Smart Grid: Key Considerations

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Agenda

- Consumer Engagement with the Smart Grid
- Architecture, Interoperability and Standards
- Security

Observation: Consumer Engagement Is Now “Table Stakes”

“We thought we were undertaking an infrastructure project but it turned out to be a customer project.”

Chris Johns, President, PG&E

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Time To Customer Engagement With AMI Shrinking

PG&E SmartMeter

2006

AMI Deployment Begins
- 1st Major AMI Deployment

2009

- Smart Meter Upgrade (with HAN)

2010

Customer Engagement Begins
- Customer interval data available on PG&E web portal
- Launched SmartRate Pricing Program

Time from initial deployment to customer engagement ~3+ years

BG&E Smart Grid Initiative

2010

- Project approved by Maryland Public Service Commission
- Customer communication to begin before technology deployment

2011

AMI Deployment Begins

Customer Engagement Begins
- Deployment of energy management technologies (portal with AMI data, IHD)

Customer engagement technologies deployed alongside AMI

Recent Commission Scrutiny (BG&E, HECO) is Prudent, but …
Adoption Curve Has Been Both Traditional and Expected

Consumer Education Case Study: PG&E

Overview: Many lessons learned during first phase of PG&E deployment, including

- Poor timing/location of initial deployment (Central California, mid-summer, rate hike)
- Lack of customer education/awareness
- Limited advertising

Results: Increasing awareness of the Smart Grid and its benefits through:

- Newspaper editorials
- Senate hearings and Editorial board meetings
- Press conferences
- Advertisement development
- 2009 EEI demo


San Francisco Chronicle

Smart Grid Technology Can Address Climate Change

Over the past 35 years, California's groundbreaking e... policies have saved ratepayers $56 b... need to build doz...

Pacific Gas and Electric Company®

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Consumer Education Case Study: AEP

Overview: AEP's gridSMART pilot program helps engage consumers on the benefits of the Smart Grid and shows its value.

energy economy environment
Sustainability at American Electric Power

Results:

- Pilot program offered potential to publicize results
- Customer video increased internal and external program visibility
- Mobile demo unit provided 1:1 customer education opportunities
- gridSMART program boosted employee and customer awareness
- Press conference with Secretary Chu to announce win of Demo City Grant

AEP AMERICAN ELECTRIC POWER

gridSMART™

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Consumer Education Case Study: OGE

Overview: OGE's pilot program for engaging consumers on the benefits of the Smart Grid helped show immediate consumer value and foster support among OGE customers.

Results:

- Project video increased internal and external visibility
- State fair participation boosted customer awareness
- Positive Energy Together site boosted employee and customer awareness
- Community outreach programs helped build groundswell of support
- Protective communications programs responded in a timely fashion to negative press

OG&E

POSITIVE ENERGY TOGETHER

Early results
- 16-20% peak reduction
- 4-5% overall reduction
- Most consumers save $
- Low income results better

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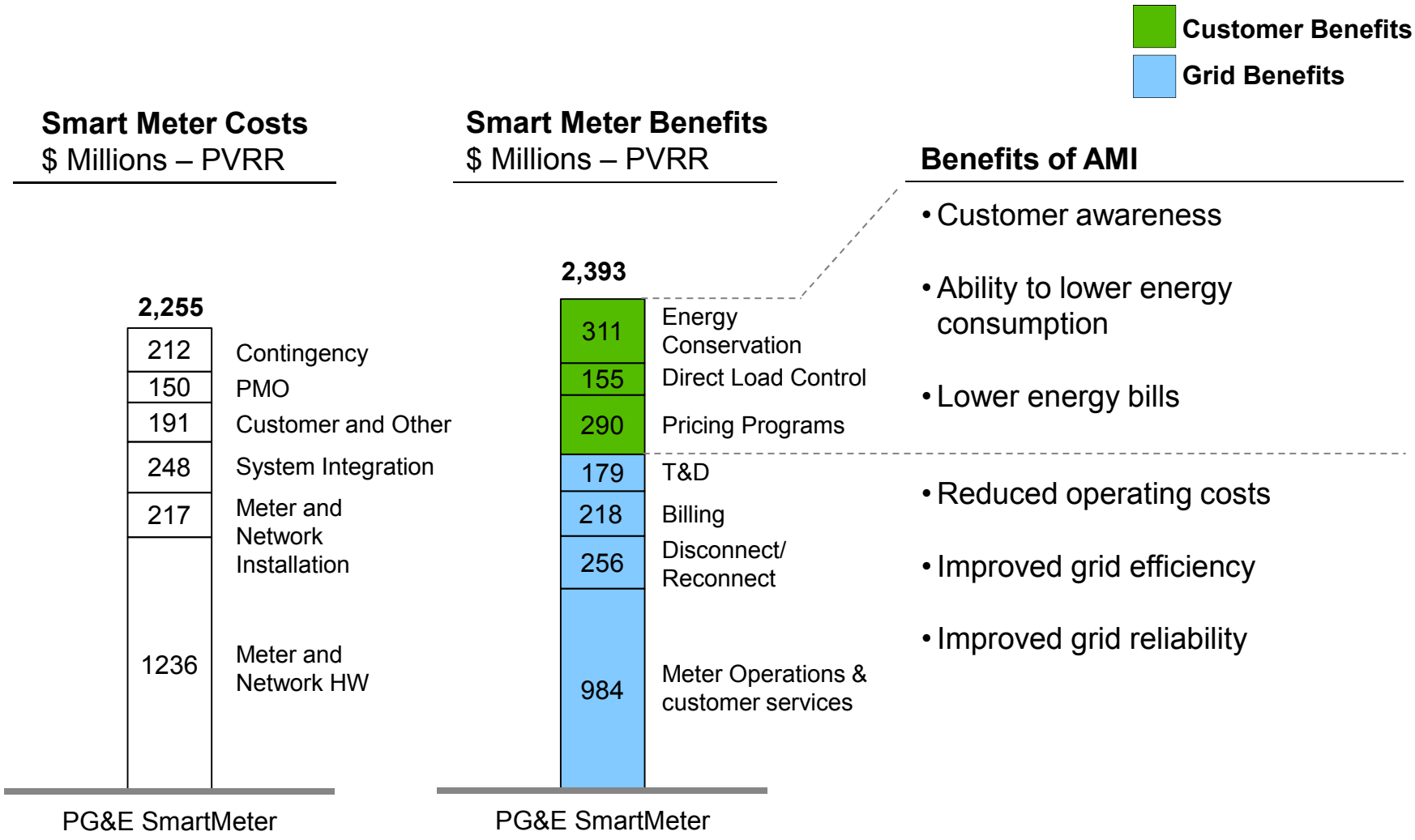
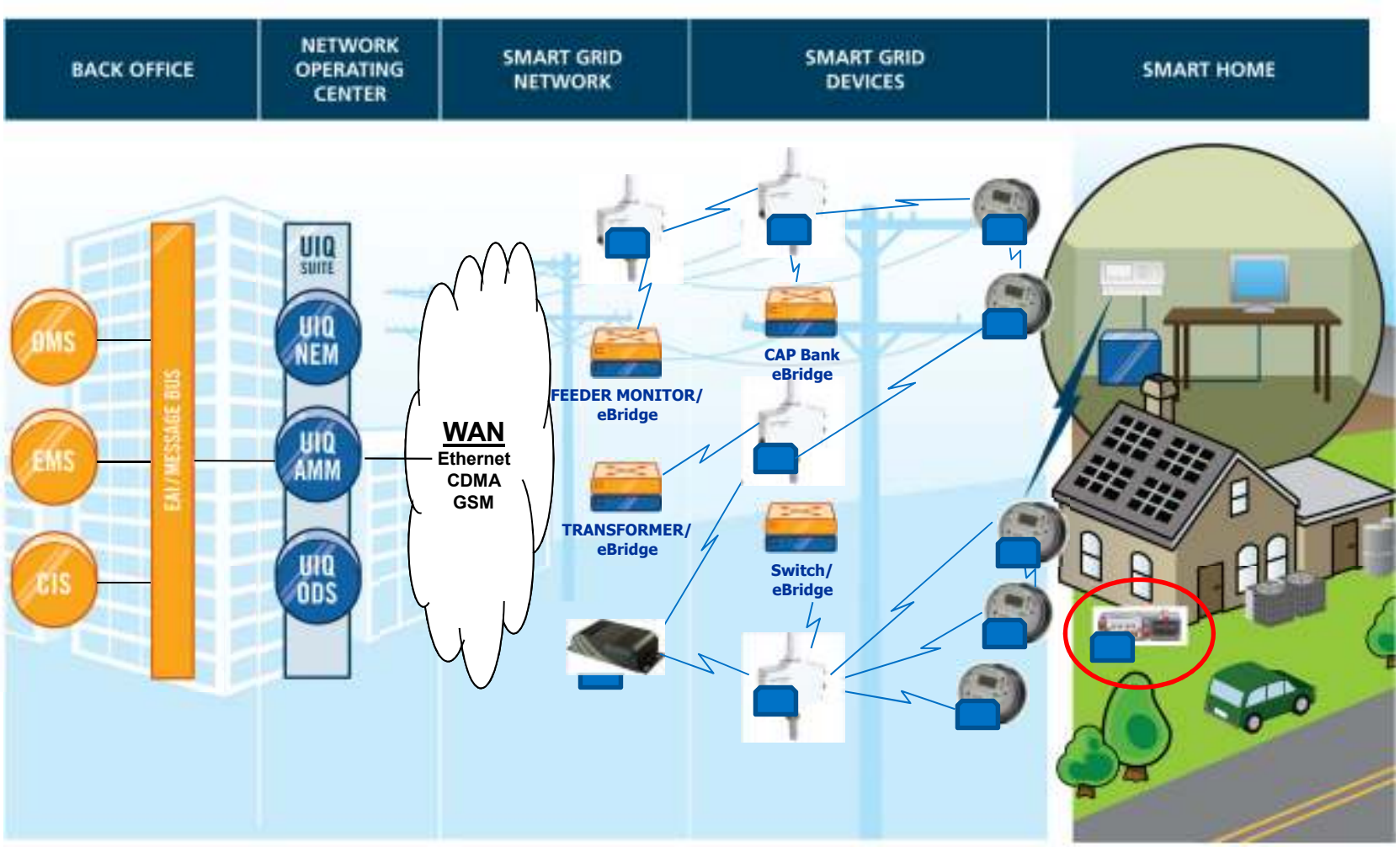
Architecture Unlocks Benefits



Consumers Pay in All Cases, So Leveraged Investment is Critical

Source: PG&E Business Case, Electric Only

Leverage Occurs By Taking A Platform Approach



Reliable, Secure, End to End IP

Interoperability (NIST definition)

"The ability of diverse systems and their components to work together—is vitally important to the performance of the Smart Grid at every level. It enables integration, effective cooperation, and two-way communication among the many interconnected elements of the electric power grid.

Effective interoperability is built on a unifying framework of interfaces, protocols, and the other consensus standards. These standards facilitate useful interactions so that, for example, 'smart' appliances and meters will tell consumers how much power they are using and at what cost, providing them with more control over their power consumption and energy bills. Widely adopted standards also will help utilities to mix and manage varying supplies of solar, wind, and other renewable energy sources and better respond to changing demand."

The NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0
http://www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf
Section 1.3.1 (PDF page 19)

Within the Grid, Adjacent to the Grid

Interoperability In Practice

- Are there really two “types” ?
  - Inter-system: interfaces (typically legacy) systems
  - Intra-system: ensures compatibility within any given SG domain
  - Sometimes (confusingly) presented as a “choice”

- Interoperability derived via “layering”, standards mapped to layers
  - Application layer: metering, DA, DR, OMS …
  - Networking layer: communications, addressing, routing …
  - Physical layer: wired, wireless

- Layering in the real world – “language analogy”
  - Application layer: comedy, drama, news, mystery …
  - Networking layer: English, Spanish …
  - Physical layer: newspaper, book, DVD, digital download …

Layering Simplifies Standardization, Accelerating Interoperability

Standards

- Standards sufficiency – consider Internet analogy
- Example of poor (non-layered) standard: ANSI C.12.22
- Key currently available standards (layered)

Layer	Existing Deployed Standard
Communications	IEEE 802.15.4 (Zigbee), IEEE 802.15.4g (SUN), IEEE 802.11 (WiFi), IEEE 802.16 (Wimax) …
Networking	IPv4, IPv6
Application -- metering	ANSI C.12.18, C.12.19, C.12.21
Application – distribution automation	DNP3
Application – demand response	OpenADR, Smart Energy Profile 2.0
Application – Home Area Networking	Smart Energy Profile 2.0

Foundational Standards in Place (or Nearing Completion)

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Security

- Myths
  - "Smart Grid makes the grid less secure than it is today"
  - "Licensed spectrum is more secure than unlicensed spectrum"
  - "Proprietary security is better than standards-based security"
  - "IP is inherently vulnerable", "IP means data is on the Internet" …

NISTIR 7628 Domain	Existing Congruent, Deployed Solutions
Authentication, authorization	Public Key Infrastructure (PKI) for digital certificate management [vs. proprietary IDs, system-wide/static keys]
Data/channel privacy	NSA Suite B encryption standards, AES 129/192/256, TLS, IPSEC, … [vs. proprietary encryption/scrambling]
Data integrity	Hashing via SHA1, SHA256, HMAC-SHA256-80 [vs. simple CRCs]
Viral attack resistance	Least-privilege design, admission control, … [vs. assumption of device integrity]
Insider threat protection	Layered authorization, … [vs. assumption of trust]
<Other threats>	…

NISTIR 7628 Provides Framework/Checklist for Ensuring Standards-Based Security

Summary

- Consumer engagement is now a significant focus
- Grid benefits achievable concurrently
- Platforms provide that leverage
  - Key/sufficient standards
  - Layering, flexibility, upgradability
  - Incremental, evolving
- Selection and validation criteria

Thank You