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Soup to Nuts: Building EM&V into Program Design

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An AESP Brown Bag presentation

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Interactive Session Agenda

- **Introduction/Overview:**  Programs
- **Setting the Stage for EM&V:** Overview of “Best Practices”
- **Brainstorm/Activity:** Develop outline for EM&V Plan
- **Reality Check:** Summary of EM&V Plans Developed for CGV programs
- **Brainstorm/Activity:** Short vs. long term evaluation activities
- **Reality Check:** CGV’s Three Year Timelines
- **Discussion:** Mid-course Corrections and Refinements
- **Reality Check:** CGV’s Actual vs. Planned Goals/Objectives
- **Pulling it All Together:** Q&A and Wrap Up

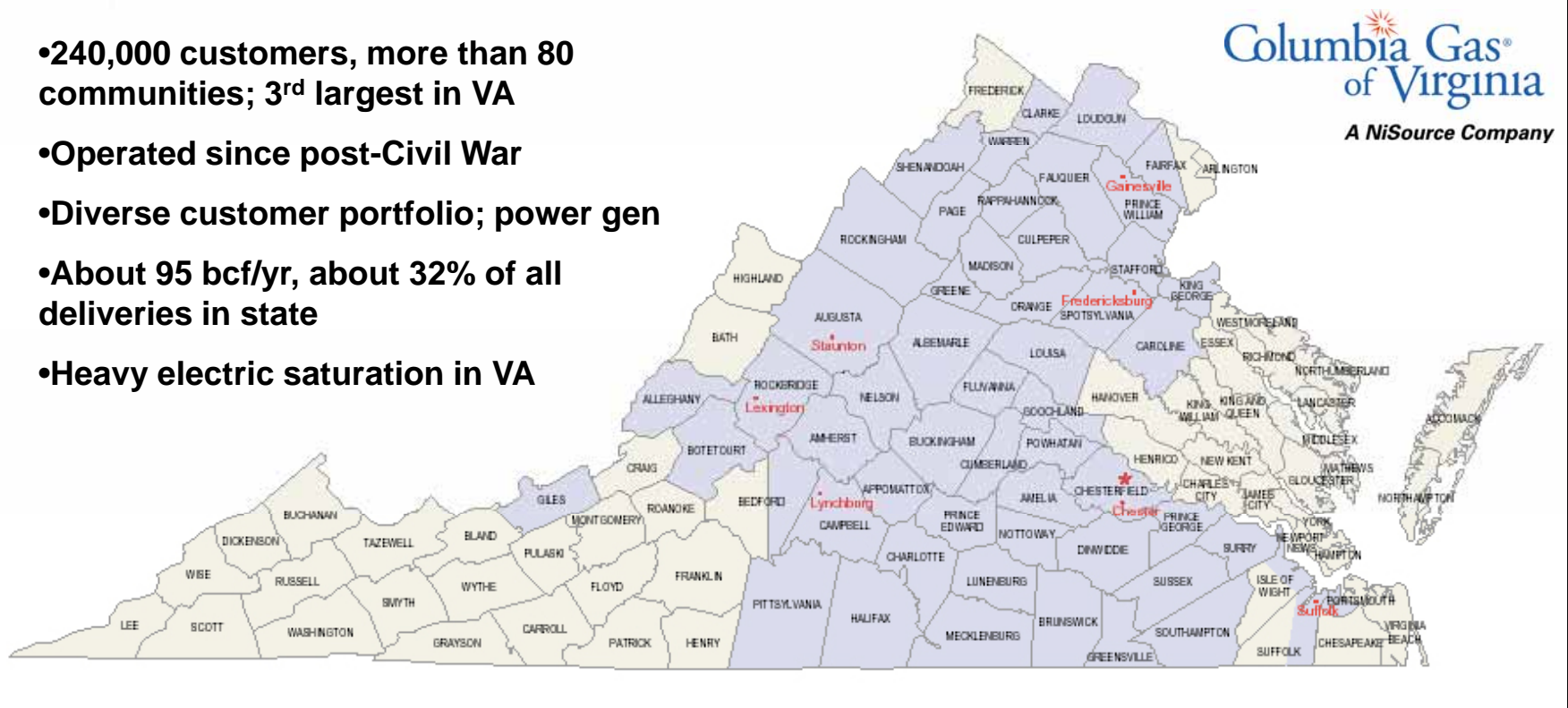
Introduction/Overview

- Summary of Columbia Gas of Virginia (CGV)
 Energy Efficiency Program Portfolio
 - Overall Goals
 - Objectives
 - Timeline and Key Drivers

Program Development and implementation

Columbia Gas of Virginia - Who We Are

- 240,000 customers, more than 80 communities; 3rd largest in VA
- Operated since post-Civil War
- Diverse customer portfolio; power gen
- About 95 bcf/yr, about 32% of all deliveries in state
- Heavy electric saturation in VA





CGV Program Framework

- CARE program created by 2008 legislation
- Combined decoupling with efficiency / conservation program
- Applied to residential / small commercial customers and support for low income
- Included incentive mechanism
- Independent review of verifiable savings
- Three year program

The Race to Implement

- Some guiding decisions
 - Had to be a “real” program
 - Structure focused on external partners
 - Disciplined process to meet implementation
- Partnered with Nexant on program design
- SCC approval in late November ‘09
- Goal was to implement by early April 2010
- Key kickoff meeting in Atlanta, Jan 12, 2010
- All key players included from beginning

Setting the Stage for EM&V



- **Definitions of EM&V**
- **Evaluation** - The performance of studies and activities aimed at determining the effects of a program.
- **Measurement and Verification** - Data collection, monitoring, and analysis associated with the calculation of gross energy and demand savings from individual sites or projects. M&V can be a subset of program evaluation.
- **EM&V**- The term “evaluation, measurement, and verification” is frequently seen in evaluation literature. EM&V is a catchall acronym for determining both program and project impacts.

Why Evaluate?



- **Quantify Results**
 - Document and measure the energy savings of a program in order to determine how well it has met its goals
- **Understand** why program effects occurred
- **Identify** ways to improve current and future programs as well as select future programs

Definition of Process and Impact Evaluations



- The American Evaluation Association defines evaluation: “***assessing the strengths and weaknesses of programs, policies, personnel, products and organisations to improve their effectiveness.***”
- **Process Evaluation** describes and assesses program materials and activities.
- **Impact Evaluation** examines long-term effects from a program, including those unintended effects.

Types of Data Collection Activities

Types of Data Collection Activities for Process and Impact Evaluations

Records Review

- Review of program database
- Review of marketing materials
- Determine program process flow

Literature Review

- Review of secondary materials
- Review of engineering estimates and approved databases
- Review of free ridership/free drivership rates

Focus Groups

- Small group discussions with customers, trade allies, or both

In-depth interviews with key stakeholders (decision-makers)

- Program staff
- Outside consultants
- Industry representatives

Surveys

- Participating customers only
- Non participating customers only
- Surveys of both groups
- Surveys of trade allies

Site Visits

- On-site observation of program operations/customers
- On-site verification of equipment operation

Low Cost



High Cost

Brainstorm/Activity #1

Small Groups: Identify The Key Issues For an EM&V Plan

- What issues need to be addressed?
- What specific challenges are involved in planning an evaluation for a program still in design?
- Who are the key stakeholder groups involved?
- What types of data need to be tracked/collected short term/long term?

Reality Check: CGV's EM&V Activities

- **Process Evaluation Activities**

- Concentrated on Program Years 1 and 3
- Variety of methods “triangulate” findings include:
 - Data Review
 - Program Materials
 - Data Tracking Bases/Key Metrics
 - Program Flow/Logic Model
 - Interviews
 - Staff - both utility and implementation staff
 - Customers - both participating and non-participating
 - Contractors - both participating and non-participating

Types of Critical Documents



- External Sources
 - National Studies
 - Trade Associations/Engineering Societies
 - Public Service Commissions
 - Neighboring Utilities
- Internal Sources
 - Other Utility Departments (engineering/marketing)
 - Professional judgment

Use Residential Survey When:

- **Need to gather information from a known population**
- **Want to explore differences between groups**
 - Participant vs. Non-participant
- **Explore differences among groups**
 - Identify demographic differences
 - Identify psychographic differences
- **Identify program impacts**
 - Direct = installation rates
 - Indirect = behavioral changes
- **Make program adjustments**
 - Compare actual installations to program records
 - Identify additional program-driven activities
- **Identify areas for program improvement**



Use Residential Site Visit When:

- Comprehensive programs that installed multiple measures
- Programs that installed custom measures
- Programs with high installation costs
- Pilot programs before launching a full program
- Site visits are an opportunity to:
 - Capture energy and demand impacts
 - Verify on-site installations
 - Provide quality control
 - Opportunity to interview critical decision-makers for anecdotal feedback



Program Impact Analysis

- Program Impact Analysis often part of a larger evaluation study:
 - Provides an objective comparison of program results against benchmarks
 - Can be used to track progress over time
 - Determines **net savings** attributable to program activities
 - Identifies areas for program improvement
- Net Savings are calculated after accounting for
 - Free Ridership
 - Free Drivership



Determining Program Impacts

- Free ridership rate is how many participants would have purchased energy efficient equipment without the program
- Free drivership rate is how many participants will install the rebated energy efficient equipment, outside the utility's service territory
- These impacts are best measured through customer survey questions conducted as part of an overall program evaluation



Apply the Appropriate Analytic Approach

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multi-variate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Brainstorm/Group Activity #2

Determine the timing and schedules for process and impact evaluations.

- Q1. What are short term - vs. long term evaluation activities?**
- Q2. What activities should be done annually?**
- Q3. What activities can be combined across process and impact evaluations?**
- Q4. What activities need to be separated for process and impact evaluations?**

Reality Check: CGV's EM&V Activities

- **Process Evaluation Activities**
 - Concentrated on Program Years 1 and 3
 - Variety of methods to “triangulate” the findings including:
 - **Data Review**
 - Review of Program Materials
 - Review of Data Tracking Bases/Key Metrics
 - Review of Program Flow/Logic Model
 - **Interviews**
 - Staff – both utility and implementation staff
 - Customers – both participating and non-participating
 - Contractors – both participating and non-participating

EM&V Activities

- **Impact Evaluation Activities**

- Concentrated in Programs 2 and 3 to maximize program participation rates
- Focused on measuring program impacts by
- Review of Ex Post Estimates – PY2
- Verification/Market Research- PY 2- PY3
- Calculate Realization Rates for each program
 - Determine free ridership rates
 - Determine spillover

Qualifying Measures for Home Savings Program

Measure	Size Category	Minimum efficiency requirements	Unit	Rebate (\$/unit)	Estimated Incremental customer cost (\$/unit)
ENERGY STAR Gas Storage Water Heater	= 75,000 btu/hr	ENERGY STAR (EF = 0.62)	Each	\$50.00	\$65.00
ENERGY STAR Tankless Water Heater	< 200,000 btu/hr	ENERGY STAR (EF = 0.82)	Each	\$300.00	\$800.00
ENERGY STAR Gas Furnace	< 225,000 btu/hr	AFUE = 90%	Each	\$300.00	\$675.00
High-Efficiency Windows*	Windows Only (No Patio/Swinging Doors, Skylights)	ENERGY STAR (North-Central) U-factor = 0.32, SHGC = 0.40	sq. ft.	\$1.00	\$2.11
Attic Insulation*	--	Minimum increment of R- 19 added	sq. ft.	\$0.30	\$0.51
Floor Insulation*	--	Minimum increment of R- 19 added	sq. ft.	\$0.30	\$0.70
Duct Sealing*	Minimum 10 feet in unconditioned space	Must complete per PTCS standards	Each	\$200.00	\$265.00
Duct Insulation*	Minimum 10 feet of uninsulated ductwork in unconditioned space	Duct Insulated with R-6 or higher	Each	\$250.00	\$407.00

Savings Goals

Home Savings Program	PY1	PY2	PY3	3yr Total	Lifetime
Gross Savings MCF	23,355	35,093	46,831	105,280	2,069,456
Net Savings MCF	15,457	23,232	31,007	69,696	1,372,858
Estimated Participant Count	4,001	6,012	8,022	18,035	NA

Key Issues That Will be Tracked

- Verifying measure installation rates
- Determining the overall effectiveness of program operations
- Quantifying program effects in terms of market transformation, spillover, measure persistence, free ridership and free drivership
- Assessing overall awareness levels among customers and contractors throughout Columbia's service territory
- Calculating the savings impacts from measure installations compared to savings projections
- Analyzing measure cost-effectiveness
- Identifying areas for program improvement

Evaluation Schedule

Program	Program Year 1 (Apr 1/10 to Dec 31/10)				Program Year 2 (Jan 1-Dec 31/11)				Program Year 3 (Jan 1-Dec 31 2012)				Final Reports	
	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-March	Apr-May
Process Evaluation Activities														
Home Savings Program														
Web-based Home Audit Program														
Business Savings Program														
Business Custom Program														
Impact Evaluation Activities														
Home Savings Program														
Web-based Home Audit Program														
Business Savings Program														
Business Custom Program														
Project Reporting														
Draft Reports														
Final Reports														
Presentations														
Project Management														

Legend	
Develop EM&V Plans	Orange
Process Evaluation Activities	Blue
Impact Evaluation Activities	Yellow
Customer Surveys	Pink
Project Reporting	Green
Draft Reports	Orange
Final Reports	Blue

Evaluation Budgets

Evaluation Budget	Total	% of Total Portfolio Budget
Process Evaluation	\$184,895	1.80%
Impact Evaluation	\$191,237	2.25%
Total	\$376,132	4.05%

Discussion: Mid-course Corrections and Refinements

- How can results from Year 1 process evaluations affect program operations in following years?
- What are strategies for increasing participation among customer segments

Reality Check



- What are the first-year results?
- What were the successes?
- What are the key challenges?
- How will EM&V be used for program improvements?



2010 By the Numbers

Free Measures

Faucet Aerators	2,741
Low Flow Shower Heads	1,478
Pipe Insulation	609
Water Heater Blanket	136
Total	4,964

Total of Each Package	Package #
435	1
4	2
136	3
378	4
18	5
396	6
63	7

1430 Total Packages



2010 By the Numbers

Rebates

Rebates through Home Savings Program

Measure	Number of Units	Rebate Amount
Tank Water Heater	30	\$ 1,500.00
Tankless Water Heater	95	\$ 28,500.00
Furnace	257	\$ 77,100.00
Windows	38	\$ 6,136.00
Attic Insulation	629	\$ 247,859.17
Floor Insulation	9	\$ 2,880.00
Duct Sealing	0	\$ -
Duct Insulation	1	\$ 250.00
Total	1059	\$ 364,225.17

Rebates through Business Savings Program

Measure	Number of Units	Rebate Amount
HE Furnace 90%	1	\$ 200.00
HE Furnace 94%	2	\$ 800.00
Total	3	\$ 1,000.00

Successes: What worked well

- Rebate and Free Measures Processing
 - Few customer issues or complaints
 - No technical issues
 - Good integration with DOE funding and processing
- Project Team Communications
 - Weekly meetings
 - Defined Responsibilities
- Website
 - Significant increase in traffic
 - On-line Audit Program and On-line Rebate Processing working as expected
- Ability to make decisions quickly and adapt



Challenges: What didn't work well

- Trade Allies
 - More challenging than we imagined
 - Geography a key component
 - Targeting All versus Manufacturer Reps
- Commercial Program
 - Different traits and reaction than residential
 - Link with Trade Allies
- Water Heater Blanket
 - Concept versus reality
 - Proactive response
- Media Outreach
 - Geography a key component
 - Too generalized
 - More targeted for 2011



What's Next?

- **JD Power**
- **New Business**
- **Trade Allies**
- **Business Custom Program**
- **2012 Filing**

Additional Sources of Information

- [California Energy Efficiency Evaluation Protocols](#) Created for the CPUC to guide evaluations of investor owned utility energy efficiency programs. These are technical specifications for conducting evaluation work.
- [Evaluation Process Protocols](#) to guide the evaluation process conducted by California state staff (CPUC and CEC staff) and are non technical.
- [Standard Practice Manual](#) (SPM) is for Economic Analysis of Demand Side Programs and Projects.
- [International Performance Measurement and Verification Protocol](#) (IPMVP) is required in the California Energy Efficiency Evaluation Protocols for some evaluation work.
- [California Evaluation Framework](#) is also required in the California Energy Efficiency Evaluation Protocols for some evaluation work.
- [EERE Guide for Evaluations](#) (pdf) is a guide for managing program evaluation studies from the US Department of Energy



QUESTIONS

Press *1 to ask a question

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