Customer-Owned Telemetry (COT) Procedure

SUMMARY

As required by California Public Utilities Commission (CPUC) Resolution E-5038 Ordering Paragraph 2, PG&E approves of the use of customer-owned telemetry (COT) to support distribution-connected generating facilities' telemetry requirements, effective October 4, 2021.

PG&E's telemetry system uses IEEE 2030.5 and California Rule 21 specified Common Smart Inverter Profile (CSIP) requirements to communicate with the generating facility's COT available for purchase from approved vendors.

Approved vendors' COT have been tested to be compatible within PG&E's IEEE 2030.5 infrastructure and to meet PG&E requirements for the equipment. See Attachment 1 for the list of approved vendors.

Level of Use: Information Use

TARGET AUDIENCE

The target audience is PG&E electric grid interconnection (EGI) interconnection customers (ICs) who use customer-owned telemetry that communicates using IEEE 2030.5 protocol to PG&E to fulfill their telemetry requirements. The telemetry requirement is typically for ICs with generation or storage devices with a total aggregate generation of 1 Megawatt (MW) or larger. COT is approved only for distribution-connected ICs with a telemetry requirement and no other protection requirements.

SAFETY

This utility procedure describes administrative tasks that do not expose personnel to any significant hazards.

BEFORE YOU START

NA

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PROCEDURE STEPS

CUSTOMER-OWNED TELEMETRY PROCESS

1   Process Overview

1.1   IC Application to Interconnect – YourProjects Application

1.   The IC APPLIES to interconnect their proposed generation via the YourProjects application portal.

2.   IF the IC has a project interconnecting onto the distribution grid that is 1 megawatt (MW) or greater (according to the system nameplate),

THEN the customer SELECTS one of the following three options:

- Customer-owned telemetry – remote site gateway

- Customer-owned telemetry – aggregator

- PG&E MiniRTU

3.   PG&E personnel STUDY proposed generation AND PROVIDE a study report to the IC.

4.   The IC REVIEWS the study report AND REQUESTS an interconnection agreement (IA) from PG&E.

5.   The EGI contact PERFORMS the following tasks:

a.   TENDERS IA to IC.

b.   REQUESTS a choice in vendor. (SEE Attachment 1, "Approved Customer-Owned Telemetry Vendors.")

c.   TENDERS Work at the Request of Others (WRO) agreement, based on a $4,000 flat cost for configuring the COT solution.

6.   The IC PROCEEDS as follows:

a.   CHOOSES a vendor.

b.   SIGNS the IA.

c.   RETURNS the IA AND REPLIES with their vendor choice to the EGI contact.

d.   RETURNS the WRO agreement signed by the customer.

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1.1 (continued)

    7.   Once the WRO agreement is signed AND payment is received, the EGI contact ASSIGNS an IT project manager for the proposed generation site.

        a.   The IT project manager ASSISTS with coordinating the configuration of the COT to PG&E's system.

    8.   The IC WORKS with the vendor to install the COT at their site, per required metering points set in Section 3, "Required Data Points," on Page 4.

    9.   The IT project manager COORDINATES the configuration of the COT onto PG&E's system.

    10.   When all systems are working correctly and other required site work and testing is successfully completed, the EGI contact PROVIDES the Permission to Operate (PTO) to the IC.

REQUIREMENTS

2   Metering Configuration

2.1   To uncover masked load and support PG&E distribution control center (DCC) switching operations, sites requiring telemetry (typically 1 MW or larger) must PROVIDE aggregate metering of each distributed energy resource (DER) type (e.g., the sum of all individual solar onsite).
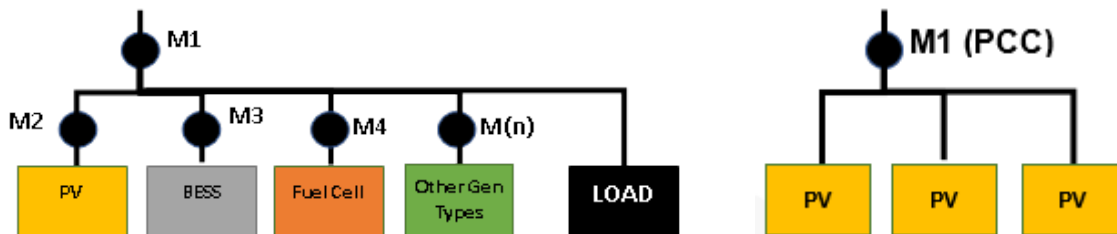

Figure 1. Required Site Metering Examples

2.2   The following data points are required at each point shown in Figure 1 above for the customer-owned telemetry solution, depending on installed generation resources:

•   M1: Site (Point of common coupling measurements). **Optional to provide PG&E additional information OR may be used as monitoring point if there is only one generator fuel type AND no other load onsite.**

•   M2: Photo-voltaic (PV) Solar (aggregate of all PV on site)

•   M3: Battery Energy Storage System (BESS) (aggregate of all storage onsite)

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2.2 (continued)

- M4: Fuel Cell (aggregate of all fuel cell generation on site)

- M(n): Any other Generation Type (aggregate of any other generation type not listed above)

3   Required Data Points

3.1   Program Description

1.   As a condition to PG&E issuing the final Permission to Operate for generator interconnection projects requiring telemetry (typically 1 MW or larger), the IC SUPPORTS PG&E's implementation of COT to provide the following real-time data from the generating facility to PG&E to satisfy Producer's Rule 21 DER telemetry requirements:

- 3-phase and total watts (W)

- 3-phase and total volt-amperes-reactive (VAR)

- 3-phase voltage (V)

- 3-phase amperes (Amps)

2.   TEST monitoring functionality at the generating facility. The day and time for testing functionality is decided in coordination with the IC to ensure minimal to no impact to existing operations.

3.   During the Operational Period, the IC must MAINTAIN the following items:

a.   The connection between the COT and its equipment.

b.   The accurate scaling of watts, VARs, volts, and amps values.

(1)   IF the IC CHANGES Item a or Item b above and such change results in inaccurate values that do not accurately reflect local conditions,

THEN the IC must RESOLVE the issue within 2 weeks of notice or discovery of the issue. Parties AGREE that the IC remains solely responsible for its obligations under these requirements and the Generating Facility Interconnection Agreement (GFIA).

4.   During the Operational Period, the IC must NOTIFY PG&E 10 days in advance of making any changes to the telemetering devices connected to the COT, along with the proposed change at: DERComms@pge.com

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3.1 (continued)

5.   During the Operational Period, the IC is RESPONSIBLE for connections with the COT equipment.

6.   Table 1 below describes the required data points for locations M2, M3, M4…M(n), as applicable. Table 2 on Page 6 describes data points for M1, as applicable (M1 is optional to provide PG&E additional information OR may be used as a monitoring point if there is only one generator fuel type AND no other load onsite).

Table 1. Directly Monitored Telemetry Points by Generation Type from the DER Site

Telemetry	Accumulation Behavior Type	Comm-odity Type	Data Qualifier Type	Flow Direction Type	Kind Type	Phase Code	Uom Type	Unit and Precision	Note
Current A	12	0	0	0	0	128	5	1 A	Always Positive
Current B	12	0	0	0	0	64	5	1 A	Always Positive
Current C	12	0	0	0	0	32	5	1 A	Always Positive
Voltage AN	12	0	0	0	0	129	29	0.1 V	Use for Wye connected meter. Omit for Delta connected meter.
Voltage BN	12	0	0	0	0	65	29	0.1 V	Use for Wye connected meter. Omit for Delta connected meter.
Voltage CN	12	0	0	0	0	33	29	0.1 V	Use for Wye connected meter. Omit for Delta connected meter.
Voltage AB	12	0	0	0	0	132	29	0.1 V	Use for Delta connected meter. Omit for Wye connected meter.
Voltage BC	12	0	0	0	0	66	29	0.1 V	Use for Delta connected meter. Omit for Wye connected meter.
Voltage CA	12	0	0	0	0	40	29	0.1 V	Use for Delta connected meter. Omit for Wye connected meter.
Active Power Total	12	0	0	0	0	224	38	1 W	Negative = Export to Grid
Active Power A	12	0	0	0	0	128	38	1 W	Negative = Export to Grid
Active Power B	12	0	0	0	0	64	38	1 W	Negative = Export to Grid
Active Power C	12	0	0	0	0	32	38	1 W	Negative = Export to Grid
Reactive Power Total	12	0	0	0	0	224	63	1 VAR	Negative = Capacitive Load
Reactive Power A	12	0	0	0	0	128	63	1 VAR	Negative = Capacitive Load
Reactive Power B	12	0	0	0	0	64	63	1 VAR	Negative = Capacitive Load
Reactive Power C	12	0	0	0	0	32	63	1 VAR	Negative = Capacitive Load

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3.1 (continued)

Table 2. Directly Monitored Telemetry Points for the Point of Common Coupling (PCC) from the DER Site (PCC metering only required for sites seeking control)

Telemetry	Accumulation Behavior Type	Commodity Type	Data Qualifier Type	Flow Direction Type	Kind Type	Phase Code	Uom Type	Unit and Precision	Note
Current A	12	0	0	0	0	128	5	1 A	Always Positive
Current B	12	0	0	0	0	64	5	1 A	Always Positive
Current C	12	0	0	0	0	32	5	1 A	Always Positive
Voltage AN	12	0	0	0	0	129	29	0.1 V	Use for Wye connected meter. Omit for Delta connected meter.
Voltage BN	12	0	0	0	0	65	29	0.1 V	Use for Wye connected meter. Omit for Delta connected meter.
Voltage CN	12	0	0	0	0	33	29	0.1 V	Use for Wye connected meter. Omit for Delta connected meter.
Voltage AB	12	0	0	0	0	132	29	0.1 V	Use for Delta connected meter. Omit for Wye connected meter.
Voltage BC	12	0	0	0	0	66	29	0.1 V	Use for Delta connected meter. Omit for Wye connected meter.
Voltage CA	12	0	0	0	0	40	29	0.1 V	Use for Delta connected meter. Omit for Wye connected meter.
Active Power Total	12	0	0	0	0	224	38	1 W	Negative = Export to Grid
Active Power A	12	0	0	0	0	128	38	1 W	Negative = Export to Grid
Active Power B	12	0	0	0	0	64	38	1 W	Negative = Export to Grid
Active Power C	12	0	0	0	0	32	38	1 W	Negative = Export to Grid
Reactive Power Total	12	0	0	0	0	224	63	1 VAR	Negative = Capacitive Load
Reactive Power A	12	0	0	0	0	128	63	1 VAR	Negative = Capacitive Load
Reactive Power B	12	0	0	0	0	64	63	1 VAR	Negative = Capacitive Load
Reactive Power C	12	0	0	0	0	32	63	1 VAR	Negative = Capacitive Load

4   COT Functional Specifications

4.1   The following are the functional specifications for the COT equipment:

    1.   COT must be CSIP certified for IEEE 2030.5.

    2.   COT must run the latest version of CSIP implementation of 2030.5 (Currently CSIP 2.1 – March 2018).

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4.1 (continued)

3.   COT must be able to update the CSIP 2030.5 version and the version should be verifiable.

4.   COT must have proven interoperability with the PG&E CSIP-certified IEEE 2030.5 Head-end system.

5.   COT must be able to translate between the CSIP implementation of IEEE 2030.5 and the local device protocol for providing telemetry information.

6.   Gateway must be able to provide the LogEvents as described in Attachment 2, "PG&E IEEE 2030.5 LogEvent Descriptions."

7.   COT must be able to provide metering point values (e.g., W per phase and total, VAR per phase and total, Voltage per phase, Amps per phase) at any uniquely identified input with the appropriate CSIP characteristics (RoleFlags, ServiceCategoryKind, AccumulationBehaviour, Commodity, DataQualifier, FlowDirection, PowerOfTenMultiplier, Qualityflags, etc.).

8.   COT must monitor status values (e.g., alarm or status points) at any uniquely identified input.

9.   COT must post data at a minimum of every 30 seconds, as defined by the posting rate given by the PG&E 2030.5 Headend server.

10.   Data must be scaled appropriately based on units of measure (kW, MW, etc.).

11.   COT must have the ability to determine the average, minimum, and maximum from a set of values.

12.   COT must be able to receive input signals from one or more serial and IP connections.

13.   COT must have methods to configure the site and site DER/load identification information.

14.   COT must have methods to configure data values as required for each measurement location within a site.

15.   COT must have methods to configure protocol parameters as required.

16.   COT must have methods to configure security parameters as required, including user access management.

17.   COT must have methods to configure communication and network parameters as required.

18.   COT must have methods to configure alarm parameters as required.

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4.1 (continued)

19.   COT must provide continuous monitoring of connections to local DER or metering interfaces.

20.   The device must automatically restart to full functionality after power is restored following the complete loss of power to the COT equipment.

5   COT Equipment Non-Functional Specifications

5.1   The following are the functional specifications for the COT equipment:

1.   Gateway should be an OS embedded type of device. Currently, PG&E does not accept Windows 10 Enterprise operating system for a Gateway. The vendor must indicate what security certification, such as ISO/IEC 15408 Common Criteria (CC) and Evaluation Assurance Level (EAL), the OS has achieved from an external-auditing organization.

2.   Minimum operating temperature range: -20° C to +70° C

a.   Preferred operating temperature range: -40° C to + 85° C

3.   Gateway is capable of being installed inside an outdoor cabinet.

4.   COT must meet all IEEE 2030.5 mandatory requirements described in the standard and must follow the IEEE 2030.5 Implementation Guide for the Common Smart Inverter Profile (CSIP 2.1), acting as a DER Client or Aggregator when communicating with the PG&E DER Headend server using CSIP IEEE 2030.5.

5.   COT must initiate all communications with the PG&E DER Headend Server according to polling and posting intervals provided by the server to ensure the Gateway has up to date settings and PG&E understands the operational state of the Gateway.

6.   The default posting rate must be every 30 seconds and must be configurable.

7.   TLS must be used for all HTTPS transaction and the Gateway must support the following cipher suite, in addition to the CSIP specified cipher suites: TLS_ECDHE-ECDSA-AES128-GCM-SHA256 (oxc02d) GCM cipher suite

8.   A valid certificate must be used in IEEE 2030.5 TLS transactions. The COT must have a 'SunSpec PKI' issued device certificate and store key files using secure methods.

9.   COT must perform mutual authentication (Two-Way Authentication) during the TLS handshake by exchanging and authenticating with the DER Headend Server's certificate. The DER Headend server will hash the COT certificate and validate it with the pre-registered SFDI/LFDI of the COT.

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5.1 (continued)

10.   COT must provide a stable communication path via public internet with Public Static (fixed) IP addresses to communicate with PG&E DER Headend Servers. The Public Static IP addresses will be submitted to add to the White List of the edge Load Balancer for Access Control List (ACL) management.

11.   COT must support access control functions, including Gateway applications checking the 'PIN' code from the registration message.

12.   COT must support the following methods to get the PG&E IEEE 2030.5 DER Headend Server's 'DeviceCapability' resource:

   a.   Out-of-Band Discovery: Gateway can be provisioned with all the DER Headend information by an out-of-band method.

   b.   Unicast-DNS and DNS-SD: Gateway is provisioned with the DNS name of the PG&E Headend server. The Gateway must perform name resolution using DNS and using DNS based Service Discovery (DNS-SD) to get the PG&E DER Headend Server IP address and port, scheme (HTTPS), and the path to the 'DeviceCapability' resource.

13.   Once the COT gets its EndDevice instance, it finds its group assignments by following the 'FunctionSetAssignmentListLink'. The COT periodically polls these resources at a rate specified by the DERProgramList:pollRate setting.

   a.   COT must also support operating with no Function Set Assignment for telemetry only installations.

14.   The PG&E DER Headend server will use the 'Time' function set (IEEE 2030.5) to distribute the current time to the Gateway. The Gateway must update the local time of the device to this time.

15.   Communication performance requirements for the interfaces to the DER Headend Server are listed below. These requirements do not constrain or define the performance of various communication systems.

   a.   Availability of Communication: Must be active and responsive whenever the end device is operating and in a continuous operating region or mandatory operating region.

   b.   Reporting Telemetry Data: Post data every 30 seconds. This is based on the default posting interval from the PG&E DER Headend Server.

   c.   Reporting Status Information: <=2 seconds. This is based on the maximum amount of time to report status information after receiving status information from an end device.

5.1 (continued)

        d.   Reporting Alarm: <=2 seconds. This is based on the maximum amount of time to report alarms after detecting and/or receiving alarms from an end device.

    16.   COT must have sufficient public documentation regarding the following:

        a.   System Installation Guide

        b.   System Administrator Guide

        c.   User (Operator) Guide

        d.   Functional Specifications and Related Technical Specifications

        e.   System Configuration Hardening Guide

6   Cybersecurity Requirements

6.1   PG&E PROVIDES network access to ICs to supply power and related telemetry data originating from an IC's DER system.

    1.   Access is governed by the security requirements defined in this procedure.

    2.   PG&E may REVOKE access if the IC violates any terms of this agreement as described in Section 6.2 below.

6.2   Any IC connecting to PG&E networks must COMPLY with the security requirements described in this procedure to ensure the confidentiality, integrity, and availability of PG&E networks, systems, and data.

    1.   General Information

        a.   Approved gateway vendors must be ABLE to communicate with PG&E's IEEE 2030.5 system using the ECDHE-ECDSA-AES128-GCM-SHA256 (oxc02d) GCM cipher suite.

        b.   The IC connecting to PG&E networks and systems must FOLLOW security principles and guidance, based on the then-current NIST CSF framework, currently NIST 800 53 r4, OR similar security frameworks.

    2.   Identify and Access Management

        a.   The IC must ENSURE that individuals operating the DER or accessing assets connected to the PG&E network are properly authenticated and have documented roles and responsibilities governing their level of access.

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6.2 (continued)

    b.   All IC devices accessing the PG&E networks and systems must have valid credentials identifying the asset and all assets and devices must be physically protected to prevent unauthorized access and use.

    3.   Network and Asset Protection

        a.   The IC DER systems or LAN(s) connecting to the PG&E IEEE 2030.5 systems must have adequate technical controls (perimeter firewalls, anti-virus protection, etc.).

        b.   The IC is RESPONSIBLE for safeguarding their internal networks (logically and physically) to protect the equipment and systems from unauthorized access and manipulation.

    4.   Cyber Event Detection

        a.   PG&E must EMPLOY tools AND techniques to detect and remediate cyber risks.

            (1)   The IC AGREES that in the event of detection of a cyber event, PG&E must PERFORM problem analysis including monitoring, scanning, and auditing of PG&E networks (and traffic to such PG&E networks). Such problem analysis must be coordinated with the IC in advance and must be initiated from PG&E sites or the IC site with the agreement of the IC.

            (2)   The IC is RESPONSIBLE for any tools and techniques to detect and remediate cyber risks within their networks or connections and is expected to perform their own analysis.

            (3)   The IC can REQUEST reporting or results of investigations or events.

        b.   The IC must PROVIDE, upon PG&E request, systems log and audit trails in support of PG&E cyber event detection and/or cyber event analysis or forensic analysis.

            (1)   PG&E can REQUEST additional data to support the analysis of IC infrastructure connections to PG&E networks to confirm that the connection is authorized and that the IC has implemented cyber safeguards and best practices, including having implemented appropriate firewall, patch, and anti-virus measures.

            (2)   The IC may also REQUEST that PG&E provide systems logs and audit trails in support of PG&E cyber event detection and/or cyber event analysis or forensic analysis.

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6.2 (continued)

    c.   PG&E LIMITS the scope of their monitoring, scanning, and auditing activities to ensure compliance with these requirements AND COORDINATES with designated members of the IC information security staff in advance.

        (1)   The IC CONSENTS to such monitoring, scanning, and auditing.

        (2)   Any proprietary or other information of the IC obtained by PG&E as a result of such monitoring, scanning, and auditing will be kept in strict confidence, will not be disclosed to third parties, and will be used by PG&E only for the purposes set forth in this Section 6.2.4.c.

    5.   Cyber Event Response

    a.   The IC must HAVE a documented and tested Cyber Incident Response Plan (IRP) or a documented process so that in the event of a confirmed cyber event the IC can NOTIFY PG&E AND PROVIDE information and the scope of exposure.

        (1)   PG&E must HAVE a similar plan AND/OR process to notify the IC and provide information on the scope of exposure, extent of conditions, etc.

    b.   The IC is RESPONSIBLE for all network activities that originate from its facilities, systems, or networks that pass into PG&E networks.

        (1)   In the event of a cyber event, PG&E may REQUEST additional logical or administrative controls be deployed as precautionary and risk mitigation measures.

    c.   Upon completion of a cyber event investigation and indication of criminal activity, PG&E in conjunction with the IC, must PROVIDE evidence to appropriate law enforcement or regulatory agencies.

7   COT Maintenance Specifications

7.1   The customer or their contracted vendor IS RESPONSIBLE for maintaining customer-owned equipment in good working order

7.2   The customer or their contracted vendor IS RESPONSIBLE for all firmware and security patching of customer-sited telemetry equipment

7.3   The customer or their contracted vendor has 30 days to repair or replace malfunctioning equipment. Security-related patching may be required in a shorter time-frame.

7.4   Gateway must have an encrypted interface for remote management to upgrade software/firmware, install security patches, and reboot device remotely.

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8   Cellular Signal Strength

8.1   To ensure PG&E is receiving quality data from the site, VERIFY the cellular signal strength is in the required range for the program.

8.2   IF the COT solution will be using a cellular connection to the internet,

THEN:

1.   PG&E REQUIRES that Reference Signal Received Quality (RSRQ) values be greater than -14 dB with corresponding Reference Signal Received Power (RSRP) values, as listed in Figure 3 below. (PG&E USES the Berkeley Varitronics Systems – Octopus Cellular Signal Meter Pro Kit to measure cellular signal strength.)

2.   DO NOT INSTALL anything less than RSRQ values of -14 dB.

a.   NOTE the negative signs and that greater than in relative terms means a smaller number.

If RSRQ (dB) is=	Then RSRP (dBm) must be:
≥ -9	≥ -105
-10	≥ -104
-11	≥ -103
-12	≥ -102
-13	≥ -91
-14	≥ -87
-15	NA - Do Not Install
-16	NA - Do Not Install
-17	NA - Do Not Install
-18	NA - Do Not Install
-19	NA - Do Not Install

**Figure 3. Cellular Signal Strength Requirements Using
Berkeley Varitronics Systems – Octopus Cellular Signal Meter Pro Kit**

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9   Frequently Asked Questions

9.1   What is the estimated cost of the new customer-owned telemetry solution?

Answers:

1.   Costs for customer-owned telemetry include the following:

- $4,000 for configuring the customer-owned gateway to the PG&E server

- Any costs that vendors charge for the procurement, installation, and support of the COT solution

2.   The goal of the system is to estimate utility-related costs for the new telemetry solution at less than $20k for ICs, including PG&E and vendor-related costs. This does not include recurring third-party telecom costs.

9.2   What is the best way to power the remote site gateway?

Answer:

1.   POWER the COT from the utility side of any breaker or disconnect device and not from the DER side. This avoids requiring permission to operate for the DER before configuring and testing the COT with PG&E's network.

END of Instructions

DEFINITIONS

Distribution-connected: Connected to PG&E's distribution system, which is the portion of PG&E's power system that is at voltage less than 60 kilovolt (kV).

Point of Common Coupling (PCC): The transfer point for electricity between the electrical conductors of Distribution Provider and the electrical conductors of Producer.

Remote Site Gateway (RSG): IEEE 2030.5 site gateway device that communicates telemetry data points to PG&E's IEEE 2030.5 server.

Utility-related costs: The Smart Inverter Working Group One Final Report defines utility-related costs as: "charges for metering equipment (meters, circuit transformers (CT) and potential transformers (PT)), communications/telemetry equipment (Remote Terminal Unit (RTU) and a modem), and charges for labor, taxes, and maintenance."

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IMPLEMENTATION RESPONSIBILITIES

The electric grid interconnection (EGI) manager for EGI retail is responsible for the front end processes.

The supervisor control and data acquisition (SCADA) operations supervisor for business applications is responsible for commissioning systems.

The integrated grid planning and innovation senior manager is responsible for overall system support.

The Applied Technology Services (ATS) grid technology engineering and evaluation team is responsible for evaluating new COT that are not included in the approved vendor list in Attachment 1.

GOVERNING DOCUMENT

NA

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

Records and Information Management:

Information or records generated by this procedure must be managed in accordance with the Enterprise Records and Information (ERIM) program policy, standards, and Enterprise Records Retention Schedule (ERRS). REFER to GOV-7101S, "Enterprise Records and Information Management Standard," and related standards. Management of records includes, but is not limited to:

- Integrity

- Storage

- Retention and Disposition

- Classification and Protection

REFERENCE DOCUMENTS

Developmental References:

NA

Supplemental References:

NA

Utility Procedure: TD-2306P-01

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APPENDICES

NA

ATTACHMENTS

[Attachment 1, "Approved Customer-Owned Telemetry Vendors"](#)

[Attachment 2, "PG&E IEEE 2030.5 LogEvent Descriptions"](#)

DOCUMENT RECISION

NA

DOCUMENT APPROVER

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REVISION NOTES

Where?	What Changed?
NA	This is a new utility procedure.

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