Spinning Reserve and Non-Spinning Reserve

Charge # 111  Spinning Reserve due ISO

Charge # 112  Non-Spinning Reserve due ISO

Description
Spinning Reserve is the on-line reserve capacity that is synchronized to the grid system and ready to meet electric demand within 10 minutes of a dispatch instruction by the ISO. Spinning Reserve is needed to maintain system frequency stability during emergency operating conditions and unforeseen load swings.

Non-Spinning Reserve is off-line generation capacity that can be ramped to capacity and synchronized to the grid within 10 minutes of a dispatch instruction by the ISO, and that is capable of maintaining that output for at least two hours. Non-Spinning Reserve is needed to maintain system frequency stability during emergency conditions.

Requirement
The ISO’s requirement for Spinning Reserve is 50% of the Operating Reserve (OR) requirement. This requirement is equal to 5% of the Demand to be met by generation from hydroelectric (hydro) resources, plus 7% of the Demand to be met by generation from other resources, plus 100% of any Interruptible Imports, or the single largest contingency (if the latter is greater).

The Operating Reserve requirement is computed for each SC in each Reserve Region. Individual import and export energy schedules and their firmness are taken into consideration. For instance, there is no Spinning Reserve requirement for Demand covered by firm purchases from outside the ISO Control Area. For SC to SC trades, the SC that is responsible for serving the load is responsible for providing the A/S Requirement.

The calculation for the OR requirement is as follows:

$$ OR = \max (OR1, OR2) + 100\% \text{ of Non-Firm Imports:} $$

Where:

$$ OR1 = \text{a percentage (5\%) of hydro generation scheduled plus a percentage (7\%) of generation from other sources. OR1 is computed separately for each SC based on its load and hydro generation schedules and then summed up over all SCs to determine the OR1 for each congestion zone, and the whole system.} $$

$$ OR2 = \text{MW loss due to most severe contingency. OR2 is computed system-wide as the maximum of the following for each hour:} $$
- Operator-entered value for each zone and for each hour
- Largest generating unit for each hour
- Largest net tie import to the ISO control area for each hour
Operating Reserve Calculation

The following example illustrates the OR obligation calculation for four SC’s:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>500 MW</td>
<td>100 MW</td>
<td>400 MW</td>
<td>50MW</td>
<td>150MW</td>
<td>0MW</td>
<td>13 MW</td>
<td>0.0541MW</td>
<td>10.81MW</td>
</tr>
<tr>
<td>SC2</td>
<td>300 MW</td>
<td>0 MW</td>
<td>100 MW</td>
<td>0MW</td>
<td>200MW</td>
<td>0MW</td>
<td>14 MW</td>
<td>0.0582MW</td>
<td>14.55MW</td>
</tr>
<tr>
<td>SC3</td>
<td>3,100MW</td>
<td>0 MW</td>
<td>50MW</td>
<td>0MW</td>
<td>3050MW</td>
<td>0MW</td>
<td>213.5 MW</td>
<td>0.88773MW</td>
<td>221.93MW</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total: 240.5 MW</td>
<td>100 %</td>
<td></td>
</tr>
</tbody>
</table>

To illustrate the complete calculation for determining the Base Operating Reserve Obligation for Scheduling Coordinator \( j \) (SC1) within Region \( x \) for Settlement Period \( t \) the following equations are used:

(a) \[
\text{BaseDemand1jxt} = \text{MeteredLoadjxt} + \text{FirmExportjxt}
\]
Base Demand 1 = 500 + 100 = 600

(b) \[
\text{BaseDemand2jxt} = \text{BaseDemand1jxt} - \text{FirmImportjxt}
\]
Base Demand 2 = 600 – 400 = 200

(c) \[
\text{BaseDemand3jxt} = \text{BaseDemand2jxt} - \text{NonFirmImportjxt}
\]
Base Demand 3 = 200 – 0 = 200

(d) \[
\text{BaseDemand4jxt} = \text{BaseDemand3jxt} - \text{MeteredHydroGenjxt}
\]
Base Demand 4 = 200 – 50 = 150

(e) \[
\begin{align*}
\text{BaseOpResReqMWjxt} &= \left[ (1) \times (\text{NonFirmImportMWjxt}) \right] + \left[ (.05) \times (\text{Max} [0,\text{Min} [\text{BaseDemand3jxt}, \text{Metered HydroGen}]) \right] + \\
&\quad \left[ (.07) \times (\text{Max} [0,\text{BaseDemand4jxt}]) \right] \\
&\quad + \text{150 MW} \\
&= \text{13 MW} \\
\end{align*}
\]

(f) \[
\text{OpResOblig}\%jxt \times \text{AdjSpinTotalMWxt} = \text{BaseSpinObligMWjxt}
\]

(g) \[
\begin{align*}
\text{SpinTotalMWxt} = &\quad \text{SpinReqDAMWxt} + \text{SpinReqHAMWxt} + \text{TotalEffectiveSelfProvideSpinMWxt} \\
&\quad = \text{200 MW}
\end{align*}
\]

Assume that ISO procures 175MW operating reserves and SC3 self provides 25MW.

NOTE: These equations are discussed in further detail later in this document.

Spinning and Non-Spinning Reserve Costs Allocation (Due ISO)

Spinning and Non-Spinning Reserves will be billed based on Metered Demand for each Scheduling Coordinator, by Region and hour, giving consideration to on demand obligation, inter-SC A/S trades and self-provision. The following equations depict the
settlement method for spinning reserve costs. Non-spinning reserve costs are allocated following the same logic. Similar equations can be used for non-spinning reserve.

Scheduling Coordinator \( j \) will have a payment obligation to the ISO for Spinning Reserve in Region \( x \) for Settlement Period \( t \) of \( \text{SpinChargeTotal}_j^x_t \), calculated as follows:

\[
\begin{align*}
(1) \quad \text{SpinChargeTotalDA}_j^x_t &= \text{SpinRateDA} / \text{MW} \cdot \text{hr}_j^x \ast \text{NetSpinObligMW}_j^x \\
(2) \quad \text{SpinChargeTotalHA}_j^x_t &= \text{SpinRateHA} / \text{MW} \cdot \text{hr}_j^x \ast \text{NetSpinObligMW}_j^x
\end{align*}
\]

**Spin Rate Calculation**

\[
(3) \quad \text{SpinRate$/\text{MW} \cdot \text{hr}_j^x} = \frac{\text{SpinPayTotalDA}_j^x_t + \text{SpinPayTotal HA}_j^x_t}{(\text{SpinReqDAMW}_j^x + \text{Spin ReqHAMW}_j^x)}
\]

\( \text{SpinPayTotalDA}_j^x_t \) = Total payments by the ISO for Spinning Reserve procured (see explanation below for reasoning of referring to logical procured amounts for cost allocation, when we actually use required amounts for the purpose of calculations) in the Day Ahead Market in Region \( x \) for Settlement Period \( t \). This is calculated by taking the total DA required amount in Region \( x \) for Settlement Period \( t \) and multiplying it by the Spin Market Clearing Price in Region \( x \) for Settlement Period \( t \).

\( \text{SpinPayTotalHA}_j^x_t \) = Total payments by the ISO for Spinning Reserve procured (see explanation below for reasoning of referring to logical procured amounts for cost allocation, when we use required amounts for the purpose of calculations) in the Hour Ahead Market in Region \( x \) for Settlement Period \( t \). This is calculated by taking the total HA required amount in Region \( x \) for Settlement Period \( t \) and multiplying it by the Spin Market Clearing Price in Region \( x \) for Settlement Period \( t \).

\( \text{SpinReqDAMW}_j^x \) = MW of Spinning Reserve procured by the ISO in the Day Ahead Market in Region \( x \) for Settlement Period \( t \). For the purpose of cost allocation we use the A/S requirement as the logical procurement amount due to Rational Buyer. Therefore, the equations represent these components to be required amounts, not procured.

\( \text{SpinReqHAMW}_j^x \) = Total MW of Spinning Reserve procured by the ISO in the Hour Ahead Market in Region \( x \) for Settlement Period \( t \). For the purpose of cost allocation we use the A/S requirement and not procurement amount due to Rational Buyer. Therefore, the equations represent these components to be required amounts, not procured.

**SC Obligations for Spinning Reserve**

The following equations describe the ISO’s Regional requirement for Spinning Reserve at the close of the Day Ahead and Hour Ahead Markets:

\[
(4) \quad \text{SpinTotalMW}_j^x = \text{SpinReqDAMW}_j^x + \text{Spin ReqHAMW}_j^x + \text{TotalEffectiveSelfProvideSpinMW}_j^x
\]

Where:
SpinTotalMW_{xt} is the amount of Spinning Reserve in Region x that is available to the ISO from net self-provision and through requirement (logical procurement) in the Day Ahead and Hour Ahead Markets.

TotalEffectiveSelfProvideSpinMW_{xt} is the total self provision in Region x that is available to the ISO less any excess self provision from Uncertified Resources.

With respect to how we procure self provided A/S and how we allocate it to the market, any A/S that is provided above and beyond a SC’s obligation that is used in the ISO market is paid for by SCs needing A/S to cover their obligation. What is used in the market is considered “Effective Self Provided” A/S. This is calculated by taking the Scheduled Self Provided A/S minus the Unqualified Self Provided A/S. The Unqualified is calculated by taking the Hour Ahead Self Provided A/S minus the Allowable Self Provided A/S.

- The Allowable Self Provision is the amount of self provision the ISO will accept based on its incremental needs.
- Scheduled SP - Allowable Self Provided A/S = Unqualified SP
- Scheduled SP - Unqualified SP = Effective Self Provided A/S

To determine a SC’s obligation, let’s define:

\[
\text{(5) OpResOblig\%}_{jxt} = \frac{\text{BaseOpResReqMW}_{jxt}}{\sum_{j} \text{BaseOpResReqMW}_{jxt}}
\]

where BaseOpResReqMW_{jxt} is the SC’s operating reserve requirement determined according to the WSCC requirements less any on demand obligations. The way this percentage is calculated is the only significant difference between the cost allocation schemes for Regulation/Replacement Reserve and Spinning/Non-Spinning Reserves.

OpResOblig\% does not change between the Day Ahead Market and Hour Ahead Market and it is used in allocating both Spinning and Non-Spinning Reserves costs. BaseOpResReqMW_{jxt} defined by the following equations:

\[
\text{(6) BaseDemand}_{jxt} = \text{MeteredLoad}_{jxt} + \text{FirmExport}_{jxt}
\]

\[
\text{(7) BaseDemand}_{jxt} = \text{BaseDemand}_{jxt} - \text{FirmImport}_{jxt}
\]

\[
\text{(8) BaseDemand}_{jxt} = \text{BaseDemand}_{jxt} - \text{NonFirmImport}_{jxt}
\]

\[
\text{(9) BaseDemand}_{jxt} = \text{BaseDemand}_{jxt} - \text{MeteredHydroGen}_{jxt}
\]

Where:

\[\text{MeteredLoad}_{jxt}\] = SC’s metered load in Region x over time interval t;
\[\text{FirmExport}_{jxt}\] = SC’s firm export from Region x over time interval t;
\[\text{FirmImport}_{jxt}\] = SC’s firm import to Region x over time interval t;
\[\text{NonFirmImport}_{jxt}\] = SC’s non-firm import to Region x over time interval t; and
\[\text{MeteredHydroGen}_{jxt}\] = SC’s metered hydro generation in Region x over time interval t.

The SC’s reserve obligation has the following components:

- Obligation due to firm imports and nonfirm exports = 0;
- Obligation due to non-firm import (even when the demand is zero) = 100%*NonFirmImport_{jxt};
- Obligation due to demand served by hydro = 5%*Max\{0,Min(BaseDemand3_{jxt},MeteredHydroGen_{jxt})\}. The Max function is used because BaseDemand3_{jxt} may be negative.
Obligation due to demand served by thermal generation or other resources = $7\% \times \text{Max}(0, \text{BaseDemand}_{4jxt})$. The Max function is used because $\text{BaseDemand}_{4jxt}$ may be negative.

Thus, the SC’s total operating reserve requirement is:

\[
\text{BaseOpResReqMW}_{jxt} = 100\% \times \text{NonFirmImport}_{jxt} + \\
5\% \times \text{Max}\{0, \text{Min}(\text{BaseDemand}_{3jxt}, \text{MeteredHydroGen}_{jxt})\} \\
7\% \times \text{Max}(0, \text{BaseDemand}_{4jxt})
\]

Let’s further define:

\[
\text{NetSpinObligMW}_{jxt} = \text{BaseSpinObligMW}_{jxt} + \text{OnDemandSpinOblig}_{jxt} + \text{InterSCSpinSold}_{jxt} - \text{InterSCSpinBought}_{jxt} - \text{EffectiveSelfProvideSpinMW}_{jxt}
\]

\[
\text{BaseSpinObligMW}_{jxt} = \text{OpResOblig}\%_{jxt} \times \text{AdjSpinTotalMW}_{xt}
\]

\[
\text{NetSpinObligMW}_{jxt} = \text{AdjSpinObligMW}_{jxt} - \text{EffectiveSelfProvideSpinMW}_{jxt}
\]

$\text{NetSpinObligMW}_{jxt}$ is the MW amount of the SC’s net spinning reserve obligation after applying his effective self provision. $\text{OnDemandSpinOblig}_{jxt}$ is the SC’s on demand obligation in the Region x.  

$\text{InterSCSpinSold}_{jxt}$ and $\text{InterSCSpinBought}_{jxt}$ are the MW amounts of Spinning Reserve capacity that the SC has sold and bought through inter-SC trades. 

$\text{EffectiveSelfProvideSpinMW}_{jxt}$ is the SC’s effective self provision for spinning reserve. This quantity is equal to the SC’s final HA self provision, which includes any self provision buy back amount, less any unqualified excess self provision.

\[
\text{EffectiveSelfProvideSpinMW}_{jxt} = \text{SchedSelfProvideSpinHAMW}_{jxt} - \text{UnqualExcessSelfProvideSpinMW}_{jxt}
\]

Where:

$\text{SchedSelfProvideSpinHAMW}_{jxt}$ = The total Self-Provided Spinning Reserve by SC $j$ in Region $x$ for Settlement Period $t$ in the final Hour Ahead Schedules. This includes the contributions from both Certified and Uncertified Resources as well as any buy back amount.

$\text{UnqualExcessSelfProvideSpinHAMW}_{jxt}$ = The unqualified excess Self-Provided Spinning Reserve by SC $j$ in Region $x$ for Settlement Period $t$ in the final Hour Ahead Schedules.
Cost Allocation to Zones

While the A/S costs are allocated to the SCs on a regional basis, the charge for a SC will further be broken down into zonal components according to the ratio of the SC’s operating reserve requirements in the member zones. Thus, the DA and HA spinning reserve service charges for SC j in zone y over time period t are calculated as follows:

\[ (15) \ \text{ZonalSpinShare}^{\%}_{jzt} = \frac{\text{BaseOpResReqMW}_{jzt}}{\sum_{x \in z} \text{BaseOpResReqMW}_{jxt}} \]

\[ (16) \ \text{SpinChargeTotalDA}^t_{jzt} = \text{SpinChargeTotalDA}^t_{jzt} \times \text{ZonalSpinShare}^{\%}_{jzt} \]
\[ \text{SpinChargeTotalHA}^t_{jzt} = \text{SpinChargeTotalHA}^t_{jzt} \times \text{ZonalSpinShare}^{\%}_{jzt} \]


<table>
<thead>
<tr>
<th>REFERENCE GUIDE FOR EQUATION COMPONENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spinning Reserve</strong></td>
</tr>
<tr>
<td>SpinPayTotal $DAxt</td>
</tr>
<tr>
<td>SpinPayTotal $HAxt</td>
</tr>
<tr>
<td>SpinReqHAMWxt</td>
</tr>
<tr>
<td>SpinReqDAMWxt</td>
</tr>
<tr>
<td>MeteredHydroGenjx</td>
</tr>
<tr>
<td>NonFirmImportjx</td>
</tr>
<tr>
<td>FirmImportjx</td>
</tr>
<tr>
<td>FirmExportjx</td>
</tr>
<tr>
<td>MeteredLoadjx</td>
</tr>
<tr>
<td>OnDemandSpinObligjx</td>
</tr>
<tr>
<td>InterSCSpinSoldjx</td>
</tr>
<tr>
<td>InterSCSpinBoughtjx</td>
</tr>
<tr>
<td>EffectiveSelfProviDeSpinObligMWjxt</td>
</tr>
<tr>
<td>TotalEffectiveSelfProviDeSpinMWjxt</td>
</tr>
<tr>
<td>TotalOnDemandSpinObligjx</td>
</tr>
<tr>
<td>OpResObligjx</td>
</tr>
<tr>
<td>TotalBaseOpResReqMWjxt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non Spinning Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSPayTotal $DAxt</td>
</tr>
<tr>
<td>NSPayTotal $HAxt</td>
</tr>
<tr>
<td>NSReqHAMWxt</td>
</tr>
<tr>
<td>NSReqDAMWxt</td>
</tr>
</tbody>
</table>
Example

Using the base parameter values included in the following table (Table 1) we will determine the Spinning Reserve charge due ISO. We will assume the sources of the energy and operating reserve requirement determined for SC1 included earlier in this section. An equation map is provided following Table 1 to better illustrate where the various components are placed within the derivation of the settlement amount.

### TABLE 1
Charge Components; Where to find / How to verify

<table>
<thead>
<tr>
<th>Charge Component</th>
<th>Example Values Given</th>
<th>Where to find / How to verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpinPayTotal $DAxt</td>
<td>$600</td>
<td>This can be found on OASIS Market Information under Ancillary (Final MCP, Day Ahead).</td>
</tr>
<tr>
<td>SpinPayTotal $HAxt</td>
<td>$75</td>
<td>This can be found on OASIS Market Information under Ancillary (Final MCP, Hour Ahead).</td>
</tr>
<tr>
<td>SpinReqDAMWxt</td>
<td>150</td>
<td>This can be found on OASIS under Ancillary, Market Goals, Day Ahead. Use ISO Total and add to the Self Provided value found at Day Ahead, Final Procurement Results. *</td>
</tr>
<tr>
<td>SpinReqHAMWxt</td>
<td>25</td>
<td>This can be found on OASIS under Ancillary, Market Goals, Hour Ahead. Use ISO Total and add to the Self Provided value found at Hour Ahead, Final Procurement Results. *</td>
</tr>
<tr>
<td>MeteredHydroGenjxt</td>
<td>50</td>
<td>Download this information from your final schedules off of Wenet.</td>
</tr>
<tr>
<td>NonFirmImportjxt</td>
<td>0</td>
<td>Download this information from your final schedules off of Wenet, however, adjustments for operating adjustments will show up in the Settlements file.</td>
</tr>
<tr>
<td>FirmImportjxt</td>
<td>400</td>
<td>Download this information from your final schedules off of Wenet, however, adjustments for operating adjustments will show up in the Settlements file.</td>
</tr>
<tr>
<td>FirmExportjxt</td>
<td>100</td>
<td>Download this information from your final schedules off of Wenet, however, adjustments for operating adjustments will show up in the Settlements file.</td>
</tr>
</tbody>
</table>
MeteredLoad\_jxt 500 Based on meter data you submitted to the ISO and will be shown on settlement statement.

InterSC\_SpinSold\_jxt 0 Download this information from your final schedules off of Wenet.

InterSC\_SpinBought\_jxt 0 Download this information from your final schedules off of Wenet.

EffectiveSelfProvide\_SpinObligMW\_jxt 2 ISO will calculate this value and provide in the settlement statement.

TotalEffectiveSelfProvide\_SpinMW\_jxt 3 ISO will calculate this value and provide in the settlement statement. This can also be found on OASIS under Ancillary, Final A/S Procurement Results, HA.

TotalOnDemandSpinOblig\_jxt 0 ISO will calculate this value and provide in the settlement statement.

OpResOblig\_\%\_jxt 0.0541 ISO will calculate this value and provide in the settlement statement.

BaseOpResReq\_MW\_jxt 13 This can be calculated using the provided formulas taking information from the SC scheduling information and from the meter data submitted to the ISO. ISO will also calculate this value and provide in the settlement statement.

TotalBaseOpResReq\_MW\_jxt 240.5 This is based on meter data submitted by all SCs. This value is provided by the ISO in the settlement statement.

* To determine the DA and HA requirement, you must evaluate two OASIS screens:
  - Market Goals (MW) - to determine the total Non Self-Provided (NSP) amount
  - Final Procurement Results - to determine the total Self-Provided (SP) amount

For example, taking the summation of the Day Ahead NSP + Day Ahead SP or the Hour Ahead NSP + Hour Ahead SP will give you the requirement for SPIN. Do not use the Total MW value listed in the Final Procurement Results report in OASIS to determine this value. The value in the Final Procurement Results report gives you what was procured given rational buyer considerations, not what was required for that particular service.

For example:

For HE 12 on 3/1/02:

The Hour Ahead NSP = 382.72 MW (Market Goals (MW) (HA report))
The Hour Ahead SP= 547.10 MW (Final Procurement Results (HA report))

The summation of these two values, 382.72 MW + 547.10 MW = 929.82 MW; this is the HA A/S requirement for SPIN

Incremental Total HA Requirement must also be considered using the following components:
  - DANSP requirement (from Market Goals (MW) (DA report))
  - HANSP requirement (from Market Goals (MW) (HA report))
  - DASP amount (from Final Procurement Results (DA report))
  - HASP amount (from Final Procurement Results (HA report))

The equation is as follows:
DeltaNSP = HANSP - DANSP;
if negative, then equals 0 and Incremental Total HA Requirement equals 0; otherwise…

First calculate any Self Provided Buy Back (SPBB):
SPBB = DASP - HASP = Buy Back of Self Provision between DA and HA; if this value is negative then BBSP=0

DeltaNSP – (DASP – Additional HASP – Gross SPBB) = Incremental Total HA Requirement

For HE 12 on 3/1/02
DeltaNSP = 382.72 - 300.14 = 82.58 MW
SPBB = 549.10 - 547.10 = 2 MW

Therefore, Incremental Total HA Requirement = 82.58 - 2 = 80.58 MW for SPIN
Settlement Price Derivation

Price = [(DANSP * DAMCP) + (Incremental Total HA Req. * HAMCP)] / (DANSP + Inc. Tot HA Req)

For HE 12 on 3/1/02:
Price = [(300.14 * 4.44) + (80.58 * .95)] / (300.14 + 80.58) = $3.70

The OASIS page in which to find the information referenced in the table above appears as shown below and can be located at: http://oasis.caiso.com/

Using the charge equation map on the following page we will determine the charge calculation for SC1 using the example scenario presented on page 2 of this section.
**SPIN AND NON-SPIN CHARGE EQUATION MAP**

\[ \text{Charge} = \text{Billable Quantity} \times \text{Rate} \]

\[ \text{SpinChargeTotal} = \text{NetSpinObligMW} \times \text{SpinRate/MWh} \]

\[ \text{SpinChargeTotal} = \frac{(\text{SpinPayTotalDA} + \text{SpinPayTotalHA})}{(\text{SpinReqDAMW} + \text{SpinReqHAMW})} \]

\[ = (\text{BaseSpinOblgMW} + \text{InterSCSpinSold}) - (\text{InterSCSpinBought}) - (\text{EffectiveSelfProvideSpinMW}) \]

\[ = (\text{OpResOblig\%}) \times (\text{SpinTotalMW}) \]

\[ = \frac{\text{BaseOpResReqMW}}{\sum \text{BaseOpResReqMW}} \]

\[ = [1 \times (\text{NonFirmImportMW})] + [0.05 \times \text{Max}[0, \text{Min} \{\text{BaseDemand3}, \text{Metered HydroGen}\}]] + [0.07 \times \text{Max}[0, \text{BaseDemand4}]] \]

**Base Parameters are indicated by the italicized text.**

Refer to Table 1 for values to given variables.
## Linking Settlement Statement File information to Equation Map

The following is a table from the California ISO Format Specification for Settlement File (located at [http://www.caiso.com/docs/1998/12/23/1998122313213915202.pdf](http://www.caiso.com/docs/1998/12/23/1998122313213915202.pdf)). The fields represent what is found in the settlement statement. The numbers to the left of the Field column represent the large bold numbers in the equation map on the following page.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Max Field Length</th>
<th>Domain</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Record Type</td>
<td>Varchar</td>
<td>1</td>
<td>‘O’</td>
<td>Indicates the type of record</td>
</tr>
<tr>
<td>2. Trading Date</td>
<td>Date</td>
<td></td>
<td></td>
<td>The trading date of the settlement</td>
</tr>
<tr>
<td>3. Trading Hour</td>
<td>Number</td>
<td>2</td>
<td></td>
<td>The trading hour of the settlement</td>
</tr>
<tr>
<td>4. Trading Minute</td>
<td>Number</td>
<td>2 0</td>
<td></td>
<td>The trading minute of the settlement (not currently used)</td>
</tr>
<tr>
<td>5. Zone ID</td>
<td>Varchar</td>
<td>12</td>
<td></td>
<td>A congestion zone.</td>
</tr>
<tr>
<td>6. Load Quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>SC’s metered load in the zone</td>
</tr>
<tr>
<td>7. Firm Export Quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>SC’s real-time firm intertie export schedules out of the zone.</td>
</tr>
<tr>
<td>8. Firm Import Quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>SC’s real-time firm intertie import schedules into the zone.</td>
</tr>
<tr>
<td>9. Non-Firm Import Quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>SC’s real-time non-firm intertie import schedules into the zone.</td>
</tr>
<tr>
<td>10. Hydro Generation Quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>SC’s metered hydro generation in the zone.</td>
</tr>
<tr>
<td>11. Record Type</td>
<td>Varchar</td>
<td>1</td>
<td>‘A’</td>
<td>Indicates the type of record</td>
</tr>
<tr>
<td>12. Trading Date</td>
<td>Date</td>
<td></td>
<td></td>
<td>The trading date of the settlement</td>
</tr>
<tr>
<td>13. Trading Hour</td>
<td>Number</td>
<td>2</td>
<td></td>
<td>The trading hour of the settlement</td>
</tr>
<tr>
<td>14. Trading Minute</td>
<td>Number</td>
<td>2 0</td>
<td></td>
<td>The trading minute of the settlement (not currently used)</td>
</tr>
<tr>
<td>15. Region ID</td>
<td>Varchar</td>
<td>12</td>
<td></td>
<td>The region to which the settlement applies</td>
</tr>
<tr>
<td>16. Ancillary Service Type</td>
<td>Varchar</td>
<td>8</td>
<td></td>
<td>Ancillary service type</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>SPIN</code>, <code>NSPIN</code>,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>REG UP</code>, <code>REG DOWN</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Day ahead self provision</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>The amount of self provision in SC’s day ahead schedule for a region and interval.</td>
</tr>
<tr>
<td>18. Hour ahead self provision</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>The amount of self provision in SC’s hour ahead schedule for a region and interval.</td>
</tr>
<tr>
<td>19. Inter SC sold quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>Amount of capacity SC sold through inter SC trades</td>
</tr>
<tr>
<td>20. Inter SC bought quantity</td>
<td>Number</td>
<td>11,2</td>
<td></td>
<td>Amount of capacity SC bought through inter SC trades</td>
</tr>
<tr>
<td>Field</td>
<td>Type</td>
<td>Max Field Length</td>
<td>Domain</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spin/NSpin: SC’s operating reserve requirement in region</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>On demand obligation</td>
<td>Number</td>
<td>11,2</td>
<td>SC’s on demand obligation for a region</td>
</tr>
<tr>
<td>23.</td>
<td>Scheduled self provision</td>
<td>Number</td>
<td>11,2</td>
<td>The maximum of the day ahead and hour ahead self provision</td>
</tr>
<tr>
<td>24.</td>
<td>Allowable self provision</td>
<td>Number</td>
<td>11,2</td>
<td>The amount of self provision ISO will accept based on its incremental needs.</td>
</tr>
<tr>
<td>25.</td>
<td>Unqualified self provision</td>
<td>Number</td>
<td>11,2</td>
<td>The difference between the scheduled self provision and the allowable self provision.</td>
</tr>
<tr>
<td>26.</td>
<td>Effective self provision</td>
<td>Number</td>
<td>11,2</td>
<td>The amount of self provision the SC will receive credit for</td>
</tr>
<tr>
<td>27.</td>
<td>Base obligation</td>
<td>Number</td>
<td>15,5</td>
<td>The amount of adjusted requirement allocated to the SC - percent obligation * total adjusted requirement</td>
</tr>
<tr>
<td>28.</td>
<td>Percent Obligation</td>
<td>Number</td>
<td>10,5</td>
<td>SC’s measured quantity divided by the total measured quantity</td>
</tr>
<tr>
<td>29.</td>
<td>Adjusted obligation</td>
<td>Number</td>
<td>15,5</td>
<td>Base obligation + on demand obligation + inter SC sold quantity – inter SC bought quantity</td>
</tr>
<tr>
<td>30.</td>
<td>Net obligation</td>
<td>Number</td>
<td>11,2</td>
<td>The difference between adjusted obligation and effective self provision</td>
</tr>
<tr>
<td>31.</td>
<td>Price</td>
<td>Number</td>
<td>10,5</td>
<td>The total payments by the ISO for the ancillary service type procured in the day ahead and hour ahead markets divided by the total MW procured in both markets</td>
</tr>
<tr>
<td>32.</td>
<td>Settlement Amount</td>
<td>Number</td>
<td>11,2</td>
<td>Net obligation * price</td>
</tr>
<tr>
<td>33.*</td>
<td>Total Day Ahead Ancillary Service Procured Amount</td>
<td>Number</td>
<td>11,2</td>
<td>Total ancillary service amount (in MW) procured in the region in the day ahead market</td>
</tr>
<tr>
<td>34.*</td>
<td>Total Hour Ahead Ancillary Service Procured Amount</td>
<td>Number</td>
<td>11,2</td>
<td>Total additional ancillary service amount (in MW) procured in the region in the hour ahead market</td>
</tr>
<tr>
<td>35.</td>
<td>Day Ahead MCP</td>
<td>Number</td>
<td>10,5</td>
<td>Day ahead market clearing price for the region and service type</td>
</tr>
<tr>
<td>36.</td>
<td>Hour Ahead MCP</td>
<td>Number</td>
<td>10,5</td>
<td>Weighted average Hour ahead market clearing price of the zones in the region and service type.</td>
</tr>
<tr>
<td>37.</td>
<td>Total Effective Self Provision</td>
<td>Number</td>
<td>11,2</td>
<td>Total effective self provision for the region</td>
</tr>
<tr>
<td>38.</td>
<td>Total On Demand Obligation</td>
<td>Number</td>
<td>11,2</td>
<td>Total on demand obligation for the region</td>
</tr>
<tr>
<td>39.</td>
<td>Total measured quantity</td>
<td>Number</td>
<td>11,2</td>
<td>Reg Up/Reg Down: Total metered load in region.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spin/NSpin: Total operating reserve requirement in region</td>
<td></td>
</tr>
</tbody>
</table>

* Lines 33 and 34 use values from the A/S requirement amounts for the purpose of cost allocation. This reason is due to the fact that when Rational Buyer scheme is used, the actual procurement amounts become distorted. The solution is to use the A/S **requirements** as the logical procurement amounts. Therefore, the equations will use the term of requirement. See note under Table 1 for more details.
SPIN AND NON-SPIN CHARGE EQUATION MAP

Charge = Billable Quantity x Rate

1. \( \text{SpinChargeTotal}_jx = \text{NetSpinObligMW}_jx \times \text{SpinRate}_jx \)

2. \( \text{NetSpinObligMW}_jx = \frac{\text{SpinPayTotalDA}_x + \text{SpinPayTotalHA}_x}{\text{SpinReqDAMW}_x + \text{SpinReqHAMW}_x} \)

3. \( \text{OpResOblig\%}_jx \times \text{AdjSpinTotalMW}_x \)

4. \( \frac{\text{BaseOpResReqMW}_jx}{\sum \text{BaseOpResReqMW}_jx} \)

5. \( [ (1) \times \left( \text{NonFirmImportMW}_jx \right) ] + [ (.05) \times \left( \text{Max } [0, \text{Min } \left( \text{BaseDemand3}_jx, \text{Metered HydroGen}_jx \right) ] \right) ] + [ (.07) \times \left( \text{Max } [0, \text{BaseDemand4}_jx] \right) ] \)

Base Parameters are indicated by the bold and italicized text.
