

PG&E's SmartMeter™ Program Reporting Highlights

A note about this document: Some terms used in the utility industry may differ from the words' standard context. For example, the word “quarantine” as used in this industry means something that is removed or withheld from service, which is not the same context as its common use.

- PG&E's SmartMeter™ program is not only one of the first advanced metering programs in the United States, it is also among the largest technology rollouts ever. It is a \$2.2 billion dollar capital program in which we are replacing a 100-year-old technology, represented in 10 million gas and electric meters across a highly varied statewide geography.
- The highly detailed work papers that we are releasing today span roughly four years and reflect several different stages of this program, including two independent work-streams—IT development and meter deployment. We and our vendors developed the programming to support meter deployment, and during meter deployment started to develop further programming. As a result, you may see discussions of IT issues that arose during deployment. Those IT issues were independent of our deployment efforts.
- These work papers reflect challenges that we experienced over the course of the project. In fact, these documents reflect virtually all issues we have faced over this period and their real time discussion. As such, there are numerous references to “issues,” “risks,” “defects” and “delays.” These are normal events in a project of this scale and we have worked diligently with our vendors for a solution that minimizes their effect on our customers. In fact, references to “risks” are only hypothetical events, items that PG&E proactively recognizes as potential issues and that it monitors to ensure they do not occur.
- Similarly, while you may see “quarantines” or “holds” on groups of meters, in which either our vendors or PG&E discovered a problem, that generally means that only a part of our supply chain may need additional review.
- In addition, these work papers discuss “alarms,” which are essentially self-diagnostics that the meters themselves provide to highlight internal issues within the equipment. These do not necessarily correspond to problems with the meter or bill but provide PG&E with substantial information to address issues before they affect customers.
- In the document that follows, we highlight “sample texts” that describe a sample of issues that PG&E encountered and addressed. Such sample texts or variations of them may appear multiple times throughout the monthly reports.

Issue:

Limited Failure of Silver Springs Network’s Network Interface Card (“NIC”) Capacitor Component

Location in CPUC Report:

Sample Text: “Silver Springs Networks determined that a component in the NIC was failing, causing the meters to cease operating.” (March 2010, page 5)

Context:

- In March 2010, Silver Springs Network alerted PG&E that a component called a “capacitor” on its “network interface card” or “NIC” had failed in some cases. Silver Springs reported that this was neither a meter-accuracy nor a safety issue, but that the failed capacitor caused a small number of meters to stop working altogether.
- A “network interface card” is a computer hardware component designed to allow computers to communicate over a computer network. A “capacitor” is an electric component on the NIC that stores energy.

Resolution:

- Although PG&E had ordered a significant number of General Electric and Landis + Gyr meters containing this NIC, PG&E had only days earlier begun deploying these meters to customers’ homes.
- Consequently, the Company only installed approximately 7,800 such meters, and has closely monitored these meters since. If any of these meters fails, it is replaced immediately.
- As for the remainder of the meters that PG&E purchased, PG&E put approximately 290,000 meters on “hold” until they can be repaired.

Deployment Status Update

	Budget (Budget / CPI)	2010 Forecast (2010 EAC / CPI)	Scope	Schedule	Resources	Issues	Risks
Deployment: (ITD)							
Deployment: YTD – February, 2010							
Endpoints (2010 YTD)							
Gas Network (2010 YTD)							
Electric Network (2010 YTD)							

Challenges

Costs & CPIs are direct workstream labor & related costs. Unit material costs not included.

Actions/Status

Deployment - Endpoint

- * Electric inventory (Single Phase)
- * Electric inventory (Polyphase) require a patch to fix a false alarm
- * TOU deployment temporarily deferred
- * Non-standard installations may impact deployment schedule

Electric Network

- * Alternate backhaul solutions are required

Deployment - Endpoint

- * SSN informed PG&E that [redacted] had experienced failures in one of its meter types. SSN determined that a component in the NIC was failing, causing the meters to cease operating. SSN isolated a non-functioning component – a capacitor on the NIC circuit board – as the cause of the failure. [redacted] SSN confirmed that there are no accuracy or safety issues associated with this NIC issue (i.e., the meter simply stops working). SSN verified that the capacitor issue is confined to a limited number of NIC production lots. PG&E has installed 7,800 meters that contain the type of NIC that is potentially impacted, but is confirming whether all 7,800 are in fact impacted.
- * PG&E initially had an additional 340,000 such meters in its inventory. The 340,000 potentially impacted meters that PG&E had in inventory were on hold pending SSN's completion of its analysis of each production lot. SSN, through its ongoing production lot analysis, has cleared 50,000 GE meters from "on hold" status. PG&E now has 290,000 meters "on hold" in inventory until further notice from SSN on the production lot status. This supply chain issue has resulted in the following:
 - * GE accelerated production of 50,000 new meters
 - * PG&E has taken other measures, including adjusting deployment areas and accelerating production by Landis + Gyr to minimize project impact
 - * Currently the project expects to miss target installations through April 2010 by up to 10%
- * Factory patched meters have been released for deployment
- * SM engineering is developing local patch process for approval
- * SSN is developing a schedule for over-the-air patch application process
- * TOU deployment strategies are pending estimate for IT effort; deployment is intended to resume July 2010
- * Phase 2 solutions development for 35 of 38 scenarios completion targeted for May and the remaining 3 scenarios will be completed by July 2010.
- * Deployment strategies completed for 60% of the Urban and 35% of the Suburban Offices.
- * Targeted deployment strategies for Richmond/Berkeley resulted in an ~35% reduction in UTCs to date from system averages. Initiated San Jose enhanced network design to address module to network communication challenges in basement meter locations.
- * Oakland and San Francisco strategy development on target for April and May respectively.

Electric Network

- * Plans to conduct a pilot test for a satellite backhaul solution being developed with SSN; completion targeted by June 2010

Issue:

A Number of Landis + Gyr Meters Have Experienced Data Storage Issues

Location in CPUC Report:

Sample text: "Landis + Gyr Focus meters with firmware version 5.33 require a patch"
(March 2010, page 10)

Context:

- In March 2010, Landis + Gyr notified PG&E that one of its meter-types, under certain circumstances, stopped retaining or transmitting the meter's otherwise-accurately-measured data.
- Landis + Gyr confirmed that there are no accuracy or safety issues associated with this issue.
- Not all of these meters exhibit the problem.
- Of the roughly 240,000 such meters that PG&E purchased, PG&E has deployed approximately 90,000, of which about 11,000 have exhibited this behavior.
- This issue results in an under-billing of impacted customers. PG&E will not seek to back-bill customers for these amounts.

Resolution:

- PG&E stopped deploying the meters.
- PG&E put the remaining approximately 150,000 meters on "hold" in our warehouse.
- PG&E repaired and redeployed 34,000 of the meters.
- The remaining 117,000 meters could not be repaired and were sent back to Landis + Gyr under warranty.

Issues Summary

#	Target Resolution Date	Issues	Impact	Owner	Status Summary
1	5/30/2010	SSN issued a temporary hold on electric supply chain due to a meter capacitor problem.	Endpoint deployment slow down, hold on electric meter inventory. Meter accuracy, data, or safety not impacted.	James Meadows	Approximately 290K meters remaining on hold in inventory, potential for excessive NIC card (capacitor) failure.
2	4/28/2010	Landis & Gyr Focus meters with firmware version 5.33 require a patch.	Hold on meter inventory until patch application process has been approved and certified.	James Meadows	These meters have been marked for return to vendor for firmware patch.
3					
4	6/1/2010	TCU deployment deferred to resolve meter connectivity and read recovery process issues.	Customer impact due to potential for estimated or delayed bills.	James Meadows	TCU deployment strategies to be finalized by 6/1/10.
5	5/31/2010	Increased resources and cost of activities related to litigation support, independent testing and CPUC responses.	Increased costs, delayed schedule and resource contention.	Colin McDonagh	SmartMeter team is reviewing cost estimates and impacts of new activities. New costs related to litigation support and independent testing activities will be reported against project Estimate at Complete (EAC) and contingency budgets.
6	6/30/2010	Need to improve timeliness on resolution of operational data collection performance issues.	Deployment and benefits realization delays, increased operational costs and potential negative customer impact.	William Devereaux	Issue resolution meetings with vendors and stakeholders are ongoing to address specific populations of meters that cannot be read consistently. Transitioned meters are being prioritized to minimize customer impact.

Issue:

PG&E Paid Performance Recognition Awards to Its Employees

Location in CPUC Report:

Sample text: Appears as a line item entitled “Performance Recognition” (line item appears in each monthly report throughout 2008, beginning in February)

Context:

- In late 2007, PG&E switched from its existing mainframe system to a more modular architecture. This transition is a key enabler of the benefits that SmartMeter™ is providing to customers.
- The Company transferred to this system to enable it to process the hourly and quarter-hourly interval data that its digital SmartMeters™ would generate – in contrast to the one read per month that PG&E meter readers historically collected from analog, electromechanical meters.
- PG&E’s SmartMeter™ group worked particularly hard on this very important project.
- During the last few months of 2007, a team of more than 330 employees worked virtually every night and weekend to develop this new platform that would enable our SmartMeter™ deployment.
- In recognition of their loyalty and hard work, to compensate them for the extra hours that they had worked, and to thank them for their considerable effort, the Company paid them bonuses – on average, less than \$2,600 per person.
- This is a customary practice in most companies.
- No officers received this bonus
- This IT upgrade enabled approximately \$5 million in annual savings related to ongoing IT cost efficiencies
- This issue does not relate to the accuracy or safety of our SmartMeters™.

Appendix – SmartMeter Contingency Reconciliation

SmartMeter Contingency Reconciliation	Total (\$000)
1. Business Case Approved Contingency	\$128,773
Total PDRs Adopted by Steering Committee	\$2,856
Remaining Contingency Balance	\$125,918

Workstream Budget Under Allocations (expect some offset by future project underruns)

CC&B Date Move 1	\$58,183
CC&B Date Move 2	\$22,300
Technology assessment	\$7,500
Non-retrofitable gas meters	\$3,315
SM 1 hardware parallel environment	\$2,997
Vendor termination fees	█
Performance recognition 2007	\$854
Use anchor reads to bill in CC&B	\$747
Labor Day OT Meter Reading	\$630
Manual review of customer bills	\$596
IVR Outage (Go Live)	\$573
TOU Deployment Deferrals	\$448
CC&B Memory Upgrade	\$416
Upgrade 4 servers from their current memory	\$386
PG&E failed to order from tendor	█
SmartTrack system	\$150
MBCDW architectural review	\$126
Vendor technical support for ongoing testing	\$115
Other	\$616
Subtotal PDRs	\$102,508
Total PDRs	\$105,364

Issue:

PG&E Experienced Higher IT Costs at the Start of the Program

Location in CPUC Report:

Sample text: “Cost overruns may be up to \$166 million (beyond CPUC authorization) for IT and substation installations” (December 2007, page 3)

Context:

- PG&E’s SmartMeter™ launch necessitated considerable IT work in the early years of the program.
- Moving from a nearly 100 year old technology to a modernized, digital system represents a considerable IT challenge.
- Indeed, this program required a tremendous IT commitment to enable actual meter deployment.
- As a result, you will see in the early monthly reports that we initially exceeded our IT budget by roughly \$166 million. However, we have made up those costs through other savings and efficiencies in the project.

Resolution:

- To a certain degree, however, we anticipated this. In the business case that PG&E submitted to the CPUC, the Company submitted a contingency amount that anticipated a strong possibility for IT overruns.
- That contingency, which was roughly \$129 million, was to cover several possible costs, but primarily IT.
- Today, PG&E’s SmartMeter™ program is on budget. From month to month in any particular report, there may be budget overruns and shortfalls for a variety of reasons, including unanticipated IT costs, but they generally offset against savings from added efficiencies.
- This issue does not relate to the accuracy or safety of our SmartMeters™.



SmartMeter™ Overall Release

Overall	EAC	Costs	Benefits	Scope	Schedule	Resources	Issues	Risks	Org Ready	Perf Metr
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Key Achievements

- First SmartMeter sourced bills to be printed 12/10/07.
- As of Thursday, 12/06/07, installed 247,666 meters, 42 substations, and 457 Data Collection Units. EOY projection: 264,000 meters.
- Benefits realization now at \$830,000, with at least 20,000 activated meters anticipated in December

Challenges (key focus areas)

EAC:
 Cost overruns may be up to \$166 million (beyond CPUC authorization) for IT and substation installations
 Offsets:
 1) Actual endpoint installation cost efficiencies - \$35 million
 2) Potential use of RF network in certain areas - \$90 million

Scope:
 1) SmartRate billing release (April 08) scope to be finalized.
 2) SmartMeter™ Upgrade project technology undetermined.

Schedule:
 1) Five meter deployment functions undelivered.
 2) Other System Deliverables for benefits realization remained unscheduled

Risks:
 1) Unsecured DCU attachment rights.
 2) Risk of production billing not working

Org Readiness:
 1) Final look and feel of System Deliverables for mass meter deployment remain unknown.

Actions

EAC:
 1) Continue pilots test of advanced radio frequency Hex-Electric networks for electric network
 2) The Project projects to ultimately draw \$41M of contingency funding

Scope:
 1) Active with CC&B scope prioritization effort to find release dates for further SmartMeter™ releases
 2) Upgrade technology being testing; selection expected in 1st quarter, 2008

Schedule:
 1) Deployment functions to be delivered by end of December 2007.

Risks:
 1) DCU site acquisition task force includes new strategy for payments, new pole permits
 2) Bills all hand reviewed; sustain minimum number of SM billed accts for a stabilization period of 90 days

Org Readiness:
 1) Request UAT for specific new processes

Issue:

In Some Cases, SmartMeter™ Devices Interfered With Customers' GFI Circuit Breakers

Location in CPUC Report:

Sample text: "Pilot test to identify common causes for interference revealed multiple causes." (May 2009, page 9)

Context:

- PG&E has seen instances where the Silver Spring Networks Electric SmartMeter™ device can interfere with certain types of GFI (ground fault interrupter) circuit breakers in meter panels adjacent to the meters.
- The interference causes the circuit breaker to trip, causing a partial interruption in power to the customer's premise.
- This was first observed by Modesto Irrigation District in its smart meter deployment and generally is indicative of meter panels that do not meet UL standards.
- This issue does not relate to the accuracy or safety of our SmartMeters™.

Resolution:

- PG&E began working with SSN to develop a solution to enable meter-installation despite such proximity between the meter and the panel.
- During this time, our installers bypassed 21,600 customer premises with this proximity issue to avoid any interruption in service.
- We now have developed a solution for this concern, and will resume SmartMeter™ deployment to these 21,600 customer premises.

#	Target Resolution Date	Issues	Impact	Owner	Status Summary
1	6/30/2009	GFI problems identified with SSN meters.	Cost and schedule impact due to skipped meter installs (~12000 skipped between 3/31-5/20). Customer impact: once an SSN meter is installed, the GFI is tripping in the customer's breaker panel.	Dan Partridge	Pilot test to identify common causes for interference revealed multiple causes. A possible solution is use of a lower watt meter when certain panel configurations exist identified. A field pilot test underway to verify if 1) a lower power radio eliminates false equipment operation, and 2) network performance is acceptable when some low power meters are interspersed with normal power meters. Field process providing guidance on identification and skipping of meters with GFI problem issues to minimize schedule and productivity impact.
2	TBD	MDM usage estimation due to inability to recognize outage.	Negative customer impact due to estimated usage being posted to CWP. No impact to billing.	Christopher Vana	Service Request on non-estimation of data gaps during power outages is under review. Discussions on a long term solution are in progress with vendors.
3	5/31/2009	Poor read performance (< expected 96%) on 1-10-09 of the installed Aclara electric meters.	Ability to turn on and read Aclara electric meters.	Vic Gorden	Per SmartMeter Senior Management decision to stand down further deployment of Aclara electric technology, enhancements or modifications to the Aclara electric technology to resolve performance issues are not being actively pursued. Aclara electric meters are expected to be replaced by April '10 per Rev. 10 deployment schedule. During the period when F5/E continues to operate the system, Aclara enhancements or modifications may be considered on a case by case basis, and may be implemented per PG&E's discretion. Project is considering firmware update to improve performance on installed Aclara electric meters. Pilot to test firmware on a small number of meters is underway.

Issue:

PG&E Ceased Sending Customer Letters in 2007 Before Resuming in 2009

Location in CPUC Report:

Sample text: “The requirement of sending letters to customers in advance of impending installs is cancelled, however door-hangers must continue to be installed at each visit.” (May 2007, page 11)

Context:

- PG&E made this decision at the start of SmartMeter™ device installation, at which time approximately 200,000 devices had been installed
- At that time, the company had received no customer inquiries or complaints.

Resolution:

- After PG&E experienced customer service issues in the Summer of 2009, the company substantially modified its customer-facing communications processes including, but not limited to:
 - A detailed welcome kit;
 - Community meetings prior to implementation;
 - Establishment of Answer Centers in areas including Bakersfield, Fresno and Oakland.
- This issue does not relate to the accuracy or safety of our SmartMeters™.

Decisions

- 1) The requirement of sending letters to customers in advance of impending installs is cancelled, however door-hangers must continue to be used after each visit.
- 2) The SM 1.0 release Go Live date is moved from 5/28 to 9/4.
- 3) Additional funding to IT/CC&B with budget transfer amount of \$21.9 million associated with new release date of 9/4.
- 4) Additional funding to Deployment with budget transfer amount of \$0.4 million associated with new release date of 9/4.
- 5) Additional funding to IT/CC&B with budget transfer amount of \$52.5 million currently in over/under allocation category.
- 6) Additional funding to PMO with budget transfer amount of \$4.7 million currently in over/under allocation category.
- 7) Staffing requests for five positions shown in Appendix.

Issue

PG&E's Steering Committee Reports Reflect Periodic Project Delays and Issues Encountered While Developing and Rolling Out the Underlying SmartMeter™ Information Technology Capabilities

Location in CPUC Report:

Sample Text: "Delay in project completion due to revisions in test plans and approach; requires contingency draw" (October 2009, page 4)

Context:

- The IT-development work associated with the implementation of advanced AMI capabilities on the scale that PG&E has undertaken – 10 million meters – is unprecedented in the industry.
- Implementing this technology on such a massive scale necessitated addition of operational systems to receive, manage, process and analyze the enormous volume of data that SmartMeter™ devices provide.
- To put this in perspective, these advanced meters provide hourly- and quarter-hourly interval data, whereas we read our traditional electromechanical meters just twice monthly.
- This systems-development work makes this data available to customers via the Internet, enables its use in billing to permit time-based pricing, and facilitates the improvement of the reliability and efficiency of the electric grid.
- Through the course of this project work, PG&E partnered with such key vendors as Oracle, Ecologic Analytics, SSN, and Aclara to design, develop, test and deploy these advanced capabilities.
- The reports represent the SmartMeter Steering Committee's real-time discussions, as reflected in these detailed work papers, regarding the issues that the Company encountered and overcame throughout the development of these systems.
- The systems had to meet high quality and reliability standards before deployment. Rigorous testing plans were developed and continuously enhanced. Like any major IT-initiative in any industry, we closely monitored the progress of these initiatives, and adjusted plans and schedules as appropriate in order to ensure system-deployment with a high level of quality and reliability.
- Through the hard-work and dedication of PG&E employees and technology partners, these issues have consistently been overcome, enabling the current and future delivery of the smart grid's benefits to our customers.

2009 Release Status Update

	Funded Budget	EAC / YTD	Scope	Schedule	Resources	Issues	Risks
IT Releases (ITD)							
Release I - Plan/Analyze							
Release J - Plan/Analyze							
Release O - Plan/Analyze							
Release X - Plan/Analyze							
2009 Other Cap. Projs. (IT PMO, 08 carry over, SM Apps, DC)							
2009 Operating expenses (CC&B, Stabilization)							

Challenges

Actions/Status

<p><u>Release I</u></p> <ul style="list-style-type: none"> Initial target for Plan/Analyze completion by 12/15/09 to meet June 2010 at risk due to pending scope finalization and resource allocation <p><u>Release X</u></p> <ul style="list-style-type: none"> Delay in project completion due to revisions in test plans and approach; requires contingency draw UIQ 3.9 test confirmed scalability to 2M SIM meter population, test for 3M meter population failed (3.9 certified for 2M meter scalability). UIQ 4.1 will need to be deployed by Q1-2010 to allow system scalability to 3M meters. <p><u>Overall</u></p> <ul style="list-style-type: none"> EA vendor delivery dependencies exist for all IT releases. HAN operating model and finalization of initial HAN pilot scope being finalized. 	<p><u>Release I</u></p> <ul style="list-style-type: none"> Scope walk-through sessions and resource allocations are progressing <p><u>Release J</u></p> <ul style="list-style-type: none"> Scope defined; budget submitted for approval <p><u>Release O</u></p> <ul style="list-style-type: none"> Verbal approval from SMEs received for Recommendations and Roadmap. RFA for Plan/Analyze to be updated by 10/9/09 for PMO review. <p><u>Release X</u></p> <ul style="list-style-type: none"> PCR identifying revised approach, remedial actions, schedule and cost impact (contingency draw) completed. Completion forecasted to 11/20/09 (best case) or 12/31/09 (worst case) against initial target of 11/2/09 Project projecting to reach 3M meter deployment threshold in Q1-2010. UIQ 4.1 release meeting project scalability targets available in Nov-09. Plans to test and deploy UIQ 4.1 by Q1-2010 to be developed. <p><u>Future Releases</u></p> <ul style="list-style-type: none"> Creating integrated SM Upgrade and future release plan by 8/31/09. <ul style="list-style-type: none"> Add Upgrade scope.
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Issue:

PG&E Experienced Communication Difficulties With Its Earlier-Generation Electric SmartMeter Technologies: DCSI and Aclara Electric.

Location in CPUC Report:

“Poor read performance (< expected 96%) on ~ 13,674 of the installed Aclara electric meters.” (May 2009, page 9)

“High defects relating to DCSI code in TNG 1.6.” (September 2007, page 6)

Context:

- PG&E found that its earlier-generation electric SmartMeter™ technologies, both DCSI and Aclara Electric (also known as Hexagram Electric) did not communicate at the high level that we expected.
- For example, our reports reflect “Poor read performance (< expected 96%) on ~ 13,674 of the installed Aclara electric meters.” This read performance is lower than the 99+% read rates that we have experienced with our current technology: Silver Springs Network.
- While Aclara Electric’s technology provided adequate performance for basic functionality, PG&E discontinued the use of the Aclara Electric technologies and began phasing it out in 2009.
- Moreover, DCSI’s initial technology, called power-line carrier (“PLC”), which we selected based on available market technologies in 2005, was in practice more expensive than we initially believed and was not going to be able to provide the advanced functionality that later technologies were able to provide.
- The initial AMI order anticipated this likelihood, requiring PG&E to monitor for such advancement in AMI technologies and evaluate transitioning to those technologies (“referred to as “Technology Monitoring” in the AMI Order). PG&E did exactly that, leading it to propose an upgrade to the new Silver Springs network technology.
- With the approval of PG&E’s upgrade-proposal, PG&E began to transition to the SSN-based technology presently in place – which is meeting the expectations of advanced AMI capabilities and represent a significant improvement over the previous technologies.

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Issues Dashboard

Issues are categorized as CRITICAL and HIGH by the following definitions:

Critical: Major threat to success (as measured against balance of quality, schedule, and budget).

High: Significant disruption to successful delivery of objectives, products, and benefits.

Critical and High Impact Issues

Project/Release	Request No.	Priority	Description:	Request Status:	Created On:	Committed Resolution Date:	Date Issue Resolved:
Smart Meter Project 1.0	32401	High	High Defects relating to DCSI code in TNG 1.6	Assign	June 12, 2007	September 14, 2007	
Smart Meter Project 1.0	33170	High	Analysis and development of the potential fixes for the SM Data Conversion meter install date issue (Defect 2202) will not allow enough time for IT Ops and AMS Operations to fully practice operating	In Progress	September 6, 2007	October 7, 2008	
Smart Meter Project 1.0	31934	High	Agreement with Southern California Edison for Streetlight & Poles in Area 4	Ready for Review	May 24, 2007	December 31, 2007	

Comments:

Confidential – Submitted Pursuant to
 PU Code Section 583

Data Source: PPMC Tool 08/17/07
 Data: / Reporter: Bob Fredianelli / Norm Sweeney
 Frequency of Update: Weekly

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