Gas Efficiency Potential and a Recommended Portfolio of Integrated Gas and Electric Statewide Programs for New York

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ABSTRACT

Given the unprecedented levels and volatility of natural gas prices — in part due to hurricanes Katrina and Rita — there is renewed interest in natural gas efficiency programs. Gas efficiency has long been an afterthought for regulators who in most jurisdictions have only mandated electric efficiency programs. Where gas programs have been offered, they generally receive little funding when compared to electric programs, and have been delivered only by select utilities, not on a systematic, statewide basis. In addition, little has been done to integrate electric and gas programs to provide fuel-neutral services. This is beginning to change. This paper describes a study for New York State that identifies the gas efficiency potential, designs and analyzes a portfolio of fuel-neutral gas-efficiency programs for statewide implementation, and models the effects on regional and national gas prices and volatility. A number of the proposed gas-efficiency programs are integrated with electricity programs. The study may be used by policymakers to consider the establishment of a gas system benefits charge (SBC), possible integration with current electric programs and whether the programs should have a centralized statewide administration. If such a gas-electric program is pursued, this would represent the first statewide delivery of a single set of comprehensive programs addressing both electricity and gas, with SBC funding coming from both fuels.

Purpose and Context of Study

The New York State Energy Research and Development Authority (NYSERDA) commissioned a study to determine the economic and "program scenario" potential for energy efficiency to displace natural gas consumption in New York State.[1] The study examines the potential to reduce natural gas consumption available from existing and emerging efficiency technologies and practices to lower end-use natural gas requirements in residential, commercial, and industrial facilities. In addition, the study designed a portfolio of integrated gas and electric programs, and assessed the achievable potential for these programs, given various funding and policy constraints. The study assessed New York's gas efficiency potential over 10-years (from 2007 through 2016).

[1]This study built on a prior study, also done by Optimal Energy, Inc., in response to a Public Service Commission Order issued for the Consolidated Edison's gas and steam business (Cases 03-G-1671 and 03-5-1672, Consolidated Edison Company of New York. Inc. – Gas and Steam Rates), issued September 27, 2004.

The study had five main objectives:

- Evaluate the potential cost-effective natural gas efficiency savings (economic potential) in the State over a 10-year horizon (2007-2016)
- Examine exemplary natural gas and electric efficiency program designs and recommend programs for implementation
- Estimate the potential achievable cost-effective natural gas efficiency savings in the State over a 10-year horizon (2007-2016) from delivery of a portfolio of recommended efficiency programs and a target funding level ("program scenario"), based on program delivery for 5 years with an additional 5 years of post-program market effects Develop a reference case natural gas price forecast and consider the potential impact of efficiency programs on natural gas prices

We identified that 28% of forecast 2016 gas building consumption is available from efficiency and would be economical compared to gas forecasted supply costs. The authors caution that economic potential estimates ***do not*** account for the market barriers to adoption of efficiency technologies ***nor*** the costs of market intervention strategies to overcome these barriers.

We also estimated substantial opportunities for delivery of cost-effective efficiency programs. Again, caution should be used in interpreting the program scenario results. We recommend a set of efficiency programs that would optimize efficiency efforts given specific funding constraints and various policy objectives. Cost-effective portfolios could be devised with significantly larger or smaller funding levels, and optimized to both these different levels and different policy constraints. However, we believe, given a full understanding, both the economic potential and program scenario analyses are useful to inform ultimate decisions about future natural gas efficiency programs and funding.

Study Scope and Approach

The project scope called for analysis of both "economic" and a "program scenario" efficiency potential from natural gas efficiency technologies and practices among residential, commercial and industrial facilities. We define these terms below:

- **Economic Potential** refers to the total technical natural gas efficiency potential over the planning period from all measures that are cost effective, as compared to the avoided gas consumption valued at the forecasted natural gas supply costs. Potential is defined as additional savings over and above what is currently expected to occur without gas program intervention.[2]
- **Program Scenario Potential** refers to the estimated maximum natural gas efficiency impacts over the planning period, given specific program designs and funding levels assumed. It considers economic and other barriers to efficiency adoption, as well as the specific funding and program strategies.

[2] The base case forecast and technology penetrations include effects from autonomous efficiency improvements that would result from natural market shifts, existing and expected codes and standards, and continuation of New York's current level of investment in electric energy efficiency.

The study scope included all applicable natural gas efficiency technologies, with the exception of fuel switching and electricity generation measures, including combined heat and power technologies. We analyzed over 2,000 distinct efficiency measures, comprising approximately 150 different technologies or practices applied to numerous facility types and markets (e.g., new construction, major renovation, planned equipment replacement and remodeling, and early retirement of operating equipment and systems). We also estimated potential and cost-effectiveness separately for up-state and down-state to reflect significant differences in markets and gas and electric supply costs.[3]

Economic Potential Approach

The basic conceptual framework for the economic analysis involved 8 steps:

- Developing a comprehensive list of efficiency technologies and practices
- Selecting final efficiency technologies and practices for analysis based on an initial qualitative screening
- Characterization of the selected technologies and practices, including defining baseline and efficient levels, costs, savings, and measure life
- Characterizing the existing and forecasted markets for each technology and practice, including identifying important industrial and commercial sectors, estimating and disaggregating sector-level gas sales by facility type and end use, quantifying existing equipment saturations, and forecasting new construction activity
- Estimating baseline penetrations among the existing and forecasted markets of standard efficiency technologies and practices, given likely natural efficiency gains, likely codes and standards, and existing New York electric efficiency programs
- Applying the per unit efficient technology and practice characterizations and baseline penetration projections to the relevant existing and forecasted markets to arrive at net potential impacts and costs
- Developing gas avoided costs using a proprietary national gas supply and demand model for commodity costs and utility data for capacity peak storage, transmission and distribution costs
- Screening efficiency measures for cost effectiveness based on the avoided cost estimates
- Removing all non-cost-effective measures
- Adjusting for mutually exclusive measures and interactions among measures

We relied on a large variety of data to support the above approach, including: prior potential analyses; published research studies; equipment and market assessments; baseline studies; NYSERDA, New York local gas distribution companies, New York Public Service Commission data; engineering analysis; building simulation modeling; and personal communication with industry experts.

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[3]Downstate is defined as New York City, Long Island, and Westchester, Orange and Rockland Counties (Con Edison, KeySpan and O&R territories). Virtually all of the industrial gas load is upstate, while the vast majority of centrally heated multifamily buildings are downstate. In addition, gas and electric supply costs are significantly higher downstate and price pressures are greater there due to substantial gas load growth expected from new electric generation.

Program Scenario Potential Approach

Development of program portfolio. The program scenario potential considers economic and other barriers to efficiency adoption, relying on past experience of exemplary gas and electric efficiency programs. The assessment of the program scenario potential assumes 5 years of program delivery at an average budget of $80 million per year, with 5 years of post-program market effects. This funding level represents approximately 0.8% of 2004 gas revenues.[4] The authors do not represent the selected funding level as a recommendation for future gas program funding. Rather, we provide it to further inform future discussions about appropriate future funding levels and program portfolios.

In development of a program portfolio, we sought to meet certain criteria. These included: maintaining equity across sectors by matching sector-level spending to existing sectoral gas consumption; providing low-income services, set at 50% of the residential budget; and providing a balance between short-term resource acquisition efforts and longer-term market transformation benefits. In addition, we sought to provide program services targeted to all New York gas customers and to address all important end uses.[5] Finally, we explicitly designed our programs around broad *markets*, rather than specific customer or technology types. In otherwords, we designed programs that would comprehensively address multiple opportunities within facilities, with strategies and services designed around specific market and supply channels to address the way transactions normally happen in the marketplace.

Central to our markets approach and focus on comprehensiveness and addressing each market given its unique characteristics, we believe the most effective and cost-effective approach to delivering gas programs in New York is to integrate them with electric efficiency services. To that end, we assume integrated delivery of *fuel-neutral, one-stop-shopping* programs to combined gas and electric customers. Our budgets and penetration rates reflect this assumption. We have not, however, attempted to redesign, restructure, or analyze the existing electric programs. However, the current broad array of New York electric programs potentially addresses all the same markets and service categories we propose here.

[4] Given significant recent gas price increases, which are expected to remain high in the near future, the funding level would be a lower portion of current revenue.

[5] The analysis assumes all gas end users except electric generators would be eligible for programs. This includes both direct LDC customers as well as transportation customers buying gas from third party marketers. Note that while we intended to address all significant opportunities, because of the limitations of the selected funding level, insufficient funds were available to provide a non-low income residential existing home program.

Developing the optimized investment portfolio included:

- Reviewing NYSERDA, and other New York State existing electric and gas programs
- Reviewing exemplary gas programs throughout North America[6]
- Considering the strategies and services that have been central to both gas and electric efficiency program success in the State and in other jurisdictions
- Assessing the economic potential results, and identifying where the most important opportunities exist, both in terms of end uses, markets, customer types, and technologies
- Selecting a small set of broad-based programs designed to address all important markets and customers and to take full advantage of the lessons learned from past program delivery and our study of exemplary programs.

The selected investment portfolio includes six programs:

Cross-Sector
- Efficient Equipment
  - Heating, hot water, washers
  - Residential & Small commercial and industrial

Residential
- New construction (ENERGY STAR® Homes)
- Low-income retrofit

Commercial / Industrial
- New construction
- Existing construction (new purchases of equipment and systems at time of planned investment and early retirement of existing operating equipment)
- Food service and processing

Program scenario potential savings analysis. The starting point for analyzing the savings and costs resulting from implementation of the program scenario is the economic potential. The following steps were used to estimate the program scenario potential:

- Mapping each measure permutation (combination of technology, market, and facility type) to a program
- For each measure, projecting the future market acceptance of efficiency technologies over time if the kinds of market intervention policies and programs designed were pursued, as well as the portion of those measures adopted by customers that would participate in the programs
- Applying the future measure penetrations to the economic potential analysis results to yield annual measure costs and savings

[6] We relied heavily on literature review of past best practices natural gas studies, including: Kushler, M., D. York and P. Witte, *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs.* Washington, D.C., American Council for an Energy-Efficient Economy, 2003; and Zabetakis, D., *An Evaluation of Natural Gas Efficiency Programs,* NYSERDA, July 2005.

- Developing *non-measure* program budgets (those costs for all programmatic activities except measure incentives) that reflect the costs of delivering the programs, assuming integration with electric programs
- Developing program measure *incentive* costs based on program incentive level designs and estimated measure adoption rates
- Analyzing the portfolio to develop estimates of overall costs, benefits, net benefits and benefit-cost ratios

Economic Potential

We conclude, if captured, the economic efficiency potential would reduce New York's annual natural gas requirements by more than 283 million dekatherms (MMDth) by 2016. This represents 28% of expected New York 2016 requirements. The study also shows peak day economic potential of more than 2 MMDth in 2016. Figure 1 shows how the captured economic potential would reduce forecasted loads. Theoretical capture of the full economic potential would eliminate all future load growth during the planning horizon, and result in a *net reduction* in load of 23% from 2007 to 2016.

Figure 1. Gas Sales Forecast Less Sector Energy Savings

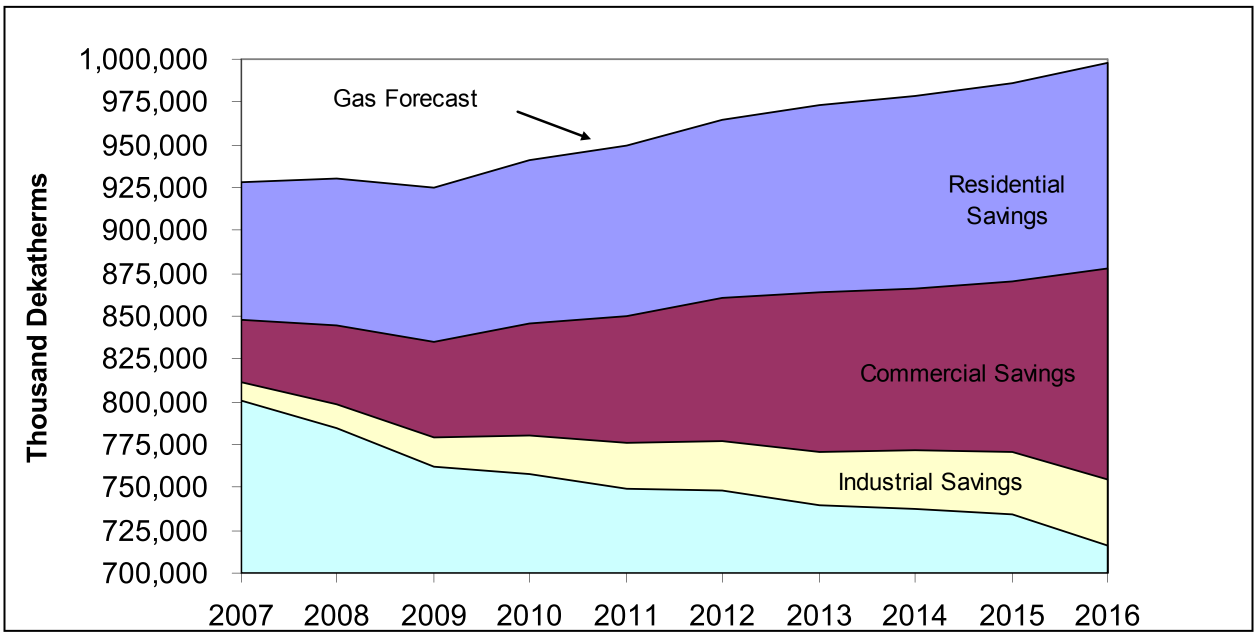
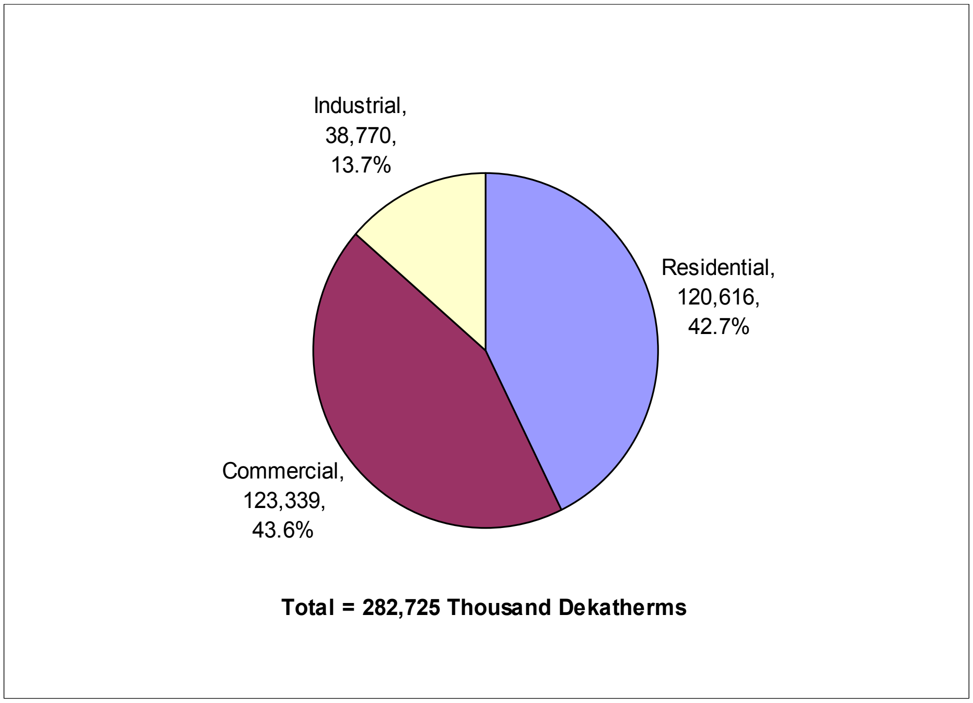


Figure 2 shows 2016 energy savings for the residential and commercial sectors are roughly comparable, with only 14% of savings attributable to the industrial sector.[7] The greatest opportunities for efficiency are in space heating, followed by domestic water heating and then food production and service technologies.

[7] The downstate region has very little industrial load, and what exists is primarily small industries without intensive gas usage.

Figure 2. 2016 Economic Potential by Sector and as % of Total



The economic potential, if captured, would be highly cost-effective. Present value net benefits (in 2005 dollars) would be $26.4 billion. In other words, the New York economic welfare would be improved by this amount if economic potential could be captured with no additional program costs.[8] The overall benefit-cost ratio (BCR) is 2.9. These results are based on a *total resource cost test* (TRC) that considers all the benefits and costs of efficiency from a societal perspective. It does not, however, include any monetized values for environmental externalities. It also does not include any price effects that would result from capture of efficiency because of the reduced pressure on current natural gas supplies.[9] The commercial sector would provide about 55% of the total net benefits, and has the highest benefit-cost ratio, at 3.85. **Error! Not a valid bookmark self-reference.** shows the TRC economic results.

The economic potential gas savings levelized cost, excluding program design costs, would be $2.47 and $3.86 per dekatherm downstate and upstate, respectively. This is considerably lower than current gas supply costs. The economic potential, if captured, would also result in lifetime reductions of 329 million metric tons of CO_2, 90,000 metric tons of SO_2, and 44,000 metric tons of NO_x. This is roughly equivalent to taking 63 million cars off the road, or the emissions from 280 million households (EPA 2006). Finally, capture of economic

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[8]Note that *it would take significant effort and program intervention costs to capture* a large portion of the economic potential, and even then, not 100% of it would be achievable.

[9]Price effects modeling, discussed below, will only be done for the program scenario. Note that we include transmission and distribution capacity costs in the TRC benefits. This is fairly standard across the utility industry. However, there is currently no consensus among parties in a New York collaborative process as to whether T&D benefits should be included in a TRC test.

potential would result in annual customer bill savings in 2016 (based on 2004 average gas rates) of $2.5 billion.

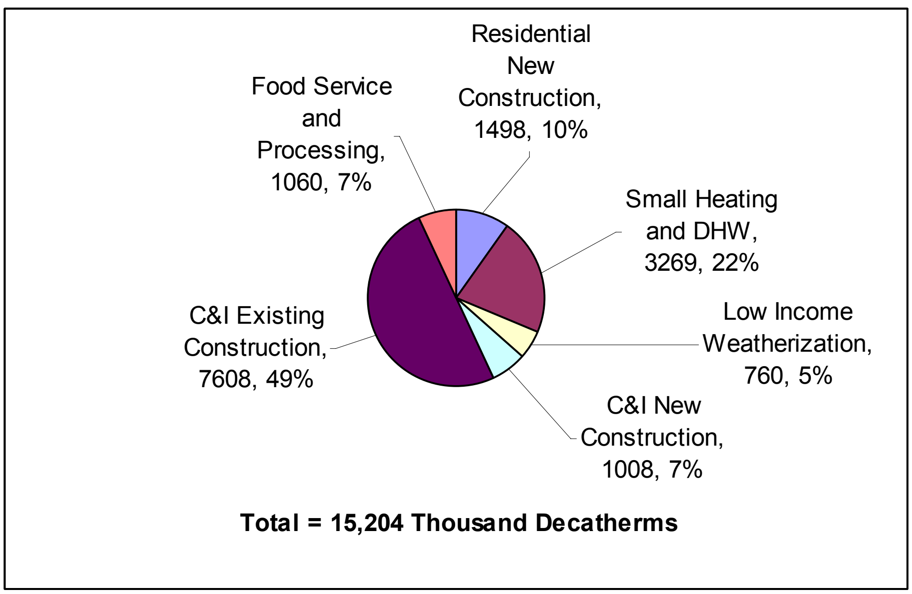
Table 1. 2016 Total Resource Net Benefits and Benefit/Cost Ratio

	Benefits ($ Million)	Costs ($ Million)	Net Benefits ($ Million)	B/C Ratio
Residential	$18,212	$7,909	$10,303	2.30
Commercial	$19,698	$5,112	$14,586	3.85
Industrial	$2,378	$892	$1,487	2.67
All Programs	$40,289	$13,913	$26,376	**2.90**

Program Scenario

Based on the funding and policy constraints described above, we estimate program scenario savings by 2016 of 15,204 MDth per year, and peak day load reductions of 100 MDth. This represents 1.5% of forecast 2016 gas requirements. Figure 23 shows program scenario potential by program.

Figure 3. 2016 Program Scenario Potential by Sector and as % of Total



The program scenario is highly cost-effective. Pursuit of this scenario would result in estimated net benefits to the economy of $1.1 billion, with an overall benefit-cost ratio of 2.48. In other words, for every dollar invested in efficiency, the scenario would return $2.48 to the local economy. The largest net benefits would come from the C&I Existing and Small Heating and DHW programs. Substantial net benefits would also come from the Residential New Construction, followed closely by Food Service and Processing, C&I New Construction, and

Low Income Weatherization programs. Table 2 shows economic results by program, not including price effects.

Table 2. 2016 Total Program Scenario Resource Net Benefits

	Benefits ($ Million)	Costs ($ Million)	Net Benefits ($ Million)	B/C Ratio
Residential New Construction	$209.3	$68.4	$140.9	3.06
Small Heating and DHW	$388.2	$162.2	$226.0	2.39
Low Income Weatherization	$102.7	$60.5	$42.2	1.70
C&I New Construction	$186.2	$74.0	$112.2	2.52
C&I Existing Construction	$913.7	$360.5	$553.2	2.53
Food Service and Processing	$76.1	$31.3	$44.8	2.43
All Programs	$1,876.2	$757.0	$1,119.2	**2.48**

In 2016, the overall levelized cost of saved gas energy from pursuit of the program scenario would be cost $3.42 and $4.47 per dekatherm downstate and upstate, respectively. This is considerably lower than current or forecast gas supply costs. It would also result in lifetime reductions of 16 million metric tons of CO_2, equivalent to removing 3 million cars from the road (EPA 2006). SO_2 reduction would be 2000 metric tons, and 1840 metric tons of NO_x would be saved. Finally, annual customer bill savings in 2016 (based on 2004 average gas rates) would be approximately $64 million.

Price Effects from Program Scenario

We will be estimating beneficial price effects for both New York and nationally, from achieving the program scenario potential impacts.[10] We will use a model developed by project team members Energy and Environmental Analysis (EEA) of the national gas supply market that fully integrates supply markets with expected demand, on a daily basis using normalized weather. It takes into account expected new supplies, as well as external market impacts. Currently, and expected at least for the next few years, the natural gas supply delivery capability is severely constrained in New York State, particularly in the downstate region. These constraints contribute significantly to the delivered gas price and volatility at the city gate. Consequently, natural gas efficiency programs are expected to lower the delivered natural gas price in the downstate region. However, the effects of statewide natural gas efficiency programs on the wholesale gas price is uncertain. Yet even if the absolute cost reduction per cubic foot is very small, multiplied over the magnitude of gas usage in New York, the potential economic benefits could be very large. As of this publication, the price effects modeling has not been completed.

Program Administration and Eligibility

There are a variety of different models that could be considered for administration and eligibility of gas energy efficiency programs in New York. The question of administration and eligibility can be subdivided into four subsidiary questions:

[10] As of publication, the price effects modeling has not been completed.

1. **Integration with existing electric programs**. Will New York's gas programs be integrated with existing electric programs, separate but coordinated, or completely separate?
2. **Uniquely local or common statewide gas programs**. Will New York offer programs that vary by utility service area or should they be identical throughout State?
3. **Local or statewide administration**. Will New York's programs – whether identical throughout the state or not – be delivered and managed by separate entities such as the LDCs, or delivered and managed by a single statewide entity?[11]
4. **Should all gas end users or only certain segments contribute to program funding and be eligible to participate?** Will New York's programs be available to the full range of gas end users? Potential possible exclusions include *transportation* customers that use the local distribution companies to transport their gas but purchase it from a third party, and *non-firm* customers who may only use natural gas sporadically and can easily substitute fuels.

Needless to say, there are advantages and disadvantages to different approaches to each of these questions. These are explored further below. Note that for analytical purposes we assumed that programs would be integrated with existing electric programs, and that the programs would be consistent throughout the state, centrally administered, and open to all end users.

Integration with Existing Electric Programs

We believe that there are significant advantages to integrating program delivery with the existing electric programs. This reduces confusion in the market, makes program offerings more attractive to trade allies and consumers, eliminates redundancy (e.g., technical assistance services, tracking and marketing systems, etc.), reduces the incremental cost of promoting gas efficiency and allows for quicker program ramp-up. It also provides the best and most appropriate customer service, in that customers want a single source of solutions for their energy needs. Finally, it supports maximization of efficiency benefits within each project by allowing a full fuel-neutral analysis to efficiency solutions that considers all the benefits and costs in a comprehensive fashion. In some cases, separate fuel programs will only address those measures that are cost-effective based only on that particular fuel's avoided cost benefits. As a result, many cost-effective measures can be ignored because neither the electric nor gas savings alone are enough to justify the investment.[12]

One of the issues that arises when electric and gas programs are integrated is the allocation of program costs – for financial incentives, marketing, training, administration and/or

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[11] Administration of statewide programs has been tried in different ways in different jurisdictions. In Massachusetts, for example, Gas Networks – a coalition of the state's gas utilities – has developed a set of programs that are identical across service territories. However, each utility still has an important role in the management of the programs. A similar approach has been taken in California and New Jersey (although that appears about to change in New Jersey with statewide program management being put out to bid). NYSERDA, Efficiency Vermont, and the Oregon Energy Trust are alternative models in which management is by an independent third-party rather than by a coalition of utilities.

[12] For example, building shell and HVAC distribution system measures will often provide electric cooling savings and gas heating savings, neither of which may be able to justify the investment on their own, but collectively make the project cost-effective.

other functions – to two different sources of revenue. One approach that has been taken in other jurisdictions is to simply allocate program costs to the electric and gas ratepayers in direct proportion to the economic value of the benefits those ratepayers receive. In a territory like New York, substantial areas are not served by a natural gas utility. Therefore, some separate accounting and allocation of fixed costs would have to be determined given that electric and gas services would not be completely geographically coincident.

Local or Statewide Programs

We believe that consistency across the state, or even region-wide, is ideal – especially for programs addressing market-driven opportunities such as new construction and equipment purchases. For such programs, statewide consistency allows not only greater efficiency in service delivery, but also greater impact on the market due to consistency in messages and requirements imposed on builders, developers, architects, HVAC contractors, equipment suppliers and others who often work across service area boundaries. Such consistency is less important when providing discretionary retrofit services, such as through the Low-Income Retrofit Program. In addition, programs designed to transform markets through upstream strategies tend to be most successful when they target a large enough market to attract the attention of, and influence, manufacturers, code and standards officials, distributors and other influential market actors.

Local or Centralized Administration

If designed well – and this is an important caveat – we also generally believe that some form of centralized statewide administration is preferable to utility-by-utility administration, at least for market-driven programs addressing new construction and equipment purchases. Centralized administration offers both the potential for reductions in administrative costs (one set of administrative staff, tracking systems, evaluations, etc. rather than one set for each utility trying to coordinate with each other), quicker decision-making, easier interface with key trade allies (one program manager to call rather than a different program manager in each utility service territory), and more effective branding of efficiency efforts. While local utilities often have established relationships with their large customers that can be leveraged to market efficiency, we believe this advantage is offset by the other benefits of a centralized approach. We also recommend that under any type of administration, performance-based arrangements, including financial incentives to the administrator for exemplary performance, are worthwhile. It is worth noting that in New York State, because it already uses a centralized administration model for electric programs, the benefits of centralized administration for gas efforts are stronger when integrating with electric.[13]

Full Service Customers Versus Transport and Non-Firm

[13] NYSERDA delivers electric programs to all electric users in New York except for customers of the Long Island Power Authority and the New York Power Authority. Because Long Island is geographically separate, and is served by a single gas utility (KeySpan), it may still make sense to preserve the NYSERDA/LIPA administration model for integrated gas-electric programs.

Customers purchasing commodity gas from third parties, and relying on the LDCs simply for delivery still offer similar end uses and efficiency opportunities within their facilities. As a result, we believe it makes sense to include them in efficiency programs. However, the final decision can be influenced by funding collection approaches. For example, under a "system benefits" or "wires" charge, typically fees are collected based on volume of energy delivered by distribution utilities ("non-bypassable").[14] Under this arrangement, transport customers would still pay into the fund and be provided services. If programs were funded directly by LDCs, then inclusion of transportation customers would necessitate volumetric fees (as opposed to % of gas bill) with cost recovery flowing to the distribution system ledger.

It is more difficult to determine the proper solution for non-firm customers. Many of these customers use dual-fuel equipment and can easily switch between gas and oil, depending on real-time economic trade-offs. As a result, a customer primarily using oil may pay very little if any into the program funds. While they will likely offer similar efficiency opportunities that will be cost-effective from a total resource or societal perspective, they are not likely to be cost-effective from a gas systems test.[15] As a result, large program expenditures could go to primarily reducing oil consumption, with little long term direct benefits to gas ratepayers. On the other hand, many gas interruptible rates are structured to be competitive with oil, and many interruptible customers do use a substantial amount of gas. As a result, we recommend that programs be offered to non-firm customers, however with program features and constraints customized to adequately deal with these issues. For example, if performing customized measure or project cost-effectiveness screening, one can rely on historic patterns of customer gas usage, and reflect the lower value to the gas system from little or no peak gas reductions.

The Future for Gas Efficiency in New York

As mentioned above, at this writing the New York PSC has not begun hearings on the establishment of a natural gas SBC. Our program scenario funding level of $80 million/yr was designed not as a recommendation of funding level, but simply one scenario, with guidance on the likely maximum achievable potential, as well as likely impacts with funding of 50% and 150% of the scenario. The funding scenario represents roughly 0.8% of 2004 gas revenues, somewhat consistent with New York's first electric SBC. Should the PSC mandate a gas SBC, this analysis provides a starting point for development of a portfolio of integrated electric and gas programs, and recommendations on administration.

References

United States Environmental Protection Agency, *Clean Energy-Environment Guide to Action,* Washington, DC, February 2006.

[14] This is currently the model in New York for collection of the electric systems benefits charge.

[15] The gas systems test is similar to the "Utility Test," and considers benefits only to the gas system rather than society as a whole.