BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of a Smart Grid System.	Rulemaking 08-12-009 (Filed December 18, 2008)

COMMENTS OF THE CONSUMER FEDERATION OF CALIFORNIA ON SMART GRID METRICS

These Comments are filed pursuant to the Assigned Commissioner's and Administrative Law Judge's Joint Ruling on July 30, 2010, inviting comments on Smart Grid Metrics proposed by the Commission Staff.

GENERAL COMMENTS

The Staff has developed metrics which will inform the Commission about the ability of the smart grid to facilitate consumers' efforts to concern, about the effectiveness of controls when outages occur and about the self-healing capability of the grid. The Consumer Federation of California has suggested additional metrics. In defense against those who will argue there are too many metrics to report, CFC would suggest: 1) most are metrics developed by more than 140 experts from utilities, equipment manufacturers, state agencies, universities, and national laboratories at workshops convened in Washington, D.C. on June 19-20, 2008, by the U.S. Department of Energy (DOE); 2) some metrics tend to be duplicative and the list might be shortened by eliminated those duplications.

Because the Staff developed metrics which implemented statutory criteria, some goals discussed at the Washington D.C. Workshops were not included. CFC would suggest that the following goals might be included:

- Optimizes Asset Utilization and Operating Efficiency
- Accommodates All Generation and Storage Options
- Integrates with other Utility Systems

- Impact on regulated electric rates and energy costs to consumers (This might be measured with metrics like consumer savings - average $ and % change in consumer annual bill by class)

In the Comments on Specific Metrics, which follows, CFC has suggested some changes to the metrics proposed by Staff.

Staff Proposal:

1. Increased Use of Digital Information and Controls to Improve Reliability, Security, and Efficiency of the Grid (§ 8360(a))

- The system□wide total number of minutes per year of sustained outage per customer served as reflected by the System Average Interruption Duration Index (SAIDI) and by customer class and location
- How often the system□wide average customer was interrupted in the reporting year as reflected by the System Average Interruption Frequency Index (SAIFI) and by customer class and location
- The number of momentary outages per customer system□wide per year as reflected by the Momentary Average Interruption Frequency Index (MAIFI) and by customer class and location
- The changes in SAIDI, SAIFI and MAIFI on a year□to□year basis due to investments in Smart Grid and grid efficiency technologies
- The number of customer reported outages versus outages identified by use of digital information
- The number of outages listed by transmission and distribution circuits
- Tons of CO2□equivalent emissions avoided through improved efficiency of the use of existing fossil resources (including ancillary services).

Comments:

System-wide Reporting. The first three metrics require reporting on a system-wide basis. The reasons are unclear. It would seem that the Commission would be interested instead in locating pieces of the grid where interruptions/outages were more likely to occur so that funds could be directed to places where interruptions are a problem.

MAIFI. It is not clear what purpose is served by requiring reports of momentary outages as they "are often caused by transient faults, such as lightning strikes or vegetation contacting a power line,"[1] over which the utility may have little control. The

[1] Wikipedia: MAIFI

use of reclosers to automatically restore power quickly is one possible use of the data, if there is a need for that information.

Emissions avoided. This metric seems misplaced, as it addresses pollution rather than reliability, security and grid efficiency.

Additional Metrics. The GridWise Alliance proposed the following metrics to implement reliability standards which are not addressed in Staff's list::

A. Reduced restoration time from major disruptions

B. Reduction in major outages

C. Improvement in Loss of Load Probability[2]

D. Avoidance of disturbances and to reduced consequences for consumers when they do occur

The DOE's Office of Energy Delivery and Electric Reliability addresses the 'self-healing' aspect of reliability, suggesting the following metrics for monitoring progress in the area of reliability. Underneath each metric is some advice about developing the metric:

- The percentage of grid assets that are monitored, controlled, or automated

The first step in developing this metric is to define which types of electric system assets are considered to be "smart grid assets." One consideration is the appropriate level of "granularity" to use, which means the extent to which the metric is applied to specific customers, feeder lines, substations, groups of substations, utility service areas, regional systems, or entire interconnections. There are a variety of potential data sources including utility tax records, circuit maps, and EMS, DMS, or SCADA systems. Analysis is needed to determine appropriate baselines and conduct benchmarking studies to help ensure comparability and consistency of data across utilities.

- The percentage of network nodes and customer interfaces that are monitored in "real time"

"The first step in developing this metric is to establish common definitions for what is meant by "nodes" and "real time." All utilities have achieved some level of this already and thus baselines will need to reflect the fact that each utility will have its own starting point. The best approach for obtaining this information is to survey the utilities and establish protocols and data definitions so that metrics and targets are comparable

[2] GridWise Alliance: Smart Grid Project Evaluation Metrics (February 23, 2009) http://osgug.ucaiug.org/Shared%20Documents/KEMA%20Smart%20Grid%20Evaluation%20Metrics%20DRAFT.pdf

across companies and regions. Analysis is needed to establish baselines and procedures to normalize based on factors such as value drivers, customer density, and system topology."

- The level of deployment of common communications infrastructure

"The first step in developing this metric is to determine definitions for "common communications infrastructure." One issue involves the broad-based need for communications standards for the interoperability of equipment across utilities, regions, and the country. Sources of data include the utilities, independent system operators, equipment vendors, and government agencies. Analysis to determine baselines could include inventories of the deployment of SCADA systems and the number of miles of fiber optic cables in service by utilities to support communications for grid operations."

- The percentage of the system that can be "fed" from alternative sources

"There are several issues to consider regarding this metric. One issue is that the target for this metric will differ depending on the topology of each utility system. Also, the costs to implement this metric will also vary considerably by utility. Data for this metric may be difficult to obtain because it involves specific information on power flows and grid design that is available from utilities in principle, but record keeping across utilities is inconsistent. Analysis is needed to determine baselines and to determine the extent of loading on alternative sources. Once baselines have been established, progress can be measured by the percentage change against the baseline or as percentage progress toward a specific target or goal."

- The geographic coverage, numbers, and MW of phasor measurement units and networks

"The first step is to determine the extent to which existing phasors are networked and providing used and useful information to support grid operations. Data on existing phasor deployments can come from NERC, the three major interconnections—east, west, and Texas. One issue is the degree to which actual phasor data will be shared among utilities and with others. Analysis is needed to identify potential smart grid applications that rely on phasor data and to assess whether existing coverage is sufficient for the application. Information to collect includes the number of smart grid applications that use phasors, the number of grid operations centers that use phasor data and the types and numbers of uses to which the data is applied."[3]

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[3] Metrics for Measuring Progress Toward Implementation of the *Smart Grid* - Results Of The Breakout Session Discussions at the Smart Grid Implementation Workshop - Office of Electricity Delivery and Energy Reliability (June 19-20, 2008 Washington, DC) (*hereafter,* Metrics for Measuring Progress) http://www.oe.energy.gov/DocumentsandMedia/Smart_Grid_Workshop_Report_Final_Draft_08_12_08.pdf

There were several California participants in the group working on these metrics, Tom Bialek of San Diego Gas & Electric Co., Merwin Brown of the University of California, Vikram Budhraja of Electric Power Group and Don Von Dollen of EPRI. Further information about the Workshop's proposals might be obtained from them.

Staff Proposal:

2. Grid and Cyber Security

- Number of attempted cyber attacks on the utility
- Number of security breaches experienced by the utility
- Number and percentage of customers affected by security breaches
- Monetary damages suffered by utilities as a result of cyber attacks on the utility or its infrastructure
- Number and total number of minutes of outages attributed to grid and cyber attacks

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Security Breaches. It might be useful to know more about the nature of the security breach, its source (if known), and the damage resulting from the breach. Information about the technology giving rise to the breach, its function, the manufacturer, and whether the breach has been fixed.

Customer Damage. It might be useful to know what harm to customers occurred as a result of security breaches, and the 'monetary damages' the customer suffered.

Hours of Repair. It might be useful, in terms of arranging for replacement power, to know how long particular breaches take to repair.

Additional Metrics

The Workshops referenced earlier suggested the following metric.

A Measurement of the Number of Alternative Paths of Supply to Any Load Point on the Distribution Grid

This metric is a measurement of the number of available paths to supplying customers with electricity in the event of a physical or cyber attack or natural disaster. As the smart grid enables greater flexibility in grid operations (e.g., through greater distributed generation capacity), this metric should improve with time and increase the resiliency of the grid as a whole. This concept of alternative paths must extend back through the entire electricity supply chain to ensure resilient operations for all hazards. For example,

the metric should consider alternative supply pathways for coal in even in the event of an attack on railways delivering coal to power plants.[4]

The amount of power capable of being "islanded" through demand management and distributed generation
Threats communicated with actionable information in a timely manner to the right people

Measurement of breadth of outage caused by physical or cyber event (Smart grid should have reduced physical or cyber footprint)

Dollar loss per thousand hours operation or lives lost per thousand hours operation

The Workshops also reported the need to determine appropriate levels of security by undertaking a risk assessment with cost considerations.[5]

Staff Proposal:

4. Deployment and Integration of Distributed Resources, Including Renewable Resources (§ 8360(c))

- The number and percentage of electricity customers and magnitude of total load served by grid-connected distributed generation (split between renewable and non-renewable)
- Total annual production of distributed generation facilities
- Percentage of substations capable of handling reverse power flows caused by distributed energy resources
- Average number of days between interconnection request for distribution-level distributed generation and activation of resource, including separate averages for consumer-owned generation and non-consumer-owned generation
- Frequency and duration of interruptions of distributed generation due to transmission or distribution interruptions as measured in terms of an interruption duration index, interruption frequency index, and momentary interruption frequency index
- Frequency and duration of interruptions of customers caused by distributed resources as measured in terms of an interruption duration index, interruption frequency index, and momentary interruption frequency index
- Tons of CO2 equivalent emissions avoided through improved efficiency of renewable resource integration
- Metric needed pertaining to frequency and impacts on distribution grid due to distributed resources)

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[4] Metrics for Measuring Progress at 28
[5] Metrics for Measuring Progress at 29

Based on the DOE Workshops Report, the following metrics should be considered:

Total Load Served by Grid Connected DG (Renewable & Non-Renewable). It would also be useful to know the amount of energy that can be controlled under emergency circumstances.

Percent of Real-Time Generation of DG and Storage that Can Be Controlled

The first step in developing this metric is to determine the location and operational status of DG and storage. The communication system architecture would also be part of this initial assessment. In developing quantitative information, direct communications with those organizations involved with devising interoperability standards will be central. A remaining question is to define the type of R&D data needed for large scale deployments.

Penetration—Percent of Load as Measured by kWh Served by Distributed Resources

There are several issues to consider including the verification of DR output overall and by various types (e.g., renewables and storage), data warehousing, and defining and capturing the data to produce information on percent of load served by DR at required times frames. In gathering data for this area, the utilization of two-way communications, AMI meters and modeling tools will be critical to success. In performing this data collection, there are several areas for further analyses including a clear definition of the baseline as well as segmenting DR. It may be necessary to measure percent renewables versus total kWh served or percent batteries versus total kWh served.

Storage—Percent of Systems Accommodating Off Peak Renewable Energy PMD Dispatching on Peak through Storage

Fundamental issues related to storage include knowing that the renewable energy is there, determining its location, and determining whether it is dispatchable. Quantifying this metric will involve the number of applications (size and location), measurement of availability, and profitability (with or without a subsidy). There will be analytical areas to resolve such as measuring and reporting performance of the storage systems and how to obtain the data on the number of applications involved.

Deployment Process Applications—Number of Days from Initial Application to Build a Distributed resource to Operation (Split by Size Class of the Distributed resource)

One effective method for scoping out the elements of this metric is to identify the number of locations applications are submitted for, determine the number of rejected or abandoned applications, and obtain a valid operational date. Once the data are defined it would be important to create a single application website. It would be useful to have access to building code permit application databases and larger distributed resource

interconnection requests at ISO/RTO/utilities. Significant areas of unknowns exist with this metric, including the following areas: abandoned applications, state-to-state variances, and data aggregation.

Improvements in Load Factors

Load factor is a comparison of the average load to the peak load and measures the disparity of the peak from typical or average usage. As the load factor increases toward unity, it is an indicator of operational efficiency in managing loads and hence is a metric of the extent of Smart Grid deployments or "grid intelligence." Information on load factors is available through utilities for estimating values at the level of customer, feeder, and other levels of aggregation throughout the system, including substations, transmission lines, and operating companies and for any time period, including daily, monthly, or annually. There is a need to develop standard approaches for the level of detail and time period for comparing load factors on a consistent basis.

Ability to accommodate 50% nondispatchable generation by 2020

The Workshop on distributed resources was attended by several Californians including Bruce Baccei of SMUD, David Michel of the Energy Commission's PIER, Mike Montoya of Southern California Edison

5. Incorporation of Cost-Effective Demand Response, Demand-Side Resources, and Energy-Efficient Resources (§ 8360(d))

- Total megawatts and percentage of peak load of demand response (expected load impact when called)
- Total megawatt-hours of energy efficiency savings
- The amount of load bidding in ancillary services market
- The amount of load clearing in the ancillary services market
- The amount of load bidding in the wholesale market
- The amount of load clearing in the wholesale market
- (How to measure consumption shifts in response to renewable production)
- (Insert any other EE metrics)
- Percentage of demand response AutoDR enabled
- Metric needed to measure total decrease in demand, by customer class and by peak and off-peak, due to demand response

The GridWise Alliance suggests some additional metrics:

- # customers and coincident peak MW participating
- MWH saved at coincident peak
- MW reduction at coincident peak
- Market price impact
- (Forecast of) customer participation in demand response and conservation programs
- # of customers and MW Greenhouse gas emissions reduction potential

- Tons GHG and per MWH; also tons GHG / customer

Other metrics might be borrowed from the distributed generation metrics, *e.g.,*

- Penetration—Percent of Load as Measured by kWh
- Percent of demand response that Can Be Controlled
- Improvement in Load Factor attributed to demand response

Deployment of Cost-Effective Smart Technologies (§ 8360(e))

- The number and percentage of installations and magnitude of total load served by substations or feeder lines that use automation equipment or that possess advanced measurement technologies
- The number of points and percentage and magnitude of the total load covered by Supervisory Control and Data Acquisition (SCADA) systems
- The number of installation points and percentage and magnitude of the total load in the service territory covered by phasor measurement units (PMUs)
- The number of installation points and percentage and magnitude of the total load served by real-time data management and visualization systems receiving data from PDCs and PMUs
- The number of installation points and percentage magnitude of the load covered by automated electric transmission systems or possessing advanced measurement

Other metrics could be borrowed from the Demand Response metrics.

7. Integration of Cost-Effective Smart Appliances and Consumer Devices (§ 8360(f))

- Number of meters with an activated Home Area Network
- Number of Home Area Networks able to communicate with consumer devices
- Number of consumer devices registered with the utility
- Number of consumer devices actively communicating with Home Area Networks
- Number of customer complaints related to interaction of consumer devices with Home Area Networks

These metrics should not be tied to the Home Area Network. There are other developing technologies which may be used to manage home energy use. The phrases "Automated Energy Use System" or "Home Energy Management System" might be used instead.

It might be useful to know the number of customers with more than one controlled appliance. It might be useful to know where the smart appliances are taking hold, so as to focus attention on other areas where more education is apparently

needed. It might be useful to know how much power can be controlled through smart appliances.

10. Provide Consumers with Timely Information and Control Options (§ 8360(h))

- The number and percentage of electricity customers and magnitude of total load served by advanced metering infrastructure
- The number of complaints related to advanced meters
- Number of advanced meters replaced annually
- Number of outages attributed to advanced meter malfunctions
- Provide any reports created in response to advanced meter malfunctions
- Number of advanced meter audits requested by customers
- Number of customers accessing energy usage information through the Internet or other web-based portal
- Number of authorized third parties accessing customer energy usage information
- Number of customers accessing real-time usage and/or pricing information and how often
- The number and percentage of electricity customers and magnitude and percentage of total load served by dynamic or time-variant pricing programs (*e.g.*, real-time pricing, critical peak pricing, *et al.*) in total and by customer class
- The number and percentage of electricity customers and magnitude and percentage of total load served by default and voluntary dynamic or time-variant pricing programs in total and by customer class
- The number and percentage of electricity customers and magnitude and percentage of total load served by load management programs (*e.g.*, interruptible tariffs, direct load control, consumer load control with incentives) by customer class
- Tons of CO2 equivalent emissions avoided (by load shifting or load reduction) as a result of increased customer awareness of the GHG emissions associated with energy consumption.

Number of advanced meters replaced annually. It may be useful to know the reasons why advanced meters are being replaced, *e.g.,* failure of mechanics, customer's request, broken by mischief-makers, etc.

Advanced meter malfunctions. It would be useful to know the kind of malfunction that occurred., if no report is created.

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CONCLUSION

The measurement of utilities progress in building a smart grid, and the direction it takes, are matters of great importance to consumers who are footing the bill for this enormous task. Metrics should constantly weigh the benefits of steps that are being taken against the cost.

Dated: August 17, 2010

Respectfully submitted,

CONSUMER FEDERATION OF CALIFORNIA

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BEFORE THE PUBLIC UTILITIES COMMISSION
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Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of a Smart Grid System.	**RULEMAKING R.08-12-009**

CERTIFICATE OF SERVICE

I hereby certify that on August 17, 2010, I served by e-mail all parties on the service lists for R.08-12-009 for which an email address was known, true copies of the original of the following document which is attached hereto:

COMMENTS OF THE CONSUMER FEDERATION OF CALIFORNIA ON
SMART GRID METRICS

The names and e-mail addresses of parties served by e-mail are shown on an attachment. In addition, I served the following persons by enclosing said document in an envelope addressed to them and depositing the envelope in the U.S. Mail, with postage prepaid.

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