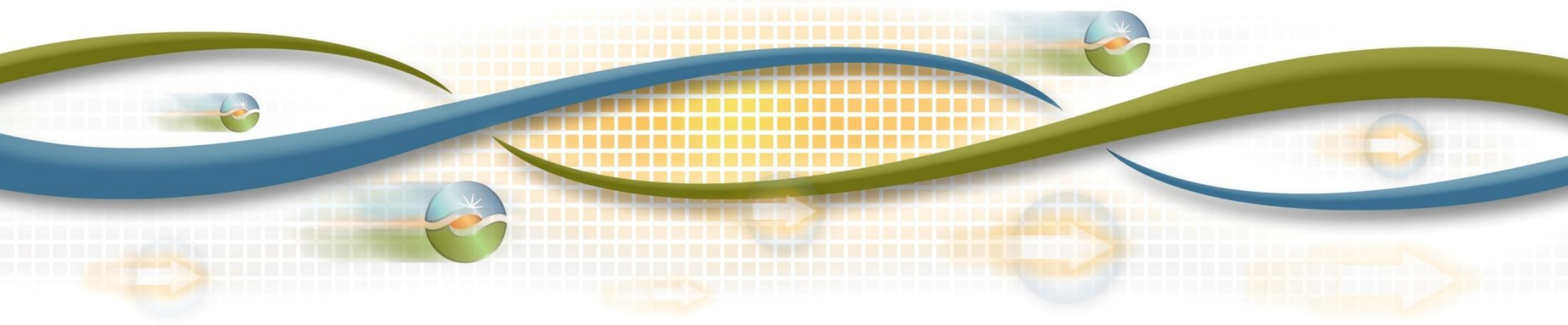
California ISO
Shaping a Renewed Future

# Multi-stage generation (MSG) model overview

A consolidation of past presentations that describe concepts of this type of resource. This document is provided for learning purposes. The tariff, BPM and BRS provide the detailed information.

August 2012



# Overview objectives

- Section 1 - Provide a bid-to-bill overview of the MSG model
- Section 2 – Enhancements and future addtions
- Section 3 - Share production experiences with market participants
- Section 4 - Clarify areas that need attention

Our goal is to facilitate a smooth transition to MSG model and MSG operation

# Section 1 – MSG bid-to-bill

Example describing a sample MSG scenario

# MSG sample configuration using an imaginary 2 x 1 resource.

- Resource ID**: Miracle_Plant**
- Physical Units contained:  GT1, GT2 and ST
- Configuration definitions:

| CONFIG_ID | CONFIG_NAME | MAX_GEN | MIN_GEN | Ramp-rate | Minimum Load Cost | Shutdown_YN | Minimum up time | Minimum Down time |
|---|---|---|---|---|---|---|---|---|
| 1X1 | One GT with ST | 160 | 50 | 6 | $1,000 | Y | 1 Hrs | 1 Hr |
| 2X1 | 2 GTs with ST | 295 | 180 | 8 | $3,000 | N | 2 Hrs | 1 Hr |

# MSG start up rules must be observed.

Startup notification time and cost curve can have up to three segments per configuration (in this example there is only one segment)

- Startup ramp time is a single value per configuration
- Not every configuration has to be “startup-able” or “shutdown-able”

| CONFIG_ID | Startup (Notification)Time | Startup Ramp Time | Startup Cost |
|---|---|---|---|
| 1X1 | 2 Hrs | 30 minutes | $2000 |
| 2X1 | 2.5 Hrs | 40 minutes | $3000 |

# A transition matrix must be defined.

There should never be an “idle configuration” that we can not startup through a sequence into or shutdown through a sequence from

- Transition notification time, transition time and cost are all single segment

| Transitions | Transition Notification Time | Transition Time | Transition Cost |
|---|---|---|---|
| 1X1 → 2X1 | 45 minutes | 30 minutes | $1000 |
| 2X1 → 1X1 | 30 minutes | 20 minutes | $1000 |

# Day-ahead bids can be offered.

Up to ten configurations can be bid in day-ahead

AS/RUC bid prices are the same for different configurations

In SIBR, the resource ID and configuration ID have to be given for a bid curve for MSG resource

| Configuration ID | Energy Bids (He 8, 9, 10, 11) |
|---|---|
| 1X1 | (50, 100): $20<br>(100, 160): $50 |
| 2X1 | (180, 250): $80<br>(250, 295): $150 |

# Day-ahead market – bidding results

Assuming DA LMP for HE 8, 9, 10 and 11 are $40, $100, $80 and $75

| Hour | IFM Results | Bid Cost involved and/or Cleared Segment |
|---|---|---|
| | Startup into 1X1 | SUC of $2000 for 1X1 |
| 8 | 1X1: 100MW | (50,100) in 1X1 at $20 and MLC $1000 |
| | 1X1 to 2X1 | Transition cost of $1000 from 1X1 to 2X1 |
| 9 | 2X1: 250MW | (180, 250) in 2X1 at $80 and MLC $3000 |
| 10 | 2X1: 200MW | Marginal-(180, 250) in 2X1 at $80 and MLC $3000 |
| | 2X1 to 1X1 | Transition Cost of $1000 from 2X1 to 1X1 |
| 11 | 1X1: 160MW | (100, 160) in 1X1 at $50 and MLC of $1000 |
| | Shutdown | |

# Day-ahead market - operational results

Minimum up and down time are considered.

| Hour | IFM Schedule | Operational Characteristics Considered |
|---|---|---|
| | Startup into 1X1 | Startup Time of 2 Hrs for 1X1 (non-binding) |
| 8 | 1X1: 100MW | Ramp-rate of 6MW/min used (binding) |
| | 1X1 to 2X1 | Transition time of 30 minutes (non-binding) |
| 9 | 2X1:  250MW | Ramp-rate of 8MW/min used (binding) |
| 10 | 2X1:  200MW | Ramp-rate of 8MW/min used (binding) |
| | 2X1 to 1X1 | Transition time of 20 minutes (non-binding) |
| 11 | 1X1: 160MW | Ramp-rate of 6MW/min used (binding) |
| | Shutdown | 1X1 is shutdown-able. (non-binding) |

# Real-time bids can be offered.

- Up to five configurations plus day-ahead and RUC committed configurations can be bid in real-time
- AS bid prices are the same for different configurations
- In SIBR, both resource ID and configuration ID have to be given for a bid curve for MSG resource
- Real-time bid has to support the RUC binding schedule and resource adequacy

| Configuration ID | Energy Bids (HE 8, 9, 10, 11) - Price up $10 from DA |
|---|---|
| 1X1 | (50, 100): $30, (100, 160): $60 |
| 2X1 | (180, 250): $90, (250, 295): $160 |

# Real-time market results (RTPD/RTD)

For simplicity, RTPD/RTD LMPs for HE 8, 9, 10 and 11 are $90, $100, $90 and $60 across intervals within hour

| Hr | RTPD/RTD<br>(ramp next page) | Bid Cost involved |
|---|---|---|
| | Startup into 2X1 | SUC of $3000 for 2X1 |
| 8 | 2X1: 200MW | Marginal (180,250) in 2X1 at $90 and MLC $3000 |
| 9 | 2X1: 250MW | (180,250) in 2X1 at $90 and MLC $3000 |
| 10 | 2X1:  180MW | Marginal (180,250) in 2X1 at $90 and MLC $3000 |
| | 2X1 to 1X1 | Transition Cost of $1000 from 2X1 to 1X1 |
| 11 | 1X1: 150MW | Marginal (100, 160) in 1X1 at $60 and MLC of $1000 |
| | Shutdown | |

# Real-time market operational results (RTPD/RTD)

All ADS target times for DOT remain intra-interval. Symmetric ramping continues to be observed. DOT issue time does not change.

| Time | ADS Instructions | Operation Characteristics Observed |
|---|---|---|
| Online 7:00 | Issued at 4:30. Startup into 2X1 (on-line at 7:00) | Startup notification time of 2.5 hrs for 2X1 |
| 7:00 to 7:05 | 2X1: DOT of 200MW | Reflect the ramp from 180 to 200 at a ramp-rate of 8 within 2X1 |
| 7:05 to 7:55 | 2X1: DOT of 200MW | No ramp here in this example. However, ramping within the same configuration is no different from a non-MSG except correct ramp-rate used. |
| 7:55 to 8:05 | 2X1: DOTs to reflect ramping from 200 to 250 | Again, ramp-rate of 8 MW/min is observed. Roughly 6.25 minutes ramp here. |

# Real-time market operational results (RTPD/RTD)

For simplicity, RTPD/RTD LMPs for HE 8, 9, 10 and 11 are $90, $100, $90 and $60 across intervals within hour

| Time | ADS Instructions | Operation Characteristics Observed |
|---|---|---|
| 8:05 to 8:55 | 2X1: DOTs of 250 | No ramp here in this example. However, ramping within the same configuration is no different from a non-MSG except correct ramp-rate used. |
| 8:55 to 9:05 | 2X1: DOTs to reflect ramping from 250 to 180 | Again, ramp-rate of 8 MW/min is observed. Roughly 9 minutes ramp here. |
| 9:05 to 9:40 | 2X1: 180MW | No ramp here in this example. However, it needs to prepare for the transition happening next |

# Real-time market operational results (RTPD/RTD)

For simplicity, RTPD/RTD LMPs for HE 8, 9, 10 and 11 are $90, $100, $90 and $60 across intervals within hour

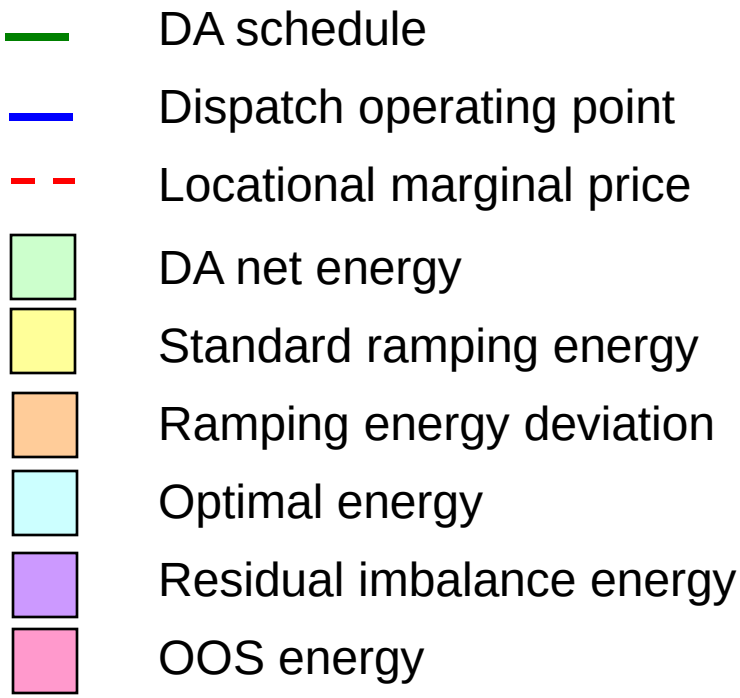
| Time | ADS Instructions | Operation Characteristics Observed |
|---|---|---|
| 9:40 to 10:00 | Issued at 9:30. 2X1 → 1X1 transition instruction issued | 30 minutes notification time observed. Instruction will show, start from 2X1, at 9:40am to end at 1X1 at 10:00am. |
| 9:40 to 10:00 | 2X1->1X1: DOTs to reflect a linear ramping in 20 mins | No ramp-rate is used here. Assume a 20-minute linear ramp from the minimum gen of 2X1 to the maximum gen of 1X1 |
| 10:00 to 10:40 | 1X1: DOTs at 160MW | No ramp here in this example. However, ramping within the same configuration is no different from a non-MSG except correct ramp-rate used. |

# Real-time market operational results (RTPD/RTD)

For simplicity, RTPD/RTD LMPs for HE 8, 9, 10 and 11 are $90, $100, $90 and $60 across intervals within hour

| Time | ADS Instructions | Operation Characteristics Observed |
|---|---|---|
| 10:45 | 1X1: Shutdown at 11:00 | Shutdown instruction can be issued earlier. Just an example. |
| 10:40 to 11:00 | 1X1: DOTS to reflect ramping from 160 to 50 and then zero | Ramp-rate of 6 is observed. Vertical ramp from Pmin to zero continue to be observed. |

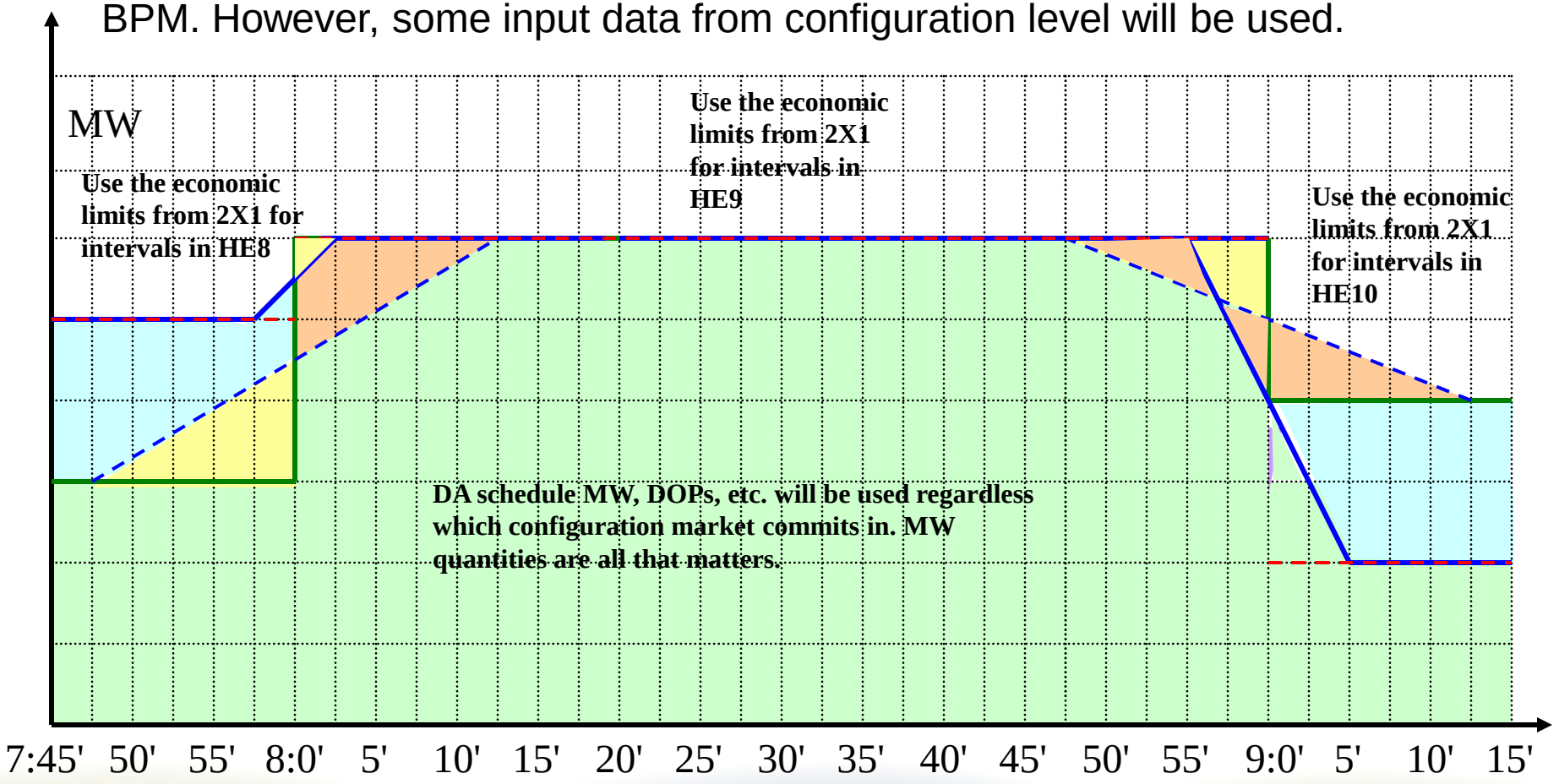
# Expected energy calculation and allocation – legend (see BPM for further explanation)




† relative to the DA Schedule

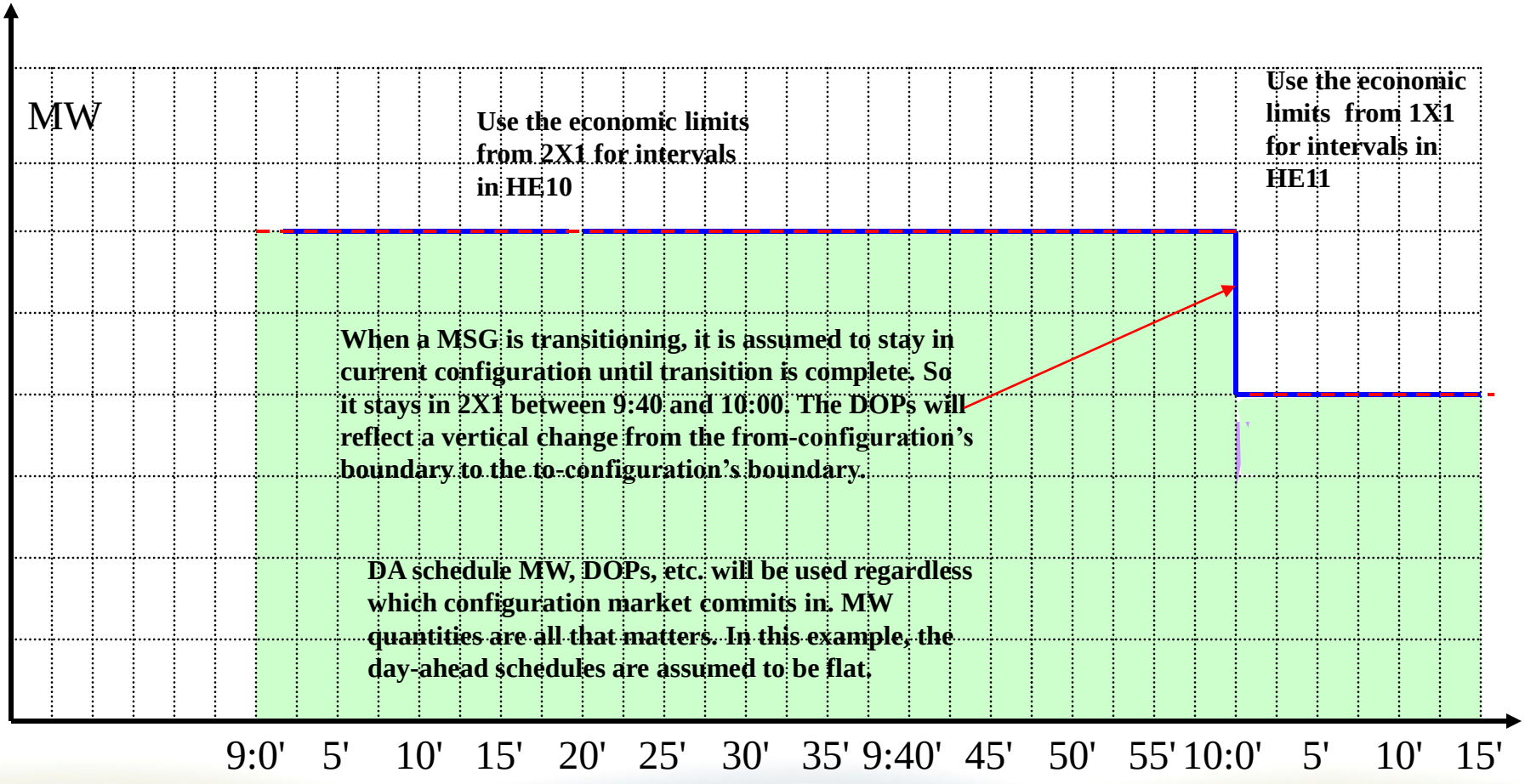
# Expected energy calculation and allocation

EE is calculated at resource level using the same methodology described in our BPM. However, some input data from configuration level will be used.



# Expected energy calculation and allocation – example with transition

- Let's look at the transition from 9:40 to 10:00



# Expected energy allocation for participating MSG resources.

- DA energy continues to be allocated to DA energy bid except that the bid is from the DA committed configuration for that hour

- RT energy continues to be allocated to RT energy bid except that the bid is from the RT committed configuration for that 15-minute interval

# Commitment costs are calculated.

- Evaluated in the order of:
  - RT, RUC and DA.
  - If qualified for RT, RUC and DA will not be evaluated. This is due to the fact that we can commit into different configurations in RT versus RUC or DA

  -- Different from non-MSG resources
- Startup cost and minimum load cost use the same rule except that those costs are from the relevant committed configurations
- Hence:
  - the startup cost of $3000 is “qualified”. The minimum load costs of $3000 (HE8), $3000 (HE9), $3000 (HE10) and $1000 (HE11) are qualified.

# Commitment costs are calculated.

- Transition cost will be allocated and evaluated to the “To-Configuration” and its commitment period
- In our example,
- (1X1 to 2X1) DA transition cost of $1000 will be allocated to the settlement intervals in HE9 and HE10
- (2X1 to 1X1) RT transition cost of $1000 will be allocated to the settlement intervals in HE11
- The reason that original DA transition cost of (2X1 to 1X1) DA transition cost is not considered is because the RT transition takes priority

# Energy settlement and bid cost recovery are calculated at the resource level.

- DA energy continues to be settled on DA LMP regardless of configuration. RT energy continues to be settled on RT LMPs regardless of configuration.

- DA bid cost continues to include DA energy allocation for energy bid cost, DA startup cost, DA minimum load cost. In addition to that, DA transition cost will be included

- RT bid cost continues to include RT energy allocation for energy bid cost, RT startup cost, RT minimum load cost. In addition to that, RT transition cost will be included

- When comparing market revenue against bid cost, the comparison is done per resource and trade day regardless of which configuration the resource is committed in within the trade day

- UIE will be calculated by comparing total expected energy and metered energy which are both on resource level.

# Section 2 – Enhancements and future additions

# MSG: Terminal condition (introduced December, 2011)

- Example: A MSG resource has the ability to transition between Configuration1 (C1) and Configuration2 (C2).
  - Assume that C1 (minimum up time = 6 hours) can transition to C2 (minimum down time is 4 hours).
  - In DA we commit them in C2 in HE 7.

- The terminal condition says in RTPD, assuming we put this unit in C2 (HE 1), we cannot transition to C1 within HE2 to HE6 (because we would have to maintain that minimum up time and in this example would not make it to C2 by HE 7).

# MSG: Two ramp rates per configuration (introduced April, 2012)

- The current MSG functionality allows only one ramp rate to be defined and bid-in per configuration
- Enhancement allows two ramp rates to be submitted in the Resource Data Template (RDT)
- Two ramp rates will be accommodated by SLIC

# MSG: Self-scheduling flexibility between day-ahead and real-time (introduced April, 2012)

- Currently, if an MSG has a day ahead self-schedule or AS award then it can submit a real-time self-schedule only into that same configuration

- With this enhancement, real-time self-scheduled configuration can be different if it can support the day-ahead AS and RUC awards

# MSG: Bidding requirements on lower configurations (introduced April, 2012)

- MSG resources need to bid in lower configurations as necessary to provide capacity up to the higher of
  - Their contracted RA capacity, and
  - Their maximum bid-in capacity

# MSG group constraint (available in May, 2013)

- Model Minimum Up Time (MUT) and Down Time (MDT) on a group of configurations
  - To further address the physical constraints on GTs with combined cycle plants, for example,
  - Register MUT on a group of configurations, i.e., 2X1 and 2X1 duct firing as 6 hours,

# MSG group constraint …*continued*

- MSG will not transition back to 1X1 within 6 hours once it moves from 1X1 to 2X1,
- But it will be able to move between 2X1 and 2X1 duct firing,
- Market participants can still define MUT or MDT on individual configurations by physical nature.

# MSG group constraint …*continued*

- A group of configurations can contain a sub-group of configurations;
- Configuration level MUT and MDT stays. For example, a unit can have MUT(2X1, 2X1 duct) as 6 hours And MUT(2X1 duct) as 30 minutes;

# MSG group constraint …*continued*

- With two groups A and B, assuming that configurations in group B is a subset of configurations in group A
  - MUT(A) >= MUT (B);  MDT(A) <= MDT (B).
- For any group A
  - MUT(Plant) >= MUT(A);  MDT(Plant) <= MDT(A).
- If registered values fail those rules, ISO will contact the market participant for justification.

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# Section 3 – Share production experiences with market participants

Questions and answers

# Question 1 - ancillary service self provision

Question 1: If an ancillary service self provision (ASSP) is provided for a given configuration, can and how does the ISO honor that self provision in a different configuration?

Answer: Yes. Both DA/RT ASSPs are considered at plant level,

1.The ASSP on a submitted configuration will undergo the capacity, ramping and regional qualifications as it is;

2. The qualified AS capacity will be then transferred to the other AS qualified configuration up to its certified capacity;

3. Capacity and ramping qualification will be performed on the transferred configuration using their capacity limits and ramp rates.

4. Optimization will evaluate those configurations to determine which configuration to observe the ASSP

# Question 2 – day-ahead awarded ancillary services in real-time

Question 2: Can a day-ahead awarded AS be observed at a different configuration that can support that capacity in real-time?

Answer: Yes. As along as the other configuration can support that day-ahead AS. Day-ahead awarded AS will become AS self provision on the same configuration in real-time. Then the transfer process in answer to question 1 will be used to evaluate other configurations.

# Question 3 – Day-ahead awarded ancillary services disqualification in real-time

Question 3: What are the reasons that a day-ahead awarded AS is disqualified in real-time?

Answer: Common reasons are real-time SLIC outages or other changes. Day-ahead AS can be partially or entirely disqualified. The qualification rules are the same as non-MSG but with the configuration level ramp rates and capacities. Also if real-time determines the MSG transition, the AS during the transition period defined by transition ramp time will be disqualified.

# Question 4 – real-time ancillary services disqualification in settlements

Question 4:  What will be the settlement rule for disqualified AS?

Answer:  AS settlement is on plant level. Rules will be the same as for non-MSG resources. Currently the disqualified AS is still paid by the day-ahead ASMP. After implementation of ISO's day-ahead AS buy-back policy, the day-ahead payment of the disqualified amount will be taken back.

# Question 5 – real-time self-schedule versus day-ahead AS

Question 5: Can a MSG resource have a real-time energy self schedule on a configuration different from the day-ahead awarded AS configuration if it can support the AS?

Answer: Yes, as long as the other configuration can support the day-ahead AS.

# Question 6 – day-ahead transition

Question 6: Currently, SCUC can provide DA energy, which is within the forbidden zone during transition hours for MSG resources. Even though this DA solution is theoretically correct, the solution is not credible for plant managers since it does not meet forbidden-zone constraints.

Answer: When transition ramp time is greater or equal to 30 minutes between two non-overlapping configurations, the DA schedule during the transition can be within the gap between configurations. This will not be the case in real-time. Market participants can change the ramp time to avoid this if desired.

# Question 7 –Transition up for non-overlapping transition

Question 7: Let's consider a transition from C1 to C2. C1 has the operating range PMin1=20/PMax1=100 and C2 the operating range PMin2 = 120/PMax2=200 and transition ramp time (C1→C2) = 120 minutes.

- How is the transition profile  computed?
- Which configuration is the transition profile applied to?
- What are the ADS DOTs/DOPs and the Expected Energy calculation during transition?

# Question 7 –Transition up for non-overlapping transition

- How is the transition profile computed?

Answer: The transition profile is calculated as the linear ramp from 100 to 120 with ramp time of 120 minutes. There are some differences between day-ahead and real-time,

1. For DA, there are two schedules in consecutive hours at 105 and 115 MWs during the transition ramp time;
2. For RT, the transition profile is used for internal imbalance calculation. The external (ADS) DOTs/DOPs remains at 100 for two hours at C1 until the end of transition.

# Question 7 –Transition up for non-overlapping transition

- Which configuration is the transition profile applied to?

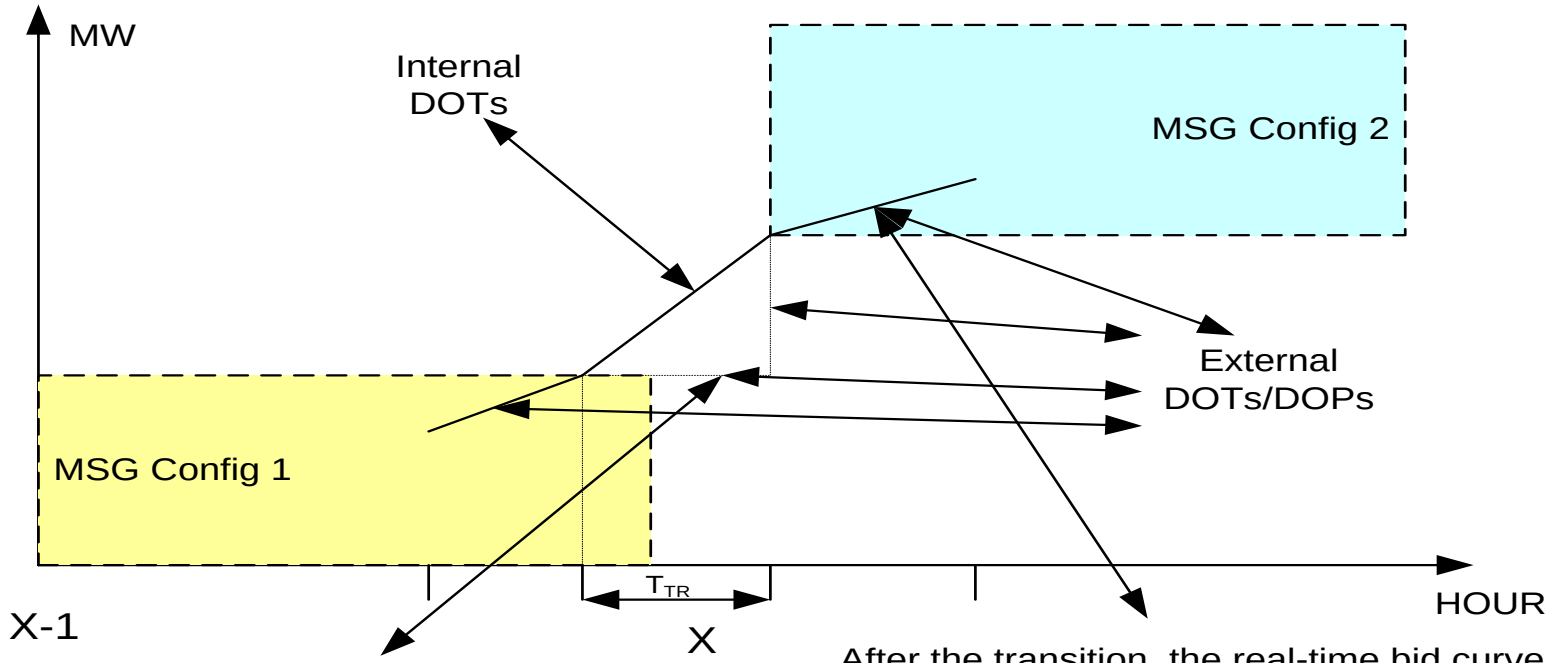
Answer: From an operational perspective, the transition profile is considered between a *from* configuration and a *to* configuration. From a settlement perspective, we assume the unit is at the *from* configuration until transition is finished. In this example, C1.

# Question 7 –Transition up for non-overlapping transition

Question: What are the ADS DOTs/DOPs and the Expected Energy calculation during transition?

Answer: They remain at 100 for two hours at C1 until the end of transition. A vertical DOP jump (like startup/shutdown) from 100 of C1 to 120 of C2 is assumed at the end of transition for expected energy calculation. For the transition period, the expected energy and allocation are calculated using the C1's real-time energy bid and other data. Expected energy and allocation use the same algorithm as non-MSG except that the bid curve and relevant data are from relevant configuration.

# Question 7 –Transition up for non-overlapping transition




For expected energy calculation and allocation during transition, the real-time bid curve and limits and other data of config 1 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 1. Same as the real-time minimum load cost/startup cost if applicable.

After the transition, the real-time bid curve and limits and other data of config 2 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 2. Same as the real-time minimum load cost/ startup cost if applicable.

# Question 8 –Transition up for overlapping transition

Question 8: Let's consider a transition from C1 to C2. C1 has the operating range PMin1=20/PMax1=120 and C2 has the operating range PMin2 = 100/PMax2=200 and Transition ramp time (C1→C2) = 120 minutes.

- How is the transition profile  computed?
- Which configuration is the transition profile applied to?
- What are the ADS DOTs/DOPs and the Expected Energy calculation during transition?

# Question 8 –Transition up for overlapping transition

- How is the transition profile computed?

Answer: The transition profile is assumed to be flat as 110 MW (the mid point of the overlapping range) for two transition hours. For both DA and RT, the energy schedules will be assumed at 110MW of C1 during these two hours.

- Which configuration is the transition profile applied to?

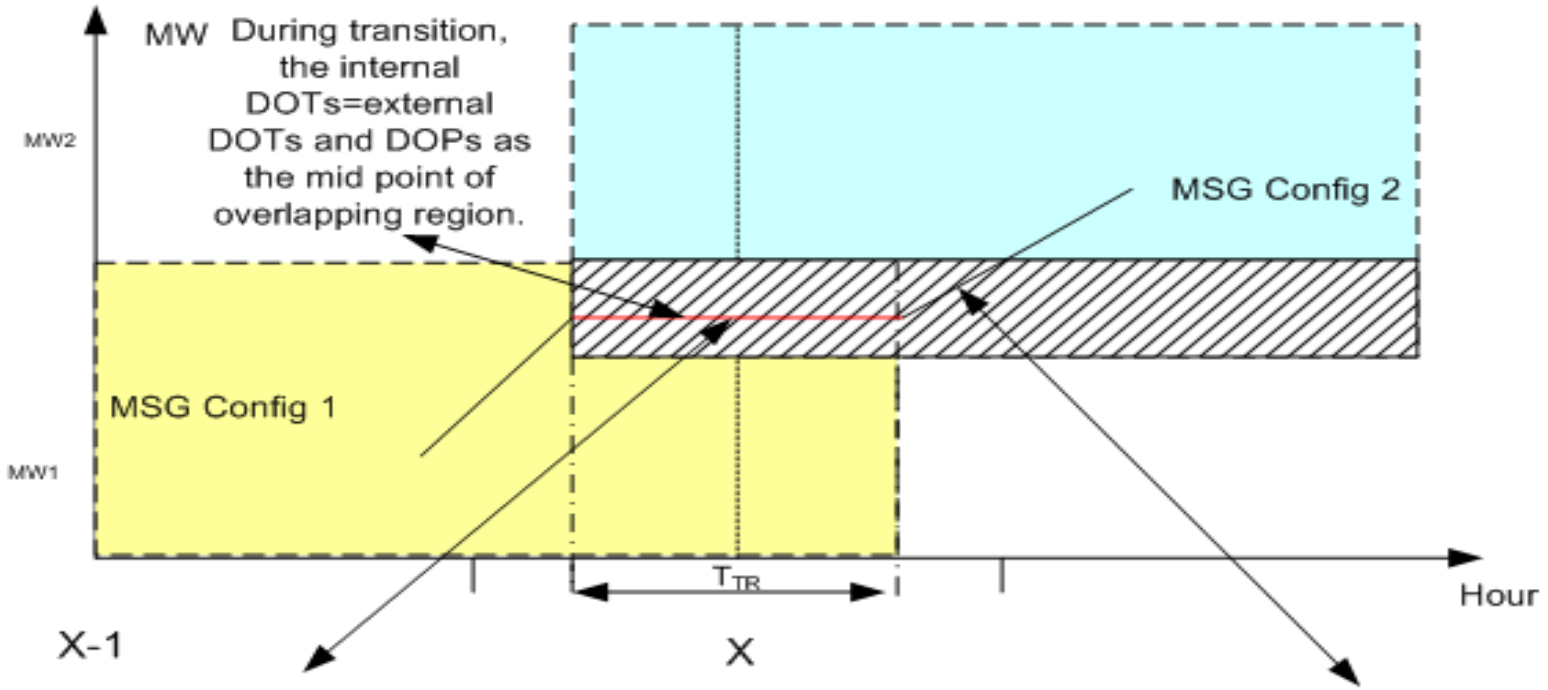
Answer: The same as the non-overlapping configurations. It is assumed at the from configuration C1.

# Question 8 –Transition up for overlapping transition

- What are the ADS DOTs/DOPs and the expected energy calculation during transition?

Answer: They stay as 110MW at C1 for two hours until the transition ends. The DOTs/DOPs are at C1 before the transition and at C2 after the transition. For the transition period, the expected energy and allocation are calculated using the C1's real-time energy bid and other data. Expected energy and allocation use the same algorithm as non MSG except that the bid curve and relevant data are from relevant configuration.

# Question 8 –Transition up for overlapping transition

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After the transition, the real-time bid curve and limits and other data of config 2 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 2. Same as the real-time minimum load cost/startup cost if applicable.

# Question 9 –Transition down for non-overlapping transition

Question 9: Let's consider a transition from C1 to C2. C1 has the operating range PMin1 = 120/PMax1=200 and C2 has the operating range PMin2=20/PMax2=100 and transition ramp time (C1-> C2) = 120 minutes.

- How is the transition profile  computed?
- Which configuration is the transition profile applied to?
- What are the ADS DOTs/DOPs and the expected energy calculation during transition?

# Question 9 –Transition down for non-overlapping transition

- How is the transition profile computed?

Answer: The transition profile is calculated as the linear ramp from 120 to 100 with ramp time of 120 minutes. There are some differences between day-ahead and real-time,

1. For DA, there are schedules in consecutive hours at 115 and 105 MWs during the transition period;
2. For RT, the transition profile is used for internal imbalance calculation. The external (ADS) DOTs/DOPs remains at 120 for two hours at C1 until the end of transition.

# Question 9 –Transition down for non-overlapping transition

- Which configuration is the transition profile applied to?

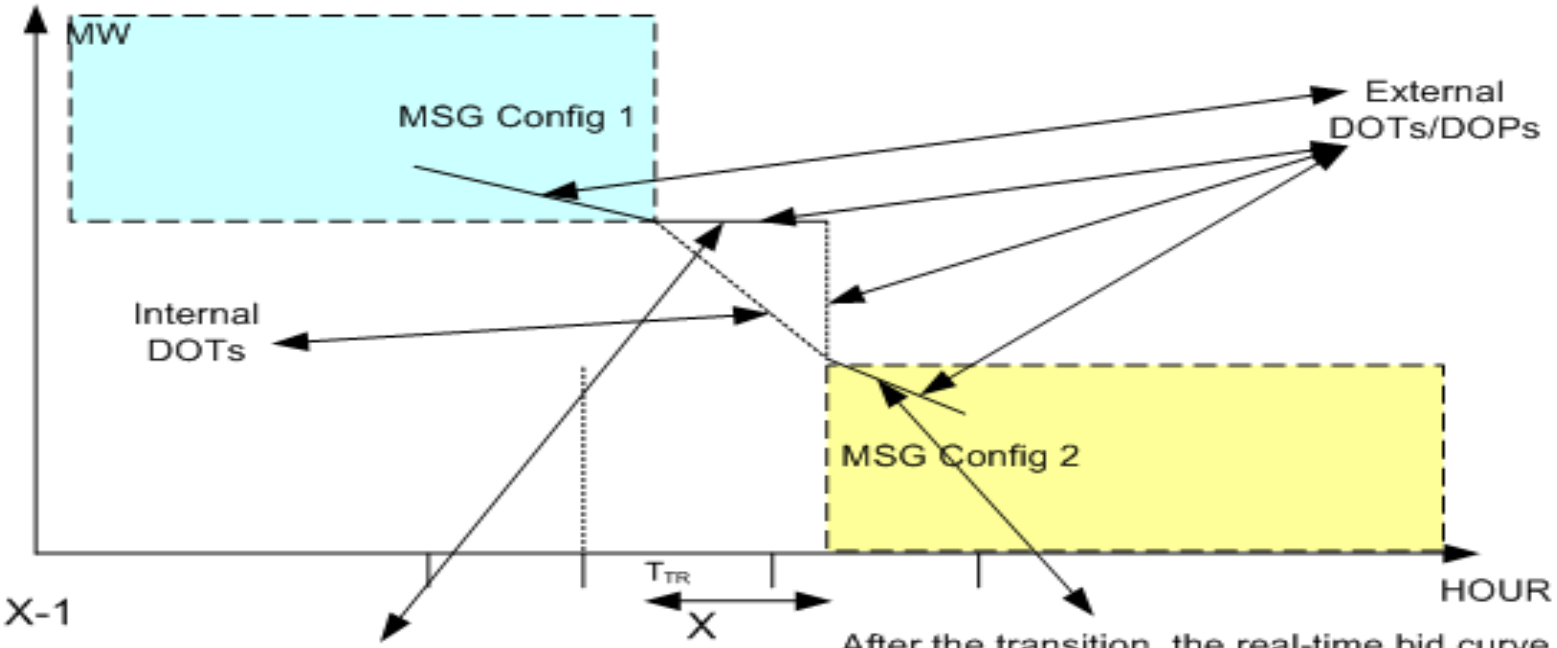
Answer: From operation perspective, the transition profile is considered between a from configuration and a to configuration. From settlement perspective, the unit is assumed to be at from configuration until transition ends. In this example, C1.

# Question 9 –Transition down for non-overlapping transition

- What are the ADS DOTs/DOPs and the expected energy calculation during transition?

Answer: They remain at 120 for two hours at C1 until the end of transition. A vertical DOP jump (like startup/shutdown) from 120 of C1 to 100 of C2 is assumed at the end of transition for expected energy calculation. During the transition, the expected energy and allocation is calculated using the C1's real-time energy bid and other data. The expect energy and allocation algorithm is the same as non-MSG, except that the bid curve and relevant data are associated with from configuration.

# Question 9 –Transition down for non-overlapping transition




For expected energy calculation and allocation during transition, the real-time bid curve and limits and other data of config 1 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 1. Same as the real-time minimum load cost/startup cost if applicable.

After the transition, the real-time bid curve and limits and other data of config 2 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 2. Same as the real-time minimum load cost/ startup cost if applicable.

# Question 10 –Transition down for overlapping transition

Question 10: Let's consider a transition from C1 to C2. C1 has the operating range PMin1=100/PMax1=200 and C2 has the operating range PMin2=20/PMax2=120 and Transition ramp time (C1-> C2) = 120 minutes.

- How is the transition profile  computed?
- Which configuration is the transition profile applied to?
- What are the ADS DOTs/DOPs and the expected energy calculation during transition?

# Question 10 –Transition down for overlapping transition

- How is the transition profile  computed?

Answer: The transition profile is assumed to be flat at 110 MW (the mid point of the overlapping range) for the two hours during transition. For both DA and RT, the energy schedules will be assumed at 110MW of C1 for those two hours.

- Which configuration is the transition profile applied to?

Answer: The same as the non-overlapping configurations. It is assumed at the from configuration C1.

# Question 10 –Transition down for overlapping transition

- Which configuration is the transition profile applied to?

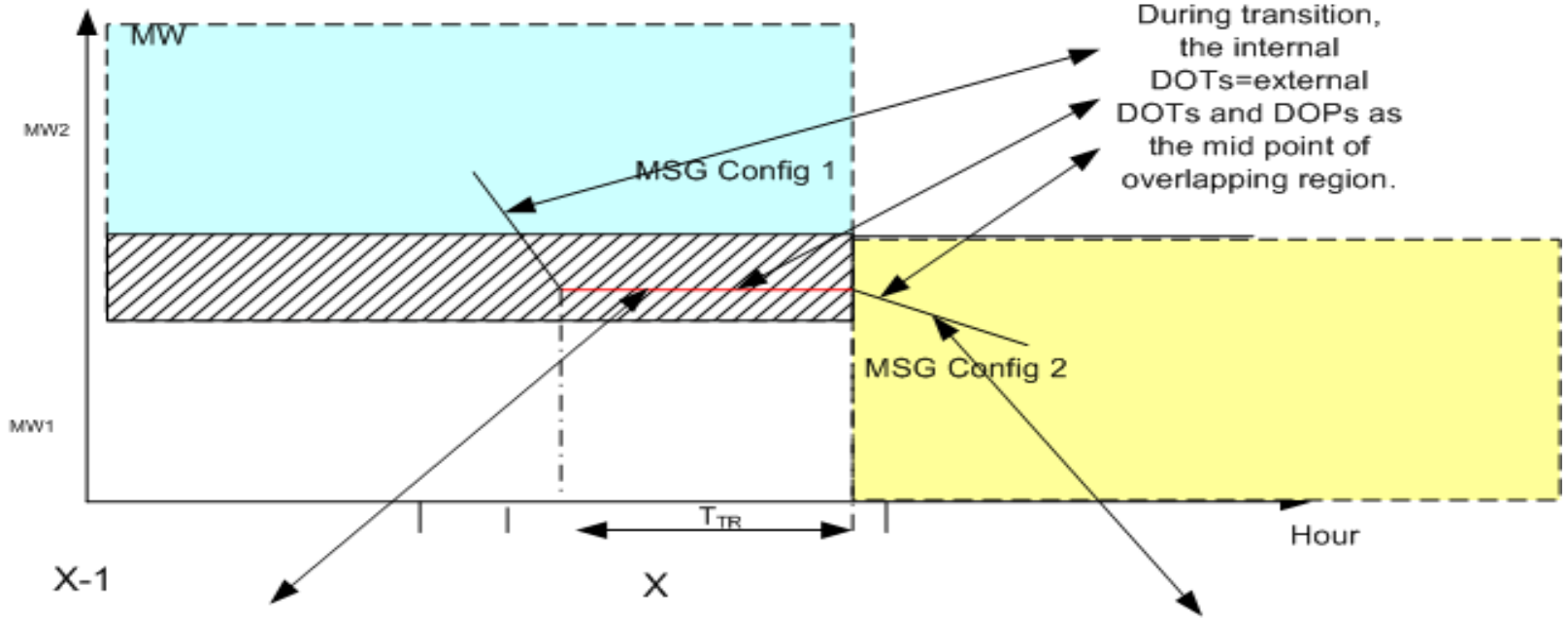
Answer: The transition profile is considered between a from configuration and a to configuration. If the question is about which configuration we assume unit is on, then the answer is that, we assume the unit is on from configuration until transition is finished. In this example, C1.

# Question 10 –Transition down for overlapping transition

- What are the ADS DOTs/DOPs and the expected energy calculation during transition?

Answer: The external (ADS) DOTs/DOPs remains at 110 for two hours at C1 until the end of transition. During the transition, the expected energy and allocation is calculated using the C1's real-time energy bid and other data. The expected energy and allocation algorithm is the same as non MSG, except that the bid curve and relevant data is associated with the from configuration.

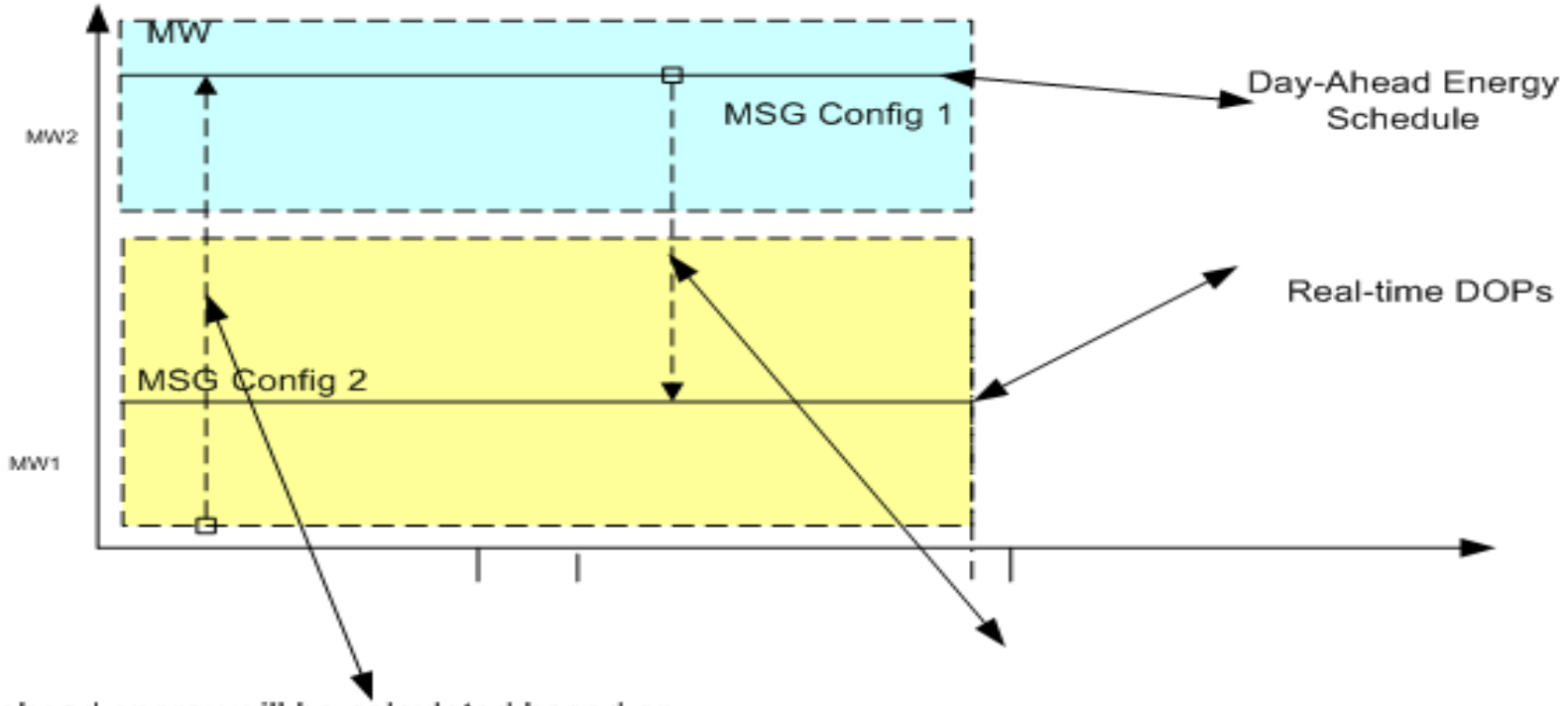
# Question 10 –Transition down for non-overlapping transition




For expected energy calculation and allocation during transition, the real-time bid curve and limits and other data of config 1 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 1. Same as the real-time minimum load cost/startup cost if applicable.

After the transition, the real-time bid curve and limits and other data of config 2 are used to calculate real-time expected energy and allocation. Config Id is the MSG config 2. Same as the real-time minimum load cost/startup cost if applicable.

# Question 11 – Energy settlement when DA and RT are different configurations




Day-ahead energy will be calculated based on Configuration 1's economic limit, Pmin and other relevant data. It will be allocated to the day-ahead energy bid on configuration 1.

Real-time energy will be calculated based on Configuration 2's economic limit, Pmin and other relevant data. It will be allocated to the real-time energy bid on configuration 2.

# Question 11 – Energy settlement when DA and RT are different configurations

So in CMRI, you will see,

1. Day-ahead energy associated with the day-ahead committed configuration (config 1 in our example);
2. Real-time energy associated with the real-time committed configuration (config 2 in our example).

There will be cases in which a real-time energy is not associated

With any configuration ID in CMRI. There are two reasons:

1. The unit is not committed in RT even it is committed in DA;
2. Due to telemetry, there can be one non-zero DOP before the first non-zero DOT interval.

# Question 12 – No configuration ID for total expected energy (TEE)

Question: Should 0 MW TEE value have a configuration ID or not. CAISO is currently leaving these points blank since that data point does not correlate to any actual configuration but it is still a required field and may be causing trouble for vendor software.

Answer: For the same reason stated in answer to question 11, when a unit is not committed in real-time, TEE will be zero and hence no configuration ID is given.

# Question 13 –How is SLIC Pmin re-rate handled?

Question 12: Let C1 has the operating range PMin1=120/PMax1=200 and C2 has the operating range PMin2=20/PMax2=100. Assuming that the unit is dispatched and running at 50MW (C2), if there is a plant re-rate to 150MW,

- How to report this in SLIC?
- How does RTD handle this situation?
- How does RTPD handle this situation?

# Question 13 –How is SLIC Pmin re-rate handled?

How is this reported in SLIC?

Answer: The Pmin re-rate has to include the following information explicitly,

1. Resource level Pmin re-rate to 150MW;
2. Configuration 1 Pmin re-rate to 150MW;
3. Outage of Configuration 2.

Note: The MSG resource owners are expected to report exactly what the resource and each configuration can do under an outage, re-rate or de-rate case. CAISO does not derive or imply any potential implication.

# Question 14 – Why exceptional dispatch energy is generated while not in ADS

Question: Explanation where exceptional dispatch data is coming from when it is not present in ADS.

Answer: Exceptional dispatch data not present in ADS comes from verbal EDs that are logged in SLIC and entered manually as part of our post-process before the T+5 settlement calculation. Such dispatch instructions are issued by our operations in real-time by phone and hence there is no ADS record in this. Same situation can happen for non-MSG.

# Question 15 – Transition cost qualification/allocation

Question: How does CAISO qualify and allocate a transition cost with regards to commitment type, commitment period and metered energy?

Answer: There are three steps in this determination,

1. A transition cost is considered eligible for BCR if it is related to a transition decision in which the *to* configuration is “ISO committed”;

   1.1. For a transition from a bid-in configuration to a self scheduled configuration, the transition cost is NOT qualified;

   1.2. For a transition from a self scheduled configuration to a bid-in configuration, the transition cost is qualified;

   1.3. Determination of ISO or self commitment will be done based on the *to* configuration’s energy self schedules, AS self provision, etc.

# Section 4 – Clarifications

Scenarios that can cause unexpected outcomes

# MSG bid scenarios that can cause unexpected outcomes

MSG Resource Name - “Good MSG”

1. C1:  Pmin=20MW, Pmax=100MW, Ramp=5MW/min;
2. C2: Pmin=120MW, Pmax=200MW, Ramp=10MW/min;
3. C3: Pmin = 220MW, Pmax = 300MW, Ramp=5MW/min.

C1 → C2:  notification time, 60 minutes; transition ramp time,15 minutes

C2 → C3: notification time, 30 minutes; notification time, 5 minutes

# MSG bid scenarios that can cause unexpected outcomes (scenario 1)

Example:
HE 7:Self schedule at C1 with 80MW;
HE8: Self schedule at C3 with 250MW.

This will likely put the MSG resource on configuration 1 at 80MW for HE7 and shuts it down at the end of HE7.

Explanation: When a resource is purely self scheduled (without energy bids), market application interprets this as a self-scheduled transition and the self-scheduled transition has to be DIRECTLY transitable across consecutive hours.

# MSG bid patterns that can cause unexpected outcomes (scenario 2)

HE 7: Self-schedule at configuration 3 with 250MW and a bid for ((250, 300), $50)
HE8: Self-schedule at configuration 2 with 150MW.

This will likely put the MSG resource on configuration 3 for HE7 if it is economically feasible BUT will not transit to HE8 on configuration 2 even it is feasible.

# MSG bid patterns that can cause unexpected outcomes (scenario 2)

Explanation: There is no bid segment between 150MW and 200MW, it will not move to configuration 2.

Cases that the transition will happen if economic,

1. HE8: Besides the self-schedule at configuration 2 with 150MW, a bid segment exists between 150 and 200MW;
2. HE8: Self-schedule at configuration 2 with 200MW.

# MSG bid patterns that can cause unexpected outcomes (scenario 3)

Example: Minimum up time of configuration 2 is one hour,

HE 7:  Configuration 1 has economic bid from 20 to 100;
HE8: Configuration 1 and 2 have economic bids;
HE9: Configuration 1 has economic bid from 20 to 100;

Assuming economic, HASP run for horizon (6:15 to 8:00) can commit this resource at configuration 1 for intervals from 6:15 to 7:45 and transition and commits this resource at configuration 2 for intervals from 7:45 to 8:00.

# MSG bid patterns that can cause unexpected outcomes (scenario 3)

Now the next HASP run for horizon (7:15, 9:00) sees the resource does not have a bid on configuration 2 at HE9 but however it has a MUT time of one hour and it has only been on-line for 15 minutes. It shuts down the resource. This is similar today's treatment of non-MSG resource in real-time.

Explanation:
As a general rule, whenever the market application finds infeasible inter-temporal constraint and cannot move, it will shut the unit down. In this case, HASP only sees the bids for two hours.

# MSG Bid Patterns that can cause unexpected outcomes (scenario 3)

Cases that this will not be a problem
HE9: Configuration 2 is bid in.

The fact that configuration 2 is bid in will allow optimization to keep the unit on configuration 2 for three 15-minute intervals and then transit to other configurations if economic feasible.

Critical area to avoid infeasibility: If a configuration's minimum up time is N hours and it is only bid in real-time for exactly N hours, the scenario described above can possibly happen due to the different horizon of RTPD.

# MSG bid patterns that can cause unexpected outcomes (scenario 4)

Real-time bids when given a day-ahead commitment

1. SIBR real-time rules enforce that
   1.1. MSG unit will bid in the day-ahead committed configuration if RUC schedule is higher than day-ahead schedule;
   1.2. The real-time bids cover the RA capacity;
2. In general, it helps real-time operation of the unit to bid in the day-ahead committed configuration.