IC-2 ISO publishes indicators of grid conditions with expectations consumers will adjust usage

ISO Smart Grid Use Case

Version 2.0

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Approvals:
Signature indicates acceptance of the IC-2 ISO publishes indicators of grid conditions with expectations consumers will adjust usage for Smart Grid Roadmap project as complete and sufficiently detailed to allow the project to be successfully executed.

_____ _____
Heather Sanders Date

Document: Publish Prices Consumer Response.doc
Author: GP

Revision History

Date	Version	Description	Author
06/25/10	0.1	Create the document	Glen Perez
07/21/10	1.0	Updated approvals/signature section	Heather Sanders
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8/24/2010	1.5	Removed OASIS from ISO Prices Publish & Subscribe Mechanism, and made more generic.	Rizwaan Sahib
09/03/2010	1.6	Updated non functional requirements in section 8	Doug Walker/Yinka Osoba
09/16/2010	1.7	Updated after meeting	Tarak Thaker
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10/19/10	2.0	Reviewed and updated activity diagram	Tarak Thaker

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1. Use-Case: ISO publishes an indicator of grid conditions with expectations consumers will adjust usage.

Demand response has been an active part of the energy environment for years. The recent Energy Policy Act of 2005 and efforts to leverage the technologies available with the smart grid have provided new momentum for growing both dispatchable and price responsive (non-ISO dispatchable) demand response. It is expected the electricity market efficiency improves and investments in transmission and generation can be displaced with a larger percentage of demand response. The concept of price responsive demand response is that as wholesale prices vary, and as long as they are highly correlated with retail prices, consumers can choose to save money by decreasing consumption when prices rise, or to increase revenue by increasing production when prices fall, where technically and economically feasible. This paradigm relies on an important assumption that wholesale prices, which reflect system conditions, are strongly correlated with retail prices and provide consumers with appropriate cost incentives to respond in ways that enhance system reliability and efficiency.

The advancement and propagation of advance metering infrastructure (AMI) supports the ability for end use customers to be aware of their real-time energy consumption as well as other information, which could include the wholesale price or an indication to increase or decrease consumption based on the current or expected system conditions. Emerging technologies also enable a "price to device" concept providing consumers the ability to set preferences for how devices should respond automatically when certain conditions indicated by price (or a related indicator) are encountered. Prices may also be received through the internet and propagated to devices connected to the Home Area Network (HAN) or to a building energy management system. These opportunities help facilitate an increase in price responsive demand response.

A significant gap remains that makes attaining this reality a challenge, which is the current disconnect between wholesale electricity prices (as generated by the ISO market) and retail electric rates. Although this use case assumes that this connection can be made, it is recognized that this connection will require considerable vetting in the appropriate policy, legislative and regulatory venues.

It is also acknowledged that as systems mature and increasing load is tied to price responsive activities; new or different information may be needed from the ISO to be provided to entities involved with demand response.

The goal of this use case is to communicate system conditions through a grid condition indicator generated from the ISO's published Locational Marginal Prices (LMPs) as well as other grid condition information to trigger demand response activity.[1] These demand response actions are taken outside the ISO market; however, it is anticipated that such load adjustments will contribute to the needs of the system if implemented appropriately. The ISO does not define in this use case any specific attributes of demand response programs or products (i.e.: response time, duration, etc.).

[1] The ISO's LMP reflects the cost of energy, congestion, and transmission losses

2. Brief Description

The purpose of this use case is to describe how the ISO will provide an indicator of grid conditions to provide information about needed action by end users or devices on a locational basis. This indicator of grid conditions will be locational and will reflect public pricing information, LMP, for each pricing node (Pnode) in addition to other important information concerning grid conditions. With the indication of grid conditions , it is expected that a percentage of end use customers will be able to and choose to take advantage of this information and reduce (or increase) their energy consumption allowing the end use customer or device to reduce their energy bill while creating a more efficient market and enhancing the reliable operation of the grid.[2] The advantage of using the grid conditions indicator reflecting LMP to incent demand response is that it will have a tangible impact on congestion at a specific location or area on the grid. Over time, the ISO should be able to identify demand response relationships with various price points and locations and be able to better predict the demand response capability. The ISO should also be able to reflect this information in the load forecasts in its long- and short-term load forecasts.

3. Actors

Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
Load Serving Entity	Organization	An entity that purchases, sells, and serves end use customers in the ISO Balancing Authority.
California Independent System Operator (ISO)	Organization	The California Independent System Operator (ISO) operates the state's wholesale transmission grid, providing open and non-discriminatory access supported by a competitive energy market and comprehensive planning efforts.
End Use Customer	Person	An individual or aggregate of end users that participate with DRP/PL to provide demand response from their facility.
Advance Metering Infrastructure (AMI) Meter	System	Advanced electric revenue meter capable of two-way communications with the utility. The meter can receive, record, display and transmit data (e.g. energy data for billing and operations, power quality data, customer data, tariff data, etc.) to and from authorized systems and provides other advanced utility functions.
DRP/LSE Demand Response Mechanism	System/Device	The mechanism in place that will translate and relay the grid condition indicator to create the demand response at the end use customer's facility. (This could be an energy management system with preset scenarios, a device that will change load, or manual actions by the end use customer.)
End use customer Demand	System	A device that receives a signal and takes

2. The ISO assumes that Load Serving Entities will implement retail programs that correlate with wholesale grid conditions.

Actor Name	Actor Type (person, device, system etc.)	Actor Description
Response Mechanism		action to either decrease or increase consumption based on indicator

4. Assumptions

1. End use customer has advanced metering infrastructure (AMI).
2. End use customer is capable of receiving day ahead and/or real time information on their energy usage and costs.
3. End use customer is capable of making a choice to adjust their demand including setting tolerances as well as manual adjustments.
4. End use customer is enrolled in a CPUC approved tariff with dynamic rate or other program that incents following ISO energy market prices and grid conditions.
5.

5. Preconditions

1. All ISO market functions (i.e. bids and schedules submitted, the market software runs successfully, and LMPs calculated) are completed and LMPs and grid condition indicators are available for publishing.

6. Post-conditions

1. Grid / price responsive demand response customers provide sufficient demand response capability that is measurable and beneficial to the grid.
2. Grid condition indicator and prices have been published and end use customers received information and implemented their grid/price responsive enabled demand response mechanisms achieving demand response.
3. Lower energy charges have been incurred based on the end user demand response.
4. The ISO detects a predictable and measured response by end users to price signals. Response is factored into ISO forecasting and unit commitment decisions

7. Flow of Events

7.1 Basic Flow: ISO publishes prices and other to End Use Customers

Step #	Actor	Description of the Step	Additional Notes
	What actor, either primary or secondary is responsible for the activity in this step?	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column..*
1A	ISO PP&SM	ISO Prices Publish and Subscribe Mechanism (ISO PP&SM) through ISO market's price interface, provides Locational Marginal Prices.	Prices are presently posted on the public system, OASIS. In order to meet response time and scalability requirements the ISO may need to provide an additional publish/subscribe (i.e. push) method for prices.
1B1	ISO Grid condition calculator	Process Wholesale Prices to unitless value based on grid conditions.	
1B2	ISO PP&SM	Publish and subscribe mechanism for grid condition indicators (by location)	Granularity of locations needs to be determined. Expected to be aggregated at some level but granular enough to indicate where response is needed (more than 3 as are the current distribution load aggregation points (DLAPs))
2A	DRP/LSE Demand Response Mechanism	Grid condition indicator or Wholesale prices (LMP) are processed, transformed to the appropriate signal, and provided to the end use customer through the AMI.	The transformation of the wholesale price information (LMP) could include a conversion to the retail rate or other measures as appropriate to the end use customer's enrolled program. It is the DRP/LSE responsibility to select the needed ISO published information to be used in their demand response mechanism.
2B	DRP/LSE Demand Response Mechanism	Use Localized Modifier to update the Grid Condition Signal provided by the ISO.	This may be a way to further reflect the condition of the system at a sub-transmission level
3A	End use customer Demand Response Mechanism	The end use consumer's device receives a signal and takes action to either decrease or increase consumption based on indicator. .	It is expected that the most timely and efficient response to a demand response signal would be an automated response; however, there may be times that manual action at the end use customer's facility is appropriate.
3B	End use customer demand response mechanism	The end use customer takes no demand response action.	

8. Requirements

#	Business Requirements	Associated Scenario #	Associated Step #
BRQ-001	The ISO will publish day ahead locational marginal prices.	7.1	1
BRQ-002	The ISO will publish real time locational marginal prices	7.1	1
BRQ-003	The ISO grid condition calculator will translate wholesale price and consider other inputs to create locational grid condition indicators	7.1	1
BRQ-004	DRP/Load Serving Entity/End Use Customer retrieves applicable ISO posted prices and/or grid condition indicator (in the future this could be a publish/subscribe (i.e. push) method for prices).	7.1	2
BRQ-005	DRP/Load Serving Entity/End Use Customer has a mechanism to translate the LMPs to meaningful signal for the end use customers.	7.1	2
BRQ-006	Demand response mechanism receives the specific signal to activate the end use customer's device to trigger the appropriate demand response.	7.1	3
BRQ-007	End use customer (through a device, or by the end use customer taking manual actions), cause the actual reduction (or increase) in the end use load.	7.1	4
BRQ-008	LSE has capability to transmit day ahead or real time market price signals to End use customer	7.1	2
BRQ-009	AMI has capability of receiving day ahead or real time price signals from LSE and delivering it to End use customer Demand Response Mechanism	7.1	2

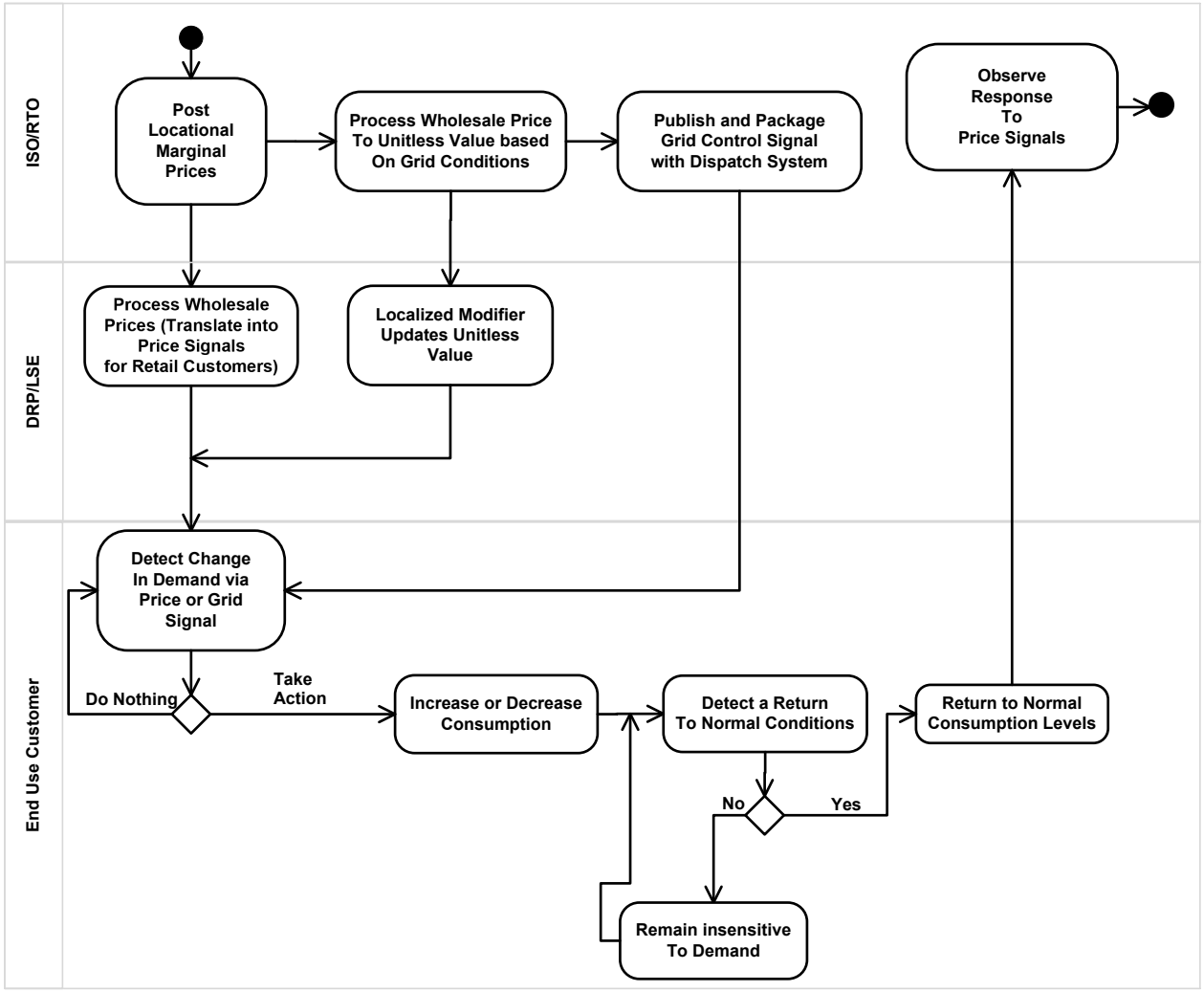
Requirements highlighted in grey in the above table are applicable to entities outside of the ISO and have been included to communicate use case intent and basis for further discussion.

#	Non- Functional Requirements	Associated Scenario #	Associate Step #
NFR-001	The ISO Price and grid indicator publication system for real-time prices / indicators shall be available 24X7X365 with an overall service availability of 99.995%	7.1	1
NFR-002	Published prices shall be accessible to all consumers	7.1	1
NFR-003	Prices shall be published to consumers with a minimal degree of latency (specifics are TBD)	7.1	1
NFR-004	The ISO Price publication system must record access, data creation/modification as well as data publication by identity for audit purposes	7.1	1
NFR-005	Audit data shall be available electronically to the ISO in predetermined formats within predetermined timeframes	7.1	1
NFR-006	Data exchanged between the ISO's systems and third party systems shall maintain its authenticity and integrity between the established source and destination.	7.1	2,3A, 3B

#	Business Rules	Associated Scenario #	Associate Step #
BRL-001	The Day Ahead market bidding closes at 10:00 hours and by 13:00 hours the ISO has published the Day Ahead Market's prices and grid condition indicators.	7.1	2
BRL-002	The Real-time prices and grid condition indicators are published every 5-minutes.	7.1	2

9. Activity Diagrams

9.1 ISO publishes prices and other information with expectations consumers will adjust usage



10. Glossary

Normal Operations: The time following Release/Recall at which a Program Administrator may require a Demand Resource to have returned its Load consumption to normal levels, and to be available again for Deployment.

Recovery Period: The time between Release/Recall and Normal Operations, representing the window over which Demand Resources are required to return to their normal Load.

Sustained Response Period: The time between Reduction Deadline and Release/Recall, representing the window over which a Demand Resource is required to maintain its reduced net consumption of electricity.

Demand Response: Changes in electric use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentives designed to induce lower electricity use at times of potential peak load, high cost periods, or when system reliability is jeopardized.

Locational Marginal Prices
Hourly Locational Marginal Prices for all PNodes and APNodes in $/MWh. For the DAM, posts the LMP, plus the Congestion, Loss and Energy Components that make up the LMP.

Interval Locational Marginal Prices
Five-minute Locational Marginal Prices for all PNodes and all APNodes in $/MWh, for each five-minute interval Real-Time Market. Posts the LMP, plus the Congestion, Loss and Energy Components that makes up the LMP.

See California ISO BPM for Acronyms and Definitions for additional glossary items.