AMI Project Overview

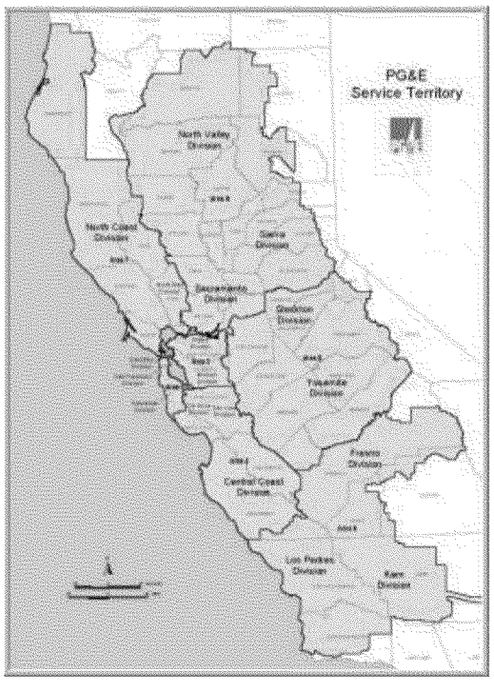
Redacted

Manager of Engineering, SmartMeter™ Program
Pacific Gas and Electric Company

California Energy Leadership

- **3 major Investor Owned Utilities (IOUs)**
  - Privately held companies
  - Regulated by California Public Utilities Commission (CPUC) and the Federal Energy Regulatory Commission (FERC)
- **De - coupling**
  - Company earnings de-coupled from revenue
- **Progressive state energy policy**
  - Energy efficiency
  - Loading order
  - Global Warming Solutions Act (AB32)

Pacific Gas and Electric Company



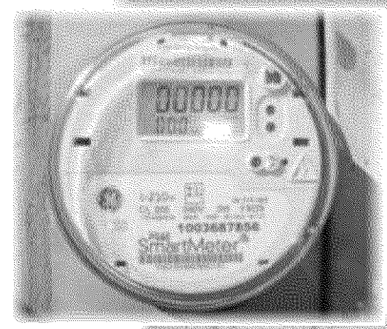
- Energy services to 15 MM people:
  - 5.1 MM Electric customer accounts
  - 4.3 MM Natural Gas accounts
- 70,000 square miles with diverse topography
- 20,000 employees
- A regulated investor-owned utility

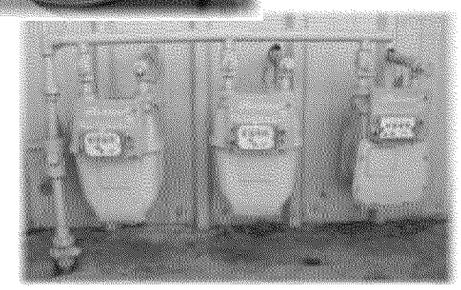
Newsweek GREEN RANKINGS 2009

Ranked the greenest utility in the United States

SmartMeter™ Program: Largest AMI Deployment In North America

- Automated meter reading for all gas and electric customers
  - Over 4 million advanced meters installed
- Frequent meter reads
  - Hourly intervals for electricity
  - Daily intervals for gas
- Two-way communication with utility
- Gateway for near real-time communication into the customer premise





SmartMeter Program Benefits

Customer Service

Provide our customers more convenience and better, faster service

- **Convenient meter reading**
- **Faster power restoration**
- **Remote connect / disconnect**
- **Faster problem resolution**
- **Better billing**

Choice and Control

Provide our customers greater choice and more control over their energy bills

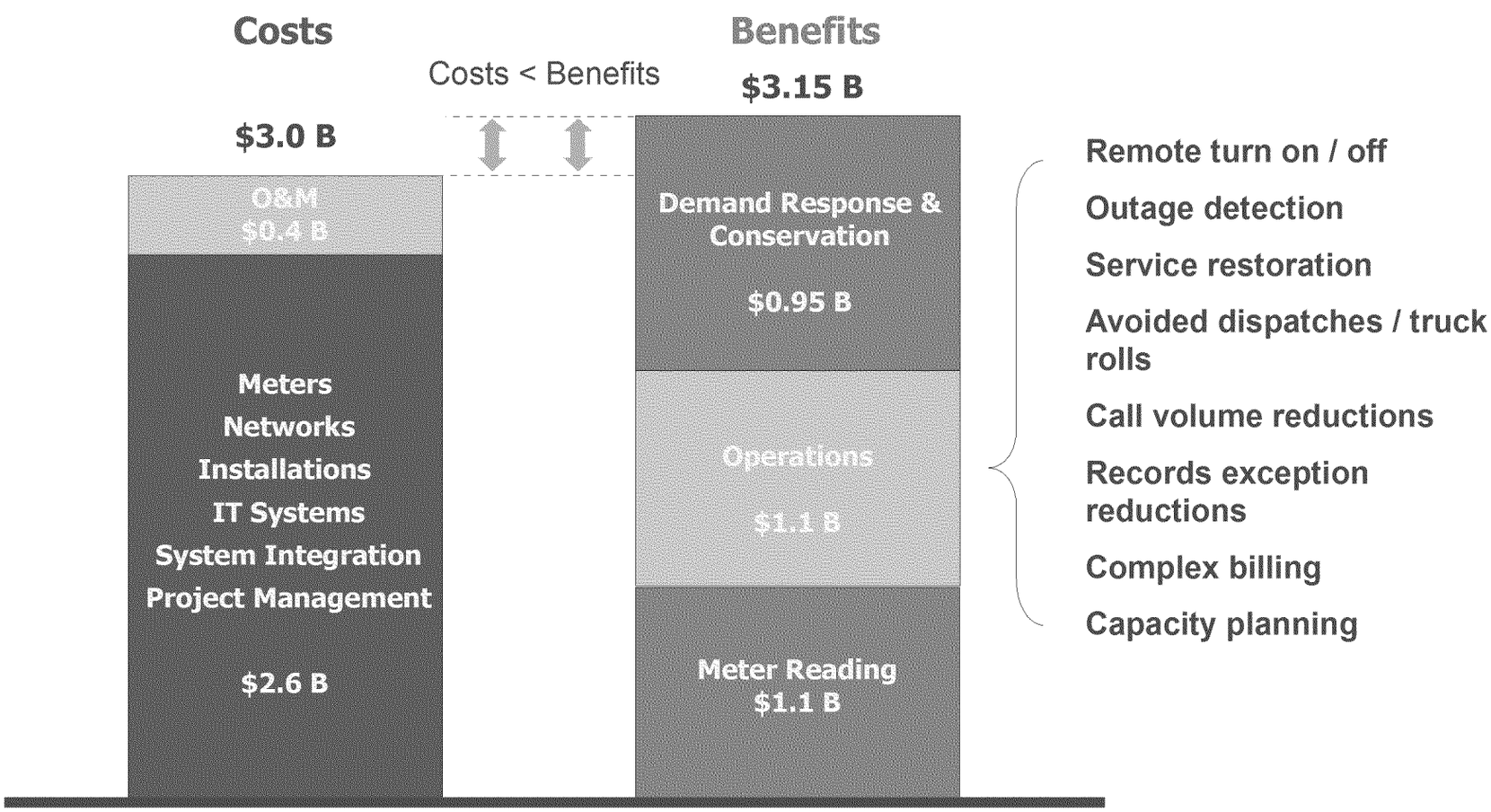
- **Energy usage data**
- **New time-differentiated electric pricing plans**

Enable the Future

Put in place a platform for future innovation

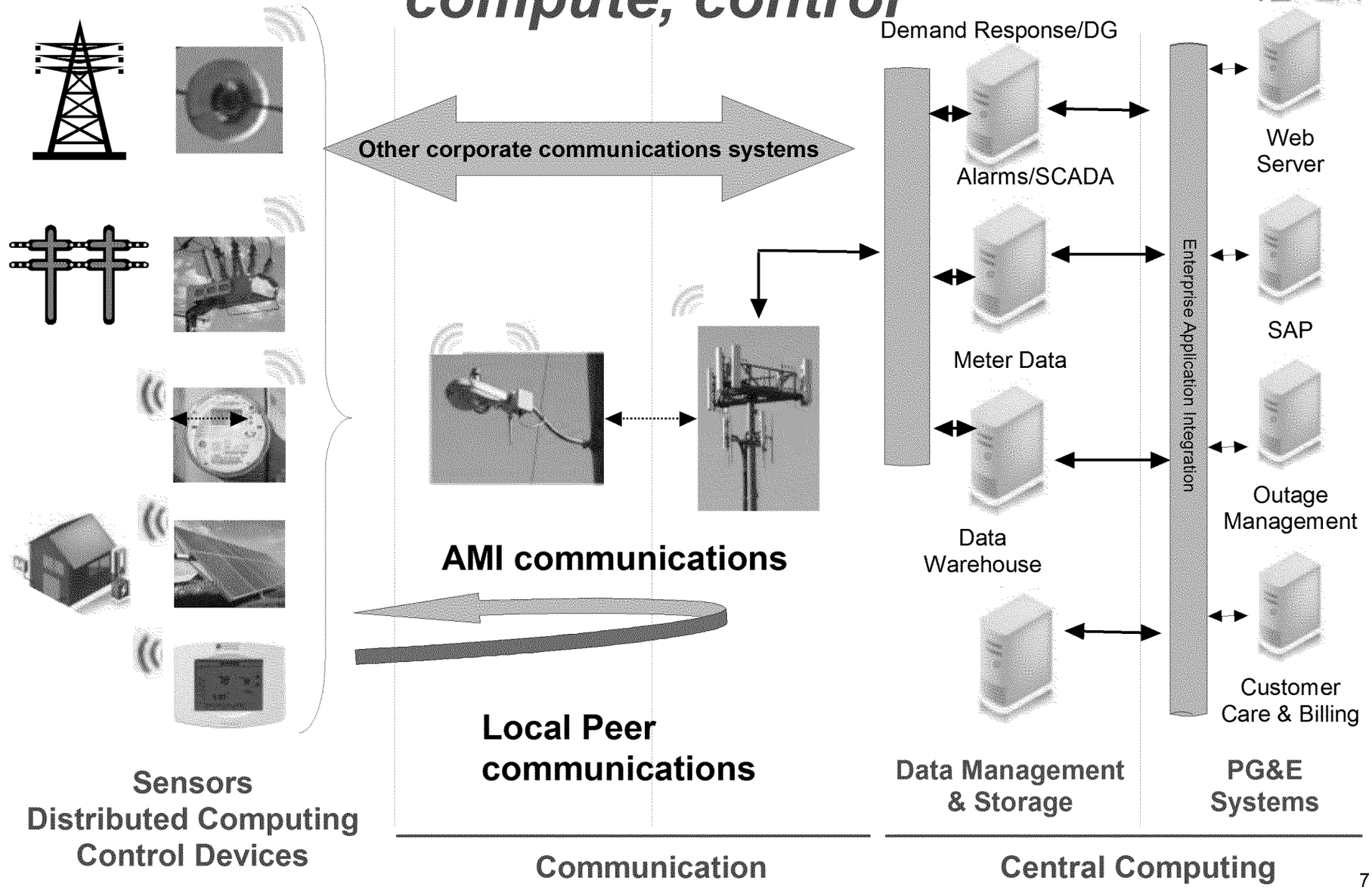
- **Customer energy management / automation**
- **Distributed generation / storage**
- **Electric vehicles**

SmartMeter Program Pays For Itself



The **SmartMeter** program has a **positive business case**: Projected benefits exceed projected costs over a 20 year program life

Smart Grid = *sense, communicate, compute, control*



SmartMeter Technology

MDM	Ecologic Analytics
Electric meter network provider	Silver Spring Networks
Gas meter network provider	Aclara Networks
Meter equipment vendors	Landis + Gyr; GE
Contract Installer	Wellington Energy
System Integrator- AMI	IBM
System Integrator – CIS	Accenture
Consultant – PMO	Veregy Consulting

SmartMeter Timeline

2005: 5000 Meter Pilot

2006: Full Deployment Launch

2007: Technology change

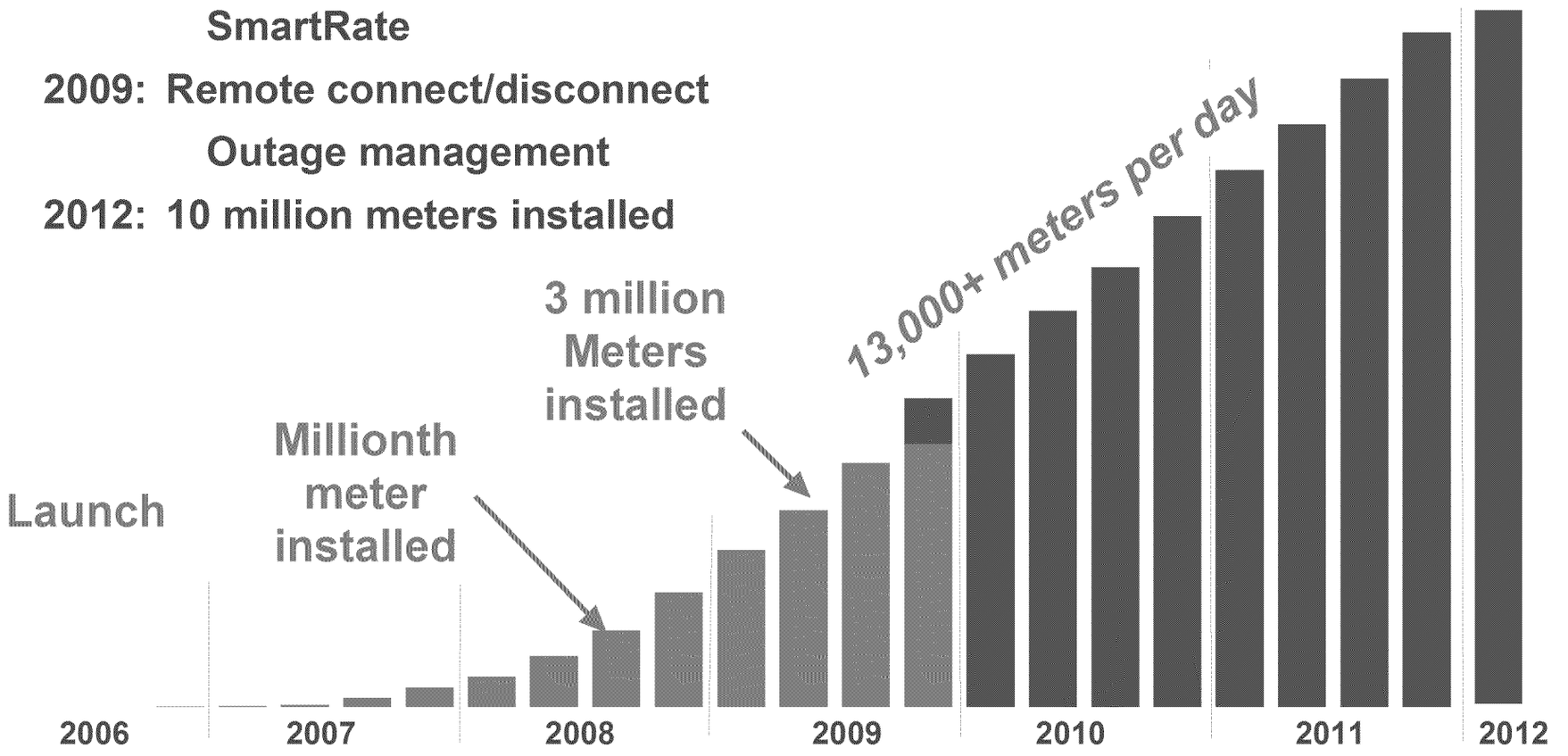
2008: Customer Online access to usage data

SmartRate

2009: Remote connect/disconnect

Outage management

2012: 10 million meters installed

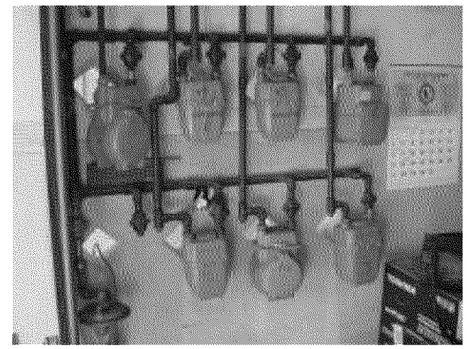


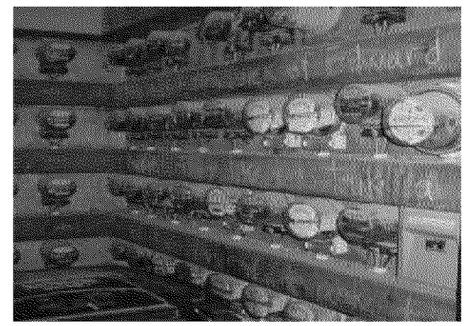
Massive Scale Of Deployment

- Two Meter factories with process including
  - Manufacturing
  - Quality Sampling
  - Returned meter analysis
- 1,500 truck loads of meters
- 10 “cross-docks”
  - Both new and removed meter processing
- 450 meter installers – deploying 14,000 meters per day
- Also
  - Journeyman and utility meter technicians
  - 70,000 Square miles of network installation

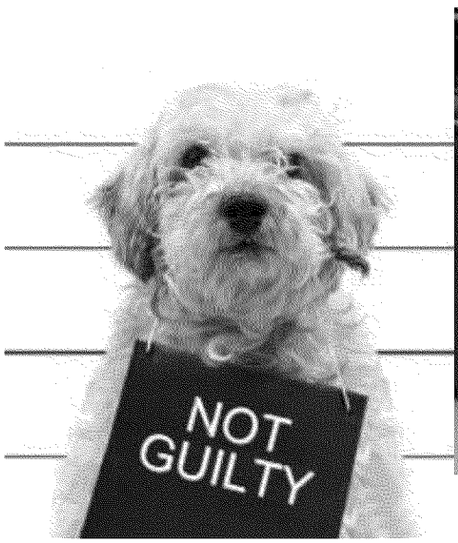
Real World Deployment Challenges

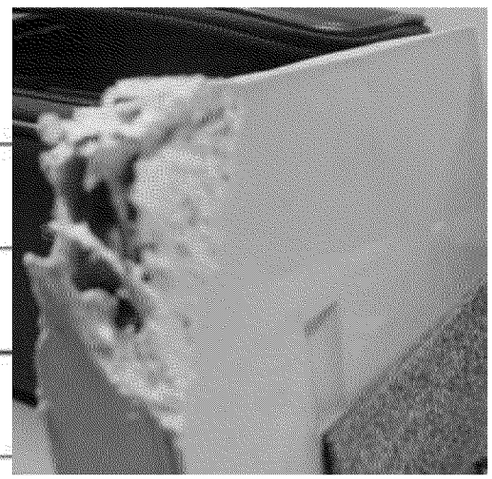
- Meter Issues
- Tracking Progress
- Deployment Coordination
- 24 Hour Clock
- Technology Evolution
- Program Benefits Optimization
- Customer Concerns



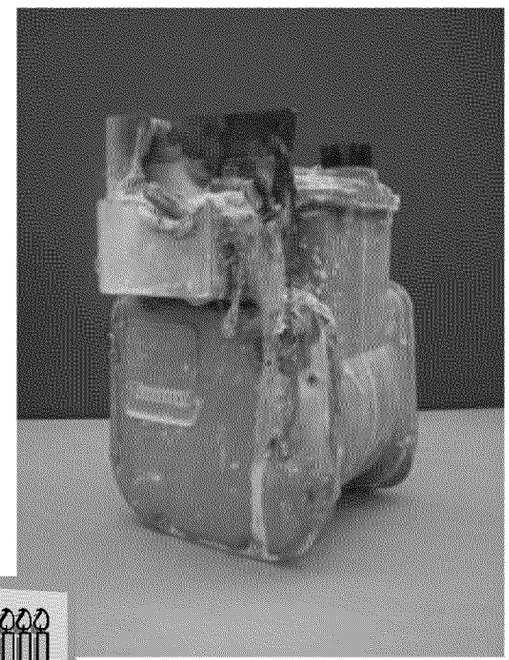


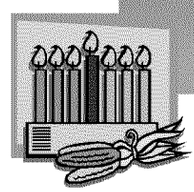
Reality





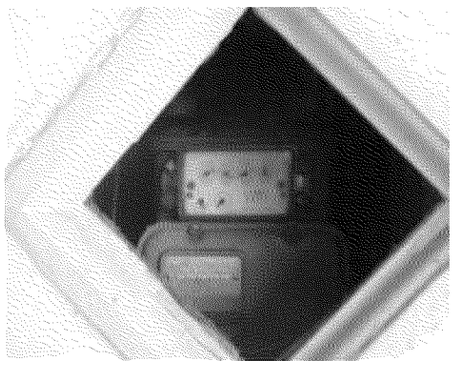
10 M meters = 500K dogs = 50k dogs that like plastic

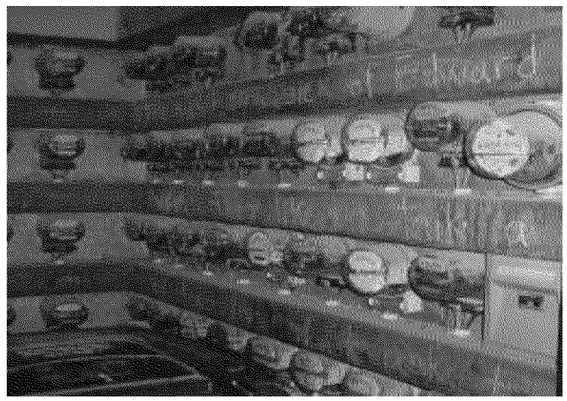


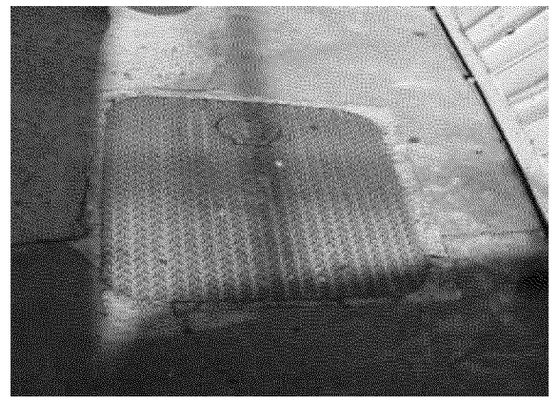


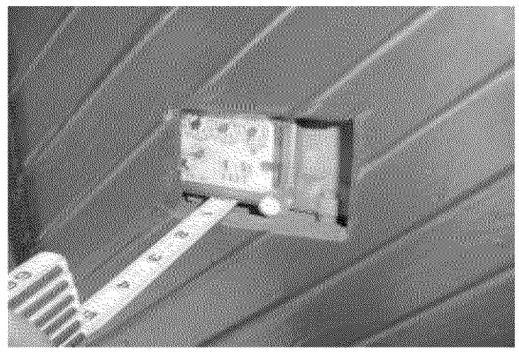
Used as candle holder

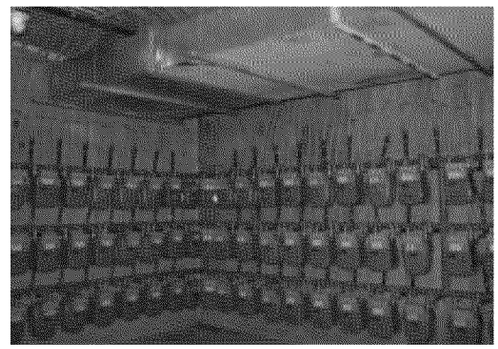
Challenge: Meter Issues











Meter Location Problem Project

- Identify problem meter locations that require non-standard deployment strategies
  - Customer Access
  - Space Limitations
  - Customer Overbuild
  - Meter Communication Conditions
- Develop
  - Engineering solutions
  - Unique deployment strategies
  - Resource plans and cost estimates

Challenge: Tracking Progress

AMI DAILY METRIC REPORT — **Report as of: December 31, 2009**

	SmartMeter Installed Records									UTC Activity		
	Installation Activity *1)*		FAS Activity *2)*		Total Installations							
	Gas	Electric	Gas	Electric	Gas	Electric	Total	Electric Network*	DCUs**	Wellington Reported to PG&E	UTCs Completed	UTCs Pending
Thursday **12/31/09**	4,577	7,647	390	317	4,967	7,964	12,931	68	-	691	303	
Retrofits		1,006		2		1,008	1,008					
Daily (inc. Retrofits)	4,577	8,653	390	319	4,967	8,972	**13,939**					
Total through 2008	1,160,984	355,048	132,526	20,735	1,293,510	375,783	1,669,293	791	1,800	103,796	69,191	
Total 2009	863,124	1,649,205	153,152	60,724	1,016,276	1,709,929	2,726,205	3,912	1,832	118,334	86,060	
Total to Date	2,024,108	2,004,253	285,678	81,459	2,309,786	2,085,712	**4,395,498**	4,703	3,632	222,130	155,251	66,879
Retrofits (post 5/31)*		188,604		934		189,538	189,538					
Total (inc. Retrofits)	2,024,108	2,192,857	285,678	82,393	2,309,786	2,275,250	**4,585,036**					

** Access Points & Relays (50 SCE installed through Dec-07)*

*** Vacaville SAT DCUs (11) now included in production count.*

1) FEX Installations *2) FAS Installations* *(Vacaville SAT meters inc. in above totals)*

** Post 5/31 retrofits count toward total SM installs count and goals, (30,633 total retrofits were done prior to 5/31/09).*

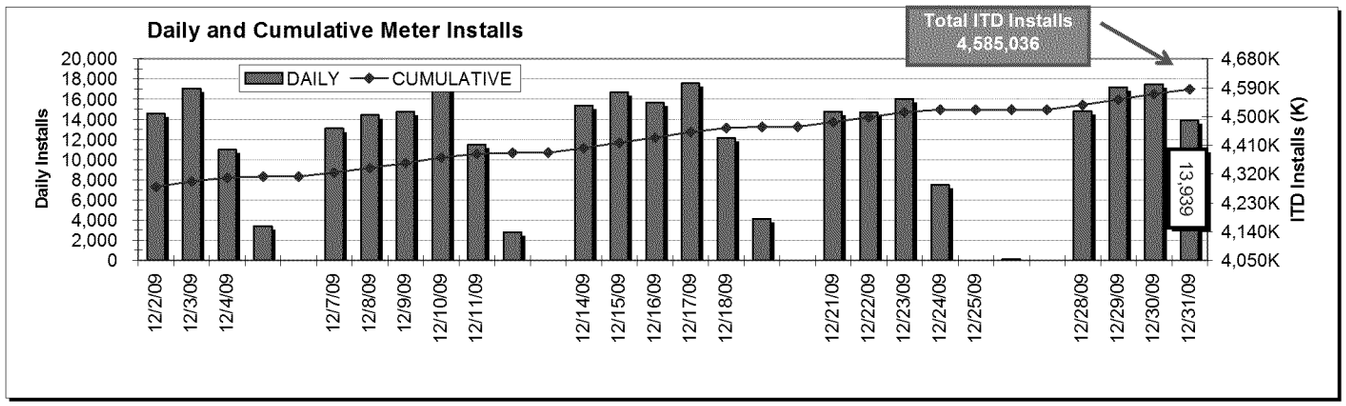
Endpoints						2009:	Actuals	Plan	Over/(Under) Plan			
2009 Summary	863,124	1,649,205	153,152	60,724	1,016,276	1,709,929	**2,915,743**	**2,800,000**	115,743	118,334	86,060	32,274
						Rev. 10	**2,915,743**	**2,800,000**	115,743			

Activated Meters	Gas	Electric	Total
2007	24,281	53,904	**78,185**
2008	576,739	129,316	**706,055**
2009	936,695	967,044	**1,903,739**
Total	**1,537,715**	**1,150,264**	**2,687,979**

Read Meters	Gas	Electric	Total
2007	50,194	101,948	**152,142**
2008	1,123,993	222,236	**1,346,229**
2009	865,358	1,390,254	**2,255,612**
Total	**2,039,545**	**1,714,438**	**3,753,983**

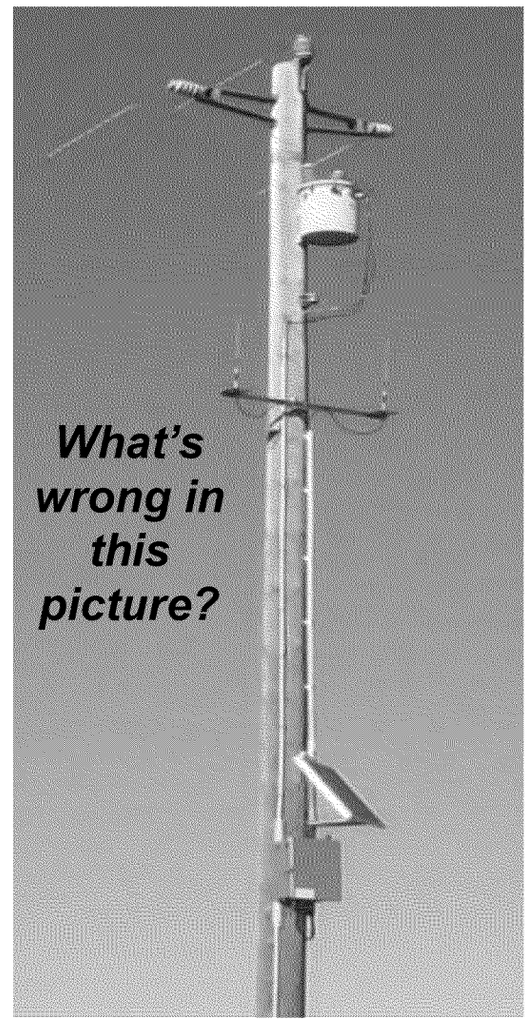
SmartRate Enrolled *(net)*

	Res	Com
2008	8,751	187
2009	17,696	(12)
Total	**26,447**	**175**



Challenge: Deployment Coordination

- Aligning deployment, operations, and engineering goals
  - Use company facilities
  - Use best RF locations
  - Use most reliable power sources
- Inaccurate pole asset data, construction rules interpretation
- Optimizing for crew management versus RF build out
- Legacy field systems



Challenge: 24 Hour Clock

- Data moves between key systems daily including
  - Shipper file
  - “full Pop” meters to install lists
  - Install file
  - Field remove
- A meter may take days before it can be “seen”
- Timing can create errors or delay trouble analysis

Challenge: Technology evolution

2006

***SmartMeter* Program**

AMR – meters, communication network, head-end system

Meter data management system (MDMS)

System integration / project management

Demand response

Installation services

2009

***SmartMeter* Program Upgrade**

Home Area Network gateway

100% remote connect / disconnect

More endpoint intelligence, processing and storage

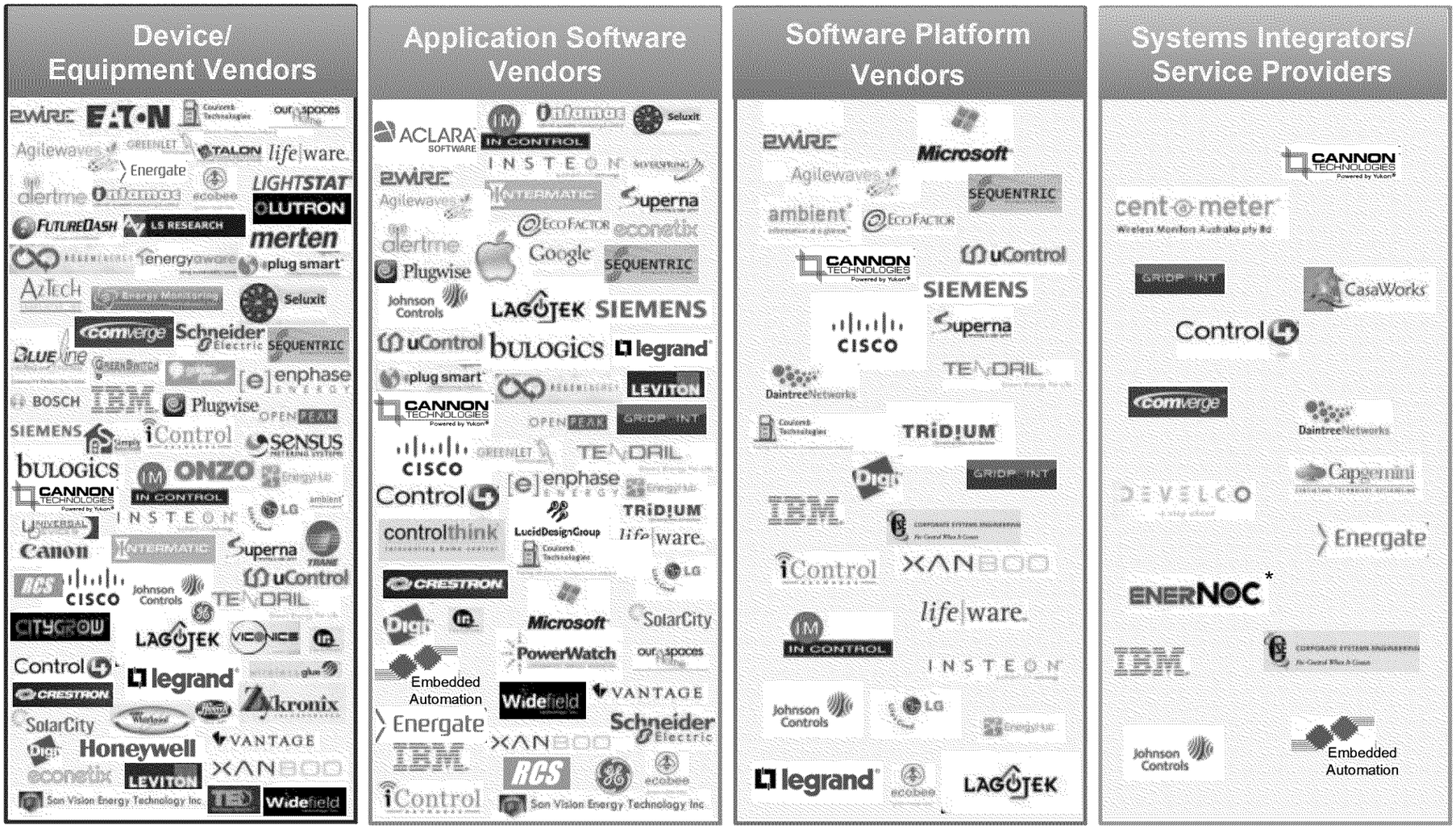
Remote upgradability

High speed, high bandwidth IP based on two-way RF mesh communications technology

Higher security level

Open standards

The Rapidly Evolving HAN Ecosystem



Challenge: Optimize *SmartMeter* Operational Benefits

Benefits (reduced cost for…)	Annual Value	Percent
Meter Reading	$105M	62%
Avoided Field Dispatch	$26M	15%
Billing and Call Center Operations	$21M	12%
Distribution Infrastructure & Operations	$11M	7%
Outage Management	$7M	4%

Four Strategies Accelerate Benefits Realization

Strategy 1: Tailor deployment to mesh technology

Strategy 2: Restructure meter reading routes in real time

Strategy 3: Use automated data to provide QA of each installation

Strategy 4: Take an integrated approach to complete hard-to-access meter locations

PG&E Employs All the Above!

Challenge: Customer Concerns

- So far minimal complaints about installers
- Broken gates on site damaged is settled at time of installation if possible
- ***Hot days and high bills focus attention on smart meters***
- Some complaints track discussion in media
- Customer notification generates installation complaints even when a meter has not been installed

Customer Concerns

Concerns about:

- Health effects
- Data privacy
- Government Intrusion
- Interference with home equipment

A New Paradigm For Energy

Electricity = a ubiquitous commodity	Electricity = a precious resource
■ Flat, tiered electric pricing	■ Dynamic, time-differentiated pricing
■ Limited or no visibility to specific cost of electricity use	■ Full visibility to cost of electricity use
■ Low energy awareness	■ High energy awareness
■ Limited energy management options	■ Robust energy management options
Utility = Service Provider **Consumer = Limited Awareness**	**Utility = Energy Partner** **Consumer = Active Participant**

At PG&E,
We Are Committed To Sustainability