

# Soup to Nuts: Building EM&V into Program Design

## Presenters:


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# *Interactive Session Agenda*

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

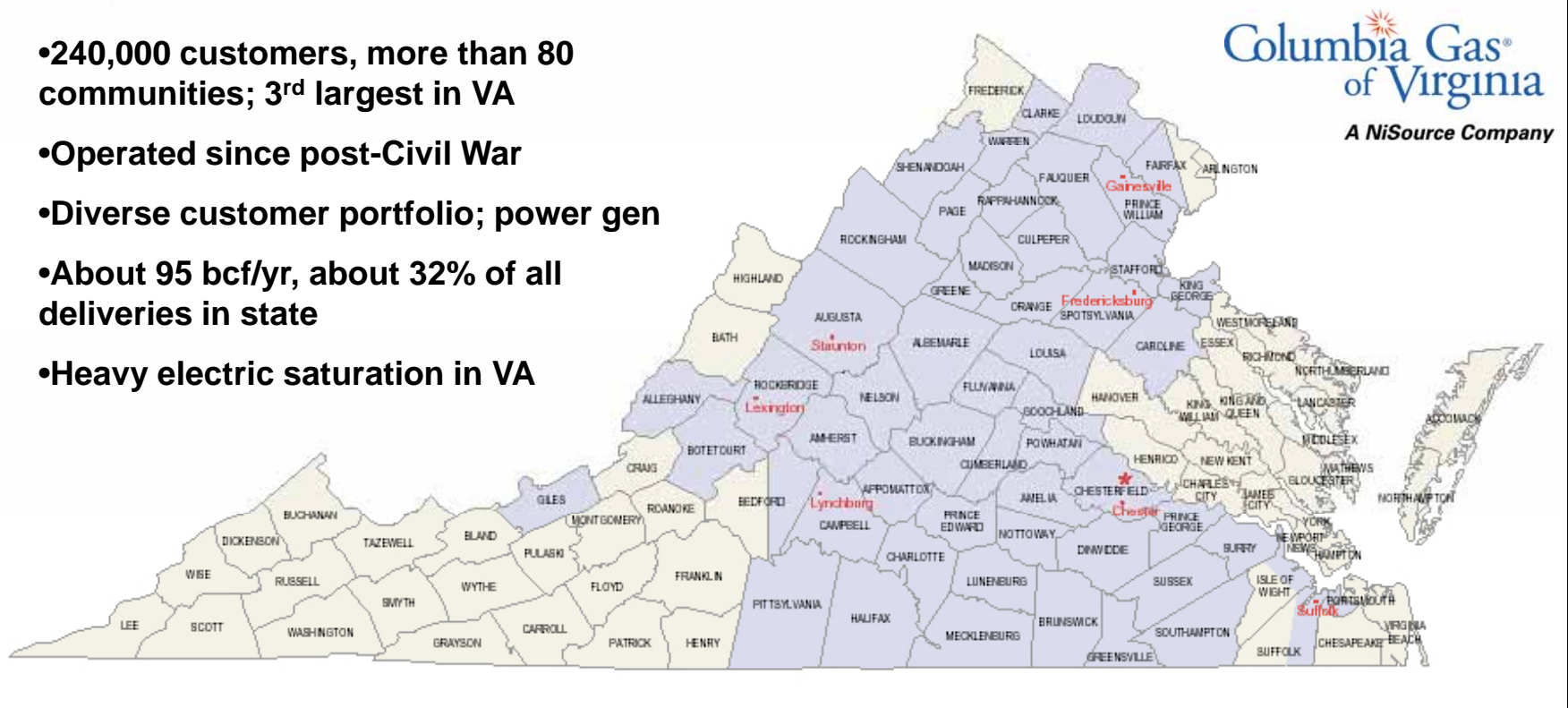
# *Introduction/Overview*

- 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; 3<sup>rd</sup> 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/Group 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
<b>Option A:</b> Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> <li>• Verified installation</li> <li>• Nameplate or stipulated performance parameters</li> <li>• Spot measurements</li> <li>• Run-time hour measurements</li> </ul>
<b>Option B:</b> Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> <li>• Verified installation</li> <li>• Nameplate or stipulated performance parameters</li> <li>• End-use metered data</li> </ul>
<b>Option C:</b> 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"> <li>• Verified installation</li> <li>• Utility metered or end-use metered data</li> <li>• Engineering estimate of savings input to SAE model</li> </ul>
<b>Option D:</b> 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"> <li>• Verified installation</li> <li>• Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models</li> <li>• Utility billing records, end-use metering, or other indices to calibrate models</li> </ul>

# ***Brainstorm/Group Activity #2***

**SMALL GROUPS:** 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*

<b>Home Savings Program</b>	<b>PY1</b>	<b>PY2</b>	<b>PY3</b>	<b>3yr Total</b>	<b>Lifetime</b>
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
<b>Process Evaluation Activities</b>														
Home Savings Program														
Web-based Home Audit Program														
Business Savings Program														
Business Custom Program														
<b>Impact Evaluation Activities</b>														
Home Savings Program														
Web-based Home Audit Program														
Business Savings Program														
Business Custom Program														
<b>Project Reporting</b>														
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	Teal

# *Evaluation Budgets*

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

# ***Group 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
<b>Total</b>	<b>4,964</b>

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

**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
<b>Total</b>	<b>1059</b>	<b>\$ 364,225.17</b>

### Rebates through Business Savings Program

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

# ***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

Save the Date



## 22<sup>nd</sup> National Conference & Expo

February 6-10, 2012  
Hilton San Diego Bay Front

