BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Approval of Modifications to its SmartMeter™ Program and Increased Revenue Requirements to Recover the Costs of the Modifications. (U39M)	Application 11-03-014 (Filed March 24, 2011) **(NOT CONSOLIDATED)**
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RESPONSE OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902 E) ON THE ADMINISTRATIVE LAW JUDGE'S RULING SEEKING CLARIFICATION

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I. INTRODUCTION

In compliance with the Ruling of Administrative Law Judge Amy C. Yip-Kikugawa ("Ruling"), dated October 18, 2011, in the above-noted dockets, San Diego Gas & Electric Company ("SDG&E") hereby provides its response to the various questions identified in the Ruling. Specifically, the Ruling provides that PG&E, SDG&E, SCE and SoCalGas shall, respond to the following questions:

1. What is an average duration (in seconds) that a residential smart meter transmits in a 24 hour period?

    a. How is this average computed or measured?

2. How many times in total (average and maximum) is a smart meter scheduled to transmit during a 24-hour period?

    a. How many of those times (average and maximum) are to transmit electric usage information?

    b. How many of those times (average and maximum) are for other purposes? What are those other purposes? Please specify number of times (average and maximum) by type/category of transmission.

3. Under what scenarios does a meter transmit outside of the daily schedule, i.e., unscheduled transmission such as on-demand read, tamper/theft alert, last gasp, firmware upgrade etc.?

4. Typically, how much of the communication between the customer's meter and the utility is unscheduled vs. scheduled?

5. Are there any other factors that go into determining duration and/or frequency of meter transmissions (e.g., if a meter can't access the network when it's trying to send data, type of a meter etc.)? If yes, please identify these factors.

6. What is the amount of RF emission at the source when a meter is transmitting data (instantaneous maximum peak level, averaged over 30 minutes)?

7. Does the amount of RF emission vary depending on duration of transmission/volume of data being sent? For example, are RF emissions higher when there is a larger volume of data to be transmitted?

8. Are there any other factors that impact the amount of RF emissions? If so, please identify the factor(s) and its impact on RF emissions.

9. Is there RF emission when the meter is not transmitting? If yes, what is the amount of RF emission?

10. Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and a smart meter with the radio out? If yes, what is that difference and how is it calculated?

11. Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and an analog meter? If yes, what is that difference and how is it calculated?[1]

[1] Ruling, at pp. 3-4.

In summary, the data provided within our Response below establishes that, on average, an OpenWay residential meter's radio(s) will transmit RF approximately one minute a day and that these meters are tested and validated to be FCC compliant.

II.
RESPONSE

1. What is an average duration (in seconds) that a residential smart meter transmits in a 24-hour period?

- The average OpenWay residential meter's 900MHz RFLAN radio will transmit a total of 53 seconds in a 24-hour period. This includes daily scheduled reads, unscheduled activities and all network overhead.

- The OpenWay residential meter's 2.4GHz Zigbee radio communicates with other HAN (Home Area Network) devices and Itron Gas Modules. The table below shows the measured transmission times for an idle Zigbee radio and a Zigbee radio with one of two sample devices joined to the meter. We expect that, for current deployments, the average meter will have either zero (idle) or one HAN device attached to it.

	Duration of transmission in a 24-hour period	Duty Cycle
Idle Zigbee Radio (no devices joined)	9.9 seconds	0.01% Duty Cycle
Meter with Tendril IHD (In Home Display)	132 seconds	0.15% Duty Cycle

- The Itron Gas Modules are directly linked to a local electric meter via the Zigbee radio. They are not part of the RFLAN Mesh network and they transmit their data on a set schedule (twice a day for profile data, consumption information and 10 times a day for network connectivity communications). The gas modules transmit a total of less than 100 milliseconds in a 24-hour period.

a. How is this average computed or measured?

- The 900MHz RFLAN average transmission duration was derived from empirical data collected at a large, representative OpenWay deployment. The total transmit time for a sample of over 6800 meters was collected and the average was calculated. The 24-hour period was representative of normal network operations with daily reads, unscheduled events

(alarms, alerts, interactive reads, etc.), a firmware download and network overhead.

- The average Zigbee transmission is based on measurements taken at Itron labs. Itron has estimated a maximum 1% transmission duty cycle for the 2.4GHz Zigbee radio based on up to 8 devices being attached to a single meter. Current deployments typically allocate zero or one ZigBee device per OpenWay meter.

- The gas module transmission duty cycle is based upon defined daily interval data which includes profile data, consumption information, and communication handshakes.

Response provided by: Simon Pontin – Itron's Chief Technology Office

2. How many times in total (average and maximum) is a smart meter scheduled to transmit during a 24-hour period?

During a 24-hr period, SDG&E has 3 scheduled interrogations:

- 12:00A.M. – This interrogation retrieves electric load profile data and electric event history for the previous 8 hours of usage. This interrogation also retrieves the time-stamped midnight electric register data and the time-stamped gas 7:00 A.M. and 10:00P.M. register read data (HAN data).

- 10:00 A.M. – (except Saturdays). This interrogation retrieves the current electric register data and the most recent time-stamped gas (7:00 A.M and 10:00P.M.) register read data (HAN data). This interrogation also retrieves the electric event history for the previous 10 hours.

- 4:00 P.M –This interrogation retrieves the current electric register data and the most recent time-stamped gas (7:00 A.M and 10:00P.M) register read data (HAN data). This interrogation also retrieves the electric load profile and the electric event history for the previous 16 hours.

Response provided by: Charlie Snyder – SDG&E Smart Meter Program Manager

Other factors include -

- In addition, for a 7-day period, SDG&E collects network statistics – Each Saturday at 10:00A.M. – This weekly interrogation collects network connectivity statistics for all electric meters.

Response provided by: Charlie Snyder – SDG&E Smart Meter Program Manager

- With a hierarchical cell structure, meters will relay upstream and downstream traffic within the RFLAN mesh. The total number of transmissions will include the scheduled reads, on-demand reads, alarms/alerts along with the network traffic needed for command and control (synchronization, security, data integrity and dynamic network resiliency).

- Based on this interrogation schedule, (2 load profile reads + one register read + one event read per day), the total transmissions for an Openway meter over a 24 hour period are:

    - The average number of transmissions in a 24-hour period is ~1,268 (less than 1 time/minute)

    - The maximum number of transmissions in a 24-hour period is ~25,916(18 times/minute or ~ once every 3.3 seconds)

    - However, 97% of the meters in this random sample transmitted less than 2500 times in a 24-hour period.

a. How many of those times (average and maximum) are to transmit electric usage information?

- All three scheduled interrogations discussed in the 24-hour period above transmit electric usage information.

b. How many of those times (average and maximum) are for other purposes? What are those other purposes?

- On Saturday only at 10:00A.M an interrogation job is submitted to pull back network connectivity statistics for all electric meters.

- The balance of the transmissions is for network command and control: synchronization, security, data integrity and dynamic network resiliency.

c. Please specify number of times (average and maximum) by type/category of transmission?

- Detailed analysis of the type/category of transmissions has not been completed. One data point from the gathered field data is that, on average, the segmentation between meter data transmissions (scheduled and/or on-demand) and network command and control (synchronization, security, data integrity and dynamic network resiliency) is expected to be:

    - Transmissions of meter data: 10%

    - Transmissions for network command/control: 90%

- Based upon the interrogation schedule above and this expected breakdown in message types, the following number of transmissions per message type per 24 hour period can be expected.

    - Transmission of Meter Data –
        a. Average = 127
        b. Max = 2,592

    - Transmission of Command & Control
        a. Average = 1143
        b. Max = 23,328

Response provided by: Simon Pontin – Itron's Chief Technology Office

Response provided by: Charlie Snyder – SDG&E Smart Meter Program Manager

3. Under what scenarios does a meter transmit outside of the daily schedule, i.e., unscheduled transmission such as on-demand read, tamper/theft alert, last gasp, firmware upgrade etc.?

- Exceptions, by definition, are transmitted when they occur in a meter, if the meter is removed from the socket by an electrician to do customer work, the meter will transmit 3 PON (power off notification) messages, when its plugged back in it will transmit a removal tamper, inversion tamper, PRN (power restore notification) message. SDG&E has 7 exception messages defined in a typical residential meter (Configuration Error, Inversion Tamper, Load Control Opt Out, Power Down, Power Up, Removal Tamper, Reverse Rotation).

    - Firmware Download: Firmware downloads over the RFLAN are typically done once a year (reflecting major system releases). The firmware download process is a background activity for the network typically spanning from 12 hours to 12

days (depending on the number/type of firmware modules downloaded).

- Network Synchronization: The nature of a RF mesh network requires that meters maintain communications with their neighbor meters to ensure the stability, self healing and integrity of the network. A good example of this is timing synchronization where meters send their neighbor meters time-synchronization packets at regular intervals to ensure all of the devices in the network are synchronized for time slot usage. Time-synchronization packets are sent approximately every 93 seconds (if no other traffic is received).

Response provided by: Simon Pontin – Itron's Chief Technology Office

4. Typically, how much of the communication between the customer's meter and the utility is unscheduled vs. scheduled?

Based on how SDG&E has scheduled their read interrogations, described in Q.2. above, Itron estimates the communication between the customer's meter and the utility is approximately 95% scheduled. The 5% is attributed to ad-hoc contingency read request for meter mitigation and firmware downloads.

Response provided by: Simon Pontin – Itron's Chief Technology Office

Response provided by: Charlie Snyder – SDG&E Smart Meter Program Manager

5. Are there any other factors that go into determining duration and/or frequency of meter transmissions (e.g., if a meter can't access the network when it's trying to send data, type of a meter etc.)? If yes, please identify these factors.

- When meters first join a network, they go through a sequence of three discovery beaconing phases to find the network and appropriate neighbor devices to sponsor them on to the network. Each of the phases are described below:

  - Phase-1 of Discovery: ~ 9 minute duration, 156 cycles of 1.04 seconds of beaconing (20ms beacon on each of 52 channels) followed by 2.5 seconds of listening (no transmissions).

  - Phase-2 Discovery: ~ 55 minute duration, 99 cycles of 1.04 seconds of beaconing followed by 32.5 seconds of listening.

- Phase-3 Discovery: Remaining time until it joins the network, continuous cycles of 1.04 seconds of beaconing followed by 1 hour, 2.5 seconds of listening.

Once on the network, it will behave as outlined above.

Response provided by: Simon Pontin – Itron's Chief Technology Office

6. What is the amount of RF emission at the source when a meter is transmitting data (instantaneous maximum peak level, averaged over 30 minutes)?

- Note that the limits for Maximum Permissible Exposure (MPE) established by the FCC accounts for a 20cm distance from the source to the measurement point. The transmitted power for the OpenWay meters deployed in the California market (HW2.0, FCC ID: SK9AMI-4) without this 20cm distance (at the antenna source) are:

  - **RFLAN (900MHz)**
    Conducted Peak Transmitted Power: 267.3 milliWatts
    Antenna Gain: 1.66 times (2.2 dB)
    Total instantaneous Peak Transmitted Power: 443.7 milliWatts
    With 1% duty cycle over 30 minute interval: 4.4 milliWatts

  - **Zigbee (2.4GHz)**
    Conducted Peak Transmitted Power: 82.6 milliWatts
    Antenna Gain: 2.75 times (4.4 dB)
    Total instantaneous Peak Transmitted Power: 227.5 milliWatts
    With 1% duty cycle over 30 minute interval: 2.3 milliWatts
    NOTE: *The transmitted power for all Itron meters is captured in reports on RF Exposure available at the FCC web site: Use Grantee Code; SK9, Product Code; AMI-4*.

- Note that while this question asks for emission data, FCC publication OET65 identifies a distance of 20 centimeters (<8 inches) "where reliable field measurements to determine adherence to MPEs [Maximum Permissible Exposures] can be made."

  As noted in Q(2)(c), the amount of time transmitting data is approximately 10% of the total transmit time. Therefore, the following emission values have been calculated using a duty cycle of 0.1% (1% duty cycle for all transmissions x 10% allocated for data transmissions), evaluated at the 20-centimeter distance, and expressed in terms of power density.

  - RFLAN: Power Density at 20cm = 443.7mW/4 π 20^2 = 0.088 mW/cm2 x 0.001 = 0.00009 mW/cm^2, or 0.0144% of the FCC's MPE guidelines for general public at 20 cm

- Zigbee: Power Density at 20cm = 227.5mW/4 π 20^2 = 0.045 mW/cm2 x 0.001 = 0.00005 mW/cm^2, or 0.0045% of the FCC's MPE guidelines for general public at 20 cm

Response provided by: Simon Pontin – Itron's Chief Technology Office

- In a sampling of RF LAN transmission activity of its active meters, SDG&E has observed an average duty cycle of 0.06%, and a peak duty cycle of 0.58%. These figures include all transmissions. Factoring in the 10% allocation for data transmission noted by Itron above, the average data transmission duty cycle would be 0.006%, and the peak data transmission duty cycle would be 0.058%. Calculated values for RF LAN emissions using these data transmission duty cycle figures would be proportionately lower than the values provided by Itron (above) using a 0.1% duty cycle.

  For additional discussion of the SDG&E smart meter system duty cycle, see pages 12-9 and 12-10 of the report *An Investigation of Radiofrequency Fields Associated with the Itron Smart Meter*, published in December 2010 by the Electric Power Research Institute. This report is available at http://my.epri.com/portal/server.pt?Abstract_id=000000000001021126.

Response provided by: Jim Turman – Project Manager – SDG&E Safety Services

7. Does the amount of RF emission vary depending on duration of transmission/volume of data being sent? For example, are RF emissions higher when there is a larger volume of data to be transmitted?

No, the transmitted power is fixed at the levels shown in the response to question #6. They do not vary due to duration or volume of data sent.

Response provided by: Simon Pontin – Itron's Chief Technology Office

8. Are there any other factors that impact the amount of RF emissions? If so, please identify the factor(s) and its impact on RF emissions.

No. The factors impacting RF emissions have been discussed above.

Response provided by: Simon Pontin – Itron's Chief Technology Office

9. Is there RF emissions when the meter is not transmitting? If yes, what is the amount of RF emission?

Yes. All solid state electronic devices emit RF signals due to processor clock signals and power supplies (such as televisions, DVD players, cell phones, computers and solid state meters). These types of unintentional RF signals have limits set by the FCC in the Code of Federal Regulations, Title 47, Part 15 (47 CFR 15), Subpart B, Class B Devices. Itron's products are tested and validated to be below the limit set and to be compliant with these FCC requirements.

Response provided by: Simon Pontin – Itron's Chief Technology Office

10. Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and a smart meter with the radio out? If yes, what is that difference and how is it calculated?

No. When the radio is off it does not transmit. The unintentional RF signals from the meter's solid state electronics will remain virtually unchanged with the radio turned off or removed.

Response provided by: Simon Pontin – Itron's Chief Technology Office

11. Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and an analog meter? If yes, what is that difference and how is it calculated?

As smart meters are solid state electronic devices and analog meters are electro-magnetic devices their behavior is different. A comparison has not been undertaken as they are so different; however, both devices comply with the same FCC regulations: Code of Federal Regulations, Title 47, Part 15 (47 CFR 15), Subpart B, Class B Devices.

Response provided by: Simon Pontin – Itron's Chief Technology Office

Respectfully submitted this 1st day of November 2011.

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