PSC DOCKET NO. 12-546
CAESAR RODNEY INSTITUTE
FOLLOW UP DATA REQUEST
TO DELMARVA POWER & LIGHT COMPANY

Question No.: CRI-7

You provided average main pipeline construction cost/foot for the last three years in your answer to AG-T-3. The 2012 cost/foot was 50% higher than the average of the previous two years. Please provide detailed cost information for the three years and explain the big increase in 2012.

RESPONSE:

The three year average of $40.23 per foot of main originally provided in November 2012 had data through October 2012. The 2012 yearly average is $46.50 per foot or a 21.85% increase over 2011. In 2012, there were 75% more short (less than 100 foot) main extensions performed than in 2011. Short main extensions for a single customer have a higher average cost per foot due to tie-in and inspection costs that occur on a per project and not on a per foot basis.

The revision of the three year average, being based on 36 months of data, reduced the cost/foot from $40.23 to $38.93. The proposed tariff change was for customers to pay the three year average cost (plus applicable taxes currently 17.1%) for main extensions in excess of 100 foot per home. Assuming this revision was approved the required customer contribution would be $45.59 for every foot over 100 foot.

Detail cost is provided on attachment.

Respondent: Robert M. Collacchi

PSC DOCKET NO. 12-546
DELAWARE PUBLIC SERVICE COMMISSION STAFF
FIRST SET OF MAIN EXTENSION DATA REQUESTS
TO DELMARVA POWER & LIGHT COMPANY

Question No. : PSC-ME-1

Ref: page 9 – lines 18-19. Does the Company have any quantitative data to support the statement, "As a result increasing numbers of Delaware residents and small business owners have approached the Company seeking to lower their energy costs."? If so, provide the number of customers who have approached the Company to request main extension service for 2011 and 2012. Provide copies of all correspondence to these customers along with all analyses that show what the project costs are for the particular projects. Include the contemporaneous analyses (e.g., cost benefit/net present value model) used to support the Company's proposal for Customer Contribution in Aid of Construction to each customer.

RESPONSE:

The company takes phone calls from customers and provides information via the phone which is not recorded or logged. These same customers at times simply do not call back. As a representative sampling, approximately 43 individual customers and 15 civic associations have approached the company in the 2011-2012 timeframe and have chosen not to move forward due to the cost of the CIAC. Please refer to attachments PSC-ME-2 and PSC-ME-6 for more information.

Respondent: Robert M. Collacchi

PSC DOCKET NO. 12-546
DELAWARE PUBLIC SERVICE COMMISSION STAFF
FIRST SET OF MAIN EXTENSION DATA REQUESTS
TO DELMARVA POWER & LIGHT COMPANY

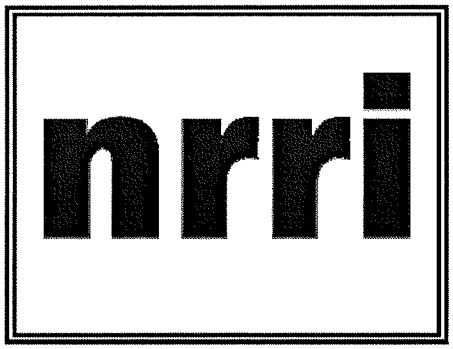
Question No. : PSC-ME-8

Ref: page 11, lines 3-5. Provide support for the statement that providing the 100 ft. of main is "more on-par with the average amount of feet of main per existing customer." Did the Company analyze the impact or offer any additional footage (e.g., 125ft, 150ft, 200ft, etc.)?

RESPONSE:

Delmarva currently has approximately 1947 miles (10.3 million feet) of gas mains. Delmarva has approximately 123,000 total customers and approximately 114,000 residential customers. This calculates to 83 ft/all customers and 90 ft/residential customer respectively. The company did not consider additional footage beyond the 100 ft/customer requested.

Respondent: Robert M. Collacchi



Line Extensions for Natural Gas: Regulatory Considerations

Ken Costello
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Mr. Ken Costello is Principal Researcher, Natural Gas Research and Policy, at the National Regulatory Research Institute. He received B.S. and M.A. degrees from Marquette University and completed two years of doctoral work at the University of Chicago. Mr. Costello previously worked for the Illinois Commerce Commission, the Argonne National Laboratory, Commonwealth Edison Company, and as an independent consultant. Mr. Costello has conducted extensive research and written widely on topics related to the energy industries and public utility regulation. His research has appeared in books, technical reports and monographs, and scholarly and trade publications. Mr. Costello has also provided training and consulting services to several foreign countries.

Acknowledgments

The author wishes to thank the Honorable James Gardner, Vice Chairman, Kentucky Public Service Commission; Laura Demman, Nebraska Public Service Commission; Robert Harding, Minnesota Public Utilities Commission; Cynthia Marple, Marple Rate Strategies; Professor Carl Peterson, University of Illinois Springfield; Joe Rogers, Massachusetts Attorney General's Office; and NRRI colleague Dr. Rajnish Barua. Any errors in the paper remain the responsibility of the author.

Executive Summary

The low price of natural gas in the U.S. has sparked interest in growing the use of this energy source. One example of this growth is residential, business, agricultural, and industrial energy consumers wanting to switch from oil, propane, and other fuels to natural gas. Many of these consumers reside in urban and suburban areas that previously had no access to natural gas, while others live in rural areas that still do not have access to natural gas.

Current and expected natural gas prices now make it economically sensible for more energy consumers to switch from oil or propane to natural gas. Switching to natural gas also may have broader public benefits, such as a cleaner environment, more reliable service, and economic development. With natural gas prices presently far lower than oil and propane prices, large-scale switching to natural gas could create public benefits substantial enough to warrant governmental actions. These actions can include financial assistance and market-facilitation support. Fuel switching might fit within a state's energy, economic development, or environmental policy. From an operational standpoint, the integration of new lines into a utility's existing distribution network can lead to internal efficiencies. These benefits can lower the average cost of a utility's service. Overall, switching to natural gas has the potential to save energy consumers substantial sums of money and contribute to a cleaner and more robust economy.

One factor for energy consumers switching to natural gas is the line-extension policies of utilities. Most state commissions require gas utilities to include these policies as part of their tariffs. Line-extension policies affect utilities' ability to extend their lines to new areas and specify the cost obligations of new customers (and property developers), which can determine whether natural gas would be cost-effective for these potential customers. These policies also can affect the prices charged to existing utility customers. Incremental prices, for example, tend to protect existing customers from the costs of line extensions and give prospective customers proper price signals on the economics of fuel switching. Yet, as some observers have argued, the alternative, rolled-in pricing, has the advantage of shielding new customers from the full costs of line extension. This cost allocation can avoid discouraging some prospective customers from switching when it would be economical and socially beneficial.

Many of the same principles that the Federal Energy Regulatory Commission applies to setting rates for interstate pipelines expansions apply to line extensions by gas distribution companies. An important principle is the justification for rolled-in pricing when existing customers benefit from an expanded pipeline network. Another principle, which tends to support incremental pricing, is giving new customers proper price signals in choosing a pipeline or an energy source. A third principle is to avoid undue price discrimination, in which prices to certain customers deviate severely from cost-based levels.

Three theoretical reasons exist for allocating a portion of extension costs to existing customers. First, a utility can earn net revenues or profits from new customers that translate into lower prices for all customers over time. As long as the utility is able to charge a high enough price to new customers to cover incremental costs, this condition should hold. The second

reason is the existence of public benefits from fuel switching to natural gas. Society may not achieve the optimal amount of benefit from fuel switching if new customers bear all of the incremental costs. The third reason is that existing customers may benefit from economies of scope. These benefits occur when the stand-alone cost exceeds the incremental cost of providing service to one group of customers when the utility simultaneously provides service to another group of customers. These economies derive from the shared use of joint inputs in serving additional customers. That is, the cost savings derive from the complementary nature of a utility serving two or more distinct customer groups. The closer-to-optimal utilization of some utility resources could cause the utility's total average cost to fall, benefiting both existing and new customers.

The problem with the last two reasons for allocating line-extension costs to existing customers is that they are hard to quantify. The optimal subsidy or cost reallocation to existing customers requires knowing (1) the difference between the public benefit and private benefits, or (2) the benefits to existing customers from economies of scope. The preferred approach, consequently, might involve not allocating any incremental costs to existing customers, other than the portion that the utility can expect to recover over time from new customers, and assign all of the remaining additional costs to new customers. Most state utility commissions, in fact, tend to support this hybrid-pricing scheme in protecting both existing customers and utility shareholders. New customers alone pay for the "uneconomic" costs of new gas lines, while existing customers absorb the remaining portion of costs that a utility expects to recover from new customers over time.

Line-extension policies encompass several topics that regulators commonly grapple with. This paper addresses each of these topics, which are as follows:

1. Utility incentives for line extensions
2. Customer incentives for fuel switching
3. Utility cost recovery of incremental cost
4. Rolled-in pricing versus incremental pricing
5. Risk sharing and fairness among stakeholders
6. The appropriate economic test for utility investments in line extensions
7. The necessary conditions for subsidization of new customers
8. The proper role of the utility in promoting and facilitating fuel switching
9. Regulatory barriers to utility action; and
10. Affordability of economical fuel switching to prospective customers

These topics have the potential for becoming areas of contention in different ways in various kinds of situations. One topic of particular interest is the sharing of the incremental costs for line extensions between existing and new customers. Another topic of interest is determining the conditions required for subsidizing new customers. There is also the question of what constitutes subsidization. In all, line-extension policies challenge regulators on various fronts. Some commissions have even deviated from long-held ratemaking mechanisms to accommodate and promote fuel switching and gas-line extensions.

This paper starts with an overview of the extension policies of several states and gas utilities. It then discusses the myriad topics embedded in a line-extension policy. It follows with a model line-extension policy that state utility commissions can use as a guide. This model contains underlying objectives; it also addresses the challenges of developing a policy that balances these objectives (which sometimes conflict) for advancing the public interest. Finally, this paper makes recommendations to state utility commissions on what to avoid and include in a line-extension policy.

This paper is applicable to other public utility industries, namely electricity and water. Those two industries differ from the natural gas sector in that consumers have no good substitute to meet certain end-use needs (e.g., lighting, air conditioning). In most states, electric utilities have assigned and exclusive service territories, as well as an obligation to serve. Natural gas lacks this essential nature, as other energy sources are able to provide all the end-use services that natural gas does.

As far as the author knows, no comprehensive study of gas-line-extension policies exists. This paper offers state utility commissions insights on and an analysis of a topic that has grown in importance. The demand for distribution-line extensions has proliferated in recent years across various parts of the country. Commissions should consider seriously reviewing their gas utilities' line-extension policies in light of this development. They may find them to be incompatible with current regulatory objectives and conditions in the natural gas sector. The New York Public Service Commission, for example, recently initiated a new proceeding on examining policies associated with the expansion of natural gas service. Other state utility commissions may want to do the same.

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Line Extensions for Natural Gas: Regulatory Considerations

I. Reasons for the Study

The shale gas revolution has dramatically changed the outlook for natural gas in the U.S. Compared to less than five years ago, projections call for lower futures gas prices and abundant supplies well into the future. This new outlook has fostered industry action and governmental policies that aim to increase the consumption of natural gas both domestically and internationally. Most of the attention so far has focused on the increased use of natural gas for generating electricity. Yet increased attention has centered on efforts to (1) expand natural gas services to unserved areas and (2) grow gas usage in underserved areas that currently have gas mains. States, communities, and regions, for seemingly good reason, have advocated that businesses and households switch to natural gas.

Current and expected gas prices now make it economically sensible for more energy consumers to switch from oil or propane to natural gas. Switching to natural gas also may have broader public benefits, such as a cleaner environment, more reliable service, and economic development. As expressed in one study:

> As a result of...oil to gas conversions, Connecticut will have cleaner air, a lower carbon footprint and its businesses and homeowners will have lower production costs on the one hand and increased household consumption on the other. If the United States can tap further into its natural gas resources, conversion from oil to natural gas may in addition reduce our imports of oil and improve the nation's trade balance.[1]

This paper calls these benefits "public benefits." With natural gas prices presently much lower than oil and propane prices, large-scale switching to natural gas could create public benefits substantial enough to warrant governmental actions. Fuel switching might fit within a state's energy, economic development, or environmental policy. Overall, switching to natural gas has the potential to save energy consumers substantial sums of money and contribute to a cleaner and more robust economy.[2]

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[1] Stanley McMillen and Nandika Prakash, "The Economic Impact of Expanding Natural Gas Use in Connecticut," Department of Economic and Community Development, December 2011, 2 at http://www.ct.gov/deep/lib/deep/energy/cep/decd-the_economic_impact_of_expanding_natural_gas_use_in_connecticut.pdf.

[2] One caveat is that to the extent that state support for gas-system expansion makes urban sprawl more attractive, environmental costs could increase as people drive farther to work and energy use grows for other reasons. A policy to expand gas use, therefore, could conceivably be counterproductive in achieving a cleaner environment. The author thanks Dr. Carl Peterson for this insight.

In today's environment, policymakers should not overlook the possibility that consumers will make erroneous decisions based on the current low price of natural gas. It is likely that sometime in the future natural gas prices will rise again, conceivably at a sharply higher level. When energy consumers contemplate fuel switching, they should understand that their decision would have a long-term effect. Thus, state utility commissions and other governmental entities that encourage fuel switching carry the risk of harming customers over longer periods.

One factor affecting fuel switching, and the topic of this paper, is the gas-line-extension policies of utilities and state utility commissions. This paper focuses on fuel switching from oil and propane to natural gas that requires gas-line extensions.[3] Gas utilities, usually in their tariffs, have explicit rules on line extensions for both main and service pipes.[4] These rules, at the minimum, specify the economic test for line extensions, the financial and other obligations of new customers, mechanisms for utility recovery of incremental costs, and protections for existing customers. Some rules also distinguish between service lines and main lines, as well as areas that currently have underdeveloped main lines and new franchise areas without any main lines.

The reach of line-extension rules encompasses several topics that regulators commonly grapple with. Ten major ones are:

1. Utility incentives for line extensions
2. Customer incentives for fuel switching
3. Utility cost recovery of incremental cost
4. Rolled-in pricing versus incremental pricing
5. Risk sharing and fairness among stakeholders
6. The appropriate economic test for utility investments in line extensions
7. The necessary conditions for subsidization of new customers
8. The proper role of the utility in promoting and facilitating fuel switching
9. Regulatory barriers to utility action
10. Affordability of economical fuel switching to prospective customers

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[3] Fuel switching can include electricity and activities that do not involve the expansion of gas lines. These cases fall outside the scope of this paper.

[4] A main line delivers gas common to more than one customer. A service line delivers gas from a main line to an individual location, such as a house or business.

These topics have the potential for becoming areas of contention in different ways in various kinds of situations. One particular topic of interest is the sharing of the incremental costs for line extensions between existing and new customers.[5] Another topic is determining the conditions required for subsidizing new customers. There is also the question of what constitutes subsidization. In all, line-extension policies challenge regulators on various fronts. Some commissions have even deviated from long-held ratemaking mechanisms to accommodate and promote fuel switching and gas-line extensions.

As far as the author knows, no comprehensive study of gas-line-extension policies exists. This paper offers state utility commissions insights on and an analysis of a topic that has grown in importance. The demand for distribution-line extensions has proliferated in recent years across various parts of the country. Commissions may want to review their gas utilities' line-extension policies to ensure their compatibility with current regulatory objectives and conditions in the natural gas sector.

A session at the 2012 NARUC Summer Meetings titled "Going the Next Mile: How Utilities and Regulators Can Work Together to Get Natural Gas to Unserved and Underserved Communities" reflected regulators' interest in gas-line extensions. The word "unserved" refers to areas remote from the nearest utility's gas system.[6] A utility may have to make substantial investments to construct a new main line to serve these areas. An "underserved" area, in contrast, may have main lines nearby but many households and businesses that consume other forms of energy. It would be cheaper for the gas utility to connect new customers in "underserved" areas than in "unserved" areas. Differences in the costs may warrant a special policy for "unserved" areas.[7] For example, new customers may have to expend substantial dollars up front to pay their fair share of the incremental extension costs. Under certain conditions, subsidizing prospective customers to induce them to switch to gas might have some validity.

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[5] In this paper, new customers can include property developers and other proxies for utility retail customers.

[6] See the presentation, for example, of Sonny Popowsky at http://www.narucmeetings.org/Presentations/PopowskySummerMeetings00157406.pdf.

[7] Minnesota was one of the early states to create a special policy for expanding gas service in unserved areas because it would be uneconomic for the utility, as well as burdensome to existing customers, under existing tariffs. (*See*, for example, Docket No. G-007/M-92-212.) As noted in this paper, options for funding such new extensions include a high surcharge on gas customers in unserved areas, a general rate increase that would burden all customers, and local government financial assistance paid for by taxpayers.

II. Summary of Gas-Line-Extension Practices

A. Common practices across states

This study did not a conduct a comprehensive survey of gas utility practices on line extensions. It instead reviewed the tariffs of several utilities that contain provisions on line extensions. The study noted several commonalities across utility practices, but at the same time, even for gas utilities in the same states, it observed distinct differences. As an example, a utility may provide "free" pipe extension up to a specified number of feet, while another utility in the same state may charge new customers for the entire footage. A second example is the method for calculating new customer financial obligations and the repayment period. Differences also lie with the economic test that utilities apply in evaluating proposed line extensions. Gas utilities in the same state may also differ in their promotion and marketing strategies for fuel switching.

One suggestion for state commissions, for consistency and fairness, is to consider establishing a statewide line-extension rule. The rule could specify: (1) the economic test, "free" allowances, and the ratemaking treatment of incremental costs; (2) utility financing for customer contribution; and (3) criteria for new customer contributions and refunds. Commissions might find that the current utility-by-utility tariffs are unfair and inefficient in addition to discouraging energy consumers from converting to natural gas. Fairness primarily involves balancing the interests of new and existing customers.

Utility tariffs commonly specify the "free" service and main-line extensions that new customers can receive and the amounts that they will have to pay for extensions that exceed the excess footage or costs. Most commissions adhere to the principle that any line extensions should not burden existing customers. In effect, most commissions apply a hybrid pricing mechanism that allocates: (1) the economic portion of new lines to all customers (rolled-in pricing[8] aspect) and (2) the uneconomic portion to new customers (incremental pricing[9] aspect). The rationale for the first part is that the utility expects to recover adequate revenues from new customers for the economic portion. The utility, in other words, expects to recover, at the minimum, its "economic" cost in rates.[10] Either existing customers would be held harmless or

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[8] Under *rolled-in pricing*, the utility adds the costs of line extensions to existing costs with prices to all customers based on this sum. New and existing customers face the same price. Analysts often refer to rolled-in prices as average or embedded cost prices.

[9] Under *incremental pricing*, the utility's price for sales to new customers differs from the price for sales to existing customers; the incremental price includes the cost of new extension lines plus the share of the existing system's costs allocated to new customers. For example, the utility might charge new customers a premium price for a fixed time to pay for new extension lines. Incremental prices relate closely to the economist's notion of marginal cost.

[10] The capital expenditures for new lines, for example, would go into rate base, and the utility would depreciate the lines over some specified time (e.g., the lines' service life, five years).

benefit (when incremental revenues exceed the "economic" costs.[11] The incremental pricing component operates by charging new customers the "uneconomical" portion of the extension costs that would burden existing customers. Overall, the hybrid pricing mechanism has the feature of achieving a fair allocation of costs based on cost-causation and "beneficiary" principles[12]—at least, most gas utilities and state utility commissions believe that the hybrid pricing of new service produces these outcomes.

A regulatory question relates to whether a state should have a uniform policy and tariffs on gas-line extensions or continue with the common practice of utility-by-utility tariffs. The commission itself or the state legislature could mandate a uniform policy. A policy might include general principles and guidelines for line-extension activities. It might prescribe more detailed rules; for example, allowing a utility to request a waiver of the policy if warranted by specific circumstances.

One conspicuous observation is the *ad hoc* nature of rules. Little rationale seems to exist for some of the provisions. Consequently, and for other reasons noted later, state utility commissions may want to revisit these rules to assess their reasonableness and compatibility with today's gas-market environment. Because of the increased attractiveness of natural gas, commissions may want to consider whether existing rules pose excessive obstacles to fuel switching that is in the public interest.

B. Specific examples

In some states, gas utilities, state utility commissions, and legislatures have taken proactive positions on promoting line extensions and fuel switching. A summary of these actions follows.

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[11] Under traditional ratemaking, when a utility collects additional revenues that exceed incremental costs, rates to all customers would tend to decrease. In the instance at hand, existing customers may see higher rates initially but lower rates in the end. In effect, they act as lenders to new customers who receive an up-front payment for a portion of the line extension costs (e.g., "free" footage) and repay existing customers through rates over some specified period. Unless utility shareholders compensate for lower-than-expected future revenues from new customers, existing customers absorb the risk.

[12] For example, the restriction of recovering only "economic" costs from existing customers avoids those customers' having to pay for costs that benefit solely new customers.

1. Nebraska

Nebraska has passed legislation facilitating the expansion of gas lines into new areas.[13] Legislators hope that by lowering the energy costs of businesses and industries, the legislation will promote economic development and job creation in rural areas.

The legislation streamlines the regulatory review process in addition to allowing utilities to spread the costs of line extensions to all of their ratepayers.[14] One of its provisions requires the different stakeholders—including gas utilities, municipalities, local businesses, and investors—to come before the Public Service Commission with a plan for line extension. The plan must consider the economic effect on the area, economic feasibility, and other options that would better advance the public interest.

The parties could request recovery of the costs from all of the utility's customers if the plan promotes economic development in an unserved or underserved area. The intent is to bolster financial support for expanded pipeline infrastructure that new customers alone are unable to fund. The legislation addresses the concern that allocating all the cost of a line extension to a single customer or a small group of customers would make fuel switching cost-prohibitive. It allows a utility to impose a surcharge that is separate from general rates.[15] The legislation also recognizes the possibility that municipalities located in remote areas would fund line extensions or provide other assistance for the purpose of economic development.

2. North Carolina

North Carolina has provided financial support for line extensions that fail an economic test. The North Carolina Clean Water and Natural Gas Critical Needs Bond Act of 1998 authorized the issue of general obligation bonds for natural gas extensions that are not economically feasible. The state General Assembly also enacted legislation that allows the creation of expansion funds for the extension of gas service to unserved areas. Gas utilities can apply the funds only to economically infeasible expansions, or to expansion estimated to produce

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[13] Legislative Bill 1115 passed in July 2012. *See* http://nebraskalegislature.gov/FloorDocs/102/PDF/Final/LB1115.pdf.

[14] The latter provision is particularly noteworthy, as the state's statutes prohibit subsidization and discrimination in utilities' rates, defined as a distortion of cost allocation relative to cost-of-service principles. The new legislation makes gas-line extensions in certain circumstances an exception. In states that prohibit subsidization, new customers are responsible for all of the line-extension costs that are unrecoverable by the utility.

[15] This treatment required a change in the state Natural Gas Regulation Act.

a negative net present value.[16] Funds can come from a surcharge imposed on existing ratepayers, supplier refunds, and other sources approved by the Utilities Commission.

Both legislative actions facilitate the development of the natural gas infrastructure in remote areas of the state where the economics would otherwise preclude development.[17] By all accounts, these actions have bolstered the development of the natural gas infrastructure throughout the state.

3. Delaware

Chesapeake Utilities has proposed a hybrid cost-recovery mechanism for line extensions before the Delaware Public Service Commission.[18] The proposal also includes the utility providing services that: (1) facilitate customer conversion to natural gas and (2) offer loans and other financial programs allowing new customers to pay their line contributions over a number of years. The utility also proposes to apply the internal rate of return (IRR) method to evaluate line-extension projects. (Part III.C.2 of this paper discusses the IRR method.)[19]

The hybrid mechanism contains two components: One recovers costs only from new customers (the infrastructure expansion service rate[20]), and the second recovers certain costs associated with line extensions from all ratepayers (the distribution expansion service rate).[21] The proposal combines both incremental and rolled-in pricing principles.

As noted in its testimony, Chesapeake contends that:

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[16] The net present value equals the present value of expected future cash inflows minus the present value cash outflows over the life of the new lines.

[17] *See Report of the Public Staff North Carolina Utilities Commission to the Joint legislative Commission on Governmental Operations: Analyses and Summary of Expansion Plans of North Carolina Natural Gas Utilities and the Status of Natural Gas Service in North Carolina,* April 24, 2012, 3-5 at http://www.pubstaff.commerce.state.nc.us/psngas/publications/bireport.pdf.

[18] At the time of this writing, the commission had not decided on the proposal.

[19] *See In the Matter of the Application of Chesapeake Utilities Corporation for Approval of Natural Gas Expansion Service Offerings to be Effective September 1, 2012*, Docket No. 12-292, application filed with the Delaware Public Service Commission, June 25, 2012 at http://depsc.delaware.gov/dockets/12-292%20app.pdf .

[20] This rate would recover most of the construction costs for new pipes.

[21] The utility proposes to integrate both rates into the monthly customer charge. The distribution expansion service rate will support administrative-related activities associated with the offering of gas service in expanded areas.

> Chesapeake's proposal will accelerate expansion of natural gas service with minimal impact on the cost of service for existing customers as compared to what they are paying today.[22]

The utility describes the proposal as an expanded version of energy efficiency: Fuel switching to natural gas has several benefits, including saving energy and contributing to a cleaner environment. A state workgroup previously issued a report that agrees with this assessment:

> Given the benefits of natural gas and the potential energy savings on a full-fuel-cycle basis, the Workgroup supports the expansion of gas service in all areas of the state and recommends inclusion of fuel switching and gas fired combined heat and power systems (CHP) toward energy-efficiency savings.[23]

4. New York

The New York State Energy Plan of 2009 stated that:

> In situations where expansion of natural gas facilities into new areas is not economically viable, it may be possible to receive contributions towards the costs of the expansion facilities from potential customers, interested municipalities in the region, and state economic development funds.[24]

In November 2012, the New York Public Service Commission initiated a technical conference on the study of policies for the expansion of natural gas service.[25] The initiative is in response to Governor Cuomo's Energy Highway "Blueprint." The document requests: (1) an examination of existing barriers to the expanded use of natural gas service by residential and businesses customers in the state and (2) appropriate measures to mitigate potential barriers.

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[22] *See In the Matter of the Application of Chesapeake Utilities Corporation for Approval of Natural Gas Expansion Service Offerings to be Effective September 1, 2012,* 12.

[23] *State of Delaware Energy Efficiency Resource Standards Workgroup Report*, June 2011,3 at http://www.dnrec.delaware.gov/energy/information/Documents/EERS/Final%20EERS%20Workgroup%20Report.pdf.

[24] New York State Energy Planning Board, *New York State Energy Plan 2009*, Volume II (Natural Gas Assessment), December 2009, 4 at http://www.nysenergyplan.com/final/Natural_Gas_Assessment.pdf.

[25] State of New York Public Service Commission, *Proceeding on Motion of the Commission To Examine Policies Regarding the Expansion of Natural Gas Service, Order Instituting Proceeding and Establishing Further Procedures*, November 30, 2012 at http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B33008B64-79D4-4DD3-B222-442061E06BAE%7D.

The Commission recognizes the potential benefits from expanded natural gas service:

> Natural gas is cleaner than other fossil fuels used for home heating and under current market conditions costs a third as much. Moreover, New York State is well-located geographically to take advantage of existing and newly developed natural gas supplies located outside our State but which, when competitively-priced, are available to supply customers within the State. New York's location relatively close to these new sources of supply could provide the State a competitive advantage in attracting and retaining employers concerned about costs of, and access to, a reliable source of energy. In addition, consumers may enjoy significant savings in household fuel expenses which in turn could benefit the State's economy to the extent that households redeploy those savings.[26]

The Commission expressed the need to revisit its policies on natural gas expansion in view of recent developments in gas markets. Specifically, the Commission noted a concern over the "subsidization of expansions by existing ratepayers, particularly as such benefits shareholders."[27] The Commission order asked utilities and other stakeholders to respond to 21 questions. Commission staff will include the responses in a report to the commissioners.

5. New England

Especially worth noting are efforts in New England to promote fuel switching from oil to natural gas. This region still has a large number of customers using fuel oil for space heating. Conversion to natural gas has the potential to save consumers large sums of money. In Maine, many oil and propane consumers would like to convert to natural gas, and competition for operating in unserved areas has intensified. A new law signed in 2012 authorizes the Finance Authority of Maine to issue bonds for the development of the state's natural gas infrastructure.[28]

Connecticut has proposed legislation that will promote fuel switching as part of the state's energy strategy.[29] Supporters contend that households could save thousands of dollars annually by converting from oil to natural gas and that businesses could substantially lower their

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[26] Ibid., 1.

[27] Ibid., 8.

[28] *See* http://www.kjonline.com/news/gas-pipeline-pitched-in-winslow_2012-12-10.html and https://bangordailynews.com/login/?redirect_to=https%3A%2F%2Fbangordailynews.com%2Fposts%2F.

[29] "SB 450, An Act concerning Energy Conservation and Renewable Energy," Connecticut General Assembly, *OLR Research Report,* 2012-0R-0153, March 20, 2012 at http://www.cga.ct.gov/2012/rpt/2012-R-0153.htm.

energy costs, making them more competitive. They recognize the barriers to fuel switching that legislation or regulatory policies can redress.[30]

Vermont has allowed its only gas utility (Vermont Gas Systems) to use ratepayer monies to start planning for line extensions that could save households and businesses large sums of money in the future. The Vermont Public Service Board reasoned that the potential benefits from expanding gas service in the state outweigh any concern over ratepayers funding development and planning costs in the near term. The Board identified these benefits as the reduction in greenhouse gases and increased economic development.[31]

6. Pennsylvania and Virginia

Pennsylvania also hopes to expand gas service into rural and other areas where gas is currently unavailable.[32] The state now has an abundance of natural gas that it wants allocated to in-state households and businesses that currently consume higher-priced and more environmentally damaging forms of energy. Virginia has passed legislation that will facilitate the recovery of costs for eligible gas-line extensions that promote economic development.[33]

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[30] The Governor hopes to have 300,000 customers convert to natural gas as part of his energy plan. Currently, only about 31 percent of homes in Connecticut have natural gas heat; the typical oil-heat customer spends about $2,650 a year on fuel and the typical gas customer spends just $1,100. The Governor and others see conversion to natural gas creating jobs, making in-state business more competitive, and improving the environment. One problem they noted is the high cost of extending a gas line to a street that lacks one. *See* http://articles.courant.com/2012-10-05/business/hc-energy-plan-1005-20121004_1_natural-gas-energy-efficiency-water-heaters.

[31] One board member dissented, saying that Vermont Gas Systems should instead use the parent company's money to support these activities. He also contended that the arrangement poses an inter-generational equity problem. Finally, he asks why current ratepayers should fund an activity that, if successful, would benefit utility shareholders in the long run. Another concern was that using ratepayer money to expand gas-distribution lines might place competitors, who do not have the same opportunity, at an unfair disadvantage. *See* Vermont Public Service Board, *Request of Vermont Gas Systems, Inc. to establish a System Expansion and Reliability Fund with funds provided by reductions in the quarterly Purchase Gas Adjustment rate under the Alternative Regulation Plan, Order Amending Alternative Regulation Plan,* Docket 7712, September 28, 2011.

[32] "Demand for Natural Gas Distribution Lines Focus of Rural PA Hearing," press release from State Senator Gene Yaw, April 12, 2012 at http://www.senatorgeneyaw.com/Press/2012/0412/041212.htm. An email received by the author from the Director of the Pennsylvania Center for Rural Development, on November 29, 2012, indicated that Senator Yaw's group is working with the Public Utility Commission, communities, and gas utilities to explore initiating "a pilot project just to see what works, what problems we run into, what lessons we learn and how that could shape a more formally structured state-level gas service expansion program."

[33] *See* http://leg1.state.va.us/cgi-bin/legp504.exe?121+sum+HB559.

Appendix A lists the major activities in nine states. Initiators of these activities include gas utilities, utility commissions, energy consumers, local governments, and state legislatures. The objective in all instances is to facilitate the expansion of gas service to unserved and underserved areas in the respective states. All of these states believe that fuel switching to natural gas has the potential to produce large public benefits.

III. Topics of Regulatory Interest

Gas-line extensions involve several topics of regulatory interest. As in most other regulatory matters, specific actions, while apparently attractive at first sight, might produce unexpected costs and, overall, negative outcomes. While in principle gas-line extensions seem like a good idea, how utilities carry them out will determine their social desirability.

A. Fuel switching

1. Recent trends

In most regions of the country, excluding rural areas, households and businesses can choose between natural gas and other energy sources. Consumers normally make these choices when their existing appliances become either physically or economically depreciated,[34] or when they purchase or build a new house. The U.S. has seen a large number of households shifting from one fuel to another over time. In 1950, over half of American households with space heating equipment used either coal or oil for space heating; by 2009, only 6 percent did. Over that same period, the combined natural gas and electricity share rose from 27 percent to 83 percent.[35] In the last twenty years, New England households have shifted in large numbers from oil to natural gas.[36] Households and business continue to switch, as oil prices rise relative to natural gas prices. Even the Pacific Northwest, where electricity is relatively inexpensive, has

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[34] Economic depreciation occurs when a household has an old gas furnace that is still functional but only has a few years of life left and is costly to operate relative to a more efficient gas furnace or electric heat pump.

[35] U.S. Energy Information Administration, *Residential Energy Consumption Survey (RECS), 2009 RECS Survey Data* at http://www.eia.gov/consumption/residential/data/2009/xls/HC6.7%20Space%20Heating%20by%20Census%20Region.xls.

[36] The percentage of households in New England using natural gas as their main space heating fuels increased from 28 percent to 40 percent during 1997-2009. Over the same period, oil's share fell from 51 percent to 42 percent. *See* U.S. Energy Information Administration, *Residential Energy Consumption Survey (RECS), 2009 RECS Survey Data* at http://www.eia.gov/consumption/residential/data/2009/xls/HC6.8%20Space%20Heating%20in%20Northeast%20Region.xls.

seen many households convert to natural gas for space and water heating. Energy market shares vary widely across regions. Natural gas water heaters dominated in most regions of the country.[37]

Notwithstanding these trends, the recent surge in natural gas supply has generated interest in accelerating fuel switching to natural gas.[38] We have already discussed the potentially large private and public benefits from fuel switching. Energy consumers can save large sums of money that they can spend on other goods and services. This increased discretionary income can bolster the local and state economy. Consumers also directly benefit to the extent that natural gas is more convenient and reliable than oil or propane.[39] Natural gas has environmental advantages over oil. Finally, an "amenity" benefit derives from the absence of an oil or propane storage tank on one's property.[40]

2. Economic and other factors

The major drivers for fuel switching in the U.S. are the relative prices of different energy sources, climate, environmental regulation (e.g., removing coal for home use), and increased natural gas availability. Fuel availability is a requisite for choice. Rural areas use little natural gas because of the scarcity of gas-distribution lines. This scarcity stems from the cost-ineffectiveness of extending lines to these areas. Natural gas is the fuel of choice in most areas where households have access to a gas-distribution main.

a. Cost-effectiveness

The cost-effectiveness of fuel switching relies on several factors: (1) conversion costs,[41] (2) the cost of additionally required natural gas connections or extension lines, (3) the avoided cost of oil or propane (e.g., fuel and other operating costs, capital costs), and (4) the incremental cost of natural gas (e.g., purchased gas costs and any additional distribution costs). The most cost-effective fuel choice often correlates with the specific conditions of a home. One specific condition is the amount of energy used in a home. Home energy use depends directly on a

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[37] *See* various issues of the U.S. Energy Information Administration's *Annual Energy Review* and *Household Energy Consumption and Expenditures*. *See* http://www.eia.doe.gov/emeu/aer/contents.html.

[38] *See*, for example, the activities discussed in Part II of this paper.

[39] For example, natural gas offers less chance of non-deliverability of energy and service shut-offs because of extreme weather conditions.

[40] Another possible benefit is protection against shut-offs during cold weather. Some states prohibit shut-offs by delivered-fuel providers, such as propane suppliers, but other states do not. The author thanks Bob Harding for this insight.

[41] Conversion costs include heating-equipment replacement, internal piping, and a meter.

number of factors including house size, the thermal efficiency of the house, climate, and the preferences for indoor ambient temperature. The attractiveness of specific fuels also depends on energy prices and their expected escalation rates. Important factors of fuel switching to natural gas are the costs of conversion and delivering gas to the house or business.

b. Micro-consumer factors

When making energy choices, consumers usually look at different factors that relate to the costs they expect to incur over the life of energy-using equipment.[42] These costs include: (1) purchase and installation; (2) annual operating cost, mainly the cost of fuel; (3) repair or maintenance cost; and (4) service life. Switching forms of energy also may require special plumbing or retrofit work. Energy choices are often house-specific. Two homes in the same city may reach different decisions on what energy sources to use because of differences in home size, building-shell energy efficiency, and the energy services desired. A small home that is highly energy efficient may opt for electric resistance heating, while a large home that consumes large amounts of energy may prefer natural gas for space heating. Fuel switching to natural gas can make sense for some customers but not others, even when they live in the same neighborhood.

3. Barriers to fuel switching

Theoretical arguments on why consumers sometimes make uneconomic decisions focus on market barriers or imperfections, including: (1) imperfect information, (2) consumer inertia, (3) high customer discount rate,[43] (4) lack of consumer access to capital, and (5) high transaction costs. Some of these barriers prevent consumers from making decisions that are in their self-interest; others reduce society's welfare. Energy-efficient gas equipment generally, for example, has higher initial cost than corresponding electric equipment. This cost differential, assuming consumers heavily discount the benefits of lower energy cost over the life of the equipment, favors certain energy sources even when lower gas prices may make gas preferable on a lifecycle-cost basis. Some consumers may decide not to switch to natural gas because of the combination of high conversion costs and their share of the cost for gas extension lines.

It would be wrong to consider all of these barriers as impediments to better market performance, thereby justifying market intervention. Inertia may reflect the reluctance of some consumers to change suppliers or products because of uncertain outcomes that could make them worse off. Some consumers might feel that low gas prices are only temporary and that they will give way to much higher prices in the future. It would therefore not be cost-beneficial to eliminate or mitigate the effects of all "barriers."[44] Trying to measure in dollars the

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[42] The lifecycle costs measure the money spent on energy over the life of the appliance in present value terms.

[43] A high discount rate means that potential natural gas customers place a diminished value on future benefits that could cause them not to switch when it would be in their long-term interest.

[44] Such risk aversion is a perfectly rational response to uncertainty.

environmental benefits of consumers' switching fuels, for example, could be costly and grossly inaccurate.[45]

In doing their part, state utility commissions might want to consider reviewing their policies and practices to make sure that they do not favor a particular fuel. Their objective should be to reduce transaction costs and other barriers with the goal of promoting efficient fuel markets. Theory suggests that when consumers have access to better information and lower transaction costs, they will be more likely to switch to another product or service. The implication is that, under these conditions, consumers are more apt to substitute one form of energy for another if the information shows long-term benefits.

4. Governmental intervention

Market forces have had the largest effect on the energy-choice decisions of consumers. With adequate information and good decision-making, consumers can best make those choices, and most often they do. This fact, however, does not preclude justification for regulatory and other governmental actions when market problems distort decision-making.

The test that state utility commissions can apply to assess the appropriateness of regulatory intervention in fuel switching is similar to the test they use to assess utility initiatives promoting energy efficiency. Most commissions mandating utility energy-efficiency initiatives require that these initiatives pass some cost-effectiveness test. Commissions generally ground these initiatives on the premise that market problems have hindered consumers from making energy-efficiency investments that are in their own self-interest in addition to society's interest. They might inquire into market problems that relate to fuel-switching decisions, as well as those that relate to energy-efficiency decisions. Commissions should examine the benefits and costs of such intervention. After review of these matters, a commission might well decide to institute a policy of promoting energy efficiency and not fuel switching, or vice versa or both. The combination of existing customers using natural gas more efficiently and oil and propane consumers switching to natural gas may optimize social welfare. Subsidization of line extensions by charging new customers below incremental cost, as an example, may bolster fuel switching on grounds of positive externalities (i.e., an increase in public benefits and social welfare) that energy consumers or utilities do not consider in their decisions. A utility subsidy can include rebates and other financial incentives for furnaces and other gas equipment.

5. Behavioral economics and fuel switching

Behavioral economics combines economics and psychology to explain how people make decisions. It assumes "bounded rationality," where people make decisions with less-than-perfect information because of limited time and mental capacity. People often exhibit what some

[45] Economists generally agree that measuring the benefits of a cleaner environment is imprecise, largely because of the difficulty of assigning a dollar value to the outcome. How much, for example, is a locality willing to pay for fewer emissions of particulate matter, sulfur dioxide, and carbon dioxide when energy consumers switch from oil and propane to natural gas?

analysts call "rational ignorance."[46] People are susceptible to making predictable and avoidable mistakes. Specifically, behavioral economics would say the following about fuel switching:

- **Real-world decision making is often inconsistent with neoclassical theoretical models of consumers making rational decisions.** Consumers make decisions in a complex environment where uncertainty, transaction costs, and conflicting information exist. Some consumers may consider these factors crucial for decision making. At first sight, it may appear rational for consumers to substitute one form of energy for another. Yet less obvious factors could make taking no action seem the more sensible course. Many customers fail to exploit fully the available information in deciding whether to switch. Reasons include confusion and bounded rationality. Customers might have difficulty processing the information—that is, using it to make good decisions. With "fuel switching," initially customers had little or no experience.

- **Policymakers can "nudge" consumers into actions that are most beneficial to the consumer.** By informing consumers of their financial losses from not substituting one form of energy for another, policymakers can "nudge" consumers to make better choices. For example, regulators can post on their websites that switching to natural gas can save the average residential customer $1,500 per year.

- **The human tendency is toward "inertia," which some people would call laziness.** Because deliberating over whether to switch to one form of energy requires effort and time, the opportunity cost for many consumers may exceed their expected benefits. Unless natural gas or some other energy source offers clear advantages (for example, large cost savings), in view of time constraints and other matters of higher priority, why should anyone spend time deliberating over energy choices? In switching to natural gas, the reality is that many energy consumers would likely see large cost differences.

- **Making information clearer to consumers may facilitate consideration of their choices.** By making price and lifecycle comparisons between fuels easier, in addition to providing information on the pluses and minuses of fuel switching, consumers are apt to be more active. Utilities, consumer groups, and regulators can work together to assure that consumers have unbiased and sufficient information.

- **In economic activities like fuel switching to natural gas, where an investment involves short-run costs much greater than short-run benefits, consumers might forgo change even though investments in fuel switching may result in higher returns in the end.** Behavioral economists call this myopic behavior "faulty

[46] *See*, e.g., Richard H. Thaler and Cass R. Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness* (New Haven, Yale Univ. Press, 2008); and Robert H. Frank, *The Economic Naturalist: In Search of Explanation for Everyday Enigmas* (New York, Basic Books, 2007).

discounting." This phenomenon exists to varying degrees in most markets and is difficult to thwart, especially at a low cost and without creating new distortions.

B. Distinction between main-line and service-line extensions

Service lines directly benefit only individual customers. By constructing a line from the street to a house, the residents of the household are the sole beneficiaries. For main lines, a group of new customers benefit. Some customers benefit earlier than others do, as new customers on a single main line sequentially sign up for service over time.

1. Three categories of benefits

We can classify new line extensions into three different groups according to the scope of their benefits. At one extreme are extensions that benefit only new customers: Utilities dedicate service lines to individual households and businesses and main lines to a group of geographically adjacent customers. The implication for pricing and cost recovery is that the utility should allocate all of the incremental cost to new customers. The reason is that private benefits equate to public benefits.

Other extensions benefit mostly new customers, but also can benefit existing customers, although to a much lesser degree. As discussed later, these differences have implications for allocating the costs of extensions. For example, to the extent that existing customers benefit, one can argue that they should pay for a portion of the line extension. Even if existing customers do benefit, utilities dedicate new lines to serve new customers. Existing customers would benefit only as a residual effect from integrating the new lines into a gas utility's distribution network. These benefits presumably are small compared with the direct benefits to new customers. This integration could lower the utility's average cost. If a utility is unable to measure these residual benefits, it might then be appropriate to ignore them for ratemaking purposes.

A third category of new lines can have wider benefits. If they are large in capacity, they can make a concrete contribution to economic development and a cleaner environment. They could also provide some minor reinforcement and reliability benefits to other parts of the utility's distribution system. Under these conditions, policymakers might want to consider subsidies from taxpayers or other governmental assistance to bolster line extensions.[47] As mentioned later, however, they should exercise caution before committing taxpayer money to an investment that, as a rule, the private sector should fund.

2. Main lines offer more challenges for policy

Rules for service-line extensions should be simpler than rules for main-line extensions. The utility can simply calculate the cost for a service extension to an individual home or business

[47] As an alternative, policymakers could institute a Pigovian-like tax on the environmentally damaging fuels, such as oil and propane, to support conversion to natural gas.

and then determine, based on the approved regulatory rules, how much to charge the new customer (e.g., via a surcharge or in rates, or both).

Main lines, in contrast, serve an unknown number of new customers. The utility would expect the number of new customers served by main lines to increase over time. Assume, for example, that a new main line costs $10 million, and initially 1,000 new customers sign up for service. Assuming that new customers pay for the entire amount, the utility would assess each customer $10,000. Assume now that the number of customers using the main line grows to 2,000 after five years. Most people would consider it unfair for the utility to charge the later new customers nothing for the main line while continuing to collect $10,000 from each initial new customer (over, for example, a 15-year time period). Through its regulatory-approved rules, the utility may charge the 1,000 additional customers $5,000 each and refund each of the initial new customers $5,000.[48] The outcome is that each new customer pays the same amount for the new line ($5,000) and the utility recovers fully its cost for the line ($10 million). This equal treatment of new customers is common among utilities.

C. Economic tests for line extensions

1. General conditions for expanded service

When should a utility extend its lines? Should it be any time a prospective customer wants gas service? This unconditional requirement would seem reasonable if the party is willing to pay the full cost for a line extension. Assume, for example, that an individual living in a remote area wants gas service. The utility estimates that it would cost $50,000 to expand a main line and construct a new service line. We assume that the utility finds the line extension uneconomic, or financially infeasible.[49] Few customers would probably pay this full amount, so the question comes down to how much the prospective customer should pay relative to the utility's ratepayers and shareholders, and even taxpayers.

Utility tariffs often include the provision that a utility has an obligation to extend its lines only if the expected revenues from new customers cover the incremental costs. As an example, the practice of New Mexico Gas is:

> In accordance with the [gas-line-extension policy], the Company is required to invest in extensions of its distribution mains to satisfy a customer's natural gas

[48] A common practice of utilities is to refund excess new-customer advance payments or contributions when they experience unexpected growth in customers on a new main line. Some utilities make refunds when annual revenues exceed expectations.

[49] The utility is unlikely to earn enough profits, or distribution margins, from these customers over time to support the $50,000 investment.

> service needs only when it is economically prudent for the Company to do so based on the probable revenues and expenses to be incurred.[50]

Most utility tariffs supplement this provision by specifying that new customers can make up for any revenue shortfalls. They recognize that if the utility extends its gas lines to oblige oil or propane customers, the new customer should assume some financial responsibility to hold both the utility and existing customers harmless. For example, new customers can pay a special surcharge or make an advance payment to the utility.

One fundamental difference to note with electricity is that gas service is not as essential because customers can always consume some other energy source (e.g., oil or propane) to satisfy their end-use demands. We should expect regulators to more willingly mandate service extensions by electric utilities. Most states, in fact, have a statutory universal service goal or mandate for electric service, but not for natural gas.

Is constructing new gas lines to accommodate consumers' desires to switch from one fossil fuel to another a "public need"? The consumer's main interest is in lowering his energy cost, not in acquiring new energy services (e.g., water heating, space heating, or cooking). Rather than serving a "public need," fuel switching, as discussed in Part II, reflects a customer-choice decision that some readers might conclude falls outside the definition of a "necessity."

2. Specific tests for comparing revenues with costs

Most utility tariffs reviewed for this study specify an economic test that compares expected revenues from new customers with the utility's incremental costs. In other words, the utility calculates both the incremental costs and the revenues from a line extension. The following excerpt from a gas utility's tariff exemplifies this point:

> CenterPoint Energy [in Minnesota] will apply the general principle that the rendering of gas service to the applicant shall be economically feasible so that the cost of extending such service will not have an undue burden on other customers. In determining whether the expenditure for gas service is economically feasible, CenterPoint Energy shall take into consideration the total cost of serving the applicant and the expected revenue from the applicant.[51]

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[50] New Mexico Gas Company, *Original Rule No. 16, Gas Line Extension Policy*, January 30, 2009.

[51] CenterPoint Energy, *Rates & Tariffs Minnesota: Gas Rate Book*, Section VI (4.04), February 2, 2009 at http://info.centerpointenergy.com/aboutus/Minnesota/pdf/section6_rules_and_regulations/4_gas_mains.pdf.

The difference between incremental revenues and incremental costs equates to the utility's distribution margins.[52] Incremental costs include non-gas costs, largely composed of capital expenditures for new lines. [53]

Some utilities use a net present value (NPV) test that subtracts the discounted costs of serving new customers from the expected discounted revenues. If the difference were positive, the utility would consider the line extension to be economical and a financially viable investment.

Other utilities use the internal rate of return (IRR) method for evaluating new lines. Firms across different industries commonly use the IRR method to evaluate the financial viability of investments. For gas-line extensions, utilities calculate the discount rate at which the present-value distribution margins equal the present value incremental costs.[54] The utility estimates the annual margins and costs over the service life of a new line or some other specified time. If the discount rate (i.e., the IRR) is greater than the utility's cost of capital[55] (frequently defined as the utility's authorized rate of return in the latest rate case), the utility would consider

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[52] Contention over the measurement of distribution margins can stem from estimating (1) the level of consumption by new customers, (2) future base rates, (3) future costs in serving new customers, (4) the discount rate, and (5) the number of years to include in the calculation. Concerning the last factor, what should be the time horizon: the expected service life of new lines, or the first several years (e.g., ten) of new-customer connection? Utilities tend to prefer a shorter time horizon to reduce the risk of cost recovery. The estimated distribution margins for some utilities, as discussed later, determine credits to new customers for line-extension costs and the amount that goes into base rates.

[53] Annual line-extension costs include maintenance and other operating costs, depreciation, taxes, and debt. Increasing the number of customers is usually far more costly to a gas utility than growing throughput from existing customers. The latter outcome, when it occurs between rate cases, normally increases a utility's profits, assuming that the utility base rates are above short-run marginal cost (which is typically true). Increasing the number of customers normally requires the utility to incur greater additional cost, especially if it has to build both new main and service lines. One study for a gas utility showed that a 1 percent increase in the number of customers raised cost by 0.71 percent. In comparison, a 1 percent growth in total retail deliveries from existing customers raised cost by about 0.11 percent. (Mark Newton Lowry, et al., *Statistical Analysis of Public Service of Colorado's Forward Test Year Proposal*, Exhibit No. MNL-1, December 17, 2010, 18 at http://xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/Exhibit_No._MNL-1.pdf.)

[54] Analysts sometimes refer to the IRR as the rate of return that makes the net present value of all cash flows (both inflow and outflow) for a particular project equal to zero.

[55] The cost of capital corresponds to the minimum acceptable rate of return. When the IRR exceeds the firm's cost of capital, the firm's value normally increases because the investment would be economically profitable.

the new line economically feasible.[56] Otherwise, the utility would have to decide whether to invest in a new line or invest under the condition that new customers will compensate for any revenue shortfall. For the latter action, the utility could calculate the customer contributions required to increase the IRR to the utility's cost of capital.[57]

A third group of utilities uses what analysts call a perpetual net present value method. The maximum level of "economical" investment equals the annual distribution margin divided by the required rate of return. The assumption is that the recovery period approaches infinity. If, for example, the average new customer contributes $300 annually to the utility's distribution margin and the utility's required rate of return is 10 percent, the utility would consider spending $3,000 per new customer to be economical. A real-world example of this method is the provision in NorthWestern Energy's (Nebraska) tariff:

> For determining contributions on pipeline projects, annual revenue will be determined by multiplying projected volumes by the projected tariff delivery rate. The annual non-PGA, non-surcharge revenues will be reduced by the annual projected Operating, Maintenance, and Property Tax expenses. The resulting net margin will be divided by the result of the current allowed return on rate base, grossed up for taxes, to determine the level of investment the load will support. Any project costs over and above the determined level of investment may be collected from the customer.[58]

Other utilities use different methods. Some utilities calculate the maximum investment cost for new lines as a specified multiple of estimated annual net revenues, or distribution margins.[59] In effect, the utility designates a minimum payback period. Assume that a utility

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[56] This condition is necessary for the utility to make the investment, but it may not constitute a sufficient condition. The utility, for example, might have limited capital funds for which it can garner a higher rate of return from other investments.

[57] One gas utility, Southwest Gas, uses a variant of the IRR method, called the incremental contribution method (ICM). As stated in its tariffs:

> The ICM is a cost of service analysis used to calculate the expected rate of return on an investment in mains and/or services and related facilities…If the ICM analysis results show a rate of return equal to or greater than the overall rate of return authorized by the Commission in the Company's most recent general rate case, the allowable investment is equal to the cost of the incremental investment.

(Southwest Gas Corporation, *Nevada Gas Tariff No. 7*, Rule 9 (Facilities Extensions), August 10, 2011 at http://www.swgas.com/tariffs/nvtariff/rules/rule9.pdf.)

[58] NorthWestern Energy, *Nebraska Natural Gas Rate Schedules*, November 2012.

[59] The author obtained results, in Excel spreadsheet format, from an American Gas Association (AGA) survey showing that about half of the gas utilities reporting (47 utilities) use a simple revenue test

wants the payback period not to exceed five years and estimates the annual net revenue for a particular customer as $400. The utility would then consider $2,000 ($400·5) to be the threshold level of investment, or the maximum amount it will spend to justify the investment economically.

One innovative approach proposed by the Massachusetts Attorney General involves a utility conducting an "open season" during which prospective customers would commit to installing natural gas equipment. The utility would calculate the required customer contribution to justify new lines. It would then estimate the minimum number of customers it needs to sign up. If the utility achieves that number, it could then start building new lines. [60] A real-world example is a homeowner's association on the outskirts of Santa Fe, New Mexico, working with the local gas utility, New Mexico Gas Company, "to bring natural gas to as many homes in [the] neighborhood as possible." In a letter to residents, the association organizer noted, "[We] need to ascertain the level of willingness to pay for this project before we take any further steps." [61]

All of the above-mentioned tests have a narrow focus, namely, the financial effect on the utility. They exclude the public benefits that might derive from switching to natural gas. The tests are analogous to what analysts call the "utility test" for evaluating energy-efficiency initiatives. While comparing revenue changes and cost changes is important for knowing the effect on a utility, it ignores the broader societal effects. For fuel switching, these effects can include economic development, a cleaner environment, and increased energy reliability.

3. Extending lines before demand evolves

A gas utility typically would invest in new lines only when enough new customers commit to make them economically feasible, or when they agree to contribute the amount of dollars needed to compensate for any revenue shortfalls. One question that has cropped up recently is whether a utility should "build out" its distribution system on a scheduled basis prior to prospective customers making commitments to switch to natural gas.[62] The idea is to allow

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(e.g., comparing the net revenues from new customers with the line extension costs) while most of the others calculate the rate of return earned from line extensions. The author thanks AGA for providing this information.

[60] *See* Massachusetts Department of Public Utilities, *Petition of Bay State Gas Company, d/b/a Columbia Gas of Massachusetts, pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., for Approval of a General Increase in Gas Distribution Rates Proposed in Tariffs M.D.P.U. Nos. 105 through 139*, D.P.U. 12-25, Order, November 1, 2012, 373-4.

[61] Tano Road Association, "Get Connected! Natural Gas Availability on Tano Road," May 2012 at http://tanoroad.org/news/natural-gas-project.

[62] Some gas utilities require new customers to identify the natural gas appliances and equipment they will use. In some instances, when customers report that they will use relatively little gas (e.g., less than 60 percent of the gas consumed by the average customer), the utility will require them to make a larger up-front contribution or advance.

demand to grow into the additional pipes. The utility may decide to move into new areas with high growth potential, independent of the immediate demand for natural gas service.[63] What would be the appropriate economic test to apply in this situation? For example, a utility may decide to invest in a new franchise area with the expectation that "we will build it and they will come." The uncertainty over future revenues and customer signups would make this endeavor risky. Expanding service in a new area, for example, poses risks in not knowing the number of interested customers: The utility could experience a slower-than-expected penetration of new customers.

One scenario is a utility's building out with the expectation that eventually enough new customers will sign up to gas service, but in the end, few customers do. Either the new customers will pay a high up-front charge that may make switching to natural gas uneconomical *ex post* or, if subsidized by existing utility customers or taxpayers, these parties will realize fewer benefits than anticipated because of the disappointing number of new gas customers.

In evaluating a build-out proposal, a commission may want the utility to provide an estimate of the number of new customers that are "reasonably expected to connect." This would help mitigate the likelihood of inefficient investments included in rate base. [64]

One utility, Northeast Utilities (NU) in Connecticut, proposed to expand its gas distribution system to underserved areas as part of the state's energy strategy. It estimated that the build-out of its system would cost $2.5 billion. As expressed in an article:

> In NU's plan to build-out the system, current natural gas customers will shoulder an extra cost in their bills of constructing and maintaining an infrastructure that will be underutilized while heating oil and electric-heat customers slowly make the switch to natural gas. The company also wants the state government to cover some of the cost for customers to make the conversion to natural gas. [65]

One policy question for utility commissions is: Should the utility absorb the entire risk, or should it pass at least a portion of the costs to existing customers? The rationale for the latter action could be that existing customers will benefit once new customers commit to future gas service. A commission should ask whether such cost recovery is really a good deal for existing customers. Perhaps the local or state government should bolster support by issuing bonds or

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[63] Sometimes a gas utility would expand its mains to a large customer and then gradually, over time, add small customers located along them.

[64] This mitigation presumes that existing customers, rather than utility shareholders, bear the risk of a lower-than-expected number of new customers signing up for natural gas service.

[65] Brad Kane, "Merged NU Pushing $2.5 B Natural Gas Build-Out," *HartfordBusiness.com*, May 21, 2012 at http://www.hartfordbusiness.com/apps/pbcs.dll/article?AID=/20120521/PRINTEDITION/305219998/0/moversshakers.

providing other financial assistance to utility infrastructure development. Because state utility commissions can expect the demand for gas service in sparsely populated areas to grow in the future, they should consider revisiting their line-extension rules to address system build-out.

4. How to apply an economic test

A final point relates to how a utility should use an economic test for decision making: Should it use the test absolutely in accepting or rejecting a proposed line extension? Should a utility, instead, use the test as a guide for action? For example, the test would constitute only one piece of information available to the utility in deciding whether to build new lines.

Gas utilities have used the economic test to calculate the maximum investment that they could support given the expected distribution margins from new lines. The difference between actual cost and economical cost usually would fall on new customers. A good example is the tariff of one Arkansas utility, CenterPoint Enegry:

> If it is determined that the Company's return on investment (ROI) on the proposed main extension will equal or exceed the Company's cost of funding capital projects, the extension will be made at no cost to the customer. If it is determined that the Company's ROI will be less than the Company's cost of funding capital projects, the customer shall be required to pay an amount sufficient to ensure that the Company is able to earn an ROI equal to its cost of funding capital projects.[66]

D. Utility incentives for extending lines

Because line extensions mainly involve capital expenditures, the most crucial outcome for a utility is to expect to earn its authorized rate of return. State utility commissions would tend to agree with this goal. Yet their duty to utility consumers and the public interest also includes making sure that this outcome does not violate generally accepted fairness and economic-efficiency standards.

With new revenues over time, a utility should benefit as long as it recovers its costs.[67] The utility would want to minimize its risk by maximizing the probability of cost recovery.

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[66] CenterPoint Energy, *Rates & Tariffs Arkansas: Gas Rate Book*, Part III – Rate Schedule No. 7 (Extension of Facilities), September 25, 2007 at http://info.centerpointenergy.com/aboutus/arkansas/pdf/Rate_Schedules/ExtensionFacilities.pdf.

[67] *See*, for example, the statement of the Massachusetts Department of Public Utilities:

> The Department's ratemaking treatment for incremental revenues from new customers allow a company to retain those revenues between rate cases...The requirement that incremental revenues from new customers exceed the incremental cost of the capital investment, including a threshold return on the incremental investment that exceeds the Company's overall rate of return, provides gas companies with the incentive to expand their distribution network.

Some utilities seem to prefer recovering more of the incremental costs from existing customers. Their thinking seems to be that recovering costs from only new customers would jeopardize the level of fuel switching or increase the risk of non-recovery.

Do utilities have the right incentive to invest in new lines? That is a difficult question to answer. Utilities generally find it attractive to increase the number of customers. After all, with more customers, their revenues and profits inevitably increase in the end.[68] Yet they may fear non-recovery of all of their incremental costs for line extensions. For example, regulators might set a cap on cost recovery from new customers based on actual revenues that turn out to be lower than expected, or based on erroneously projected capital expenditures. Consequently, utilities might be content with serving fewer customers but assured of full cost recovery. We observe varying utility dispositions to promote fuel switching, presumably reflecting different risk profiles or assessments of likely full cost recovery.

Regulatory lag may be another factor affecting a utility's motivation to expand its service. When a utility receives prompt cost recovery—for example, through a surcharge rider—and retains the profits from serving new customers until the next rate case, the utility would likely exhibit more proactive behavior in extending its lines.

E. "Free" line extensions

Several gas utilities, on a limited basis, provide new customers with line extensions at no cost. Based on a survey that the author obtained from AGA, 49 out of the 83 gas utilities reported that they offer limited free line extensions. Industry observers often refer to the "no cost" pipes as allowances in the form of a dollar credit toward the new customer's financial obligation for a line extension. Utilities may specify the number of "free feet," fixed dollars of "free" pipes, or the maximum dollars of "free" line extensions based on a formula that considers

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(Massachusetts Department of Public Utilities, *Petition of Bay State Gas Company, d/b/a Columbia Gas of Massachusetts, pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., for Approval of a General Increase in Gas Distribution Rates Proposed in Tariffs M.D.P.U. Nos. 105 through 139*, D.P.U. 12-25, Order, 381.)

[68] A gas utility typically recovers non-gas costs from customers by charging them a fixed monthly customer charge plus a volumetric or usage charge. The utility recovers a portion of its fixed costs (i.e., costs that do not vary with customer usage, at least in the short run) through a volumetric charge. Thus, the utility's ability to recover its authorized rate of return depends on the level of gas sales. The utility would have an incentive to promote gas sales, as long as additional sales increase revenues by more than costs. This is why a utility would benefit from increasing sales.

estimated usage.[69] The dollar value often represents the distribution margins that the utility expects to earn from a new customer over some specified time.[70]

The dollar amount of the "free" extension generally goes into the utility's rate base. Thus, all ratepayers initially fund the "free" pipe with payback over time from the distribution margins earned by the utility from new customers. These margins would tend to lower future rates for existing customers based on rate-of-return ratemaking.[71] In effect, existing customers are providing a loan to new customers who pay back through their monthly gas bills. Giving new customers credits toward their financial obligations attempts to balance their interests with the interests of existing customers and utility shareholders.

In its decision approving various line-extension rules for gas and electric utilities, the California Public Utilities Commission discussed the rationale for revenue-based allowances:

> Revenue-based allowances (supported by applicant revenues) for both gas and electric line extensions provide an equitable arrangement between the applicant and ratepayer, as well as between various classes of applicants. The revenue-based allowances, which represent the utility investment, are based on then expected supporting revenues from the loads to be served by the extension. This amount is then used as the allowance and is credited to the applicant's total cost for the extension. The allowance is stated in dollars in order to maintain consistency among and between a large variety of applicants.[72]

F. Customer contributions

Utilities construct new lines at a cost that often exceeds their net present value. To avoid causing existing customers, as well as utility shareholders, to subsidize new customers, a utility will impose a separate charge on a new customer. New customers in a sparsely populated area may produce additional revenues for the utility that are far below the cost of extension. The utility may calculate the difference and charge it to new customers.[73] Industry observers refer to

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[69] Someone has to pay for the "free" pipes, so their costs just pass to someone else, namely, utility shareholders or existing customers.

[70] To hold the utility's existing customers harmless, the allowance should not exceed the discounted expected value of the distribution margins from new customers.

[71] Even by paying higher rates in the short term, existing customers should pay lower rates over time as new customers contribute toward the utility's distribution margins. In this sense, existing customers are not subsidizing new customers.

[72] California Public Utilities Commission, *RE Line Extension Rules of Electric and Gas Utilities*, D.94-12-026, 58 CPUC2d 1, 73, n.2.

[73] An alternative to this approach, which apparently few if any utilities follow, is to assign responsibility for the shortfall to utility shareholders. As new customers connect to a new main line, the

these charges as customer advances for construction,[74] or contributions in aid of construction (CIAC).[75] Utilities do not rate base these charges, but the Internal Revenue Service treats CIAC as revenue for tax purposes.[76]

A separate charge presumes that new customers value switching to natural gas more than what they pay for gas service under the utility's rates. In economics jargon, they receive a consumer surplus, defined as the difference between the value that they place on a good or service and the amount that they actually pay. Thus, new customers could pay an additional charge and still realize a net benefit from converting to gas. Nevertheless, a large up-front charge may discourage them from switching to gas, even if they benefit in the end.

To elaborate, one policy concern is that customer contribution could be so high that some prospective customers would decide not to switch to natural gas even when it is cost-beneficial from a lifecycle perspective.[77] This trade-off between maximizing economical fuel switching and holding new customers responsible for the incremental costs is a matter that will likely confront state commissions in the future. A utility, for example, may require a new customer to pay $15,000 up front to cover her portion of new service and main lines. As an alternative, and

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utility could add more of the costs for line extensions to its rate base. The utility would assume more of the risk but in the process could achieve greater profits in the end from a higher rate base. Overall, this approach might better motivate the utility to increase the number of new customers on new main lines.

[74] Customer advances are funds deposited with the utility as a refundable advance for the customer's share of a line extension determined by the utility to cover that portion of the extension not economically feasible. Refunds may be partial or full over a designated period.

[75] CIAC are funds deposited with the utility as a non-refundable contribution to assist in the financing of a line extension. As with customer advances, the utility calculates CIAC based on "excess" cost" relative to the projected revenues received from new customers. Depending on the utility, new customers may be able to pay their share of CIAC over some designated period. CIAC reflects the need to charge certain customers a special fee when they demand unusual service or reside in an area remote from the utility's infrastructure.

[76] This fact leads to the observation that a utility would have a financial incentive to minimize the CIAC charged to new customers by placing more of the line expansion costs in rate base. The utility would then earn a higher profit, but the downside is that existing customers end up paying a higher share of the line expansion costs.

[77] Another concern raised in regulatory proceedings is that the utility overstates the CIAC. For example, new customers could increase the utilization of a utility's internal resources, thereby benefiting existing customers by lowering average cost. As the argument goes, this cost improvement should translate into a lower CIAC obligation for new customers. *See* Massachusetts Attorney General, *Initial Brief of the Attorney General, Petition of Bay State Gas Company, d/b/a Columbia Gas of Massachusetts, pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., for Approval of a General Increase in Gas Distribution Rates Proposed in Tariffs M.D.P.U. Nos. 105 through 13,* D.P.U. 12-25, August 21, 2012.

what some utilities allow, the customer could pay back her contribution over a number of years. The utility could collect the contribution through a special surcharge. The surcharge could be a CIAC or incorporated into rates. By spreading the customer contribution over, say, five years, customers would be more inclined to switch.[78] One question relates to the appropriate payback period for customer contributions. Extending the period over too many years can impose unnecessary risk on the utility in recovering its costs. Perhaps the threshold for determining the payback period should be whether the monthly contribution is lower than the monthly energy savings for a new customer. If it were, the new customer would still benefit from switching to natural gas.

G. Effect on existing customers: rolled-in versus incremental pricing

1. No-burden criterion

A common objective of line extension rules is to hold existing customers harmless. That is, utilities apply what economists call a "burden test" to protect existing customers. That is why, for example, rules require new customer contributions and economic tests[79] for assessing proposals for line extensions. As a rule, when a utility receives revenues from new customers equal to or greater than the incremental cost, existing customers are either no worse off or better off. The revenues from new customers can filter through rates and a separate surcharge (*see* the previous section).

The addition of new customers, at least in theory, can benefit existing customers. A concept called economies of scope says that by providing another service—for example, service to new customers—a firm might more efficiently use its internal resources. As an illustration, with added customers, a utility might lower its average cost for IT activities, general personnel, billing, and metering. The result is a lowering of the utility's average cost, which benefits all customers, both new and existing.[80]

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[78] In Minnesota, some gas utilities have what they call a New Area Surcharge (NAS) for new customers in locations previously unserved. They calculate the yearly surcharge as the prevent value of the annual difference between the capital and operating costs of the line extension, and the non-gas revenues. The utilities treat the surcharge as a CIAC for both accounting and ratemaking purposes. One reason for this treatment is that the surcharge would more directly track the extension costs. NAS applies only to previously unserved areas that cannot support economically a line extension under the utility's tariffs.

[79] By failing an economic test, a line-extension project is not feasible, justifying a separate advance or contribution from new customers. Feasibility, in generic terms, means that the expected distribution margins from new customers would support the incremental costs from constructing new lines.

[80] It would be wrong to infer that line extensions to serve new customers create the same economies as building lines to increase system reliability, access new gas supplies, or provide

2. Economies of scope, incremental prices, and rolled-in prices

This section explores the relationship between economies of scope and price limits on service to both existing and new customers. It also provides a formal definition of cross-subsidization, which links to the regulatory concept of undue price discrimination. Finally, this section addresses "fairness" from the angle of cost allocation.

a. "Acceptable" pricing limits

Formally, economies of scope derive from the following relationships:

$$IC_{NC} = C(NC,EC) - C(0,EC),$$

where the incremental cost in serving new customers (IC_{NC}) equals the utility's cost in serving both new and existing customers [C(NC,EC)] minus the utility's cost in serving only existing customers [C(0,EC)].[81] Economists call this last term the "stand-alone cost of serving only existing customers." We will refer to this cost as SAC_{EC}.

In the absence of economies of scope, the incremental cost of serving new customers equals

$$IC'_{NC} = C(NC,0) = SAC_{NC},$$

where the incremental cost (IC'_{NC}) equals the utility's cost in serving new customers alone [C(NC,0).], which is the stand-alone cost (SAC_{NC}).

In the presence of economies of scope, the following relationship holds:

$$C(NC,EC) < C(NC,0) + C(0,EC) = SAC_{NC} + SAC_{EC}.$$

Assume that the utility's cost in serving new customers alone is $12 million ($SAC_{NC}$), in serving existing customers alone is $100 million ($SAC_{EC}$), and in serving both groups of customers collectively is $110 million [C(NC,EC)]. The benefit to new customers from the utility's serving existing customers simultaneously is $2 million; that is, the difference between the cost of serving new customers alone ($12 million, or SAC_{NC}) and the cost of serving new customers when the utility is serving existing customers ($10 million, or IC_{NC}).[82] The $2 million are the

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interconnections. We should expect the system benefits from the line extensions to serve new customers to be much smaller and ostensibly marginal.

[81] NC denotes new customers and EC existing customers.

[82] The incremental cost of serving existing customers, assuming that the utility previously served new customers, is C(NC,EC) – C(NC,0). We are now reversing the definition of "new customers" to include the previous existing customers and the existing customers to include the previous new customers. The amount equals $110 million - $12 million, or $98 million.

benefits from economies of scope. This illustration shows how serving both groups of customers simultaneously can benefit new customers.

Similarly, we can show that economies of scope can benefit existing customers as well. Assume that existing and new customers consume, on average, the same quantity of gas. In our example, the total cost for the utility increases by 10 percent (from $100 million to $110 million) when the utility serves new customers. Assume also that the stand-alone cost per existing or new customer is the same. New customers would then grow the utility's sales by 12 percent and reduce the utility's average cost by roughly 2 percent.[83] Thus, rates to existing customers would tend to decrease.

By definition, economies of scope measure the difference between the sum of the cost for serving existing and new customers separately and serving them simultaneously. We assume that serving one group of customers is distinct from serving the other group. As long as the utility recovers from new customers sufficient revenues to cover the incremental costs, no burden falls on existing customers. From the perspective of existing customers, the prices are compensatory.

In the above example, if the utility charges new customers $8 million (below the incremental cost), existing customers are worse off by $2 million. Whereas prior to new customers existing customers were paying $100 million, now they are paying $102 million for the same service ($110 million - $8 million). We can say that existing customers are cross-subsidizing new customers. Cross-subsidization, according to economists, occurs whenever a utility charges any individual service or customer class more than its stand-alone cost. When the utility charges a particular service or group of customers more than the stand-alone cost, it is necessarily charging another service or group of customers less than the incremental cost. This outcome constitutes a cross-subsidy. Many economists have argued that a utility should not charge more for any service or customer than the stand-alone cost, on grounds of both "fairness" and economic efficiency.

If instead the utility recovers more than incremental costs from new customers—say, $14 million—existing customers are better off by $4 million,[84] but new customers are cross-subsidizing existing customers. The reason is that new customers are paying more than their stand-alone cost, which, as we assumed earlier, is $12 million.[85] This outcome means that new

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[83] As assumed earlier, the stand-alone costs for new customers and existing customers are $12 million and $100 million, respectively.

[84] Existing customers now pay $96 million, a decrease of $4 million from what they previously paid for the same service.

[85] Charging above incremental cost does not always result in a cross-subsidy. If the utility charges new customers $11 million, they are paying more than their incremental cost ($10 million) but less than their stand-alone cost ($12 million).

customers would be better off if the utility only served them and not existing customers.[86] In sum, prices violate a fairness standard whenever a customer class or service pays more than its stand-alone cost.[87] That statement presumes that regulators associate unfairness with a cross-subsidy.

For cross-subsidization not to occur, the total costs allocated to (1) existing customers cannot exceed $100 million and (2) new customers cannot exceed $12 million. Otherwise, each group of customers would be better off without the other. As long as the utility recovers sufficient revenues from each group to cover the group's incremental cost, each group benefits from the presence of the other. That is, each group is paying less than the stand-alone cost for that group. This outcome mimics the operation of a well-functioning competitive market. One implication is that existing customers are better off, or at least not worse off, when the utility charges new customers at least the incremental cost of serving them.[88]

b. What is fair?

The utility charging the incremental cost for each group of customers might pose a "fairness" problem. In our example, the sum of the incremental cost for both customers, $108 million,[89] falls short of the utility's total cost of $110 million.[90] The shortfall comes from the

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[86] Although it would be difficult to measure stand-alone cost, the condition that no customer pays more than this cost hinges on two reasonably measurable outcomes: (a) the utility's revenues equal its total cost and (b) all customers at least pay the incremental cost of serving them. Thus, no customer is paying more than the stand-alone cost when the utility earns normal profits, and no cross-subsidy exists.

[87] As noted by one economist:

> The stand-alone cost concept is equivalent to the game theoretic concept of an imputation that lies in the core of a "cost-sharing game," requiring each subset of members of a coalition to receive as a result of their membership a payoff at least as large as they could obtain for themselves if they were to leave the coalition and fend entirely for themselves.

(William J. Baumol, *Superfairness: Applications and Theory* (Cambridge, MA: The MIT Press, 1987), 121.)

[88] Another way of expressing this idea is that as long as the revenues received from existing customers are below their stand-alone cost, assuming the utility earns a normal profit, the utility is collecting more than the incremental cost from new customers. In our example, assume that the utility charges new customers $12 million, which is $2 million more than the incremental cost of serving new customers. With a total cost of $110 million, the costs allocated to existing customers are $98 million. This amount is $2 million below what existing customers would have had to pay without the new customers (i.e., SAC_{EC}).

[89] We calculated, above, the incremental cost of new customers as $10 million and the incremental cost of existing customers as $98 million.

missing $2 million that derives from common or shared costs.[91] How then should the utility assign responsibility for the shortfall of $2 million between the two groups of customers? If the utility decides, for example, to charge new customers the incremental cost of $10 million, existing customers would pay $100 million, as they did prior to the utility's signing up new customers.[92] This outcome, at first sight, seems reasonable in not burdening existing customers. Yet all of the benefits from economies of scope would transfer to new customers, a situation that some regulators might consider unfair.[93]

Whereas previously we defined fairness in terms of a cross-subsidy, we now apply a less rigorous test. Charging new customers more than the incremental cost may be fairer, if not the most economically efficient action. While in this example, no customer group receives a cross-subsidy, regulators could determine that the benefits from more efficient operations (i.e., economies of scope) should more evenly pass down to both customer groups. Cost allocation inevitably comes down to the regulators' judgment in weighing and trading-off different societal objectives.[94] If economic efficiency is one objective, and weighed heavily, regulators would tend to allocate more of the common costs to customers with the lowest price elasticity of demand. Applying in our example what economists call the Ramsey or second-best pricing rule, existing customers would seem to bear disproportionately those costs.[95] In sum, even when

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[90] Assuming that the utility earns a normal profit, it should collect enough revenues from both groups of customers collectively to cover C(NC,EC), or $110 million.

[91] These costs occur when the utility uses the same input or resources to serve both existing customers and new customers. The shared nature of these inputs means that it becomes impossible to assign them unambiguously to each customer group.

[92] One can show that the total cost of serving existing customers and new customers together is the sum of the stand-alone cost of serving existing customers and the incremental cost of serving new customers.

[93] Utilities might find this outcome favorable to their interests, as they would have the tendency to keep down the cost burden to new customers relative to existing customers. The reason is that existing customers are more captive and, therefore, less responsive to price. (*See* a fuller discussion in the next section.)

[94] Some economists would label this subjective cost allocation as arbitrary. It seems, however, that because regulators have an obligation to allow utilities an opportunity to earn a reasonable rate of return, they have no choice but to use their judgment, especially in spreading common and joint costs across different customers and services. Common costs, for example, are costs incurred jointly for two or more types of operation or the provision of two or more services. They include the capital cost of a new distribution main serving residential, commercial, and industrial customers.

[95] Ramsey pricing maximizes social welfare, given a revenue-requirement constraint. Specifically, it says that when setting prices equal to marginal or incremental cost fails to produce sufficient revenues for the utility, regulators should adjust rates to minimize efficiency losses. The way to achieve this outcome is to increase rates the most for those services or customers exhibiting the lowest price elasticities of demand. As we discussed earlier, existing customers likely would have a lower price

applying incremental-pricing principles, because of the traditional-ratemaking objective to set revenues equal to a utility's total costs, regulators must grapple, in the absence of an objective standard, with how to allocate a portion of the utility's costs among customers and services.

H. Cost recovery for a utility

Two policy questions relate to (1) how the utility should recover its incremental costs from new customers and existing customers, and (2) over what period the utility should recover those costs. One answer is that new customers should bear all of the incremental costs. Otherwise, existing customers would be worse off, as shown in the previous section. Besides, new customers are already benefiting from joining the utility system, assuming the presence of economies of scope. One exception occurs when existing customers benefit indirectly—say, from cleaner air or economic development. Other than that, for both economic-efficiency and equity reasons, existing customers should not have to bear any of the incremental costs.

Gas utilities would have an inclination toward shifting some of the incremental costs to existing customers. Charging those customers a slightly higher rate would likely have little effect on their gas consumption. Some prospective customers, on the other hand, may forgo switching to natural gas if they have to pay the full incremental cost. Cost allocation to existing customers in this instance would constitute price discrimination.[96]

The timing and likelihood of cost recovery can affect a utility's incentive to invest in new lines (*see* Part III.D). Specifically, more prompt and certain cost recovery would heighten a utility's motivation to add new customers. Mitigating regulatory lag by allowing a utility to recover capital expenditures on a periodic basis outside of a rate case would improve financial certainty for the utility. The regulator should assure ratepayers that any costs passed through are prudent and reflective of good utility management.[97] Did the utility, for example, spend the

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elasticity than prospective customers, who are contemplating fuel switching. Yet whether this pricing rule is fair, or at least fairer than other rules that violate efficiency conditions, lacks any objective evidence. Some readers might argue that the Ramsey pricing rule is unfair because it would increase prices more to "captive" customers. According to this view, there is an inevitable conflict between achieving both efficiency and fairness goals.

[96] Discriminatory pricing generally occurs when price differences for the same service do not correspond to cost differences. Discriminatory pricing considers customers' willingness to pay, which depends on the ability of customers to find alternative suppliers or to engage in self-supply. Prospective customers, by definition, can choose between remaining with their current energy source or switching to natural gas. Existing customers are less likely to respond to a higher price by switching to another energy source. A utility may have to offer prospective customers a rate below incremental cost to entice them to convert to natural gas. Yet, as discussed earlier, such a rate can burden existing customers and diminish economic efficiency.

[97] *See*, for example, Ken Costello, *How Should Regulators View Cost Trackers?* NRRI 09-13, September 2009, at http://nrri.org/pubs/gas/NRRI_cost_trackers_sept09-13.pdf. The paper points out that cost trackers or riders for which relevant costs do not undergo a thorough review by the regulator can

minimum amount on constructing new service and main lines? Were the capital expenditures justified based on a sound economic test for assessing new lines?

I. Ratemaking treatment of incremental costs

1. Challenges for regulators

Line extensions pose special problems for commissions for pricing and charging new customers for the additional costs:

- What are the proper principles for pricing utility service for new customers?
- Should a utility, for example, use rolled-in pricing or incremental pricing for setting prices to new customers?
- Should a utility charge new customers an additional amount that falls outside the tariff?
- If so, how should the utility determine the size and method of new-customer contribution?

We have already addressed most of these questions. One important policy question relates to how a utility can expand its service without cross-subsidization between customer classes, and between existing and new customers. The outcome would have both equity and economic-efficiency implications. Under strict rolled-in pricing, all customers pay for the incremental costs of new lines. Supporters of this pricing argue that existing customers pay for only the service they receive; they have no entitlement to continue using old pipes at the same (or depreciated) cost irrespective of new circumstances. Charging new customers a higher rate, under this principle, would be discriminatory: New customers would pay higher rates just because they initiate service at a later date. All customers—existing and new—should pay the same price for utility service.[98] On the opposite side are advocates of incremental pricing who argue that rolled-in pricing is economically inefficient and results in the subsidization of new gas lines: Prospective customers receive the wrong price signals, and other fuels face a competitive disadvantage.

2. Options for ratemaking

A utility has different options on how to recover its costs for line extensions. It can impose a surcharge on new customers corresponding to the "excess" costs not incorporated into

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weaken a utility's incentive to control those costs. They can also diminish the effect of regulatory lag on a utility's cost performance.

[98] Unlike most utilities' tariff rules, new customers would not face a special surcharge or pay extra for "excess" costs in some other way.

base rates. A utility also can create a special rider or cost tracker that recovers costs periodically outside a rate case. The utility may apply the rider only to new customers or to all of its customers. The utility can also increase the customer charge to account for investments in new lines. As a rule, a utility would include those capital investments for new lines that pass the economic test in rate base.

3. Rolled-in versus incremental pricing

Regulators generally approve rolled-in pricing when a new investment stands to benefit all customers, or when demand by all customers creates the need to increase system capacity. It would be wrong to infer that rolled-in pricing is inherently discriminatory, unfair, and economically inefficient. As argued in Part III.G of this paper, its appropriateness depends on the specific circumstances. One example is a gas utility investing in new storage capability to meet the growing demand of its customers. Because the investment would benefit all customers, it would be appropriate to roll-in the costs into the rates of all customers. They would then be responsible for paying the costs for this investment. When new customers require the utility to build lines dedicated to serving them,[99] rolled-in pricing becomes less defensible, especially if the benefits to existing customers are less than their share of the costs they bear. Analysts would contend that in this instance new customers would receive a subsidy at the expense of existing customers. Unless the utility can argue that in some way it built a new line because of the demand for gas services by existing customers, incremental pricing would be both economically efficient and fair.

The reader may ask why new customers should pay more for the same gas service than existing customers do. Does this not represent "vintage pricing," which economists have long criticized for its unfairness and inefficiency? In the context of gas-line extension, a utility expands its lines strictly to accommodate new customers. Existing customers are not signaling to the utility that it should invest in new lines. They would not pay for the gas-line extensions at any price. Charging incremental rates in this example would be consistent with the cost-causality principle, which is a tenet of good utility pricing. [100] Cost causality has no connection to vintage pricing, however. Vintage pricing, in which later customers pay more than other customers, is both unfair and economically inefficient when departing from cost-causality principles. New utility customers should pay more than existing customers because they alone require the utility to incur additional cost for new pipes. If new customers do not require other than incidental costs for the utility, prices to both new and existing customers should be similar. In this instance, charging new customers a higher price for the same service would be unfair.

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[99] The beneficiaries are easily identifiable.

[100] It would also be incompatible with the principle that prices should relate to customers' willingness to pay for a service or good. If existing customers place no value on line extensions to serve new customers, they should not have to pay anything for them.

Pricing utility service to new customers below incremental cost produces negative outcomes. First, new customers see improper price signals that can result in excessive fuel switching to natural gas. Second, this price places other fuels at a competitive disadvantage. Third, existing customers are worse off. The presence of new customers, in fact, raises the rates of existing customers, thereby failing the "burden test." Another way to restate this outcome is that existing customers would be better off without the new customers on the utility system. Pricing below incremental cost essentially increases rates for existing customers at the benefit of new customers.

Some utilities spend money for marketing and outreach programs to promote fuel switching. A few offer loans and other financial assistance to new customers. Others provide management support for facilitating fuel switching. This function would lower the transaction cost for energy consumers to switch to natural gas. If regulators feel these activities would benefit existing customers, they may allow the utility to pass their costs to them. Otherwise, if regulators view these activities as promotional in nature, they may decide to have utility shareholders or new customers pay for them.

J. Subsidization of new customers: When is it justified?

1. Public benefits

When benefits from line extensions extend beyond those received directly by fuel-switching consumers (i.e., public benefits exceed private benefits), regulators should ask whether it is appropriate to spread the costs to all customers. Assume that a line extension ultimately connecting 2,000 customers could produce a cleaner environment and less dependency on foreign oil. Regulators might approve the utility's recovering from all customers the costs associated with the line extension. Yet if fuel-switching customers alone stand to benefit, no costs should fall on the general ratepayer. The rule here is that growth should pay for itself by requiring new customers to pay the full costs for extending service to their areas.

2. The special case of line extensions in remote areas

Another seemingly defensible reason for a subsidy is that in some unserved remote areas, constructing new lines would be unprofitable to the utility or unaffordable to new customers. From a lifecycle perspective, new customers may be willing to pay the utility enough through rates and special surcharges to make it profitable for the utility.

As an example, assume that the present value benefit to new customers from switching to gas is $2 million. Assume also that the utility requires $1.5 million in revenues, whether from their normal rates or a special upfront customer contribution, to consider the new line adequately profitable or financially neutral. It would then appear that both new customers and the utility would be better off with the line extension: The customer could pay the utility enough for the line extension to make the investment both profitable for the utility and beneficial to her in the long term. What could hinder the building of the new line? One obstacle could be that the required advanced customer contribution might pose an obstacle for new customers. Given the

expected revenues for the utility and the line cost, the average advanced contribution per customer might come to, say, $10,000. Just like other investments that payoff in the end, consumers may forgo them because of the high initial cost.[101] Many households, for example, may decide they cannot afford to take $10,000 from their savings at this time, or take out a loan of that amount.[102]

Perhaps, then, just like subsidizing customers for energy-efficiency investments, the utility could have existing customers pay some portion of the advanced contributions. The utility could argue that fuel switching would be net beneficial but unaffordable to some prospective customers. Why not then increase slightly the rates of existing customers so that prospective customers would switch to natural gas? One answer is that it may be more appropriate for the government to provide financial assistance to new customers. Especially if the line extension contributes to economic development in the rural area, funding with taxpayer money might be the preferred course. Another answer is that, instead of charging existing customers a higher rate, the utility could think of creative ways for new customers to pay their advanced contribution in a more accommodating way. For example, the utility could allow new customers to pay back their special financial contribution over several years, lessening their immediate financial burden.

3. When a subsidy is bad policy

Some readers might conclude that the above example fails to justify a subsidy. Even if one agrees that a problem exists, the "subsidy" solution may be inferior to other actions. In other words, subsidization can represent a blunt and cost-inefficient response to achieve some social objective.

One seemingly preferred action would be for the utility to allow new customers to pay the $5,000 over a number of years. Prospective customers then might find switching to gas, which would be in their long-term interest, affordable. As a rule, efficient fuel switching requires that those who benefit pay the full cost of converting furnaces and other equipment, plus the new lines. Commissions and other policymakers should regard this outcome as the default solution, unless evidence supports some financial assistance from either existing customers or taxpayers. Thus, they should exercise caution in approving subsidies for customers who switch to natural gas. In the absence of large-scale public benefits or utility internal efficiencies, subsidies funded by a utility's existing customers come across as both unfair and economically inefficient:

1. It is unfair to existing customers because they are involuntarily funding new customers at no benefit or less-than-commensurate benefits to them.

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[101] One example that regulators can relate to is energy-efficiency investments.

[102] In today's tight credit market, households may find it difficult to get loan approval.

2. It is also economically inefficient if it induces additional energy consumers to switch to natural gas when they otherwise would not have if they had to pay the full cost of line extensions.

3. Subsidies also may distort competition among energy sources. By offering new gas customers subsidies, suppliers of oil, propane, and electricity would be at a disadvantage.

4. Even with public benefits, subsidies funded by existing customers might not constitute the most cost-effective approach for increasing the number of new gas customers and gas consumption. Funding from taxpayers or utility shareholders might create less inefficiency.

5. Even if policymakers can justify subsidies for fuel switching and line extensions, they need to ask which forms would be most cost-effective and create the least distortion.

Some readers may justify subsidies for fuel switching to natural gas similarly to the justifications used for governmental subsidies to rural electric cooperatives. Those subsidies assisted in the expansion of electric service to areas that privately owned utilities would not find financially viable. One difference is that rural people and businesses would not have access to electricity without the cooperatives. Yet prospective natural gas customers do have access to some other energy source (even if it is not their preferred source) to meet their demands. The main reason for switching would be to save money on energy, not to have available some new end-use service.

K. Role of local, regional, and state governments

Notwithstanding the previous section's discussion, some people would argue that the public benefits from fuel switching justify governmental assistance. These benefits are in addition to the benefits that energy consumers directly receive when they switch to natural gas. They include a cleaner environment, bolstering economic development, and national security. [103] A state can include as part of its energy strategy the promotion of customers switching to natural gas. The rationale for state financial assistance is that: (1) market forces are not accounting for the public benefits or (2) market barriers are stifling the amount of switching. Either condition may result in suboptimal levels of fuel switching.

[103] The positive effects, especially a cleaner environment and national security, apply more to switching from oil to natural gas. The environmental effects of propane are comparable to those for natural gas. When released into the atmosphere, and unlike natural gas, propane has no greenhouse gas effect. Domestic production accounts for about 98 percent of the propane consumed in the U.S., avoiding any national security problems.

1. Proactive states

Part II identified those states that have enacted special legislation, taken specific actions, or proposed actions, all with the intent to facilitate gas-line extensions. These states include Connecticut, Delaware, Maine, Nebraska, New York, North Carolina, Vermont, and Virginia. These actions mainly serve to remove barriers to fuel switching that originate on both the consumer and utility sides. All of these states presume potentially large benefits from energy consumers switching to natural gas.

2. General governmental actions

Justification for governmental assistance must rest on potentially large benefits from fuel switching to natural gas for a locality, region, or state. These benefits, although theoretically plausible, so far lack empirical support, at least in providing policymakers with reliable evidence that their magnitude is sufficient to warrant governmental actions.

Other than direct financial assistance, governments can take more incremental action by facilitating fuel switching through information dissemination and promotional practices. Government units can collaborate with utilities and consumers in developing proposals for the expansion of gas service. They can then present their proposals before the state utility commission or other pertinent entities for review and approval.

IV. Model of a Line-Extension Policy

A major goal of a line-extension policy is to achieve a proper balance of outcomes for the different stakeholders. Five conditions advance this goal:

- **Financially viability of the utility:** The utility recovers all of its incremental costs deemed prudent by the regulator.
- **Affordability of economical fuel switching to new customers:** New gas customers generally pay both conversion costs and at least a portion of line-extension costs. Even when fuel switching is economical, these two costs together can pose barriers to prospective customers. Payment plans or other schemes that help lift the immediate financial burden on new customers can make fuel switching more affordable.
- **Minimal negative effect on existing customers:** One outcome of a good policy is to prevent unduly burdening existing customers. Any rate increase to existing customers should be commensurate with the benefits they receive from the connection of new customers.
- **Level playing field for all energy sources:** By subsidizing customers who switch to natural gas, oil and propane suppliers face a disadvantage created by regulation. These suppliers may lose customers directly from gas utilities charging new customers below incremental cost for service connections.

- **Overall, balancing of regulatory goals as they relate to fairness, economic efficiency and other outcomes:** One feature of fairness is that all customers of similar characteristics receive the same treatment from the utility. Otherwise, the utility could discriminate among prospective customers based on their willingness to pay for switching to natural gas. The utility, for example, would have an incentive to charge a higher line extension cost to customers who stand to benefit the most from switching.

A. Regulatory objectives and options

Six regulatory objectives should underlie a line-extension policy. The major ones are fairness to all stakeholders and economic efficiency. The previous sections talked about them in some detail.

Table 1 lists different options for achieving the six objectives. A discussion of them follows.

1. Good utility incentives

Utilities should engage proactively in promoting fuel switching when in the public interest. The natural inclination of a utility would be to promote activities that add to their future revenues and profits. With an opportunity to profit and only moderate regulatory lag, and combined with certain cost recovery, the utility should welcome new customers. On the downside, a utility may fear the risk of less-than-full cost recovery.

One example of a proactive utility in expanding gas service is NSTAR in Massachusetts. It has an aggressive outreach and information program showing large benefits for energy consumers who switch from oil to natural gas. The utility calculates that even with high up-front costs for conversion (the sum of the cost for new heating equipment, new service connection, and new main extension), households can save on net by lowering their energy bill by an average $2,000 annually when they switch from oil to natural gas. The utility recognizes the importance of having financial arrangements in which consumers would pay the up-front costs over time rather than in one large lump sum (which NSTAR says could easily exceed $14,000).[104]

2. Good energy-consumer incentives to switch

Energy consumers should switch to natural gas when society saves enough in energy costs to justify the capital expenditures and other incremental costs associated with switching. Inertia, high up-front costs, lack of adequate information, and other reasons explain why energy consumers might not switch even when they gain economically. Energy consumers need to be well informed and face proper price signals. Subsidizing them excessively can motivate energy consumers to overinvest in switching by failing an economic test.

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[104] *See* Dave Allain, "NSTAR Gas Marketing Program," presented before the Northeast Gas Association, August 23, 2011, at http://www.northeastgas.org/pdf/d_allain_nstar.pdf.

The objective of a line-extension policy should *not* be to maximize the number of new customers. Such an objective would motivate utilities to offer excessive subsidies to new customers, which likely would conflict with economic-efficiency and equity goals. For example, existing customers would see higher rates not reflective of the benefits they receive from new customers. Utilities would tend to favor rolling the costs of line extensions into the rates of all customers. Utilities probably would also prefer that existing customers pay for marketing and outreach programs. Overall, a policy to maximize new customers would tilt rates in their favor at the expense of existing customers. One motivating factor is gas utilities wanting to compete more successfully with other fuels.

3. Affordable economical line extensions to prospective customers

A potential conflict exists between economical fuel switching from a lifecycle perspective and unaffordable up-front cost for prospective customers. As some utilities currently do, others may want to consider spreading out in time the cost obligations of a new customer. For example, instead of paying $3,000 to a utility up front, the utility could impose a surcharge of $600 annually for five years on a new customer.[105] In many jurisdictions, this surcharge would be more than offset by the customer's actual energy savings (e.g., the customer was paying $3,600 annually to his oil dealer, whereas now his annual gas bill is $2,000).

4. Fair to all stakeholders

"Fairness" is subjective, but limiting bounds can delineate between what is fair and what is unfair. For example, most people probably would agree that a utility should recover all of its prudent costs in serving new customers. Another condition is that existing customers should bear none of the incremental costs when they receive no benefits from the addition of new customers. A rolled-in pricing scheme, for example, would be inappropriate if all the benefits from fuel switching accrue to new customers or the utility itself. Fairness might also entail new customers not paying more to the utility than the additional (i.e., incremental) costs they impose on the utility.

5. Compatibility with other governmental objectives

If a state, for example, is promoting economic development and a cleaner environment, fuel switching to natural gas may be consistent with those goals. As a state entity, the utility commission may want to advance those goals within limits. Public utility statutes and commission rules would delineate those limits. The statutes, for example, may prohibit any subsidization and consideration of public benefits by the commission. Commission rules might specify new-customer financial obligations and protections for existing customers. A hybrid funding mechanism can combine taxpayer and ratepayer funding of fuel switching projected to produce non-minimal public benefits.

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[105] The utility may add an interest charge.

The appropriate form of market intervention depends on whether energy customers switch to natural gas below the optimal level because of public benefits or barriers to energy consumer action. The first reason could justify more taxpayer subsidies; the second reason could call for dissemination of better information on the benefits of fuel switching and the lowering of transaction costs.

6. Optimal line-extension investments

Optimality means that the benefit of a new investment is equal to its marginal or incremental cost. Overinvestment occurs when the utility extends its lines beyond what is economically tenable. A utility, for example, may want to extend construction of new lines to inflate its rate base. Underinvestment is also conceivable, especially when the utility views building new lines as too risky relative to the returns. A simple economic rule says that a line extension is economically justifiable when it can pay for itself. For example, if a new line costs $1 million, the benefits to new customers should at least equal this amount. New customers should then be willing to pay at least $1 million to have gas service. If they are not, then from a strict economics perspective, the utility should not build the new line.

One concern is that the utility may lack the incentive to build new lines even when new customers are willing to fund them. The utility may consider the likelihood of adequate cost recovery too low or judge that it could earn a higher return from allocating its limited capital funds to other investments.

B. Dealing with conflicting regulatory objectives

As in other matters, regulators try to make the best decision in a world of uncertainty and conflicting objectives. In the end, regulators have to act based on value judgments in the face of imperfect information. In the matter of line extensions, the regulator might want to advance certain objectives that impede others. One good example is encouraging fuel switching by lowering the cost to prospective customers. Assume that the actual cost of extending a line to a customer is $5,000. Evidence shows that charging this amount would discourage many prospective energy consumers from switching. The regulator desires to lower the cost to these customers to, say, $3,000. More fuel switching would occur, but someone has to bear the $2,000 shortfall. It could be the utility shareholders or existing customers. One could argue that both options are unfair to either group. If evidence shows large public benefits from fuel switching, the regulator might want to shift a portion of the incremental cost to existing customers. The regulator could argue that because existing customers benefit from cleaner air or bolstering of the local economy, they should bear a share of the costs for service expansion.

A counterexample is prohibiting any funding of line extensions by existing customers. One way to achieve this is to charge new customers the full incremental cost. Regulators might decide that both existing customers and new customers would benefit from any economies of scope. Thus, they might even find it appropriate to charge new customers above incremental cost to allocate a portion of the benefits from economies of scope to existing customers (*see* Part III.G.2.b).

C. Service expansion to remote areas: a special challenge

State utility commissions, along with other governmental entities, might face a situation in which gas service to sparsely populated areas would have large public benefits but not be economically feasible for a utility. Access to natural gas might bolster local economic development and save residents large sums of money. Because of the low number of connections, especially during the initial years, however, it could be several years before the utility would collect adequate revenues to pay for the new lines. The utility would have little motivation to build the new lines. If the utility required new customers to compensate them for revenue deficiencies, the cost to customers might be prohibitive. Yet, in the end, the new pipes would benefit the local economy and pay for themselves as the number of new customers increases.

This scenario might call for governmental intervention. One option is for municipalities and other local governments to provide financial assistance. They can compensate for the revenue shortfalls either by reimbursing the utility or by providing direct assistance to new customers, say, for the first five years of gas service. Another option is for the state government to provide financial support. Expanding gas service could be a part of the state's energy strategy. States often provide financial support for investments that benefit the state but are not profitable for the private sector. Gas-line extensions to remote areas would seem to fall in this category. The rationale for state assistance is the inability of markets to achieve a socially desirable action because of its unprofitability.

V. Recommendations for State Utility Commissions

This paper recommends that commissions review the line-extension practices of gas utilities. Many of them may not match the current market environment. Natural gas prices have moved substantially below oil and propane prices and projections call for this relationship to continue for at least the next several years. [106] For many jurisdictions, both the private and public benefits from line extensions are likely much greater than projected at the time when commissions first approved extension rules for gas utilities. Commissions may find existing rules incompatible with current regulatory objectives and conditions in the natural gas sector. New York is one example where the Public Service Commission has recently initiated a new proceeding on examining policies relating to the expansion of natural gas service. Other state utility commissions may want to follow suit. Appendix B includes several questions that commissions can ask in their review of current line-extension practices.

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[106] At the time of this writing, propane prices were lower than fuel oil prices by around 16 percent, adjusting for consumers needing to purchase 1.37 times more gallons of propane than fuel oil to receive the same amount of heat. *See* http://www.eia.gov/petroleum/heatingoilpropane and Heating Oil vs. Propane | Irving Energy.

The basic elements of a good line-extension policy should balance the criteria of fairness, reasonableness, economic efficiency, and predictability. Over the years, state utility commissions have struggled with attaining an appropriate balance. Fairness pertains to equitable treatment of new customers, existing customers, and utility shareholders. Utilities should not overcharge new customers for line extensions. They also should not burden existing customers by charging them higher rates that are not commensurate with increased benefits from system economies. Utilities should also have a reasonable opportunity to recover their incremental costs from extending lines. "Reasonableness" relates to rates not being excessive for any customer, whether new or existing. "Economically efficient" means that a line-extension policy should provide all customers with proper price signals. Fuel switching should be cost-effective in reducing energy costs to new consumers.

Commissions should consider encouraging gas utilities to foster fuel switching through marketing, market facilitation, and financial assistance. Utilities, for example, can charge prospective customers a fee for facilitating conversion and arranging for loans. The rationale for such actions is that energy consumers are fuel switching below the socially optimal level. On the other hand, commissions need to recognize circumstances in which fuel switching is occurring at an optimal level, because in these circumstances any assistance funded by general ratepayers would be untenable.

Commissions and other governmental agencies should realize that line extensions may produce public benefits, justifying subsidies and other inducements to encourage fuel switching. Just as several commissions advocate subsidies for energy efficiency, they could require financial assistance to prospective customers who want to switch to natural gas. In fact, commissions may find that gas utilities' expending a fixed amount of dollars on fuel switching yields a higher societal return than from spending the same dollars on energy efficiency.

One idea for consideration is the development of a collaborative arrangement in which the different stakeholders would work together to expand gas lines into towns and rural areas that currently do not have gas service. They can assemble a package that calls for municipal, county, or even state financial assistance and present it before the state utility commission for review. Recent legislation in Nebraska facilitates such collaboration among parties.

A good extension policy should feature certain objectives. One is to prevent substantial or unwarranted burden on existing customers. A second objective is to create a level playing field among the different energy sources. A third objective is to allow new customers the flexibility to compensate their utility over a multi-year period for "excess" costs that existing customers or utility shareholders should not have to shoulder. Especially for line extensions in remote areas or new franchise areas that require substantial cost, a large one-time charge to prospective customers may dissuade them from fuel switching, even when it would benefit them in the end.

Policymakers might want to consider governmental financial support for line extensions that promote economic development and other public benefits. The socialization of benefits might warrant burdening a wide group of stakeholders, including taxpayers, with responsibility

for funding the line extensions. Evidence of public benefits, as of now, is more theoretical in nature, as proponents of direct governmental involvement have so far provided scant empirical support to justify taxpayer funding of line extensions.

Table 1: Line Extension Options to Advance Regulatory Objectives

Regulatory Objective	Option
Good utility incentive	▪ Opportunity for utility profit ▪ Utility fully recovering prudent costs ▪ Regulatory scrutiny of costs ▪ Moderate regulatory lag
Good energy-consumer incentive to fuel switch	▪ Proper price signals ▪ Adequate information ▪ Minimal transaction cost ▪ Reasonable up-front cost
Affordable, economical line extensions to prospective customers	▪ Spreading out over time new-customer share of line extension costs
Fair to all stakeholders	▪ Utility fully recovering prudent costs ▪ Protection of existing customers from cost shifting not commensurate with benefits ▪ Level playing field for all energy sources ▪ Avoidance of excessive costs to new customers
Compatibility with other governmental objectives (e.g., economic development, clean air)	▪ Subsidies to new customers with evidence of non-minimal public benefits ▪ Combined public and ratepayer funding with demonstration of non-minimal public benefits
Optimal line-extension investments	▪ Balancing of utility profit and risk ▪ Private benefits commensurate with incremental cost

Appendix A: Gas-Line-Extension Activities in Nine States

State	Activity
Connecticut	▪ Aggressive fuel-switching plan in the state's draft energy strategy ▪ Proposed build-out plan by Northeast Utilities
Delaware	▪ Chesapeake Utility's hybrid pricing proposal before the Public Service Commission; the utility also proposed other services to facilitate fuel switching ▪ Gas-service expansion as part of a recommended state energy strategy
Maine	▪ Intense competition among gas companies to serve new areas ▪ High demand for gas in remote and other unserved areas ▪ Legislation authorizing issuance of general fund bonds for gas expansions
Minnesota	▪ Back in the early 1990s, the Public Utilities Commission's investigation of the unique problems in funding new extension lines in remote areas
Nebraska	▪ Establishment of a process to allow communities and gas utilities to advocate before the Public Service Commission for gas-infrastructure development
New York	▪ Public Service Commission-initiated technical conference on policies for expansion of natural gas service ▪ Recommendation for fuel switching to natural gas in the Governor's Energy Highway "Blueprint"
North Carolina	▪ Natural gas bonds for uneconomic line extensions ▪ Expansion funds for uneconomic line extensions
Vermont	▪ Ratepayer funding of planning and development activities for future service expansion
Virginia	▪ Special rider for cost recovery of line extensions that contribute to economic development

Appendix B: Questions State Utility Commissions Can Ask About Gas-Line Extensions

1. What are the benefits and costs of line extensions from the perspectives of (a) the utility, (b) existing customers, (c) new customers, and (d) society at large (e.g., local economy, accounting for environmental benefits)? If they differ, what implication does this have for policy?

2. When should a utility extend its lines? What are the necessary conditions? What is efficient and economical service expansion?

   - When prospective customers indicate their commitments to immediate demand?
   - Before or ahead of known (i.e., firm, committed) demand but in potentially high-growth areas?
   - If the latter, how should the utility recover any current or future revenue deficiencies?

3. What is the proper balance of risk and reward for the utility and its customers?

4. Should regulators distinguish between main lines in underdeveloped and undeveloped (e.g., rural locations without previous gas service) areas? If so, what are the implications for policy?

5. Who should pay for lines?

   - How much should new customers pay?
   - Existing customers?
   - Utility shareholders, government taxpayers?
   - What is a fair sharing of the costs?

6. How can a commission ensure a utility that it will recover all of its prudent costs for investments in line extensions?

7. Can subsidization of new customers ever be justified?

   - What do we mean by subsidization in this context?

- Is this situation similar to the federal government subsidizing rural electric co-ops to expand electric service to areas that otherwise would not be served because of the unprofitability to investor-owned utilities?

8. How should the utility recover their costs from new customers?
   - Through an existing ratemaking mechanism?
   - Through some other mechanism (e.g., special surcharge)?
9. Should the utility recover any incremental costs from existing customers?
   - Should existing customers be always held harmless when a utility extends service to new customers?
   - If not, under what conditions?
10. Over what period should a utility recover the costs for line extensions that pass an economic test?
11. Should utilities offer "no cost" extension lines to new customers? If so, who should pay for them?
12. How should utilities structure customer contributions?
    - What is their rationale?
    - How large should they be?
    - Over what timeframe should utilities recover them (e.g., one-time up-front, amortized over five years)?
    - Should they include refunds? If so, what are the criteria for refunds?
    - How can utilities design up-front customer contributions so as not to discourage fuel switching to gas that is economical?
    - Could customer contributions place utilities at a competitive disadvantage with other fuels?
    - Under what conditions, if any, should regulators include facilities paid for by customer contributions in rate base?
13. Should regulators approve line-extension projects that may not be economically feasible using traditional criteria, like NPV and IRR?
14. What incentives and disincentives does a utility have to invest in new lines?

- What explains any distorted incentives?
- What can regulators do to eliminate them?

15. What are the line-extension policies of different gas utilities in your state?
    - Do utilities have similar policies, or do they differ?
    - What are the positive and negative features of each?