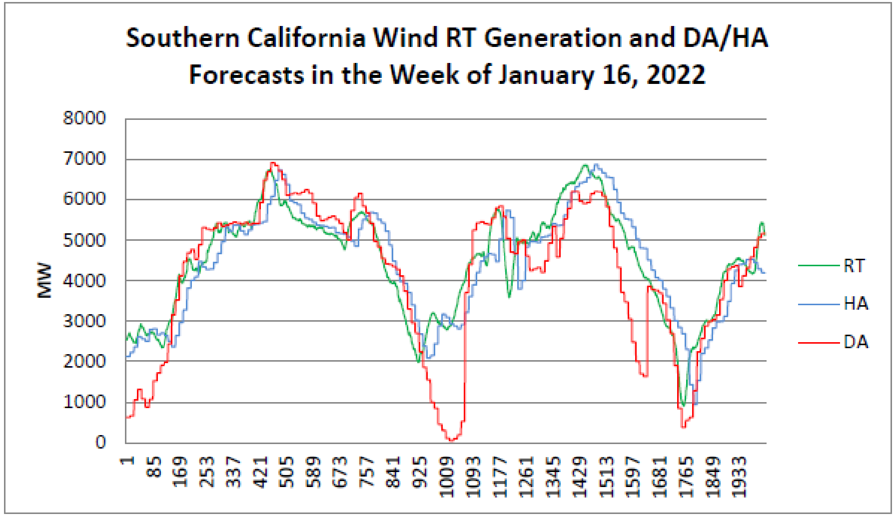


1. Simulation 2 resorts to flexible system resources to assess disturbances.
2. Next Day-Ahead (DA) takes corrective actions to minimize the impact.

➔ The model allows estimating the impact of unexpected events.

Case Study: Western Interconnection (WI) US





To compensate for sub-hourly variability and uncertainty, the system needs to have generation ramping capability and/or cycle units.

Energy Exemplar

Argonne National Laboratory. *Modelling and Analysis of Value of Advanced Pumped Storage hydropower in the United States*. June 2014

PLEXOS BY ENERGY EXEMPLAR

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13/13. Short Term in Long Term

Short-term in long-term

Long-term hourly simulations can be broken into smaller time blocks or stages to improve computational efficiency and manage complexity.

Example:
1 year in daily steps

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How to solve each small steps?

1

Sequential Montecarlo

- Current step reads initial conditions from previous:
  - Initial generation
  - Unit on/off
  - Min up/down times
  - Storage levels
  - Constraint usage
- Must be solved sequentially.
- Only parallel capability is in the solver.

2

Parallel Montecarlo

- Break dependencies between simulation steps.
- Solve steps in parallel → faster, better utilization of compute resources
- What about initial conditions?:
  - Mid/Large sized storage get targets from MT Schedule.
  - Small storage/batteries/pumped storage: reoptimized each step.
- Add sequential steps and relinking option to create a hybrid mode: parallel mode with sequential steps.

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PLEXOS Demo

Battery valuation using hourly simulations

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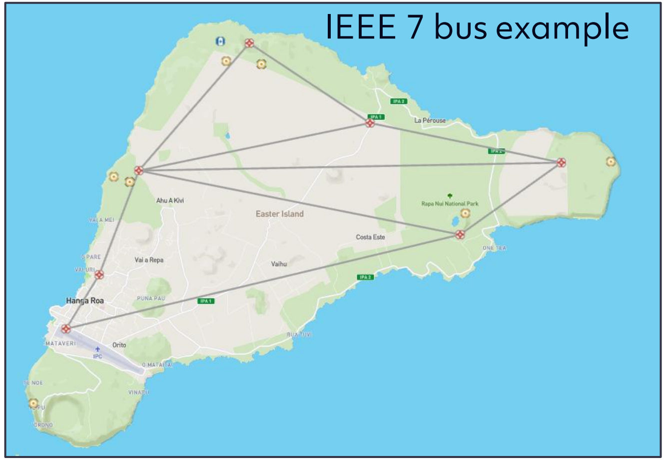
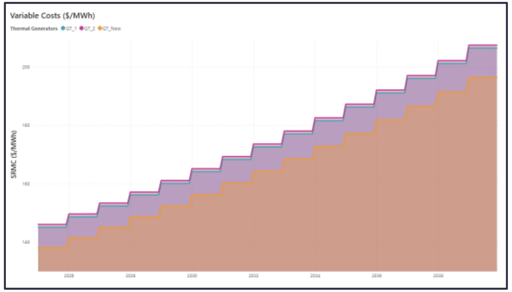
Short Term in Long Term Demo
Power System Description

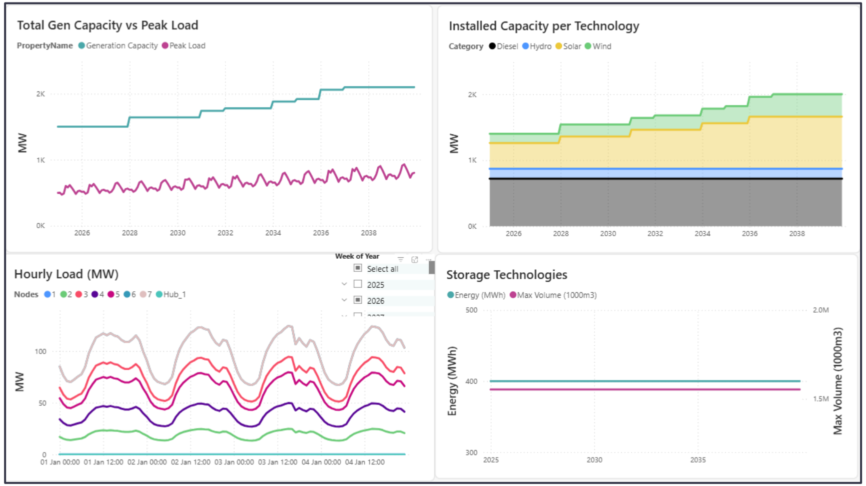
- 7-bus system with Diesel, Hydro, Solar, and Wind generation.
- Thermal units have increasing variable costs.
- Large hydro reservoir enables water storage across periods.

Objective: Assess impact of battery size on system operation.

Simulation: Hourly nodal OPF over 15 years.







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Performance for 7 models

- Executed in parallel in same machine 8 cores and 64 GB RAM.
- 17 minutes to simulate and produce outputs for Cloud.

Simulation History

Status	Model		Credits Used	Engine Version	CPU (core)	Memory (GB)		Version	Created	Started	Completed	Elapsed Time (mins)	Engine Time (mins)
Successful	ST_Battery_Pot.100_Ener.400	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6
Successful	ST_Battery_Pot.120_Ener.480	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6
Successful	ST_Battery_Pot.140_Ener.560	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6
Successful	ST_Battery_Pot.160_Ener.640	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6
Successful	ST_Battery_Pot.180_Ener.720	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6
Successful	ST_Battery_Pot.200_Ener.800	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6
Successful	ST_Battery_Pot.220_Ener.880	Feli	2.00	11.0 R05	8	64	Sir	3	06 Nov 2025, 11:47	06 Nov 2025, 11:53	06 Nov 2025, 12:04	17	6

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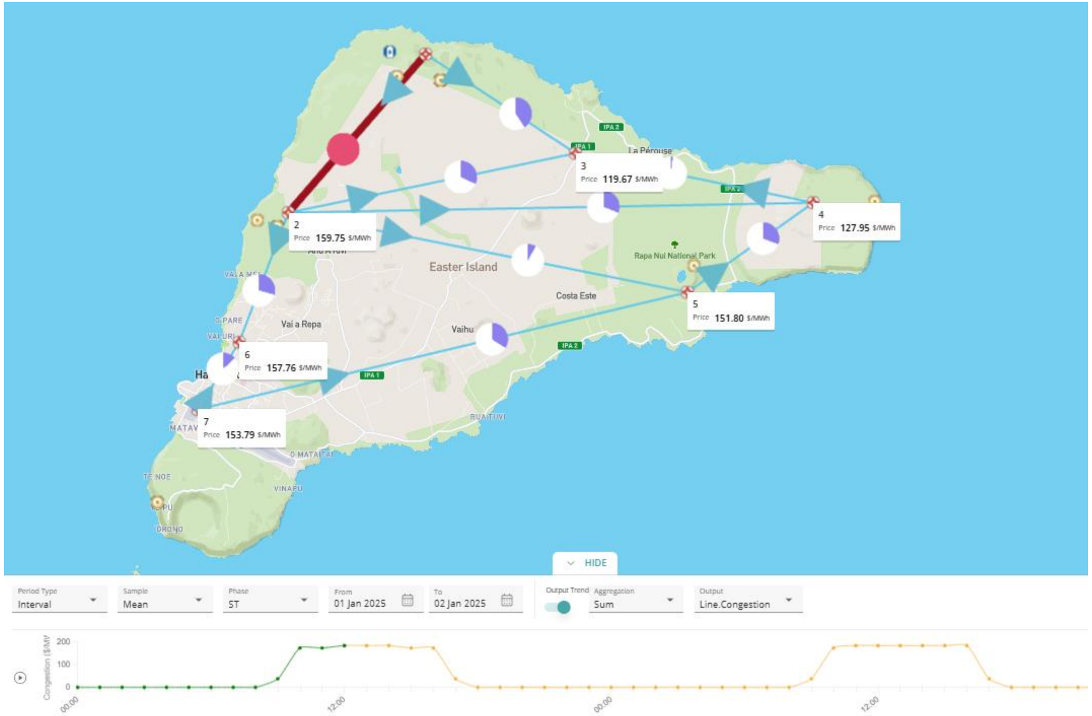
Short Term in Long Term
Map Outputs

- View LMP, flow, and congestion directly on a geocoded map.
- Colour and line thickness indicate congestion severity and power flow.
- Node pop-ups show LMP values and generation/load mix.
- Hourly snapshots let users track changes through time.
- Trend chart below shows aggregated metrics (e.g., total congestion).

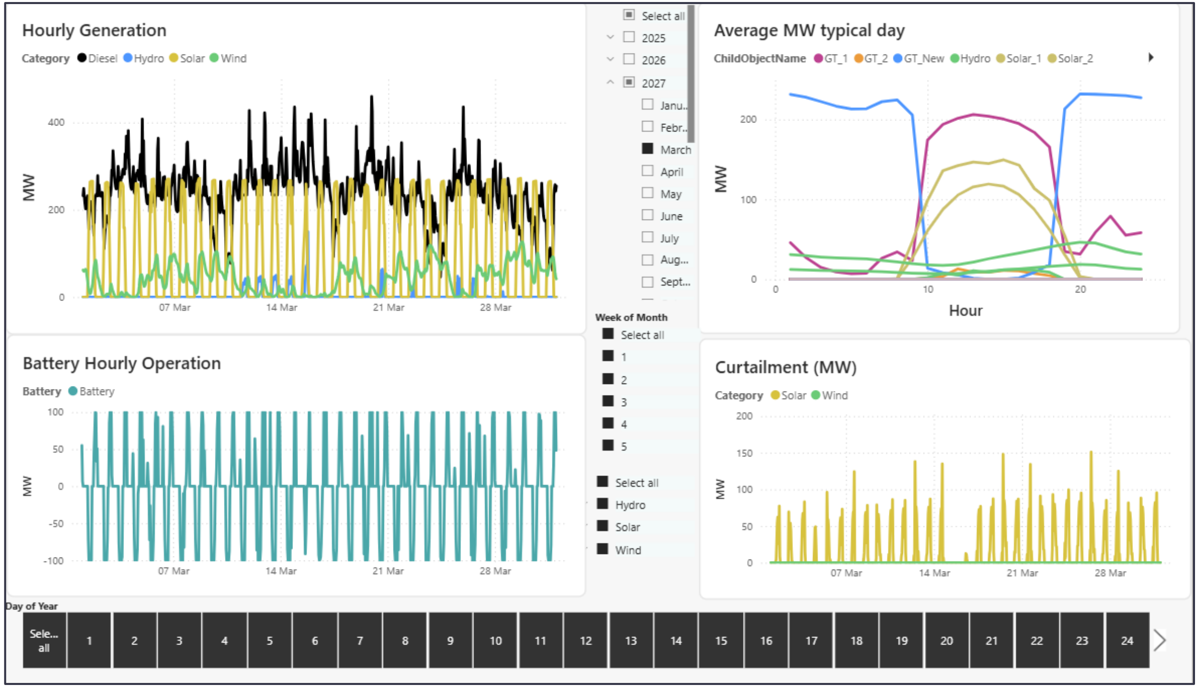
IEEE 7 bus example



Short Term in Long Term

- Hourly OPF ensures optimal economic dispatch.
- Thermal units operate mainly at night when solar is unavailable.
- Battery charges during solar hours and discharges at night.
- Curtailment occurs due to limited transmission capacity.

Generation Insights



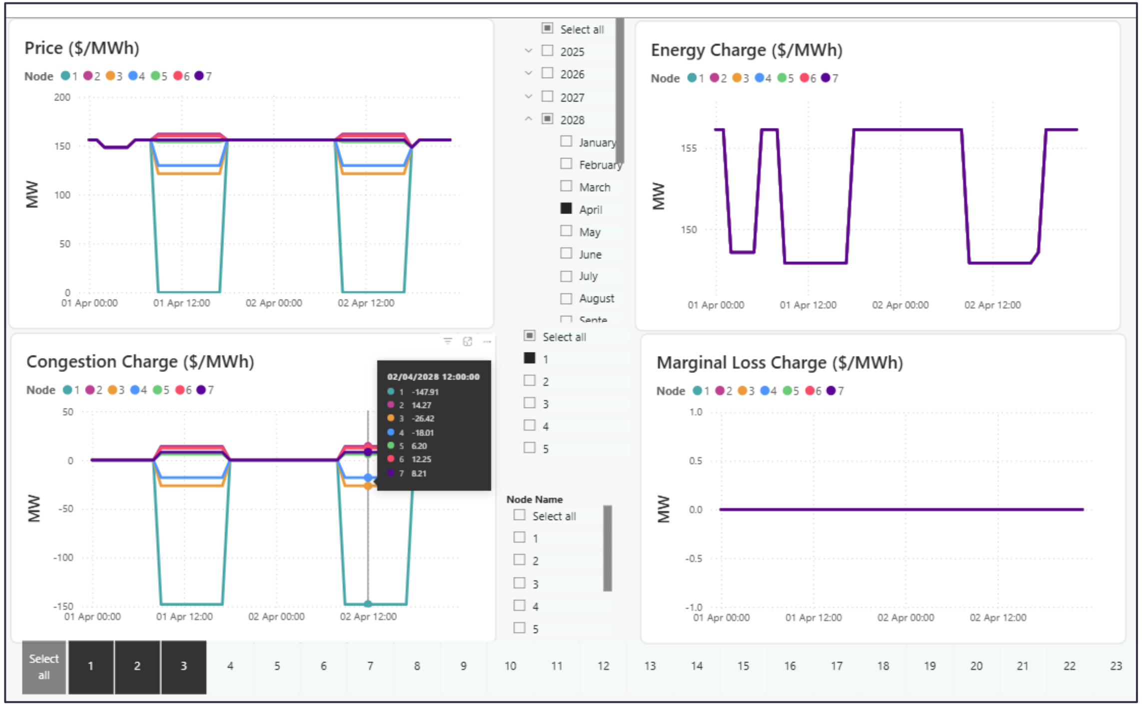
Short Term in Long Term

- Hourly nodal prices reflect local system conditions.
- Price differences arise from network congestion.
- Price decomposition reveals drivers of these differences.
- Negative congestion component indicates cheap generation can be curtailed.
- zero marginal prices indicate curtailment.

Nodal Insights

Price = Energy Charge + Congest Charge + Marginal Loss Charge

Energy Charge: system marginal energy cost.



+ Congestion Charge: Injection **worsens** congestion
- Congestion Charge: Injection **relieves** congestion
0 Congestion Charge: No constraint binding

0 Marginal Loss Charge: No Losses are modelled.

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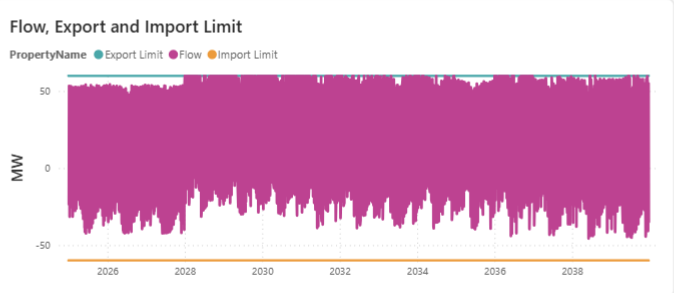
Short Term in Long Term

- Hourly line flows are computed for all network elements.
- Flows reaching capacity indicate congestion events.
- Congested hours show how often a line is capacity - limited.
- Loading levels reflect utilization relative to maximum capacity.

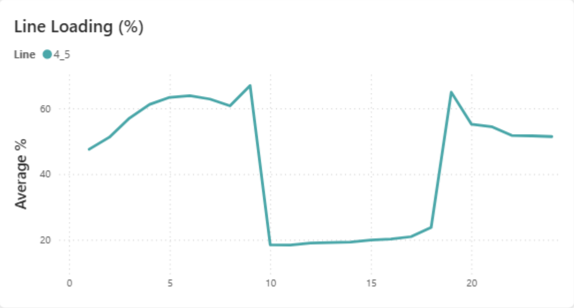
Line Insights



Line Name
- Select all
- 1_2
- 1_3
- 2_3
- 2_4
- 2_5
- 2_6
- 3_4
- 4_5
- 5_7
- 6_7_1
- 6_7_2

- Select all
- 2025
- 2026
- 2027
- 2028
- 2029
- 2030
- 2031
- 2032
- 2033
- 2034

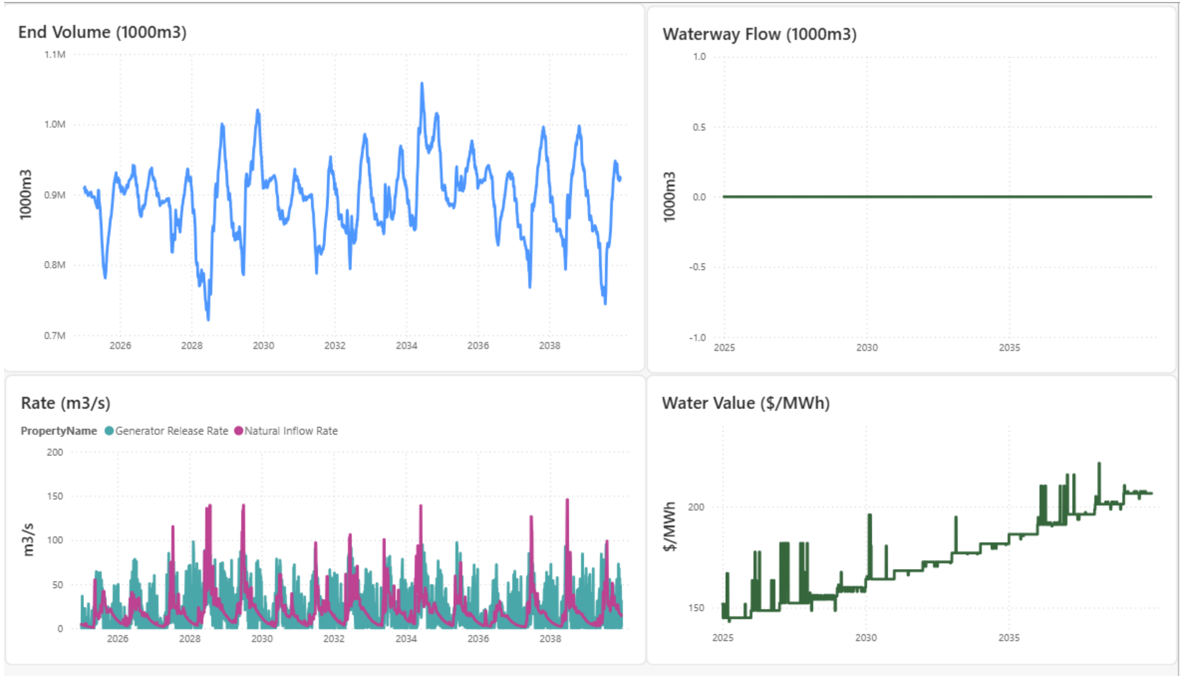
Line	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	203
1_2	3,259	3,270	3,283	3,206	3,234	3,250	3,152	3,073	3,121	2,884	2,877	2,382	2,432	2,58
1_3	0	0	0	0	0	0	0	0	0	0	0	0	0	
2_3	0	0	0	0	0	0	0	0	0	0	0	0	0	
2_4	0	0	0	0	0	0	0	0	0	0	0	0	0	
2_5	0	0	0	0	0	0	0	0	0	0	0	0	0	
2_6	0	0	0	0	0	0	0	0	0	0	0	0	0	
3_4	0	0	0	0	0	0	0	0	0	0	0	0	0	
4_5	0	0	0	46	52	59	25	13	7	4	0	78	0	
5_7	0	0	0	0	0	0	0	0	0	0	0	0	0	
6_7_1	0	0	0	0	0	0	0	0	0	0	0	0	0	
6_7_2	0	0	0	0	0	0	0	0	0	0	0	0	0	



Short Term in Long Term

- Reservoir stores water for optimal multi-period operation.
- No spill occurred. All inflows were fully utilized.
- Inflow vs. release differ as storage shifts water to high-value periods.
- Water value increases over time, tracking variable cost trends.
- MT used to decompose water targets at the end of each ST step.

Hydro Insights



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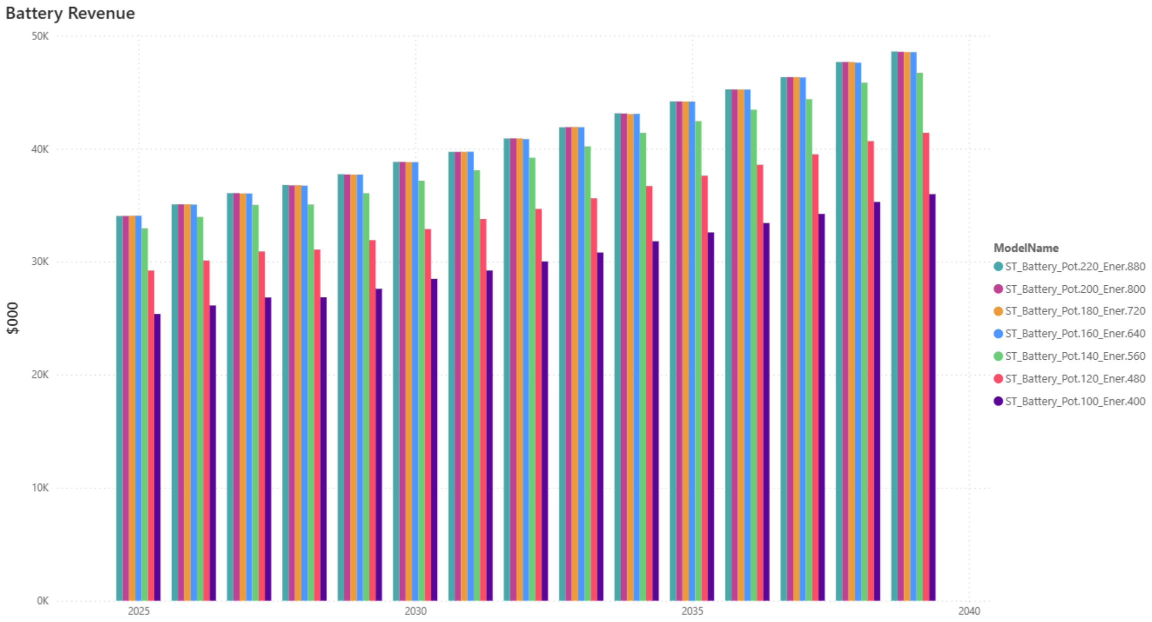
Battery Size Valuation

- Hourly simulations capture renewable-based battery arbitrage over 15 years.
- Battery charges only with renewable energy produced at its node (not from the grid).
- Annual pool revenues used for project valuation.
- Increasing battery size yields smaller incremental benefits beyond a certain point.
- OPEX results needs to be combined with CAPEX for full financial assessment (NPV, IRR, etc.).

Battery Insights



Key Take Aways

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Key Take Aways

1. **Unified Platform.** PLEXOS provides an integrated environment for short, medium and long-term decision support.

2. **Globally Proven Solution.** Trusted by system operators, regulators, utilities, and investors worldwide.

3. **Cloud -Powered.** Deployed in the cloud to deliver high performance, real-time collaboration and interactive visualization.

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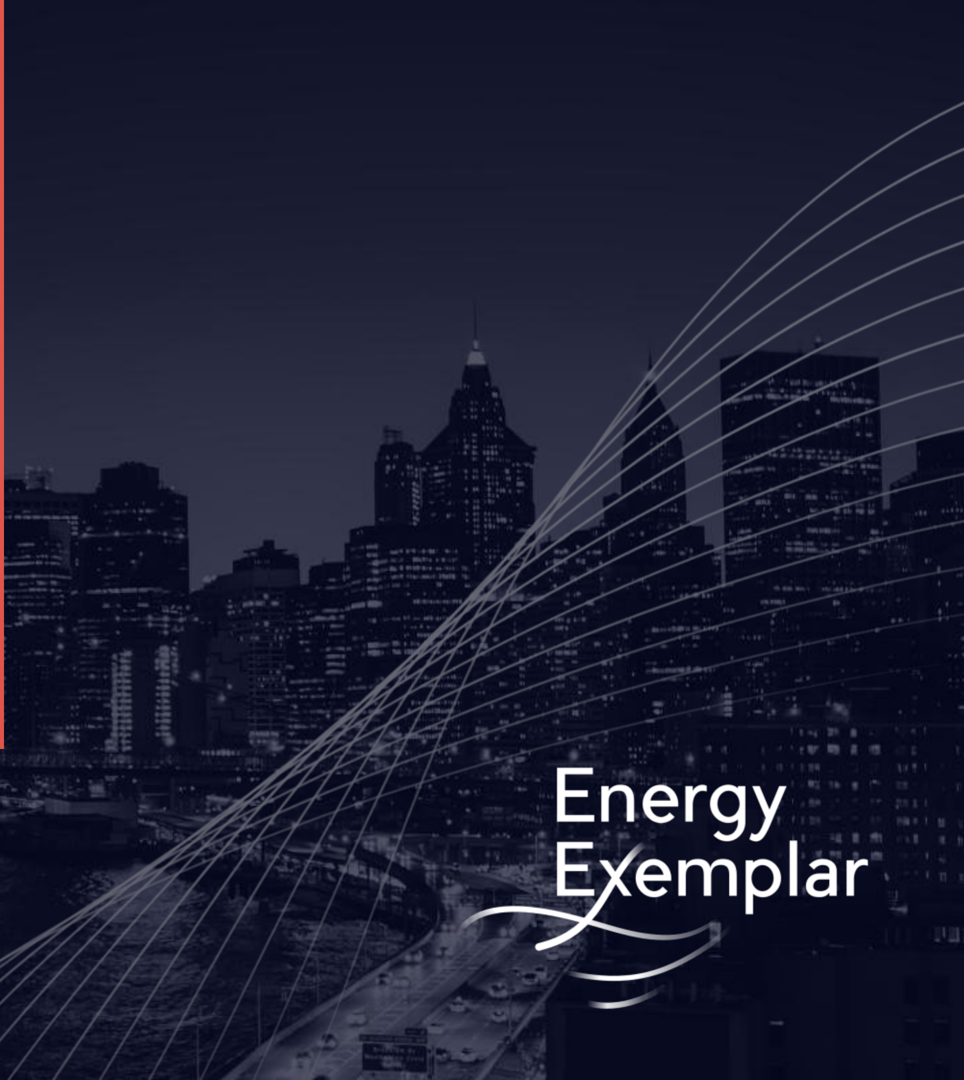
Obrigado!

Felipe Valdebenito

felipe.valdebenito@energyexemplar.com



Energy Exemplar

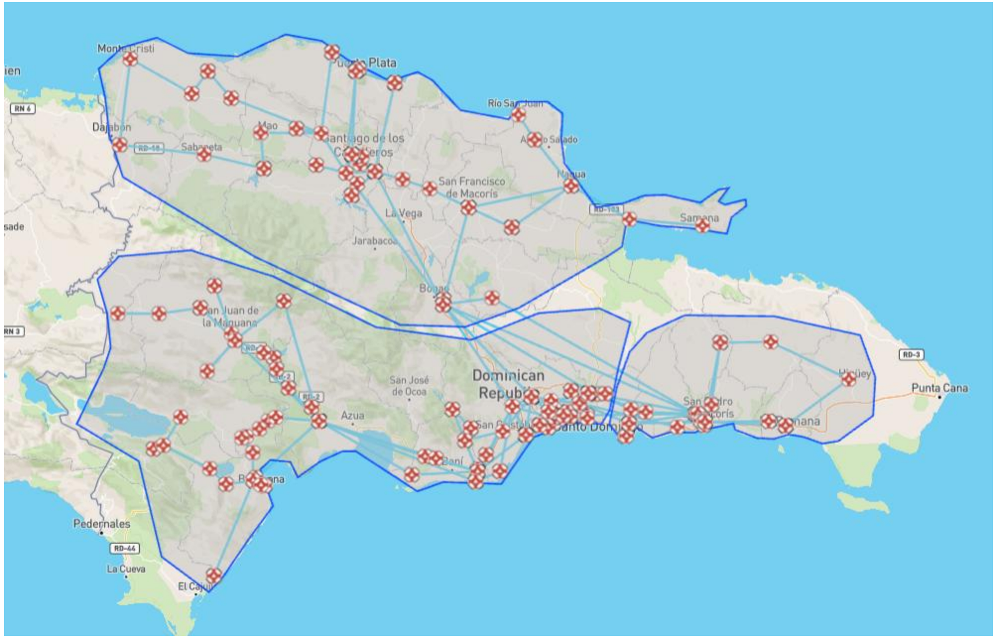
Appendix

PLEXOS Commodities

Energy Exemplar

1. PLEXOS Electricity

- Simulates electricity markets across **energy, capacity, and reserves**.
- Models all generation types, from **renewables to hybrids.**
- Optimizes **dispatch and unit commitment** under real-world constraints.
- Accounts for **transmission, losses, and contingencies**.
- Supports nodal and zonal simulations at any scale.



PLEXOS Electric Model Classes

Generator	Emissions
Fuel	Electrical Node
Storage	Transmission Line
Waterway	Batteries

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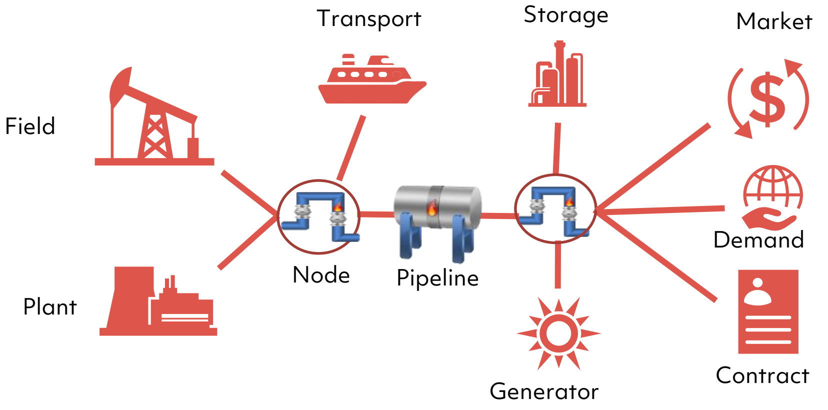
2. PLEXOS Gas

- Models gas supply, demand, pipelines, and storage.
- **Co-optimizes** gas with electricity and hydrogen systems.
- Simulates gas markets: contracts, tariffs, and trading.
- Analyzes pipeline flows, congestion, and linepack.
- Optimizes gas dispatch for cost and reliability.
- Evaluates infrastructure needs and investments.

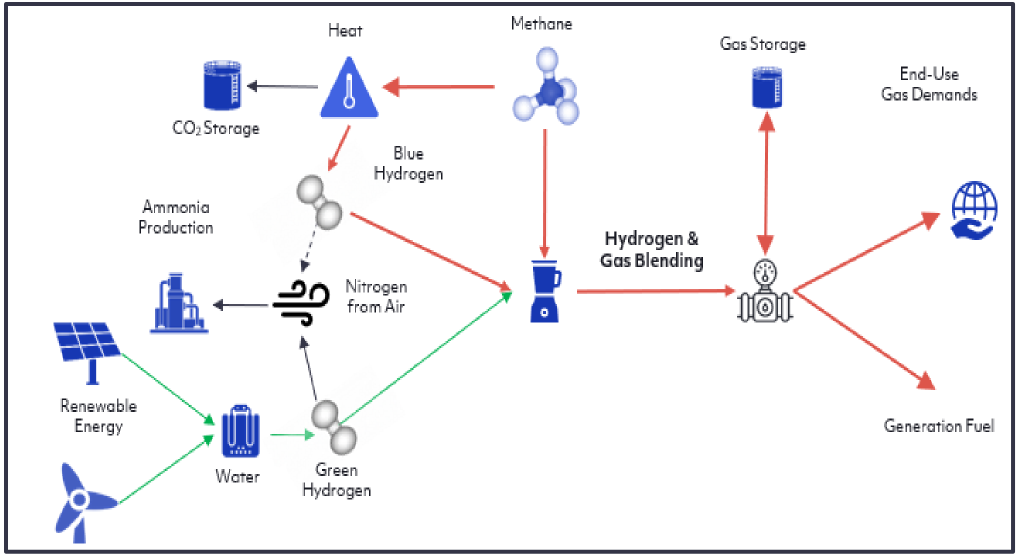


PLEXOS Gas Model Classes

Energy Exemplar

3. PLEXOS Hydrogen

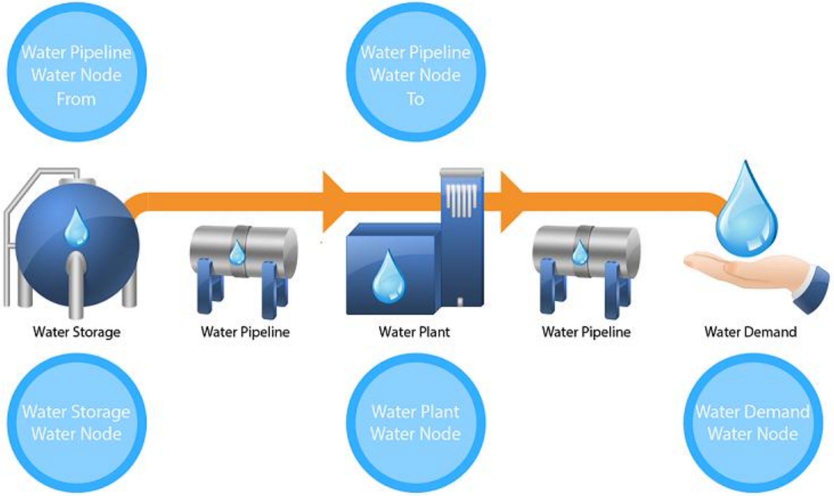
- Models the entire hydrogen value chain — production, storage, transport, and use.
- Supports green, blue, and other hydrogen production pathways.
- Optimizes production based on renewables, prices, and demand.
- Simulates logistics across pipelines and storage tanks.
- Captures spatial and temporal supply–demand dynamics.
- Evaluates costs and emissions of hydrogen strategies.



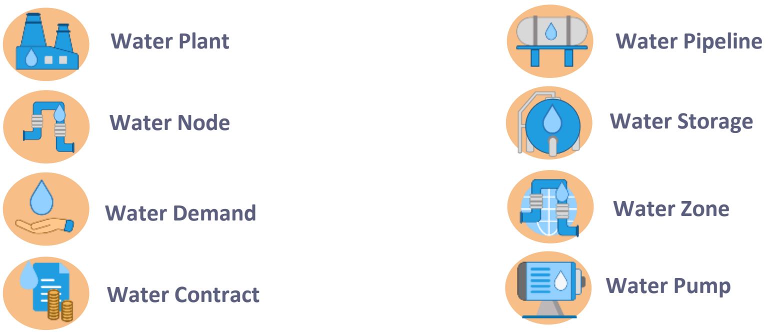
Energy Exemplar

4. PLEXOS Water

- Simulates **end-to-end water systems**: desalination, storage, transport, and demand.
- Models infrastructure, routing, losses, and delivery constraints.
- Supports **co-optimization** with electricity, gas, and heat systems.
- **Balances** water use across sectors, including energy generation.
- Integrates **long-term planning** with cost and capacity analysis.



PLEXOS Water Model Classes

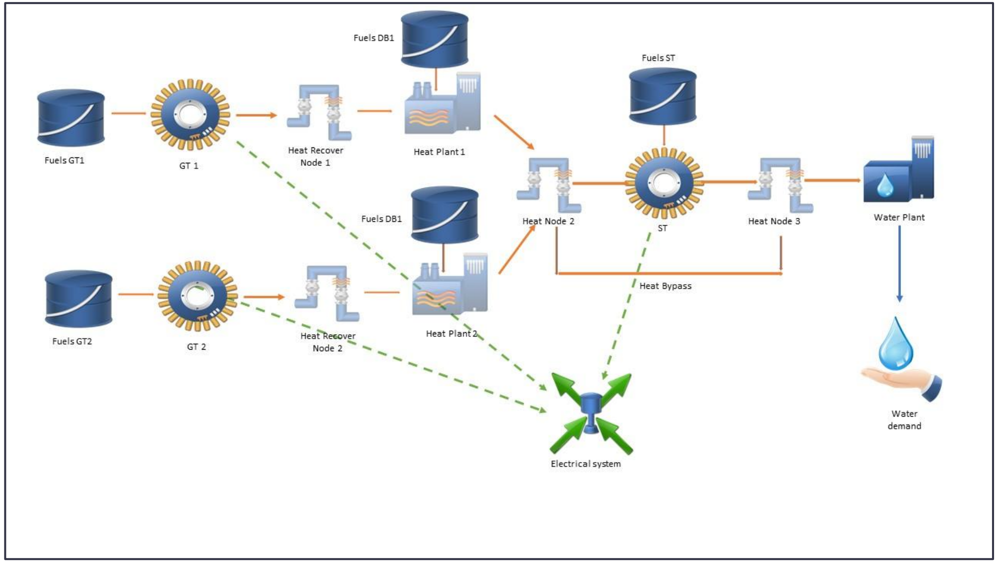


Energy Exemplar

5. PLEXOS Heat

- Models heat production, transport, storage, and consumption.
- Supports district heating, CHP operations, and industrial process heat.
- Optimizes **thermal storage** and desalination-related heat use.
- **Co-optimizes** heat with electricity and gas systems.
- Enables **long-term investment planning** for CHP, pipelines, and storage.

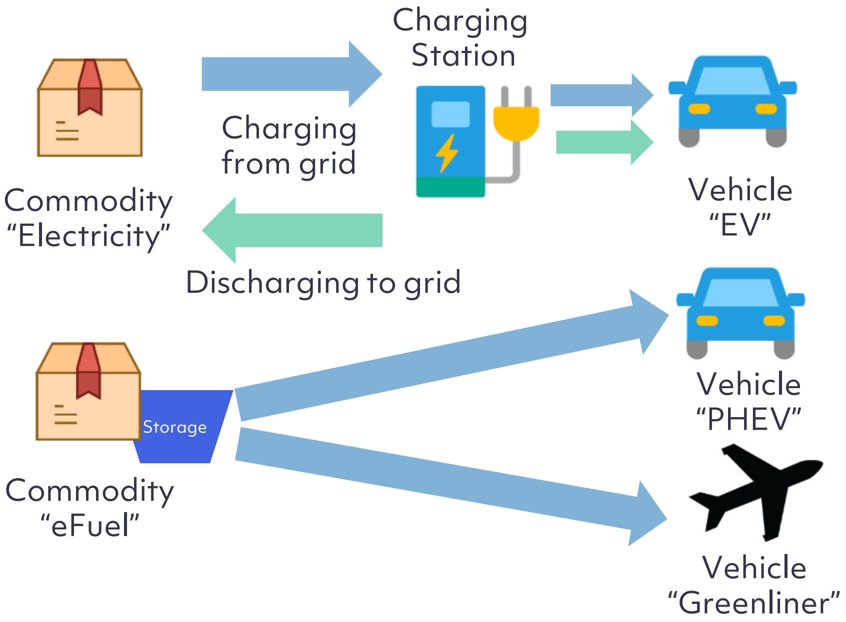
CCGT/Desalination Water Power Plant Example

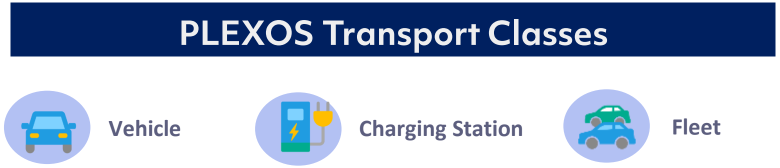


6. PLEXOS Transport

- Simulates **EV, hydrogen, and fleet** energy use.
- Models charging behaviour, infrastructure, and V2G.
- **Co-optimizes** transport with power and fuel systems.
- Tracks **emissions** and supports decarbonization planning.
- Enables **investment** optimization for fleets and stations.

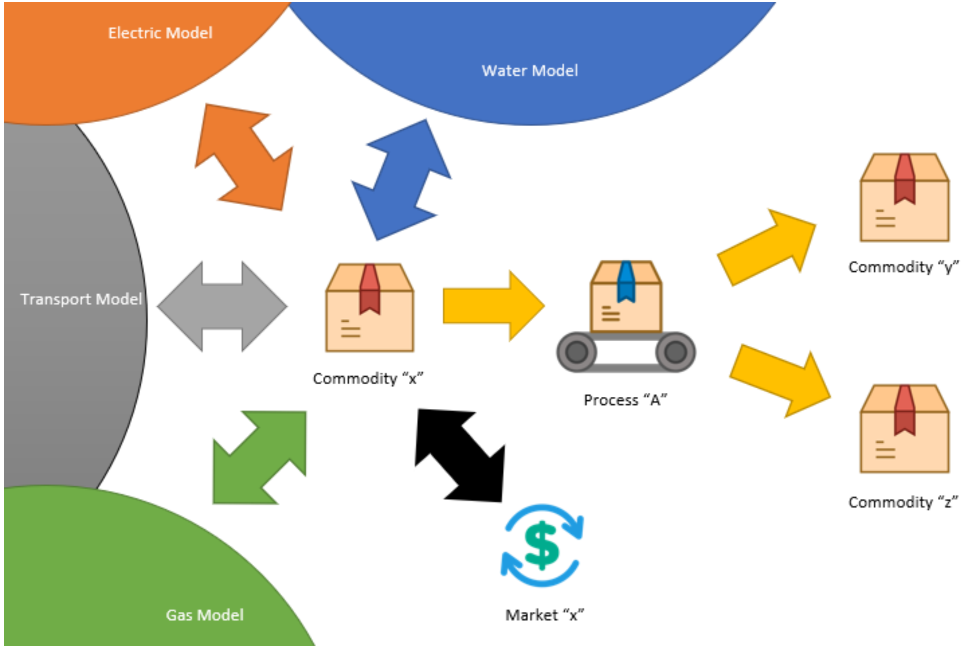
Example:





7. PLEXOS Universal

- Enables custom variables, constraints, and relationships beyond standard PLEXOS classes.
- Core concepts:
  - Commodity: Entity that can be produced, consumed, stored, or traded.
  - Process: Conversion between commodities
  - Facility: Consumes commodities.
  - Flow Node/Path/Storage: Represent and connect locational storage networks.
- Supports user-defined logic for tailored equations and cross-system links.
- Facilitates integration across sectors — electricity, gas, heat, transport, water, hydrogen, and carbon.
- Ideal for prototyping new technologies and market mechanisms.



PLEXOS Universal Class

- Commodity
- Process
- Facility
- Flow Storage
- Flow Path
- Flow Node