2.1 Market Entities

The entities that engage in the operation of the CAISO Markets are described in the following subsections.

2.1.1 CAISO

CAISO is a non-profit public benefit corporation that:

- Has Operational Control of transmission facilities of all Participating Transmission Owners
- Is the Balancing Authority Area Operator for the CAISO Balancing Authority
- Administers the CAISO Markets

2.1.2 Scheduling Coordinators

It is important to note that all business with the CAISO Markets, except for acquisition and holding of Congestion Revenue Rights (CRRs), must be conducted through CAISO-approved and registered entities called Scheduling Coordinators (SCs). The primary responsibilities of SCs include as applicable:

- Represent Generators, Load-Serving Entities, Proxy Demand Resources (PDR), Reliability Demand Response Resources (RDRR), importers, and exporters
- Provide NERC tagging data
- Submit Bids[1] and Inter-SC Trades
- Settle all services and Inter-SC Trades related to the CAISO Markets
- Ensure compliance with the CAISO Tariff
- Submit annual, weekly, and daily forecasts of Demand

2.1.3 Participating Generators

A Participating Generator is a Generator that is able to sell and provide Energy or Ancillary Services through an SC over the CAISO Controlled Grid from a Generating Unit with a rated capacity of 1 MW or greater, or from a Generating Unit providing Ancillary Services and/or submitting Energy Bids through an aggregation arrangement approved by CAISO, that has undertaken to be bound by the terms of the CAISO Tariff, in the case of a Generator through a Participating Generator Agreement.

A Participating Generator must register with an SC who acts on the Participating Generator's behalf for the sale of Energy or Ancillary Services into the CAISO Markets. All CAISO Markets

[1] Including Virtual Bids

transactions engaged in by the SC for specific Participating Generators is settled with the applicable SC.

2.1.4 Constrained Output Generator

A Constrained Output Generator (COG) is a Generating Unit with a zero or very small operating range between its Minimum Load (Pmin) and Maximum Capacity (Pmax).

Generating Units are eligible to elect COG status, on an annual basis, and benefit from the flexible COG model only if their actual operating range (Pmax – Pmin) is not greater than the highest of three (3) MW or five percent (5%) of their actual Pmax. Eligible Generating Units that elect COG status must make an election before each calendar year. Resources with that have zero operating range must participate as COGs. Resources with a non-zero operating range have the option to participate as a COG. The election is made by registering the resource in the Master File as having a PMin equal to PMax less 0.01 MW (PMin+ PMax -0101 MW) within the time frame for submitting Master File changes so that the change becomes effective by the first of the year. . COGs must also elect the Proxy Cost or Registered Cost option for Start Up and Minimum Load cost, similar to all other Generating Resources. Registered COGs may submit an Energy Bid to indicate participation in the market for the relevant Trading Hour. The submitted Energy Bid will be replaced by the CAISO with a Calculated Energy Bid determined by dividing its Minimum Load Cost by MW quantity of the resources PMax. COG may not bid or self-provide Regulation or Spinning Reserve, but they may be certified for Non-Spinning Reserve provision if they are Fast Start Units. Registered COGs may also self-schedule at their Pmax. COGs are not eligible to submit RUC bids or received compensation for any RUC Awards.

2.1.5 Multi-Stage Generating Resources

Generating Units and Dynamic Resource-Specific Resources may register and qualify as Multi-Stage Generating Resources pursuant to the requirements specified in Section 27.8 of the CAISO Tariff. Multi-Stage Generating Resources are Generating Unit or Dynamic Resource-Specific System Resource that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. Subject to the requirements in Section 27.8 of the CAISO Tariff, the following technical characteristics qualify a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource if the resource; (1) is a combined cycle gas turbine resource; (2) is a Generating Unit or Dynamic Resource-Specific System Resources with multiple operating or regulating ranges but which can operate in only one of these ranges at any given time; or (3) has one or more Forbidden Operating Regions. Metered Subsystems,

Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources do not qualify as Multi-Stage Generating Resources.

This modeling approach allows for a specified number of discrete states (one Off state and at least two On states with different resource configurations). Each on-line state represents a MSG Configuration in which the Multi-Stage Generating Resource can operate. Operating limits and technical characteristics are defined for each MSG Configuration separately and are retained in the Master File. Each MSG Configuration is modeled as a logical generator with its own individual components such as operating limits, ramp rate, Minimum Load Cost, Transition Costs, and Energy Bids.

The Transition Matrix contained in the Master File includes a prescribed set of feasible MSG Transitions that indicate the feasible transition from one MSG Configuration to another. Transition Costs and Transition Times, defined in the registered Transition Matrix can be different for each defined transition. Transitions that are not registered in the Transition Matrix are not considered by the CAISO Market processes. Each of the MSG Configurations have specified minimum on-state time, minimum off-state time.

The following are some of the characteristics of Multi-Stage Generating Resources:

- The Economic Bids and Self-Schedules are defined at the MSG Configuration level.
- The outage information from outage management system is obtained at the MSG Configuration and the Generating Unit level (i.e. plant level). The market applications use PMax derate or PMin uprate information from outage management system at the MSG Configuration level for most processes; however it uses outage information at the overall plant level for validating Exceptional Dispatch instructions.
- The Scheduling Coordinator may register up to six MSG Configurations without any limitation on the number of transitions between the registered MSG Configurations in the Transition Matrix. If the Scheduling Coordinator registers seven or more MSG Configurations, then the Scheduling Coordinator may only include two eligible transitions between MSG Configurations for upward and downward transitions, respectively, starting from the initial MSG Configuration in the Transition Matrix.
- In addition, no Forbidden Operating Region (FOR) is allowed in any MSG Configuration, and Operational Ramp Rate curves are limited to two segments within a given MSG Configuration. Consequently, the ramp-rate de-rate from outage management system will be limited to two segments for a given MSG configuration accordingly.
- Separate Minimum Up Time (MUT) and Minimum Down Time (MDT) constraints can be enforced at both the plant and individual MSG Configuration levels. In addition, MUT and

MDT constraints may be specified for a group of MSG Configurations. Specific features are as follows:

- Plant level: MUT includes the Transition Times of all the MSG Configurations being switched.
- Group level:
  - MUT represents the total time that the Multi-Stage Generating Resource must stay within the group. For example, suppose a Multi-Stage Generating Resource has 6 configurations, with configurations 5 and 6 part of a group with a MUT of 6 hours. Once dispatched into either configurations 5 or 6, the resource may transit freely between configuration 5 and 6, but cannot move to a different configuration until the 6 hour MUT has passed. Transition time between MSG configurations within the group is considered as "ON" Time of the group.
  - MDT represents the total time that the Multi-Stage Generating Resource must stay outside of the group. When considering the MDT of a group, the time that the Multi-Stage Generating Resource is operating in a configuration outside the group or within transition outside of the group is considered as the "OFF" time period for the group, in addition to the time that the resource is off line.
- Configuration level: When considering the MDT of a given MSG Configuration, the time that the Multi-Stage Generating Resource is operating on a different configuration or transitioning is considered as the "OFF" time period for the given MSG Configuration, in addition to the time that the resource is off line.

2.1.6 Participating Loads

A Participating Load is an entity providing Curtailable Demand, that has undertaken in writing (by executing a Participating Load Agreement between CAISO and such entity) to comply with all applicable provisions of the CAISO Tariff, as they may be amended from time to time.

From the electrical point-of-view, curtailing Participating Load is analogous to increasing electricity Supply or Generation. Most Participating Loads are Pumping Loads.

Curtailable Demand is Demand from a Participating Load that can be curtailed at the direction of CAISO in the Real-Time Dispatch of the CAISO Controlled Grid. SCs with Curtailable Demand may offer their product to CAISO to meet Non-Spinning Reserve or Imbalance Energy.

There are at least three types of Participating Load: 1) Pumping Load that is associated with a Pump-Storage resource, 2) A single Participating Load (i.e. Pumping and non-Pump Load) that is not associated with a Pump-Storage resource; and 3) Aggregated Participating Load (i.e. aggregated Pumping and non-Pumping Load that is an aggregation of individual loads that operationally must be operating in coordination with each other.

The table below illustrates which of these models are used to accommodate the various types of Participating resources:

Participating Resources	Model Used	Comments
Pump-Storage Resources (i.e. Helms, San Luis)	Pump-Storage Hydro Unit Model	Model can support generation and pump mode. Pump mode is effectively negative generation mode.
Single Participating Load (single Pump and non-Pump Load)	Pump-Storage Hydro Unit Model.	For load (pump-only) the Generation capability of the Pump-Storage model is set to 0 MW. Therefore pump can use negative generation.
Aggregated Participating Load (i.e., aggregated Pumping and non-Pumping Load)	Extended Non-Participating Load Model	Energy will be bid and scheduled using Non-Participating Load in the Day-Ahead Market. To the extent resource is certified to provide Non-Spin, a pseudo-generator model will be used to offer Non-Spin and to the extent necessary dispatch energy from Non-Spin Capacity representing dropping pump load.

CAISO only accepts Bids for a Participating Load from an SC. If the SC is not the entity that operates the Participating Load itself, the SC submits Bids on behalf of the Participating Load for the Supply of Energy or Ancillary Services into the CAISO Markets. All CAISO Markets transactions engaged in by the SC, for a specific Participating Load, are settled with the applicable SC.

Below the following three categories of Participating Load that can participate in CAISO Markets are described further:

- Pumped-Storage Hydro Units
- Single Participating Load (i.e., Pumping load or non-Pumping Load)
- Aggregate Participating Load (i.e. aggregated Pump Load or non-Pumping Load

2.1.6.1 Pumped-Storage Hydro Unit Model

Under this model, the resource looks like a Generating Unit on one side and looks like Load (On or off – single segment) on the other. There are thus three distinct operating modes for a Pumped-Storage Hydro Unit (PSHU) that uses the full functionality of the model. These operating modes are:

- Pumping (i.e., pump on and consuming Energy)
- Offline (i.e., both generation and pump off and not producing or consuming Energy)
- Generating Energy like an ordinary Generating Unit

It is not necessary to utilize all three modes. Some pumps are just pumps in that they only consume Energy, and do not generate Energy. If these pumps wish to participate and sell Imbalance Energy or Non-Spinning Reserves then they must use the same model as the Pumped-Storage Hydro Unit for submission of their Bids into the CAISO Market, but need not enter the Generation side of the model for the optimization. The Generator Bid data of the PSHU model can be left blank. Thus whether a facility is a PSHU or merely a pumping facility the same model is used in the optimization, but with differing levels of Bid data required depending on the functionality being supported.

PSHU can perform either as Generating Unit by supplying Energy or as Loads by consuming Energy from the grid, and therefore they are modeled in the CAISO Markets as Generating Units whose output can go negative when they are functioning as pumps. The PSHU model for Participating Loads models the pumps as Generating Unit with negative Generation capabilities and therefore schedules and settles them at nodal LMPs.

Pumps are modeled with a two-part Bid, namely Shut-Down Costs and Pumping Costs.

1) A Shut Down Cost is an event driven non-Energy based cost that is similar to Start-Up Costs associated with a Generating Unit. The Shut Down Costs represent the costs associated with action of shutting down the pump in dollars per shut-down

event. This information is bid in. If the SC does not include any Shut Down Cost component, then the Scheduling Interface and Bidding Rules application (SIBR) inserts a pump Shut Down Cost of $0.

2) Pumping Cost is the hourly cost of operating a hydro pump and it occurs while the pump remains online. In each Trading Day, Pumping Costs are submitted separately for the IFM and the RTM, and may vary by each Trading Hour. Pumping Cost applies only to PSHU and hydro pumps.

3) Pumping Costs are similar in nature to Minimum Load Costs because they are single segment and are represented as a single price for a given Trading Hour for the quantity (MW) of Energy associated with the cost of operating the unit in pumping mode. The pumping operation is restricted to a single operating point, the pumping level, which is submitted with the Bid and can be different in each Trading Hour and across the CAISO Markets. The Pumping Cost is used in the DAM/RTM to optimally schedule the unit in pumping mode. The Pumping Cost represents different things depending on the following:

   a) If the facility is bidding to pump in either DAM or RTM then it represents the Energy Bid Costs the pump is willing to pay in either market, assuming the pump is not already scheduled to consume Energy in that market.

   b) In RTM if the facility has a pumping schedule then the Pumping Costs represent the price at which the pump is willing to be paid to curtail in RTM.

A PSHU facility may submit a Pump Shut Down Cost. If none is submitted, the CAISO will generate these values based on the Master File information. (See BPM for Market Instruments) No shut-down ramp rate is required as it is assumed to be infinite. The PSHU model does not handle Ramp Rates in pumping mode, i.e., the pump starts up / shuts down immediately.

Inter-temporal constraints in pumping mode consist of (1) minimum pumping time (separate from minimum generating time), (2) the maximum pumping Energy per Trading Day, (3) the maximum number of pumping cycles in a Trading Day, (4) minimum lag time between consecutive pump starts in a group[2], and (5) minimum down time. The CAISO minimum down time model will allow for the specification of separate minimum down time values for each of four potential switching sequences:

- Minimum down time when switching from pumping to off to pumping (MDTpp)
- Minimum down time when switching from pumping to off to generation (MDTpg)

[2] See section **Error! Reference source not found.**~~6.6.2.2~~ for more information on grouping constraints.

- Minimum down time when switching from generation to off to pumping (MDTgp)

- Minimum down time when switching from generation to off to generation (MDTgg) (essentially the existing minimum down time feature for generating resources)

In addition, if the PSHU is defined as a group, the following optional features are available:

- A unison operation feature will prevent simultaneous operation of resources in different modes. If selected, the feature will prevent PS resources within a group of resources from being committed in generation mode if any unit within the group is in pumping mode, or vice versa.

- A minimum lag feature specifies the minimum period between the time when the last PS resource in a group is shutdown in pumping mode and the first resource is started in generating mode and vice versa.

An additional feature pertains solely to the PSHU model. In most cases SCs may not submit Demand Bids in RTM because RTM clears Supply against the CAISO Forecast of CAISO Demand. Participating Load using the PSHU model is an exception to this rule in that it can submit Self-Schedules of Demand for Energy in RTM using the same PSHU model method discussed above. The PSHU model does not support aggregation of Participating Load. Rather, to the extent Participating Load makes use of the PSHU model it must represent a single load with a single telemetry and metering scheme.

2.1.6.2 Single Participating Load (Pumping and non-Pumping Load)

Although pumps are bid-in to consume Energy when they are pumping, pumps are modeled as negative Generation in DAM. In DAM an SC may either bid to procure Energy to pump using its Pumping Costs as a substitute of an Energy Bid, or it may Self-Schedule Energy to pump. Each pump is modeled individually. The SC may not submit an Economic Bid to Supply Energy because the generating mode of the PSHU model is not available for a single Participating Load. Furthermore, an SC may not bid to curtail a pump in DAM because in DAM a pump may only have a Pumping Cost or a Self-Schedule to consume Energy. An SC may offer Non-Spinning Reserve capacity in DAM from a pump, but such capacity is only awarded if the pump is scheduled to consume Energy in the DAM. In RTM if an SC wishes to bid to curtail a pump to provide either Energy or Non-Spinning Reserves then it must have a non-zero pumping Schedule from DAM results. If the SC wishes to bid to pump (consume Energy) in RTM it must likewise have a zero pumping Schedule from DAM or a higher pumping level in RTM compared to their pumping schedule in the DAM.

The nature of an SC's schedule as the SC enters a market constrains the options available to facilities. If the SC has a zero pumping Schedule from DAM then obviously it cannot be curtailed to provide Energy in RTM as there is nothing to curtail. If the SC submits a pumping Self-Schedule

or pumping ETC Self-Schedule, the resource will stay in pumping mode and will not be curtailed. Pumping Self-Schedule like any other Self-Schedule is a commitment to be on at minimum load and is effectively fixed. As a result, there is no economic signal available to de-commit the pump. Otherwise the resource will be scheduled optimally to pump or shutdown the pump based on its Pumping Cost and Pump Shut Down Cost.

Pumps can provide two products to the RTM, namely Imbalance Energy and Non-Spinning Reserves, if they enter that market with a non-zero pump Schedule from DAM.

2.1.6.3 Aggregated Participating Load (i.e. Pump and non-Pumping Load)

An Aggregated Participating Load will be modeled and will participate only in the CAISO's DAM as both a Non-Participating Load (NPL) for energy and as a pseudo generating unit for Non-Spinning Reserve through the Extended Non-Participating Load Model. In the first release of MRTU, the Aggregated Participating Load will not be able to participate in the CAISO's markets using a Participating Load model. Rather the Scheduling Coordinator on behalf of the Aggregated Participating Load may submit two Bids for the same Trading Day: (1) using a Non-Participating Load, model a Day-Ahead Self-Schedule with an Energy Bid Curve with a maximum 10 segments; and (2) as a Generator representing the demand reduction capacity of the Aggregated Participating Load, a submission to Self-Provide Non-Spinning Reserve or a Bid to provide Non-Spinning Reserve. The CAISO will assign two Resource IDs: one for Non-Participating Load Bids and one for Generator Bids. Both Resource IDs will be in the Master File on behalf of the Aggregated Participating Load. The Aggregated Participating Load will be treated as a Participating Load for settlement and compliance purposes. As a result the Aggregated Participating Load will be settled at an Aggregate Pricing Node that represents the prices only of those PNodes that make up the Aggregate Participating Load.

2.1.6.4 Non-Pumping Facilities

While most Participating Loads are Pump Loads, There are two ways in which non-pumping Participating Load Resource[3] can participate in the CAISO Markets:

1) To the extent that the non-pumping facility, such as a Demand Response Program (DRP) represents price sensitive Demand that has not executed a Participating Load Agreement, such Demand can be bid to procure at a price, using the ordinary Non-Participating Load Demand Bid in DAM. In this manner the non-pumping facility is represented in the shape of the Demand Bid submitted by the SC. This option does not use the PSHU model. If such Demand Response Program is Non-Participating Load, it is settled at the Default Load Aggregation Point (LAP) price.

[3] Demand Response Programs (DRPs) are one example of non-pumping facilities that can submit Participating Demand bids,

2) Participating Loads that can model themselves in the same On/Off states as pumps and execute a Participating Load Agreement (PLA), can participate like pumps as described in Section 2.1.4.2. For the non-pumping facilities that represent price sensitive Demand, many of the programs are triggered by specific events such as CAISO declaring a staged emergency. If the non-pumping facility Demand is dispatchable in RTM, then the Demand may utilize the PSHU, by responding to Real-Time prices. Non-pumping facilities may bid a similar Pumping Cost into the RTM to either consume Energy in RTM if not already scheduled in DAM or to curtail from the Day-Ahead schedule.

3) Aggregated Participating Loads that represent an aggregation of loads that are not at the same Location and have executed a Participating Load Agreement can submit an Energy Bid Curve, using the non-Participating Load Demand Bid in the DAM and submit a Bid into the Non-Spinning Reserve Market as described in Section 2.1.4.3. Under this model, CAISO adds a pseudo-generator to the CAISO network model to represent the Participating Load, to support bidding and dispatch of Non-Spinning Reserve. For Aggregated Participating Loads, CAISO adds a pseudo System Resource to the network model that allows Energy Bids to be modeled using the same functionality as exports from CAISO.

Attribute	Pump-Storage Model	Extended Non-Participating Load Model
Model	Pump model as negative generator	Load operates as Non-Participating Load. Manual workaround by CAISO allows for participation as Non-Spinning Reserve
Number of Operating Bid Segments	Single segment – Pump is either on or off	Up to 10 segments
Aggregate physical resource?	No	Yes
Bid Component	Two part Bid: ▪ Shut-Down curtailment cost ▪ Pump Energy cost	One part Bid: ▪ Energy Bid curve
Base Load supported	No	No
Settlement	In DAM, Pump can only submit Bid to buy Energy. If scheduled, Pump Load is charged DAM LMP, If not scheduled in DAM, no charge.	CDWR Participating Loads have separate LAPs for DAM and RTM LMP calculation. For other Participating Loads, CAISO determines feasible level of LMP

	In RTM, any curtailment from DAM Schedule is paid nodal LMP plus Shut-Down curtailment cost, If Pump is not scheduled in DAM, Pump Load may offer to buy (i.e., to pump) in the RTM	disaggregation on a case by case basis. DAM Schedule is settled at the DAM LMP. Difference between DAM Schedule and RTM Demand is settled at RTM LMP. Participating Load is not subject to Uninstructed Deviation Penalty.
Treatment in DAM	Modeled as a negative generator. Participating Load may only submit Bid to buy in DAM.	Energy is scheduled in DAM as Non-Participating Load. Participating Load is eligible to submit Bid for Non-Spinning Reserve, using pseudo-generators placed at the locations of the load.
Treatment in RTM	In RTM, Pump may offer to curtail from DAM Schedule (if scheduled in DAM) or offer to buy in RTM (if not scheduled in DAM).	Participating Loads determine RTM operating point by monitoring RTM LMPs. CAISO dispatches Non-Spinning Reserve as contingency only reserve, using pseudo-generators at the locations of the Participating Load. Actual response is expected as a reduction in Demand
Inter-temporal constraints	Yes ▪ Minimum Up Time (minimum time to stay pumping after switching to that mode) ▪ Maximum number of status changes (maximum number of times Pump can switch from pumping mode) ▪ Daily Energy Limit	No
Load Ramping	No	No
Ancillary Service Eligibility	Eligible to provide Non-Spinning Reserve	Eligible to provide Non-Spinning Reserve

2.1.7 Non-Participating Loads

SCs may submit Bids for Non-Participating Loads in DAM to procure Energy. Such Bids may represent an aggregation of Loads and must be bid-in and Scheduled at an Aggregated Pricing Node. Non-Participating Load may not be bid-in to be curtailed in RTM.

2.1.8 Utility Distribution Companies

A Utility Distribution Company (UDC) is an entity that owns a Distribution System for the delivery of Energy, and that provides regulated retail electricity service to Eligible Customers, as well as regulated procurement service to those End-Use Customers who are not yet eligible for direct access, or who choose not to arrange services through an alternate retailer. A UDC has to execute a UDC Operating Agreement with CAISO.

2.1.9 Metered Subsystems

A Metered Subsystem (MSS) is a geographically contiguous electricity system located within an Existing Zone Generation Trading Hub that has been operating as an electric utility for a number of years prior to the CAISO Operations Date as a municipal utility, water district, irrigation district, State agency or Federal power administration, and is subsumed within the CAISO Balancing Authority Area and encompassed by CAISO certified revenue quality meters at each interface point with the CAISO Controlled Grid and CAISO certified revenue quality meters on all Generating Units or, if aggregated, each individual resource and Participating Load internal to the system, that is operated in accordance with an MSS Agreement described in Section 4.9.1 of the CAISO Tariff.

To participate in the CAISO markets, MSSs must be represented by SCs, which can be the MSS itself.

2.1.10 Balancing Authority Areas

The CAISO Balancing Authority Area is one of the Balancing Authority Areas (BAAs) that is under the jurisdiction of the Western Electricity Coordinating Council (WECC). The CAISO Balancing Authority Area is directly connected with the following Balancing Authority Areas. The modeling description is also indicated:

- Bonneville Power Administration (BPA) – external
- PacifiCorp West – external
- Sierra Pacific Power – external
- Nevada Power – external
- Western Area Power Administration-Lower Colorado Region (WAPA-LCR) – external

- Sacramento Municipal Utility District –adjacent
- Arizona Public Service – external
- Salt River Project – external
- Imperial Irrigation District – external (candidate adjacent in future)
- Los Angeles Department of Water & Power – external (candidate adjacent in future)
- Comision Federal De Electricidad – external (candidate adjacent in future)
- Turlock Irrigation District – adjacent

In addition to the modeling of the CAISO Balancing Authority Area, there are three types of Balancing Authority Area modeling designations as briefly discussed below and further explained in the *BPM for Managing Full Network Model* :

- **External** – External Balancing Authority Areas are generally modeled in detail by using the same model for the EMS State Estimator and the CAISO Markets, including where New Participating Transmission Owners (PTOs) have converted their Existing Rights to the CAISO Controlled Grid,[4] and Integrated Balancing Authority Areas. For external Balancing Authority Areas, imports and exports are modeled as injections at Scheduling Points in the detailed external network model, at tie points where Transmission Interfaces are interconnected, and in which Real-Time power flows developed in the State Estimator account for unscheduled as well as scheduled power flows. The CAISO models the resistive component for transmission losses in external Balancing Authority Areas but does not allow such losses to determine LMPs, since these losses are settled by the external Balancing Authority Areas.
- **New PTO Model**: For the CAISO Controlled Grid that is comprised of the New PTO's Converted Rights, the network model includes physical branches within external Balancing Authority Areas, and enforces the limits of the Existing Rights.
- **Integrated Balancing Authority Areas –** For external Balancing Authority Areas where there is sufficient data available or adequate estimates can be made for an IBAA, the FNM used by the CAISO for the CAISO Markets Processes will include a model of the IBAA's network topology. The CAISO monitors but does not enforce the network Constraints for an IBAA in running the CAISO Markets Processes. Similarly, the CAISO models the resistive component for transmission losses on an IBAA but does not allow such losses to determine LMPs that apply for pricing transactions to and from an IBAA and the CAISO Balancing Authority Area, unless allowed under a Market Efficiency Enhancement Agreement. For Bids and Schedules between the CAISO Balancing Authority Area and the IBAA, the CAISO will model the associated sources and sinks that are external to the CAISO Balancing Authority Area using individual or aggregated injections and withdrawals at locations in the FNM that allow the impact of such injections and withdrawals on the CAISO Balancing Authority Area to be reflected in the CAISO Markets Processes as accurately as possible given the information available to the CAISO.

[4] The New PTOs' Converted Rights are in portions of the Los Angeles Dept. of Water and Power, Western Area Power Administration Lower Colorado, Arizona Public Service, PacifiCorp East, and Sierra Pacific Control Areas.

The CAISO has executed a number of Interconnected Balancing Authority Areas Operating Agreements with interconnected Balancing Authority Areas to establish the relationship between CAISO and the neighboring Balancing Authority Area. Balancing Authority Areas that are eligible to participate in the CAISO Markets must do so through an SC (which can be the same entity).

2.1.11 Participating Transmission Owners

A Participating Transmission Owner (PTO) is a party to the Transmission Control Agreement whose application under Section 2.2 of the Transmission Control Agreement has been accepted and who has placed its transmission lines and associated facilities, and Encumbrances under CAISO's Operational Control in accordance with the Transmission Control Agreement between CAISO and such PTO.

There are two types of Participating Transmission Owners:

- **Original** Participating TO – PTOs as of December 31, 2000
- **New** Participating TO – PTOs since January 1, 2001

2.1.12 System Resource

A System Resource is a group of resources, single resource, or a portion of a resource located outside of the CAISO Balancing Authority Area, or an allocated portion of a Balancing Authority Area's portfolio of resources that are either a static interchange schedule or directly responsive to that Balancing Authority Area's Automatic Generation Control (AGC) capable of providing Energy and/or Ancillary Services to the CAISO Balancing Authority Area, provided that if the System Resource is providing Regulation to the CAISO it is directly responsive to AGC. There are different types of System Resources:

1) Dynamic System Resource: A System Resource that is capable of submitting a Dynamic Schedule, including a Dynamic Resource-Specific System Resource. Unless otherwise noted, Dynamic System Resources are modeled and treated in the market similar to Generating Resources.

2) Non-Dynamic System Resource: A System Resource that is not capable of submitting a Dynamic Schedule, which may be a Non-Dynamic Resource-Specific System Resource.

3) Dynamic Resource-Specific System Resource: A Dynamic System Resource that is physically connected to an actual generation resource outside the CAISO Balancing Authority Area.

4) Non-Dynamic Resource –Specific System Resource: A Non-Dynamic System Resource that is physically connected to an actual generation resource outside the CAISO Balancing Authority Area.

2.1.13 Non-Generator Resources

Non-Generator Resources (NGRs) are Resources that operate as either Generation or Load and that can be dispatched to any operating level within their entire capacity range but are also constrained by a MWh limit to (1) generate Energy, (2) curtail the consumption of Energy in the case of demand response, or (3) consume Energy.

More generally, NGRs are resources that operate as either generation or load and can be dispatched within their entire capacity range, inclusive of the generation and load. They are also constrained by an energy (MWh) limit to generate or consume energy on a continuous basis. NGRs include limited energy storage resources (LESR), and Generic resources. By modeling the generation range from negative to positive, the NGR model provides NGRs the same opportunity as generators to participate in the CAISO energy and ancillary service markets subject to meeting eligibility requirements.

NGRs have the following characteristics:

- NGR is a resource that has a continuous operating range from a negative to a positive power injection; i.e., it can operate continuously by either consuming energy or providing energy, and it can seamlessly switch between generating and consuming electrical energy. An NGR functions like a generation resource and can provide energy and AS services. Because of the continuous operating range, NGRs do not have minimum load operating points, state configurations, forbidden operating regions, or offline status (unless on outage). Therefore they do not have startup, shutdown, minimum load, or transition costs.
- The ISO can use its NGR functionality to model a Limited Energy Storage Resource (LESR). However, NGR functionality is not limited to a storage resource. Any resource that can operate seamlessly from negative to positive can use this functionality.
  - For an NGR, the energy limits (MWh) is the maximum or minimum energy the device can store; this energy can be stored in the form of electrical charge, chemical energy, potential energy, or kinetic energy and it can be discharged to generate electricity. Based on an initial stored energy (state of charge (SOC)), the continuous energy consumption or generation is constrained by the maximum or minimum stored energy limit (specified in the Master File), accounting for inherent losses while charging and discharging.
  - For NGRs that elect not to use Regulation Energy Management, the day ahead and real-time markets observe the energy limits in the energy and ancillary service optimizations.
  - For NGRs using Regulation Energy Management, energy limits are observed in real-time economic dispatch only.

- The energy limits for NGRs are not required for the resource if the resource does not have that physical limitation; nevertheless, if the NGR resource has a stored energy limit, it must register the limit value with the ISO so that the ISO can observe the limit in the market. When resource energy limits are not provided, the ISO assumes that the NGR does not have these constraints. The resource owner and Scheduling Coordinator must manage any resource energy constraints in order to comply with ISO dispatch instructions in the ISO Market.

- The algebraic power output of a NGR is limited between a minimum and a maximum capacity measured in MW. The minimum or maximum capacities can be negative. The maximum capacity is greater than the minimum capacity. For an NGR, the maximum capacity (positive) represents the MW injected to the grid when it is discharging at its maximum sustainable rate; minimum capacity (negative) represents the MW withdrawn from the grid when it is charging at its maximum sustainable rate.
- NGRs have distinct ramp rates for operating in a consuming mode (charging) or in a generating mode (discharging), but is limited to one segment for each mode.
- NGRs can provide energy and ancillary services (AS).
  - NGRs can provide ancillary services (AS) continuously while they are charging or discharging. The dispatch of a NGR providing AS must employ a stored energy management scheme to manage the state of charge and ensure that there is sufficient stored energy in the device to dispatch to satisfy the AS when they are called upon.
  - NGRs can provide regulation from anywhere within their regulation range.
  - NGRs will be subject to Spin/Non-Spin No Pay based on the resource's energy limit on an after the fact basis.
- Generic NGR model has the ability to generate or consume energy. Market Participants can use the Resource Data Template (RDT) to register their resources under the Generic NGR model. This functionality allows Scheduling Coordinator to submit bids and Base Schedules for resources using Generic NGR model. Additionally, the Generic NGR model will be subject to Local Market Power Mitigation (LMPM) for its entire capacity (Pmax-Pmin). (see BPM for Market Operations Appendices section B.1.2)

2.1.13.1 Non-Generator Resources Providing Regulation Energy Management

Under regulation energy management (REM), non-generator resources that require an offset of energy in the real time market to provide regulation can elect to participate only in the ISO's regulation markets. REM functionality will allow an NGR to purchase or sell energy in real-time to meet the continuous energy requirements for regulation procured in the day-ahead market and real time market. When a resource elects REM, the regulation capacity awarded in the day-ahead market is evaluated as four times the regulation energy it can provide within 15 minutes.

Non-Generator Resources providing Regulation Energy Management must register their minimum and maximum energy limits in order for the ISO to continuously optimize and balance the resource through Regulation energy.

Note that the buying and selling of energy in the real-time market supports the regulation obligation. NGRs using Regulation Energy Management do not participate in the ISO's energy market or operating reserves.

2.1.14 Pseudo-Tie

A Pseudo-Tie is a single resource physically located outside of the CAISO Balancing Authority Area, but contractually part of the CAISO Balancing Authority Area for purposes of production, ancillary services responsibility, operating jurisdiction, etc. Unless otherwise noted, Pseudo-Tie Generators are modeled and treated by the market similar to Generating Resources.

2.1.15 Use-Limited Resources

Resources may register and qualify as Use-Limited Resources pursuant to the requirements specified in Section 30.4.1.1.6.1.1 of the CAISO Tariff. To initiate the process, the Scheduling Coordinator should submit a request to register use limitations via CIDI with the subject 'Use-Limited Registration'. The ISO will validate if the use limitations the Scheduling Coordinator is requesting to register in the Use Limit Plan Data Template (ULPDT) meet the use-limitation criteria in section 30.4.1.1.6.1.1. If CAISO approves any submitted limitation to be registered, the CAISO will designate resources as Use-Limited Resources in Master File Generator Resource Data Template associated with the approved use limitation.

For the CAISO to designate a resource as Use Limited, the CAISO and Scheduling Coordinators must perform the following:

1. First, the CAISO must approve at least one qualifying limitation in the use limitation registration process (approved limitations) for the resource to qualify as a Use-Limited Resource.

2. Second, the Scheduling Coordinator must register approved limitations in the Use Limit Plan Data Template.

For the first step, the Scheduling Coordinator must provide sufficient documentation to support the SC is eligible to register the use limitation in the Use Limit Plan Data Template based on meeting all three criteria defined in Section 30.4.1.1.6.1.1. The approved use limitation(s) will be

defined as the unique combination of use limit type, granularity, effective start date, effective end date, and whether the limitation values are fixed or dynamic. For fixed limitation values, the qualifying limitation values are registered as fixed values where the explicit value is validated in the registration process. For dynamic limitation values, the qualifying limitation values are registered as dynamic values where the methodology used by the SC to determine the limitation value is validated in the registration process.

For a use limitation to qualify, the limitation must meet all three criteria of Section 30.4.1.1.6.1.1 and must be able to be rationed in response to ISO energy price signals over the registered granularity. The criteria are:

- There is a limitation on the resource number of starts, run-hours, or energy output due to design considerations, environmental restrictions, or qualifying contractual limitations.
- The resource limitation cannot be reflected within the market optimization horizon (e.g. monthly limitations that extend beyond the day-ahead market 24 hour horizon).
- The resource's ability to select hours of operation is not dependent on an energy source outside of the resource's control and the resource can ration the limitation in response to energy price signals.

The following capacity will not be eligible to request consideration of use limitations since the Resources are not subject to opportunity costs. These resource types are not subject to opportunity costs because they do not have the ability to select the hours or energy output levels that can be provided to ISO market:

- Variable Energy Resources
- Reliability Must Run
- Regulatory Must Take
- Reliability Demand Response Resources

For the second step, the Scheduling Coordinator must register only the approved values as defined in the registration process in the ULPDT. See Attachment B of the Market Instruments BPM for instructions on registering the approved limitations in Master File. Based on the approved limitations, the ISO will designate the resource or Multi-Stage Generator as a Use-Limited Resource (details in Section 2.1.15.3).

Use-Limited Resource designation results in the following CAISO processes or procedures being available to the Scheduling Coordinator to manage these resources:

- Exempts Resource Adequacy Capacity of a Use-Limited Resource from bid generation under Section 40.6.8(e).

- Access to the Annual Use Limit Reached, Monthly Use Limit Reached, Other Use Limit Reached, Short Term Use Limit Reached nature of work outage cards. See the Outage Management BPM for more information on the definition of the nature of works and the Reliability Requirements BPM for more information on the substitution requirements and resulting Resource Adequacy Availability Incentive Mechanism (RAAIM) exposure for each nature of work outage card.

- Ability to seek to establish an opportunity cost adder[5] to its start-up, transition, minimum load bid caps or to a generated energy bid or default energy bid, with the exception of use limitations with a daily granularity.

2.1.15.1 Request to Register Use Limitations

To register a use limitation, the Scheduling Coordinator must open an Inquiry Ticket via the Customer Inquiry Dispute and Information (CIDI) tool with the subject**,** "Use-Limited Registration". The CIDI Ticket must include specific operating data for the unit and supporting documentation similar to those described above. The inquiry ticket should include, but not be limited to:

- Use Limit Plan Data Template with records for qualifying use limitations under Section 30.4.1.1.6.1.

- A detailed explanation of why the resource is subject to the qualifying use limitations.

- Documentation, such as environmental permits or operating manuals, as well as page numbers or section numbers in the supporting documentation, substantiating the detailed explanation of why the unit is subject to use limitations.

- Limitation Translation Templates that describe the methodology, including input values and formulas where possible, to translate limitations into the use limit types, granularity, and limitation values submitted in the ULPDT. If a formulaic translation cannot be provided, provide a detailed explanation of how the type, granularity, and limitation value was translated based on supporting documentation including page numbers or section numbers in the supporting documentation.

- If limitation type cannot be translated into a standard use limit type of 'START', 'RUNHOURS', or 'ENERGY', a detailed explanation of why the limitation could not be

[5] See Attachment N of the Business Practice Manual for Market Instruments for more information.

translated.

- If limitation granularity cannot be translated into a standard use limit type of 'MONTHLY, 'ANNUALLY', or 'ROLL 12', a detailed explanation of why the limitation could not be translated.

- Explanation stating whether the resource's operation is dependent on an energy source outside of the resource's control being available during select hours. For example, SOLAR, WIND, WATER, and GEOTHERMAL resources that are dependent on intermittent energy sources will need to provide detailed explanation of the design features that allow it to operate in any hour similar to resources with prime movers not based on intermittent energy resources.

- Explanation stating whether the resource has available fuel or fuel equivalent (i.e. water) available across the granularity of the limitation to allow it to participate economically in the ISO market. The resource must be able to respond to energy price signals to support that the use limitation imposes an opportunity cost on the resource.

- Any additional data in order for ISO to understand the operating characteristics of the unit.

If multiple resources are subject to a use limitation based on the same supporting documentation, the Scheduling Coordinator should submit a single CIDI ticket for the use limit plan and its supporting documentation and provide a list of all resources that are limited based on the attached documentation. SC should attach the ULPDT with records for each resource or configuration limited based on the attached documentation. For example, a Demand Response Provider may have contracted with a LSE to participate in a demand response program where it has multiple Proxy Demand Response (PDR) providers under the same LSE DR program, should submit a CIDI request for Use-Limited Resource status for resources under the LSE DR program, attach the DR program documents, and submit ULPDT with records for each resources under that LSE DR program. Additional examples provided in the next section.

If the supporting documentation does not explicitly state the use limitation as either a 'START', 'RUNHOUR', or 'ENERGY' limit type, the Scheduling Coordinator must attempt to translate the limitation based on the documentation into either the 'START', 'RUNHOUR', or 'ENERGY'. If the supporting documentation does not explicitly state the granularity as either 'DAILY', 'MONTHLY', 'ANNUAL', or 'ROLL 12' granularity, the Scheduling Coordinator must attempt to translate the limitation based on the documentation into either the 'DAILY', 'MONTHLY', 'ANNUAL', or 'ROLL 12'. The Scheduling Coordinator must submit a written explanation of this translation methodology including formulas so the ISO can validate the submitted ULPDT against the supporting documentation.

If the Scheduling Coordinator cannot translate the non-standard limitation type or granularity, then the Scheduling Coordinator should register in the appropriate field the 'OTHER' value. The ISO will notify the Scheduling Coordinator of the need to enter a consultation with the ISO to determine the USE LIMIT TYPE, GRANULARITY, PLAN STRT DT TM, PLAN END DT TM, and methodology for determining the LIMITATION values. The consultation is based on what translation methodology will best allow the ISO to respect the use limitations of these resources. Following the consultation, the ISO will provide the SC a written report based on the consultation for use in a revised use limitation registration request via CIDI.

The following sections will discuss in more detail specific instructions for submitting supporting documentation for the request based on a non-exhaustive list of potential use limitations.

2.1.15.1.1 Emission Limitations

SC may seek to register use limitations in the ULPDT based on emission limitations from air permit restrictions that are imposed on the operations of the unit on a 24-hour or longer applicability horizon. The daily start limitations will only be accepted for resources with a cold start-up time of 300 minutes or less because otherwise the resource is a long start resource that only receives binding start-up instructions in the day-ahead market where the daily limitation can be recognized in the day-ahead optimization horizon.

The CAISO anticipates that many air permits impose operational conditions on the units not to exceed a certain number of fired starts or fired engine hours of operation by the turbine or for the combined turbines of the plant. The Scheduling Coordinator should register its limitation and granularity based on the specified number of engine starts or run hours listed in the air permit. The Scheduling Coordinator must provide, in its supporting documentation, the section and page number where the specified operation condition per granularity is listed. For example, if the permit provides a limitation on the number of run hours per turbine per year, then the MSG resource would need to register an MSG configuration-level limitation in the ULPDT along with the corresponding implied starts associated with each configuration in the GRDT. If the permit provides a limitation on the number of hours of operation for all the configurations, the MSG resource would register a MSG plant-level limitation on the run hours with the applicable granularity.

The CAISO anticipates that the air permit may differentiate between the limitation on run hours during start-ups and/or limitation on run hours from start-up through its run time and shut-down. The Scheduling Coordinator can request multiple use limit types based on the limitations documented in the permit. For the former, a limitation on the run hours during start-up, the Scheduling Coordinator may be able to translate this to a limitation on the number of starts. For the latter, a resource with a limitation on the number of run hours from start-up through its run time, the Scheduling Coordinator will register this as a limitation on the number of run hours of the resource. The Scheduling Coordinator must document the section and page number of the

air permit page where the limitation is documented along with applicable documentation supporting the translation to the limitation requested in the ULPDT.

While less expected, the ISO understands that some air permits may not explicitly state the operational condition on starts, run hours, or energy output in order to provide more flexibility to the plant operator. In that event, the ISO anticipates the air permit would explicitly list the pollutants and emission limits that the resource is subject to and over what period of time along with a limitation on the heat input of the plant based on MMBtu per day and per year. The Scheduling Coordinator must submit an excel document that shows the emission limitations, heat input limitations, and the proposed methodology for translating the heat input limitations into 'START', 'RUNHOURS' or 'OUTPUT' limitation. The ISO will ask for additional information such as capacity factor of the unit and the SC's expectations of emission rates at various operating levels efficiency (e.g. heat rates). The limitation methodology may translate the emission limitations into starts, run-hours, or energy based on likely use of the plant and the operational use needing to be better optimized.

For resources with fuel-switching capabilities where the limitations may differentiate between multiple modes of operation, the Scheduling Coordinator must register the limitation for the operating mode that provides more operational flexibility if it does not want to enter into a negotiation for opportunity costs if approved. The more complex nature of multiple operating modes being subject to multiple limitations on the same use limit type that is conditional on type of mode is more appropriate to be determined through a negotiation. The Scheduling Coordinator could register the complex limitation of its resource as 'OTHER' if it wants to be considered for negotiations and document the reason as multiple operating modes with different use limitations depending on its use of that mode.

2.1.15.1.2 Storage capability limitations – Non-Hydro

Resources seeking Use-Limited Resource status based on limited storage capability that can be supported by design documentation should submit the design documentation to the registration request. The Scheduling Coordinator must attach a translation methodology for translating the storage capability into start, run-hours, or energy output limitations and specify its storage inventory levels that it needs to maintain in its storage inventory based on external obligations such as providing reliability needs during peak conditions. If Scheduling Coordinator is unable to provide a translation methodology into start, run hour, or energy output, designate the USE LIMIT TYPE as 'OTHER' in the attached ULPDT.

2.1.15.1.3 Storage capability limitations – Hydro

To be eligible for use limitation registrations, hydro resources must be subject to use limitations for hours, or starts it can provide during the period it is subject to a use limitation.

The granularity that the use limitation is available for should be the period where the first day the entire limitation is available based on projections of inflows and outflows during the period where the acre-feet of water is being managed to meet minimum reservoir targets. As the inflows and outflows during the period actualize, the ISO anticipates the Scheduling Coordinator will resubmit the ULPDT with the revised values given actual data or more timely projections. The projected outflows include all the releases to manage minimum flow requirements, synchronize flow rates upstream and downstream, water deliveries, etc.

The amount available on the first day of the granularity is the excess amount of water above that reserved for water operations that can be converted into MWh and either released for energy production or reserved for later use based on the ISO price signals. The ISO is asking each Scheduling Coordinator to provide their methodology for translating the water available for electric generation outside of other water operations.

For example, if resource is subject to a two-year limitation, the granularity would be 'OTHER' and the effective plan start and end dates would capture the two consecutive years. ISO would assume the hydro two-year limitation is two consecutive water years. The limitation value would be the projected MWh available for dispatch in ISO market across the two-year period in response to ISO price signals – outside of outages and not accounting for energy production that is a byproduct of water operations. The initial value registered could be current elevation (TAF) plus projected inflows, minus projected outflows needed to meet water use requirements and/or water deliveries, minus the reserve margin needed to hedge risk for dry periods, and minus the minimum reservoir target. The Scheduling Coordinator can update the value subject to a five-business day processing time as information on inflows and outflows change.

Potential granularities for limited storage capacity limitations:

- If operational requirements prescribe when the water flows including releases for water use or operations to manage flow rates upstream and downstream, these are treated in ISO market as operational requirements not use limitations that have an opportunity cost in ISO market.

- If operational requirements allow for MWhH production in response to ISO price signals across the 24-hour period as long as the MWHh daily energy limit is respected, the hydro resource limitation would be registered as a 'DAILY' limitation.

- If operational requirements allow for MWh production in response to ISO price signals across period greater than 24 hours but less than a month as long as the MWHh energy limit is respected, the hydro resource limitation would be registered as an 'OTHER' limitation. The effective date range should match the granularity of the 'OTHER' period.

- If operational requirements allow for MW~~H~~h production in response to ISO price signals across period of a month as long as the MW~~H~~h energy limit is respected, the hydro resource limitation would be registered as a 'MONTHLY' limitation.

- If operational requirements allow for MW~~H~~h production in response to ISO price signals across period greater than a month but less than a year as long as the MW~~H~~h energy limit is respected, the hydro resource limitation would be registered as an 'OTHER' limitation. The effective date range should match the granularity of the 'OTHER' period.

- If operational requirements allow for MW~~H~~h production in response to ISO price signals across period of a year as long as the MW~~H~~h energy limit is respected, the hydro resource limitation would be registered as an 'ANNUALLY' limitation.

- If operational requirements allow for MW~~H~~h production in response to ISO price signals across period greater than a year as long as the MW~~H~~h energy limit is respected, the hydro resource limitation would be registered as an 'OTHER' limitation. The effective date range should match the granularity of the 'OTHER' period.

2.1.15.1.4 Technical Standards Operating Limits

Resources may seek to register use limitations based on submitting a technical standard for that technology's operation (e.g. IEEE/ANSI C50.10-1977 - American National Standard General Requirements for Synchronous Machines). The Scheduling Coordinator should provide the technology-specific standard, OEM recommendation containing the lifecycle of the plant, and the template that translates the lifecycle limitation on starts and/or run-hours into an available annual start and/or run-hour limitation(s).

The ISO expects the standard will establish either a number of starts or number of run-hours across the lifecycle of the unit or it will further refine the lifecycle limitation by an annual limitation. The annual limitation would be more limiting and would effectively ration the lifecycle uses so the Scheduling Coordinator should establish the limitation at the annual value. If the standard establishes a lifecycle limitation, the Scheduling Coordinator will be required to translate the lifecycle limitation into an annual limitation by dividing the remaining available uses out of the lifecycle limitation into annual profiles.

For example, if the standard says that the technology should be limited to 50,000 run-hours across the 30-year lifecycle of the unit based on OEM recommendation, and the unit has already operated for 20,000 run-hours and is 15 years old, then the available use is 30,000 run-hours across the remaining 15 years of the lifecycle. ISO will require the Scheduling Coordinator to register the limitation assuming that the SC pro-rated the use equally across the remainder of the lifecycle. For this resource this would be 2000 run-hours on an annual granularity (=30,000 run-

hours available/15 years remaining). If the standard says that a synchronous machine should not start more than 10,000 starts for its lifecycle and no more than 500 starts per year, the Scheduling Coordinator would register the design-based limitation at 500 starts per year.

2.1.15.1.5 Battery Storage Warranty Limitations

Resources that have use limitations because of battery storage warranties can request to register the storage limitations (e.g. Proxy Demand Response Resources, Limited Energy Storage Resource). Any documentation that reflects an externally imposed limitation based on either design or regulatory restrictions (per Tariff) will be reviewed and evaluated for meeting the criteria. ISO will validate the limitations meet all three criteria of Section 30.4.1.1.6.1.1.

The SC should submit request with an attached UPDT that includes record for the limitation that specifies the use limit type, granularity, effective dates, and limitation amount and attach the supporting documentation. The Scheduling Coordinator must identify in its submission what section and page of the supporting documentation that includes the details for the use limitation.

2.1.15.1.6 Demand Response Program Limitations

Proxy Demand Response (PDR) should submit request to be registered as Use-Limited Resources based on their California Public Utility Commission demand response program contracts to be eligible for CAISO processes or procedures available to Use-Limited Resources.

Proxy Demand Response (PDR) Resources may register the use limitations based on its program limitations. Demand Response Resources include both load curtailment and storage-backed demand response providers.

Demand Response Resources have design limitations due to programmatic limitations that refer to the maximum events or hours per a deliverability period for which customers are expected to be willing to curtail or deploy state of charge when called upon. For each DR resource, the Scheduling Coordinator must identify the name of the entity that is the Load Serving Entity or Electric Service Providers and Community Choice Aggregators acting as the Load Serving Entity [DR Buyer] that the DR is under contract with, the name of the demand response program, the associated program description, and the contracts.

The SC should attach to submission:

- Use Limit Plan Data Template to include each use limitation under a participating program.
- Spreadsheet that details the name of the entity that is the Load Serving Entity or Electric Service Providers and Community Choice Aggregators acting as the Load Serving Entity [DR Buyer] that the DR is under contract with, the name of the demand response program, contract name, and the resource ID.

- Demand Response Program Documents and Description

- Demand Response Program Contracts

2.1.15.1.7 Qualifying Contractual Economic Limits

Resources seeking to register use limitations based on qualifying bilateral contractual economic limits are only eligible to register these use limitations until 3 years after the Commitment Cost Enhancements Phase 3 project is in effect. Qualifying bilateral contractual limitations are new-build long-term contracts that were reviewed and approved, or pending approval, by a Local Reliability Authority (LRA) by January 1, 2015 that explicitly states a limitation on starts, run-hours, or energy output. ISO will require that the contract and the order approving the contract be submitted as supporting documentation. If the contract was non-public, the contract can be provided under a non-disclosure agreement.

2.1.15.2 Validating Use Limitations

The CAISO will respond to the Scheduling Coordinator initially to confirm receipt of the use limit status request and pending completion of the validation of the use limit plan.

Per Section 30.4.1.1.6.1.1, Scheduling Coordinators are ineligible to register any use limitation that does not meet all three criteria for a qualifying limitation with an opportunity cost. Use limitations are ineligible for registering in Master File ULPDT if:

- Resource cannot provide sufficient supporting documentation to show that the resource is subject to use limitations that affect the number of starts, run-hours, or energy output due to design considerations, environmental restrictions, or qualifying contractual limitations.

- Market process cannot capture the limitation. If the market process can capture the limitation through economic bids, self-schedules, or outages then this is considered an operational limitation that can be captured by the market process. For example, if a resource cannot control its output because of other operational constraints and need to limit its capacity, the resource can reflect this in the market through submitting an outage card.

- The resource is not able to operate continuously and consequently does not participate economically in the ISO energy market.

- For start limitations, the granularity of the limitation must be shorter than the resource's appropriate commitment process in CAISO market. For example, an extremely long start or long start resource (highest startup time registered is greater than 300 minutes), that has use limitations on starts that apply on a daily granularity will not be eligible to register

the use limitation since this resource can only be committed in the day-ahead market which can support daily start limitations.

The following table includes a non-exhaustive list of limitations and the expected ISO determination for each category. The first column, Limitation Category, describes the type of limitation that ISO anticipates a Scheduling Coordinator may try to register the limitation as a use limitation under Section 30.4.1.1.6.1.1 of the Tariff. The second through fourth columns represent the three criteria that must be met for the CAISO to validate a limitation qualifies as a use limitation. For each limitation category, columns three through four show a 'Y' or 'N' if the ISO expects to validate that category meets or does not meet each criterion respectively. The final column, Limitation Outcome, shows 'Accepted' if all three criteria are met where columns three through four show a 'Y'. Otherwise, the Limitation Outcome is 'Rejected' when any criterion is not met.

Limitation Category	**Tariff Section 30.4.1.1.6.1.1 Criterion (1)**	**Tariff Section 30.4.1.1.6.1.1 Criterion (2)**	**Tariff Section 30.4.1.1.6.1.1 Criterion (3)**	**Limitation Outcome**
Emission Limitation (Air District) - Less than daily limit	Y	N	Y	Rejected
Emission Limitation (Air District) - Daily limit or greater	Y	Y	Y	Accepted
Emission Limitation (Air District) - Daily limit or greater - cannot control output due to other operating requirements.	Y	Y	N	Rejected
Firm delivery of power or natural gas at resource location limited under long-term agreement where the underlying limitation is an infrastructure limitation in storage or transport capability combined with need to manage resources to meet ISO needs and other customers.	Y	Y	Y	Accepted
Storage flexibility to maximize economics of power production for period greater than 24 hours: Energy production largely not dependent on a prime mover outside of its control due to intermittency, energy	Y	Y	Y	Accepted

Limitation Category	Tariff Section 30.4.1.1.6.1.1 Criterion (1)	Tariff Section 30.4.1.1.6.1.1 Criterion (2)	Tariff Section 30.4.1.1.6.1.1 Criterion (3)	Limitation Outcome
deliverability, or water requirements. Amount of stored fuel, energy, or water is available to maximize economic value of generation for more than 24 hours in addition to other requirements (reliability, native load, or water use).				
Storage flexibility to maximize economics of energy production for period of 24 hours: Energy production is largely but not completely dependent on prime mover outside of its control due to intermittency, energy deliverability, or water requirements. Amount of stored fuel, energy, or water is available to maximize economic value of generation over 24 hours in addition to managing other requirements (reliability, native load, or water use).	Y	Y	Y	Accepted
Storage flexibility to maximize economics of ancillary service provision for period greater than 24 hours while selecting hours to operate in energy market: Energy production dependent on prime mover outside of its control due to intermittency, energy deliverability, or water requirements. Amount of stored fuel, energy, or water is available to maximize economic value of ancillary service provision on top of self-scheduled energy capacity when made available.	Y	Y	N	Rejected

Limitation Category	Tariff Section 30.4.1.1.6.1.1 Criterion (1)	Tariff Section 30.4.1.1.6.1.1 Criterion (2)	Tariff Section 30.4.1.1.6.1.1 Criterion (3)	Limitation Outcome
Storage flexibility to maximize economics of ancillary service provision for period of 24 hours while selecting hours to operate in energy market: Energy production dependent on prime mover outside of its control due to intermittency, energy deliverability, or water requirements. Amount of stored fuel, energy, or water is available to maximize economic value of ancillary service provision on top of self-scheduled energy capacity when made available.	Y	Y	N	Rejected
No storage flexibility to maximize economics of energy production instead limited to selecting hours to operate: Energy production dependent on prime mover outside of its control due to intermittency, energy deliverability, or water requirements. Not able to maximize economic value of generation so must select hours to operate within 24-hour period.	Y	N	N	Rejected
Resource subject to conditional use permit from an external entity that restricts number of uses across extended period where resource is agnostic to which hours within that period are dispatched.	Y	Y	Y	Accepted
Resource subject to conditional use permit from an external entity that restricts number of uses during specific periods.	Y	N	N	Rejected
Resources subject to operating constraints where the resource does not have the ability to select the hours to operate and instead	Y	N	N	Rejected

Limitation Category	Tariff Section 30.4.1.1.6.1.1 Criterion (1)	Tariff Section 30.4.1.1.6.1.1 Criterion (2)	Tariff Section 30.4.1.1.6.1.1 Criterion (3)	Limitation Outcome
must self-schedule or submit outages to reflect the inflexibility of the operating constraint.				
Combined Heat & Power Plant (i.e. Cogeneration) that economically participates in ISO energy market that has restrictions on starts, run-hours, or energy as result of design, environmental, or contract limitations over extended period (across 24 hours or more). Because the Combined Heat & Power Plant energy production is not fully subject to upstream process, where energy production is not fully dependent on the CHP operations and resource is responsive to energy price signals.	Y	Y	Y	Accepted
Combined Heat & Power Plant (i.e. Cogeneration) that cannot economically participate in ISO energy market even if it has restrictions on starts, run-hours, or energy as result of design, environmental, or contract limitations over extended period (across 24 hours or more). Because the Combined Heat & Power Plant energy production is subject to upstream process where energy production is dependent on the CHP operations and non-responsive to energy price signals.	Y	N	N	Rejected
Participating Generator Agreement Limitation Schedule	N	Y	Y	Rejected
Resource Data Template Fields	N	Y	Y	Rejected

Limitation Category	Tariff Section 30.4.1.1.6.1.1 Criterion (1)	Tariff Section 30.4.1.1.6.1.1 Criterion (2)	Tariff Section 30.4.1.1.6.1.1 Criterion (3)	Limitation Outcome
Variable Energy, Regulatory Must Take, Reliability Must Run, Reliability Demand Response Resources	Y	N	N	Rejected
Contract limit explicitly stated in contract filed at LRA not meeting date requirements	N	Y	Y	Rejected
Contract limit explicitly stated in contract filed at LRA meeting date requirements	Y	Y	Y	Accepted

2.1.15.3 Designating Use-Limited Resources

If the ISO was unable to validate a use limitation submitted in the use-limited registration process met all three criteria, the ISO will not designate the resource as a Use-Limited Resource. The ISO will notify the Scheduling Coordinator the resource is ineligible for use limit status.

If the CAISO was able to validate a use limitation submitted in the use-limited registration process met all three criteria, the ISO will designate the resource as a Use-Limited Resource. The ISO will set the GRDT USE_LIMIT flag to 'Y' and notify the Scheduling Coordinator of the effective date in Master File. As soon as the USE_LIMIT flag is set to 'Y' in Master File GRDT, the Scheduling Coordinator can update the ULPDT into the Upload tab of the Master File portal with the CIDI Ticket number in the batch comment field. See Attachment B.6 of the Market Instruments BPM Use Limit Plan Data Template for instructions on updating the Master File ULPDT.

2.1.15.4 Maintaining Use-Limited Resource Designation

Use-Limited Resources are required to submit a use limitation registration renewal request each year by November 1st to maintain their Use-Limited Resource status designation. The renewal will be for 24 months for rolling 12 limitations and 12 months for all other limitation granularities. If SC does not submit the renewal request for the Use Limitation Registration, then the ISO will remove the resource's Use-Limited Resource Designation.

To maintain the designation, Scheduling Coordinator must submit via CIDI use limitation registration renewal request no later than November 1st to ensure it can maintain an active

limitation record in the Use Limit Plan Data Template[6]. If the approved limitation previously registered and its supporting documentation did not change, the Scheduling Coordinator can submit with its annual registration renewal request for future years a statement in the CIDI case attesting that the use limitation(s) and all supporting documentation have not changed.

Alternatively, if the limitation definition has changed based on changes to supporting documentation or a desired change to the translation methodology used, the Scheduling Coordinator must submit a new use limitation registration request to register the new use limitations. The ISO considers a use limitation to have changed if the use limit type, granularity, or fixed values or dynamic methodology changes.

If there is an active use limit plan data template record associated with a resource ID, the ISO will maintain the Use-Limited Resource status designation in Master File Resource Data Template as Use-Limited. If there is no longer an active ULPDT record associated with a resource ID, the ISO will set the Use-Limited Resource status designation in Master File Resource Data Template to not Use-Limited.

2.1.15.5 Multi-Stage Generator with Registered Start Limitations

The IMPLIED_STRTS fields contained in the MSG_CONFIG tab of the Generator Resource Data Template (GRDT) is for Multi-Stage Generator (MSG) resources with start limitations to register the number of starts associated with moving a resource from offline to online or from online to a higher configuration that is implied by the use limitation plan's supporting documentation. The DOC_NAME including the CIDI ticket number for the approved ULPDT will provide support for the values registered in these fields.

Only Use-Limited MSG resources with start limitation(s) can have implied starts greater than 1. Implied starts for non-MSG resources are assumed to be one. The number of implied starts for an MSG configuration shall be measured from the MSG resource being entirely off to being started directly to that configuration. MSG resources have to include an implied start value in the MSG_CONFIG tab of the GRDT for every configuration of the MSG resource. An implied start for the configuration can be set to zero for a configuration.

For MSG resources that submit use limitations that are for use limit types of 'RUNHOURS', 'ENERGY', or 'OTHER', the Scheduling Coordinator should not submit values in the IMPLIED_STRTS field. The IMPLIED_STRTS field will be defaulted to NULL in the GRDT.

For MSG resources, the limitation on the number of starts in the use limitation plan is the number of implied starts to be determined based on the supporting documentation for the use limitation request. The supporting documentation provided during the use-limit registration process should describe how the plan implies that a usage of its start limitation should be measured. Each implied start will contribute to the usage of the start limitation on file in the ULPDT in the 'LIMITATION' field. Implied starts registered in the GRDT should be the same resolution level on which the

[6] Attachment B.6 Use Limit Plan Data Template.

MSG configuration will submit the use-limit limitation of number of starts. The following examples will explain to what "resolution level" refers.

The following table shows the likely scenarios of use plan limitations, and consequently how to register the implied starts for each of these scenarios. The first column, 'Scenario', shows a short name for the next column describing the 'Use Plan Limitation Type.' If the MSG resource's limitations fall under these implied start types, the Scheduling Coordinator should register the IMPLIED_STRTS in the MSG_CONFIG tab of the GRDT as shown in the examples. The transition implied starts will be derived by the CAISO from the implied starts registered for each MSG configuration, implied start values must be based on the type of use limitation and supporting documentation.

Scenario	Use Plan Limitation Type
PLANT_A	• Plant level[7] limitation that does not consider a transition a "start" where each start=1. • ULPDT limitation registered at MSG resource level not configuration level. • Supporting documentation considers ISO startup commitment of any configuration in the plant a use of the limit. • SC registers IMPLIED_STRT for each configuration as 1. • Transition IMPLIED_STRT will be derived as the difference between IMPLIED_STRT of 'To Configuration' and IMPLIED_STRT of 'From Configuration'. Derived transition IMPLIED_STRT should be equal to 0 for this limitation type.
PLANT_B	• Plant level limitation that does not consider a transition a "start" where each start=number of engine (e.g., CT) starts. • ULPDT limitation registered at MSG resource level not configuration level. • Supporting documentation considers fired turbine starts from offline a use of the limit. • SC registers IMPLIED_STRT for each configuration as the number of fired turbines associated with starting up the configuration from offline to that configuration. • Transition IMPLIED_STRT will be derived as the difference between IMPLIED_STRT of 'To Configuration' and IMPLIED_STRT of 'From Configuration'. The derived transition implied start will not be equal to

[7] Non-MSG resources, resource level limitations and MSG resources plant-level limitations are treated similarly. A MSG resource level limitation is the same as a MSG plant-level limitation.

Scenario	Use Plan Limitation Type
	the transition implied starts appropriate for this type of limitation (derived transition IMPLIED_STRT = 0). • Functionality does not support ability to model opportunity cost for this type of plant level limitation. Scheduling Coordinator needs to identify the derived transitions are not compatible with plan. The ISO will negotiate an opportunity cost adder.
PLANT_C	• Plant level limitation that does consider a transition a "start" where each start or transition=number of CT starts. • ULPDT limitation registered at MSG resource level not configuration level. • Supporting documentation considers starts or transitions (fired turbines) a use of the limit. • SC registers IMPLIED_STRT for each configuration as the fired turbines associated with starting up the configuration from offline to that configuration. • Transition IMPLIED_STRT will be derived as the difference between IMPLIED_STRT of 'To Configuration' and IMPLIED_STRT of 'From Configuration'.
CONFIG_A	• Configuration level limitation that does consider a transition a "start" where each start or transition=number of CT starts. • ULPDT limitation registered at MSG configuration level not plant level. • Supporting documentation considers starts or transitions (fired turbines) a use of the limit. • SC registers IMPLIED_STRT for each configuration as the fired turbines associated with starting up the configuration from offline to that configuration. • Transition IMPLIED_STRT will be derived as the difference between IMPLIED_STRT of 'To Configuration' and IMPLIED_STRT of 'From Configuration'.
CONFIG_B	• Configuration level limitation that does consider a transition a "start" where each start or transition=1 (E.G. C3 Limitation). • ULPDT limitation registered at MSG configuration level not plant level. • Supporting documentation considers ISO startup commitment or ISO transition instruction of the configuration a use of the limit.

Scenario	Use Plan Limitation Type
	• SC registers IMPLIED_STRT for the configuration as 1. • Transition IMPLIED_STRT will be derived as the difference between IMPLIED_STRT of 'To Configuration' and IMPLIED_STRT of 'From Configuration'. The derived transition implied start will not be equal to the transition implied starts appropriate for this type of limitation. Transition IMPLIED_STRT must be set to 1 for every transition into the configuration. • Functionality does not support ability to model opportunity cost for this type of plant level limitation. The Scheduling Coordinator needs to identify the derived transitions are not compatible with plan. The ISO will negotiate an opportunity cost adder.

The next table relates the anticipated scenarios for MSG use limitation types to the values to be submitted by the Scheduling Coordinator in the MSG_CONFIG tab for IMPLIED_STRT to the configuration and the values that will be set for the feasible transitions.

For each Scenario, the first three blue columns represent the possible movements of the MSG resource from offline to online into each configuration. These values are to be submitted in the MSG_Config tab of the GRDT at the CONFIG_ID level. For example, the value registered for Configuration 1 is the IMPLIED_STRT from offline to Configuration 1 (i.e. $S_{0,1}$). The same pattern follows for each configuration of the MSG resource.

The next three orange columns will be values set by the ISO through the approval of the ULPDT and its valid implied starts. ISO will set the IMPLIED_STRTS used downstream in internal ISO systems as shown based on the scenarios. The columns represent the number of starts that count towards the start limitation as the result of a transition from a 'From Configuration' to a 'To Configuration', for example a transition from Configuration 1 to Configuration 2 is denoted as $T_{1,2}$. The same pattern follows for all feasible transitions.

Supported Y/N	Scenario	Use Plan Limitation Type	$S_{0,1}$	$S_{0,2}$	$S_{0,3}$	$T_{1,2}$	$T_{1,3}$	$T_{2,3}$
Y	PLANT_A	Plant level limitation that does not consider a transition a "start" where each start=1	1	1	1	0	0	0
N	PLANT_B	Plant level limitation that does not consider a transition a "start" where	1	2	3	0	0	0

Notify ISO MSG needs negotiation		each start=number of CT starts						
Y	PLANT_C	Plant level limitation that does consider a transition a “start” where each start or transition=number of CT starts	1	2	3	1	2	1
Y	CONFIG_A	Configuration level limitation that does consider a transition a “start” where each start or transition=number of CT starts	1	2	3	1	2	1
N Notify ISO MSG needs negotiation	CONFIG_B	Configuration level limitation that does consider a transition a “start” where each start or transition=1 (E.G. C3 Limitation)	0	0	1	0	1	1

The following table illustrates the scenarios of MSG use limitation plans that imply a combination of plant-level and configuration-level limitations. Of the anticipated combinations of the plant or configuration scenarios described above, only one of the combinations can be accurately registered and modelled. The combination of PLANT_C and CONFIG_A can be registered with a USE_LIMIT_TYPE of ‘START’ with its associated configuration implied starts. The other combinations should be registered as USE_LIMIT_TYPE equal to ‘OTHER’ so the CAISO can initiate further discussions on registering limitations or negotiating opportunity costs.

Plant and Configuration Combination – Modelled (‘START’) or Negotiated (‘OTHER’)

Plant & Configuration Combinations that can be modelled	**CONFIG_A**	**CONFIG_B**
PLANT_A	‘OTHER’	‘OTHER’
PLANT_B	‘OTHER’	‘OTHER’
PLANT_C	‘START	‘OTHER’

The following sections provide examples for most of the anticipated MSG use limitation scenarios. Examples 1-4 provides examples for scenarios in which the MSG resource has either a plant level or configuration level limitation. Examples 5-8 provides examples for the scenarios in which the MSG has a combination of both plant and configuration level limitations.

The Scenarios PLANT_A and PLANT_C are the scenarios that the ISO considers more likely to be registered, and examples provided for these below. Note – any use limitations with supporting documentation that implies limitations under scenario PLANT_B and CONFIG_B cannot be accurately registered. The Scheduling Coordinator will need to register the USE_LIMIT_TYPE of the limitation as 'OTHER' so it can be evaluated for a negotiated opportunity cost.

Example 1: Plant level limitation that does not consider a transition a "start" where each start=1 (PLANT_A)

The resource is limited to 300 starts per year where transitions are not considered a start that counts against the resource's annual start limitation. The Scheduling Coordinator of the resource will fill out the use-limited plan data template to reflect the annual start limitation as shown below. The Scheduling Coordinator would input an implied start of one per configuration to reflect that transitions are not considered a "start" against the limitation. The resulting implied starts for each transition will then be calculated by the ISO as zero (Implied start "to-configuration" minus implied start "from-configuration").

ULPDT

SC_ID	RES_ID	CONFIG_ID	USE_LIMIT_TYPE	GRANULARITY	PLAN_STRT_DT_TM	PLAN_END_DT_TM	LIMITATION
SC_1	RES_A		START	ANNUALLY	1/1/2018	12/31/2018	300

Implied Starts in GRDT

CONFIG_1	CONFIG_2	CONFIG_3
1	1	1

ISO derives transition implied starts based on configuration implied starts data, which is shown below for each feasible transition.

Implied Starts by Transition

From Config	To Config	GRDT Tab	Mechanism	Implied Starts
Offline	CONFIG_1	MSG_CONFIG	SC registers	1
Offline	CONFIG_2	MSG_CONFIG	SC registers	1

Offline	CONFIG_3	MSG_CONFIG	SC registers	1
CONFIG_1	CONFIG_2	TRANSITION	ISO derives	0
CONFIG_1	CONFIG_3	TRANSITION	ISO derives	0
CONFIG_2	CONFIG_3	TRANSITION	ISO derives	0
CONFIG_1	Offline	TRANSITION	ISO derives	0
CONFIG_2	Offline	TRANSITION	ISO derives	0
CONFIG_3	Offline	TRANSITION	ISO derives	0

Example 2: Plant level limitation that does consider a transition a "start" where each start or transition=number of CT starts (PLANT_C)

The resource is limited to 300 starts per year where transitions are considered a start that counts against the resource's annual start limitation. The following implied starts indicate that if the resource is directly started into configuration 2, it uses up two of the fired turbine starts it is allowed during the year. Furthermore, if it then transitions into configuration 3, one additional fired turbine start is used. The resulting implied starts for each transition will then be calculated by the ISO as one (Implied start "to-configuration" minus implied start "from-configuration").

ULPDT

SC_ID	RES_ID	CONFIG_ID	USE_LIMIT_TYPE	GRANULARITY	PLAN_STRT_DT_TM	PLAN_END_DT_TM	LIMITATION
SC_1	RES_A		START	ANNUALLY	1/1/2018	12/31/2018	300

Implied Starts in GRDT

CONFIG_1	CONFIG_2	CONFIG_3
1	2	3

ISO derives transition implied starts based on configuration implied starts data, which is shown below for each feasible transition.

Implied Starts by Transition

From Config	To Config	GRDT Tab	Mechanism	Implied Starts
Offline	CONFIG_1	MSG_CONFIG	SC registers	1
Offline	CONFIG_2	MSG_CONFIG	SC registers	2

Offline	CONFIG_3	MSG_CONFIG	SC registers	3
CONFIG_1	CONFIG_2	TRANSITION	ISO derives	1
CONFIG_1	CONFIG_3	TRANSITION	ISO derives	2
CONFIG_2	CONFIG_3	TRANSITION	ISO derives	1
CONFIG_1	Offline	TRANSITION	ISO derives	0
CONFIG_2	Offline	TRANSITION	ISO derives	0
CONFIG_3	Offline	TRANSITION	ISO derives	0

Example 3: Configuration level limitation that does consider a transition a "start" where each start or transition=number of CT starts (CONFIG_A)

Configuration 3 can only be started 50 times a year based on the number of turbine starts. The implied starts indicate that C3 can only start turbines 50 times per year. The configuration level limitation is based on number of turbine starts, which can be used through either starts or transitions. For example, if the resource was started from offline to C1 and then transitioned to C3 that should be considered as number of additional turbines needed to be started to transition to the higher C3 configuration.

ULPDT

SC_ID	RES_ID	CONFIG_ID	USE_LIMIT_TYPE	GRANULARITY	PLAN_STRT_DT_TM	PLAN_END_DT_TM	LIMITATION
SC_1	RES_A	CONFIG_3	START	ANNUALLY	1/1/2018	12/31/2018	50

Implied Starts in GRDT

CONFIG_1	CONFIG_2	CONFIG_3
1	2	3

ISO derives transition implied starts based on configuration implied starts data, which is shown below for each feasible transition.

Implied Starts by Transition

From Config	To Config	GRDT Tab	Mechanism	Implied Starts
Offline	CONFIG_1	MSG_CONFIG	SC registers	0

Offline	CONFIG_2	MSG_CONFIG	SC registers	0
Offline	CONFIG_3	MSG_CONFIG	SC registers	3
CONFIG_1	CONFIG_2	TRANSITION	ISO derives	0
CONFIG_1	CONFIG_3	TRANSITION	ISO derives	2
CONFIG_2	CONFIG_3	TRANSITION	ISO derives	1
CONFIG_1	Offline	TRANSITION	ISO derives	0
CONFIG_2	Offline	TRANSITION	ISO derives	0
CONFIG_3	Offline	TRANSITION	ISO derives	0

Example 4: Configuration level limitation that does consider a transition a "start" where each start or transition=1 (CONFIG_B)

Configuration 3 can only be started 50 times a year based on number of actual starts or transitions. The second limitation implied starts indicate that C3 can only be actually started or transitioned into 50 times per year. The configuration level limitation is based on actual starts or transitions and not the turbine starts. For example, if the resource were started from offline to C1 and then transitioned to C3 that should only be considered one start against the limit on C3.

ULPDT

SC_ID	RES_ID	CONFIG_ID	USE_LIMIT_TYPE	GRANULARITY	PLAN_STRT_DT_TM	PLAN_END_DT_TM	LIMITATION
SC_1	RES_A	CONFIG_3	START	ANNUALLY	1/1/2018	12/31/2018	50

Implied Starts in GRDT

CONFIG_1	CONFIG_2	CONFIG_3
1	1	1

ISO derives transition implied starts based on configuration implied starts data, which is shown below for each feasible transition.

Implied Starts by Transition

From Config	To Config	GRDT Tab	Mechanism	Implied Starts
Offline	CONFIG_1	MSG_CONFIG	SC registers	0

Offline	CONFIG_2	MSG_CONFIG	SC registers	0
Offline	CONFIG_3	MSG_CONFIG	SC registers	1
CONFIG_1	CONFIG_2	TRANSITION	ISO derives	0
CONFIG_1	CONFIG_3	TRANSITION	ISO derives	1
CONFIG_2	CONFIG_3	TRANSITION	ISO derives	1
CONFIG_1	Offline	TRANSITION	ISO derives	0
CONFIG_2	Offline	TRANSITION	ISO derives	0
CONFIG_3	Offline	TRANSITION	ISO derives	0

Because the transition IMPLIED_STRTS need to be set at different values than the functionality will calculate based on the difference of the 'To Configuration' and 'From Configuration' implied starts, CONFIG_B cannot be registered accurately. Scheduling Coordinator will need to register the USE_LIMIT_TYPE of the limitation as 'OTHER' so it can be evaluated for a negotiated opportunity cost.

If a MSG resource has start limitations on both plant and configuration levels that require different implied start counts for each configuration based on the plant and configuration(s) limitation(s), the ISO cannot support multiple IMPLIED_STRTS value per MSG resource or configuration so cannot model these types of combined plant and configuration(s) limitations. The Scheduling Coordinator should register the MSG resource or MSG configuration(s) limitations as the USE_LIMIT_TYPE='OTHER' and the IMPLIED_STRTS should be NULL.

If an MSG resource has plant level and configuration level start limits that are the same for each configuration based on the plant and configuration(s) limitations, the Scheduling Coordinator should register the IMPLIED_STRTS values by configuration and the same value will be used to count number of starts that count towards the plant or the configuration(s) limitations.

Example 5: PLANT_A and CONFIG_B Combination

Example 5 is an example of plant and configuration level limitations that cannot be modelled either as a combination or separately since CONFIG_B's transition implied starts would not be derived correctly. The combination of limitations on this MSG resource are:

- The resource is limited to 300 ISO start-up instructions per year limitation where transitions do not count against the resource's annual start limitation.
- Configuration 3 can be started or transitioned 50 times a year based on number of ISO start-up instruction or transition instructions.

SC_ID	RES_ID	CONFIG_ID	USE_LIMIT_TYPE	GRANULARITY	PLAN_STRT_DT_TM	PLAN_END_DT_TM	LIMITATION
SC_1	RES_A		START	ANNUALLY	1/1/2018	12/31/2018	300
SC_1	RES_A	CONFIG_3	START	ANNUALLY	1/1/2018	12/31/2018	50

SC would register the IMPLIED_STRTS for each configuration as follows.

Implied Starts in GRDT

CONFIG_1	CONFIG_2	CONFIG_3
1	1	1

ISO derives transition implied starts based on configuration implied starts data, which is shown below for each feasible transition. The ISO would determine the transitions shown in orange for the PLANT_A limitation. The transition implied starts shown for CONFIG_B are the implied starts based on the plan documentation, which current functionality cannot correctly derive.

Implied Starts by Transition

From Config	To Config	Mechanism	Implied Starts – PLANT_A	Implied Starts – CONFIG_B
Offline	CONFIG_1	SC registers	1	0
Offline	CONFIG_2	SC registers	1	0
Offline	CONFIG_3	SC registers	1	1
CONFIG_1	CONFIG_2	ISO derives	0	0
CONFIG_1	CONFIG_3	ISO derives	0	1
CONFIG_2	CONFIG_3	ISO derives	0	1
CONFIG_1	Offline	ISO derives	0	0
CONFIG_2	Offline	ISO derives	0	0
CONFIG_3	Offline	ISO derives	0	0

Because the IMPLIED_STRTS for a given configuration need to be different to represent accurately the limitations, this combination cannot be registered accurately. Scheduling Coordinator will need to register the USE_LIMIT_TYPE of the limitation as 'OTHER' so it can be evaluated for a negotiated opportunity cost.

Example 6: PLANT_A and CONFIG_A Combination

Example 6 is an example of plant and configuration level limitations that cannot be modelled as a combination since the configuration implied starts are not the same for the plant and configuration level limitations. The combination of limitations on this MSG resource are:

- The resource is limited to 300 ISO start-up instructions per year limitation where transitions do not count against the resource's annual start limitation.
- Configuration 3 can be started or transitioned 50 times a year based on the number of turbine starts.

SC would register the IMPLIED_STRTS for each configuration as follows and the ISO would derive the transition implied starts shown in orange.

Implied Starts by Transition

From Config	To Config	Mechanism	Implied Starts – PLANT_A	Implied Starts – CONFIG_A
Offline	CONFIG_1	SC registers	1	1
Offline	CONFIG_2	SC registers	1	2
Offline	CONFIG_3	SC registers	1	3
CONFIG_1	CONFIG_2	ISO derives	0	1
CONFIG_1	CONFIG_3	ISO derives	0	2
CONFIG_2	CONFIG_3	ISO derives	0	1
CONFIG_1	Offline	ISO derives	0	0
CONFIG_2	Offline	ISO derives	0	0
CONFIG_3	Offline	ISO derives	0	0

Because the IMPLIED_STRTS for a given configuration need to be different to represent accurately the limitations, this combination cannot be registered accurately. SC will need to register the USE_LIMIT_TYPE of the limitation as 'OTHER' so it can be evaluated for a negotiated opportunity cost.

Example 7: PLANT_C and CONFIG_B Combination

Example 7 is an example of plant and configuration level limitations that cannot be modelled as a combination since the configuration implied starts are not the same for the plant and configuration level limitations. The combination of limitations on this MSG resource are:

- The resource is limited to 300 turbine starts per year limitation where transitions count against the resource's annual start limitation.
- Configuration 3 can be started or transition 50 times a year based on number of ISO start-up instructions or transition instructions.

SC would register the IMPLIED_STRTS for each configuration as follows and the ISO would determine the transitions shown in orange.

Implied Starts by Transition

From Config	To Config	Mechanism	Implied Starts – PLANT_C	Implied Starts – CONFIG_B
Offline	CONFIG_1	SC registers	1	0
Offline	CONFIG_2	SC registers	2	0
Offline	CONFIG_3	SC registers	3	1
CONFIG_1	CONFIG_2	ISO derives	1	0
CONFIG_1	CONFIG_3	ISO derives	2	1
CONFIG_2	CONFIG_3	ISO derives	1	1
CONFIG_1	Offline	ISO derives	0	0
CONFIG_2	Offline	ISO derives	0	0
CONFIG_3	Offline	ISO derives	0	0

Because the IMPLIED_STRTS for a given configuration need to be different to represent accurately the limitations, this combination cannot be registered accurately. SC will need to register the USE_LIMIT_TYPE of the limitation as 'OTHER' so it can be evaluated for a negotiated opportunity cost.

Example 8: PLANT_C and CONFIG_A Combination

Example 8 is an example of plant and configuration level limitations that can be modelled as a combination since the configuration implied starts are the same and the derived transition implied starts are representative of the use limitation plan for both the plant and configuration level limitations. The combination of limitations on this MSG resource are:

- The resource is limited to 300 turbine starts per year limitation where transitions count against the resource's annual start limitation.
- Configuration 3 can be started or transitioned 50 times a year based on the number of turbine starts.

SC would register the IMPLIED_STRTS for each configuration as follows and the ISO would determine the transitions shown in orange.

Implied Starts by Transition

From Config	To Config	Mechanism	Implied Starts – PLANT_C	Implied Starts – CONFIG_A
Offline	CONFIG_1	SC registers	1	1
Offline	CONFIG_2	SC registers	2	2
Offline	CONFIG_3	SC registers	3	3
CONFIG_1	CONFIG_2	ISO derives	1	1
CONFIG_1	CONFIG_3	ISO derives	2	2
CONFIG_2	CONFIG_3	ISO derives	1	1
CONFIG_1	Offline	ISO derives	0	0
CONFIG_2	Offline	ISO derives	0	0
CONFIG_3	Offline	ISO derives	0	0

Because the IMPLIED_STRTS counts for both PLANT_C and CONFIG_A are the same value for each configuration and transitions, the SC should register both limitations in the ULPDT under the USE_LIMIT_TYPE='START'. PLANT_C limitation would be registered under the MSG resource ID with no configuration ID and CONFIG_A limitation would be registered in ULPDT under the configuration ID for configuration 3. In the GRDT MSG CONFIG tab the IMPLIED_STRTS would be registered as CONFIG_1=1, CONFIG_2=2, and CONFIG_3=3. The transitions will be derived by ISO as the difference (Implied start "To Configuration" minus implied start "From Configuration").