

PacifiCorp - Stakeholder Feedback Form

Integrated Resource Plan

PacifiCorp (the Company) requests that stakeholders provide feedback to the Company upon the conclusion of each public input meeting and/or stakeholder conference call, as scheduled. PacifiCorp values the input of its active and engaged stakeholder group, and stakeholder feedback is critical to the IRP public input process. PacifiCorp requests that stakeholders provide comments using this form, which will allow the Company to more easily review and summarize comments by topic and to readily identify specific recommendations, if any, being provided. Information collected will be used to better inform issues included in the IRP, including, but not limited to the process, assumptions, and analysis. In order to maintain open communication and provide the broader Stakeholder community with useful information, the Company will post appropriate feedback on the IRP website based on your selection below.

Date of Submittal 2024-07-03

*Name: Jim Himelic

Title: _____

*E-mail: jhimelic@firstprinciples.run

Phone: 5209791375

*Organization: Renewable Northwest

Address: _____

City: _____

State: _____

Zip: _____

Public Meeting Date comments address: _____

Check here if related to specific meeting

List additional organization attendees at cited meeting: _____

*IRP Topic(s) and/or Agenda Items: List the specific topics that are being addressed in your comments.

Configuration details for Plexos Modeling Exercises

Check here if you want your Stakeholder feedback and accompanying materials posted to the IRP website.

*Respondent Comment: Please provide your feedback for each IRP topic listed above.

While Renewable Northwest (RNW) is still awaiting a response from PacifiCorp regarding our original Stakeholder feedback form submitted on May 2nd, which inquired about the specific PLEXOS LT settings PacifiCorp is employing, we would like to add the following PLEXOS-related questions to that request:

- **PLEXOS Production Settings:** Please provide a copy of the production settings used for all final PLEXOS runs. If separate settings were used for LT and MT-ST runs, please provide each set of settings.
- **PLEXOS Performance Settings:** Please provide a copy of the performance settings used for all final PLEXOS runs. If separate settings were used for LT and MT-ST runs, please provide each set of settings.
- **PLEXOS Horizon Settings:** Please provide a copy of the horizon settings used for all final PLEXOS MT-ST runs.
 - Has PacifiCorp explored the impacts on modeling results and run times when using Typical Week Per Month reduced chronology for the ST Schedule?
 - Note: While RNW does not encourage this setting for reliability-focused ST runs, the mode can be effective in reducing run time requirements when performing economic-focused simulations across an extended planning horizon.
- **PLEXOS MT Settings:** Please provide a copy of the performance settings used for the MT phase of PLEXOS simulations.
 - For the decomposition of the MT targets, does PacifiCorp implement this as a quantity-based target (i.e., a hard constraint) or as a price-based target (i.e., a soft constraint)?
 -
- **Other:**

* Required fields

- o Please discuss to what extent PacifiCorp has explored the various options provided by Energy Exemplar to PLEXOS users for configuring PLEXOS LT runs, particularly in balancing the tradeoffs between chronology resolution and run times. Specifically, please address whether PacifiCorp has considered options such as:
 - Mixed Chronology
 - Rolling Horizons
 - Multistep Optimization with overlapping steps
 - Integerization horizon for expansion decisions optimality
- o Has PacifiCorp explored using the Projected Assessment of System Adequacy (PASA) modeling stage to assist with a first pass reliability run or creating planned maintenance schedules for their thermal generation fleet?
- o Related to performance settings, has PacifiCorp explored using the Gurobi Tuner software program provided by Energy Exemplar?
 - This tool optimizes the settings for the Gurobi solver specific to each model by using an MPS file description of the modeled portfolio.
 - The program identifies the optimal set of solver settings, including undocumented parameters beyond those available through the PLEXOS interface, for a user-specified MIP gap.
- o Has PacifiCorp explored using the [Load Subtractor] property under the Generator class?
 - This parameter allows the chronology algorithm in PLEXOS LT to be applied to the net load profile (i.e., gross load netted out with zero variable costs generation) rather than the gross load profile.
 - This enables a more efficient allocation of the fixed number of blocks accessible to the optimizer to the critical periods in the planning horizon.
- o Does PacifiCorp perform any backcasting validation runs on their PLEXOS model regularly?

Please note that RNW is requesting this information to assist PacifiCorp in addressing their modeling needs. RNW recognizes the complexity associated with effective capacity expansion, resource adequacy, and production cost modeling. Given the size and complexity of PacifiCorp's portfolio, these tasks are even more challenging. In that spirit, RNW has PLEXOS modeling expertise under retainer and offers this support in the spirit of collaboration and continuous progress for the IRP process. RNW is also supportive of PacifiCorp hosting a technical modeling workshop to discuss these items, along with other related modeling topics, if that would be most effective for all stakeholders.

Data Support: If applicable, provide any documents, hyper-links, etc. in support of comments. (i.e. gas forecast is too high - this forecast from EIA is more appropriate). If electronic attachments are provided with your comments, please list those attachment names here.

Recommendations: Provide any additional recommendations if not included above - specificity is greatly appreciated.

Please submit your completed Stakeholder Feedback Form via email to IRP@PacifiCorp.com

Thank you for participating.

* Required fields

PacifiCorp Response (8/12/2024):

Thank you for your feedback and engagement in the Integrated Resource Planning process. Please see the following tables, which display the Plexos settings used in the 2023 IRP Update:

PLEXOS Production Settings:

	LT Models	MT/ST Models
Category	-	-
Dispatch by Power Station (Yes/No)	Yes	Yes
Power Station Aggregation Mode	None	None
Unit Commitment Optimality	Linear	Linear
Rounding Up Threshold	0.5	0.5
Rounded Relaxation Commitment Model	Central	Central
Rounded Relaxation Tuning (Yes/No)	No	No
Rounded Relaxation Start Threshold	0.25	0.25
Rounded Relaxation End Threshold	0.75	0.75
Rounded Relaxation Threshold Increment	0.05	0.05
DP Capacity Factor Threshold (%)	20	20
DP Capacity Factor Error Threshold (%)	20	20
Capacity Factor Constraint Basis	Installed Capacity	Installed Capacity
Forced Outage Relaxes Min Down Time (Yes/No)	No	No
Gas Demand Resolution	Interval	Interval
Heat Rate Detail	Detailed	Detailed
Unit Commitment Heat Rate Detail (Yes/No)	Yes	Yes
Integers in Look-ahead	Never	Never
Cooling States Enabled (Yes/No)	No	Yes
Run Up and Down Enabled (Yes/No)	No	Yes
Transitions Enabled (Yes/No)	Yes	Yes
Start Cost Method	Optimize	Optimize
Start and Stop Enabled (Yes/No)	No	Yes
Ramping Constraints Enabled (Yes/No)	Yes	Yes
Pump and Generate (Yes/No)	No	Yes
Increment and Decrement (Yes/No)	Yes	Yes
Fuel Use Function Precision	0	0
Max Heat Rate Tranches	5	3
Min Heat Rate Tranche Size	0	0
Heat Rate Error Method	Warn Adjust Report Adjusted	Warn Adjust Report Adjusted
Formulate Upfront (Yes/No)	Yes	Yes
Formulate Ramp Upfront (Yes/No)	Yes	Yes
Warm Up Process Enabled (Yes/No)	Yes	Yes

* Required fields

PLEXOS Performance Settings:

	LT Models	MT/ST Models
Category	-	-
SOLVER	Gurobi	Gurobi
Small LP Optimizer	Auto	Auto
Small LP Nonzero Count	250000	250000
Cold Start Optimizer 1	Barrier Homogeneous	Auto
Cold Start Optimizer 2	None	None
Cold Start Optimizer 3	None	None
Hot Start Optimizer 1	Barrier Homogeneous	Auto
Hot Start Optimizer 2	None	None
Hot Start Optimizer 3	None	None
Concurrent Mode	Deterministic	Deterministic
Presolve (Yes/No)	Yes	Yes
Scaling (Yes/No)	Yes	Yes
Crossover (Yes/No)	Yes	Yes
Feasibility Tolerance	0	0
Optimality Tolerance	0	0
Objective Scalar	1	1
Objective Tolerance	0	0
Maximum Threads	-1	-1
MIP Root Optimizer	Auto	Dual Simplex
MIP Node Optimizer	Auto	Dual Simplex
MIP Relative Gap	0.0002	0.0002
MIP Improve Start Gap	0	0
MIP Absolute Gap	0	0
MIP Max Relative Gap	0	0
MIP Max Absolute Gap	0	0
MIP Max Time (s)	7200	3600
MIP Max Relaxation Repair Time (s)	-1	-1
MIP Maximum Threads	-1	12
MIP Start Solution	Within Step	Within Step
MIP Focus	Balanced	Balanced
Carry over MIP Time (Yes/No)	Yes	No
MIP Max Time with Carry over (s)	-1	-1
MIP Hard Stop (s)	-1	-1
MIP Interrupt (Yes/No)	No	No
Hint Mode	Start	Start
Monitoring Periodic Clearing	0	0
Monitoring Maximum Threads	-1	-1
Maximum Monitored MIP Iterations	-1	-1
Maximum Parallel Tasks	-1	-1
Feasibility Repair Failure	Continue	Continue

* Required fields

PLEXOS Horizon Settings:

	LT Models	MT/ST Models
Category	-	-
Periods per Day	24	24
Compression Factor	1	1
Date From	1/1/2023	1/1/2023
Step Type	Year	Year
Step Count	20	20
Look-ahead Count	0	0
Day Beginning	0	0
Week Beginning	0	0
Year Ending	0	0
Chronology	Full	Full
Chrono Date From	1/1/2023	1/1/2023
Chrono Period From	1	1
Chrono Period To	24	24
Chrono Step Type	Day	Week
Chrono At a Time	1	1
Chrono Step Count	7305	1043
Look-ahead Indicator (Yes/No)	No	Yes
Look-ahead Type	Day(s)	Day(s)
Look-ahead At a Time	2	3
Look-ahead Periods per Day	12	12

* Required fields

PLEXOS MT Settings: Performance settings.

There do not appear to be any “MT Schedule” settings in PLEXOS 9.2, that relate to “...the decomposition of the MT targets...” as described in this question.

MT targets are generally set based on the specific property and associated spanning condition. PacifiCorp is taking steps to change the model properties in order to bypass the MT phase where appropriate when running an ST deterministic model run. For example: we have specifically defined the “Max Capacity Factor Week” for DSM-Demand Response. Rather than attempting to optimize demand response dispatch based in the MT phase, a portion of the overall demand response capability is allocated to each week in the relevant season, with more events in periods with greater risk or need. This emulates actual practice, where, outside of an emergency where a program would immediately be used to the maximum extent allowed, a portion of the events will be reserved in case they are needed in the remainder of the season.

Other:

- **Configuring PLEXOS LT runs**

- PacifiCorp has explored and continues to explore all model setups/options on an ongoing basis in an attempt to improve modeling performance and in order to achieve LT portfolio results that are more reliable and consistent with the results we see in the ST phase of PLEXOS modeling. We do not see a setting for “Mixed Chronology”, however, we currently use the “Partial” chronology setting in our LT model runs.

Fitted and sampled have been tested multiple times. We see the best results using the combination of partial and our custom slicing combined with 7 Blocks/Month. Rolling Horizons had been tested in the past but this setup was not functioning; however Energy Exemplar has indicated this functionality has been fixed and should work. We are testing this setup currently for the 2025 IRP, but it reports faulty infeasibilities. Tests using the integerization horizon for expansion decisions has not resulted in meaningful run-time improvements.

PacifiCorp has found that focusing on specific unit types being modeled as linear/integer results in more significant run-time improvements. For example, only existing plant retirements and certain transmission upgrades may need to be considered on an integer basis.

- PacifiCorp has not explored the use of the PASA modeling stage.
- PacifiCorp has not explored using the “Gurobi Tuner” software, but the Company is interested to learn more about this. As stated, we are always looking to improve our model setups and assumptions.
- **Load Subtractor:** PacifiCorp had tested using a load subtractor setup to help the model with Blocking, but it did not appear to provide a useful improvement. Because load subtractor is tied to specific volumes identified prior to running the LT, it does not incorporate the outcomes of the portfolio selection. This setup would not work with our current LT setup that uses custom slicing which accounts for our wind and solar profiles.
- PacifiCorp has not attempted to perform any type of backcasting validation within PLEXOS. PacifiCorp has been reviewing historical load, market price, and generator availability data to see whether the forecasting and modeling of these inputs can be improved to better reflect both the expected variation in these inputs experienced on an actual basis and the correlation among these inputs. In actual operations, PacifiCorp balances much of its requirements using market products transacted on a forward and day-ahead basis. PLEXOS currently only uses hourly balancing, so it does not have forward and day-ahead market products, nor does it capture all of the impacts of hedging requirements and forecast error. For the 2025 IRP, PacifiCorp is working to incorporate the forward showing requirements associated with the Western Resource Adequacy Program (WRAP), and those requirements are likely to impact how forward market transactions are used in practice. Similarly, PacifiCorp expects to begin operating within the CAISO’s Enhanced Day-Ahead Market (EDAM) starting in 2026, which may also impact operations. These two developments are likely to improve the alignment between actual operations and PLEXOS and will reduce the relevance of recent actual results. PacifiCorp remains open to specific suggestions that might improve the performance and accuracy of our modeling.