Index Research for Gaz Metro's Groupe de Travail

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Plan of Presentation

Introduction

The Gaz Metro Group de Travail has proposed a new "mécanisme incitatif"

The mécanisme has escalation formulas for O&M and capital expenses which have X factors

Pacific Economics Group ("PEG") Research LLC was retained by the Task Force to measure Gaz Metro's productivity and help choose X

A report on our research was completed in March

This presentation discusses our research

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Credentials

PEG Research LLC

Leading North American consultancy on incentive regulation (IR)

50+ man years of experience

Multinational practice, many Canadian projects

Diverse clientele
- Utilities
- Trade Associations
- Regulators
- Consumer groups

Services
- IR plan design
- Empirical (*e.g.* productivity) recherche

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Mark Newton Lowry

President, PEG Research

20+ years experience as regulatory economist

Testified 30+ times on IR issues

Previously
- Assistant Professor, Pennsylvania State University
- Visiting Professor, HEC Montreal

PhD Applied Economics, University of Wisconsin

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Mandate

1. Calculated productivity trends of Gaz Metro 2000-2009
   - TFP, O&M, and capital expense ("capex") productivity
   - Excluded costs (*e.g.* pensions & benefits) that would not be subject to indexing in mechanisme incitatif
2. Considered suitable inflation measures
3. Considered appropriate stretch factors

Productivity Research Results

Research on productivity trends widely used in North America to design IR plans

- Price Caps
- Revenue Caps
- Cost Targets

Two methodologies used

- Productivity indexes
- Econometric productivity targets

Productivity Research Results

	Productivity Growth (%)		
	O&M	Capex	TFP
Productivity Indexes			
Gaz Metro (2000-2009)	0.73	2.08	1.66
Enbridge (2006-2010)	NA	NA	1.07
Union (2006-2010)	NA	NA	1.65
USA (1999-2008)	NA	NA	1.18
Econometric Productivity Target	1.55	1.92	1.11

Basic Concepts

Productivity Indexes

Productivity is a measure of enterprise efficiency

Conventionally measured using indexes

An index makes comparisons using ratios

e.g. Inflation $P^{gasoline} = (P^{gasoline}_{2011} / P^{gasoline}_{2010}) - 1$

Indexes can summarize multiple comparisons by taking weighted averages

e.g. IPC d'Ensemble^{Quebec}

Basic Concepts

Productivity Indexes

Productivity index is ratio of output & input quantity indexes

Productivity = Outputs/Inputs

Thus,

Growth Productivity = growth Outputs – growth Inputs

Output quantities: *e.g.* number of customers, miles of line

Input quantities: *e.g.* number of employees, number of vehicles

Productivity Indexes (cont'd)

Indexes can measure trends in *multiple* quantities using weighted averages

e.g. Input Price & Quantity Indexes

With *cost share* weights, calculus shows that they measure impact of input price & quantity growth on cost

e.g. Output Indexes

With *cost elasticity* weights, calculus shows that they measure impact of *output* growth cost

Basic Concepts (cont'd)

Input Quantity Indexes

Input indexes vary in scope of costs considered

Labor cost	Labor productivity
All O&M expenses	O&M productivity
Capex	Capex productivity
Total cost	Total factor productivity ("TFP")

Input Quantity Indexes (cont'd)

How to calculate multi-category input quantity indexes?

When input price and quantity indexes have *cost share* weights

growth Cost = growth Input Prices + growth Input Quantities

and

growth Input Quantities = growth Cost – growth Input Prices

For example,

growth Labor $\text{Quantity}^{\text{GasMetro}}$
= growth Labor $\text{Cost}^{\text{GasMetro}}$ – growth Labor Price $\text{Index}^{\text{Quebec}}$

Capital Quantity Indexes

TFP indexes require measures of capital cost & quantity

$$\text{Cost}^{\text{Capital}} = \text{Price}^{\text{Capital}} \times \text{Quantity}^{\text{Capital}}$$

This concept has confused many regulators and stakeholders

PEG Research has developed method for decomposing capital cost that mirrors the cost accounting in regulation

- Cost = Depreciation + Return on Plant
- Historical valuation of plant

Resultant capital prices is quite stable

Frequently used in Ontario

Capital Quantity Indexes (cont'd)

Capital quantity based on many years of plant additions

$$\text{Quantity}_t = f\left(\frac{\text{Additions}_t}{\text{Price}}, \frac{\text{Additions}_{t-1}}{\text{Price}}, \frac{\text{Additions}_{t-2}}{\text{Price}}, \ldots\right)$$

Need additions, construction cost index for 35+ past years

Gaz Metro has additions data only since 1995 (*15* years)

Need to guess additions in earlier years

>>> Difficult to measure Gaz Metro's *total* factor productivity accurately

One argument for focus on capex productivity

Elasticity-Weighted Output Indexes

Cost Elasticity = % change in Cost from 1% change Output
= Marginal Cost /Average Cost

Elastioities & marginal costs can be estimated *econometrically*

e.g. Given econometric model

$\ln \text{Cost} = a_0 + = a_1 \ln \text{Customers} + a_2 \ln \text{Line Km} + a_3 \text{Trend}$

a_1 and a_2 are elasticities

We search for best output specification in our models

Econometric Model of O&M Expenses

VARIABLE KEY

N = Number of Gas Customer
E = Number of Electric Customers
GC = Degree Days Binary Variable
CI = % Cast Iron Distribution Mains
Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC	P-VALUE
N	0.800	86.10	0.000
E	-0.014	-4.69	0.000
GC	0.147	8.76	0.000
CI	0.000	13.29	0.000
Trend	-0.012	-4.70	0.000
Constant	8.040	118.46	0.000

System Rbar-Squared	0.994
Sample Period	1986-2000
Number of Observations	360

1 output variable identified (N)

Trend = 1.2%

Basic Concepts (cont'd)

Econometric Productivity Targets

Denny, Fuss, and Waverman found that

growth TFP = Scale Effect + Business Condition Effects
+ Trend Effect

Econometric model can be used to estimate these effects

Can be tailored to local business conditions (*e.g.* customer growth)

Precedent: California

Table 3

Productivity Indexes for Cost Efficiency Measurement

Year	Costs: Labor Index	Costs: Labor Growth	Costs: Labor Share	Costs: Capital Index	Costs: Capital Growth	Costs: Capital Share	Costs: Total Cost Index	Costs: Total Cost Growth	Input Quantity Index: Labor Index	Input Quantity Index: Labor Growth	Input Quantity Index: Capital Index	Input Quantity Index: Capital Growth	Input Quantity Index: Aggregate Input Index	Input Quantity Index: Aggregate Input Growth	Cost Share Weight Indexes: Adjusted Aggregate Input Index	Cost Share Weight Indexes: Adjusted Aggregate Input Growth	Productivity: TFP Index	Productivity: TFP Growth	Productivity: Output Index	Productivity: Output Growth
1997	100.0	NA	24.3%	100.0	NA	4.7%	100.0	NA	100.0	NA	100.0	NA	100.0	NA	100.0	NA	100.0	NA	100.0	NA
1998	98.1	-1.9%	22.0%	106.1	6.0%	4.9%	99.9	-0.1%	98.4	-1.6%	107.0	6.9%	101.0	1.0%	101.0	1.0%	99.1	-0.9%	100.1	0.1%
1999	96.0	-2.2%	20.5%	114.1	7.5%	4.9%	98.2	-1.7%	96.7	-1.8%	114.3	6.8%	102.4	1.4%	102.4	1.4%	95.9	-3.2%	98.1	-2.0%
2000	95.0	-1.0%	19.3%	121.4	6.4%	4.9%	96.4	-1.8%	95.0	-1.7%	121.4	6.2%	103.8	1.4%	103.8	1.4%	92.8	-3.2%	96.3	-1.8%
2001	93.0	-2.1%	18.3%	128.4	5.7%	4.9%	94.7	-1.7%	93.4	-1.6%	128.4	5.8%	105.2	1.3%	105.2	1.3%	90.1	-2.9%	94.8	-1.5%
2002	90.0	-3.3%	16.4%	136.0	5.9%	4.9%	92.2	-2.5%	90.7	-2.9%	136.0	5.9%	106.7	1.4%	106.7	1.4%	86.4	-4.2%	91.5	-3.4%
2003	88.0	-2.2%	15.4%	143.6	5.6%	4.9%	90.2	-2.2%	88.7	-2.2%	143.6	5.6%	108.2	1.4%	108.2	1.4%	83.4	-3.5%	88.5	-3.3%
2004	86.0	-2.3%	14.4%	151.2	5.3%	4.9%	88.2	-2.2%	86.7	-2.3%	151.2	5.3%	109.7	1.4%	109.7	1.4%	80.4	-3.6%	85.5	-3.4%
2005	84.0	-2.4%	13.4%	158.8	5.0%	4.9%	86.2	-2.3%	84.7	-2.4%	158.8	5.0%	111.2	1.4%	111.2	1.4%	77.5	-3.6%	82.5	-3.5%
2006	82.0	-2.5%	12.4%	166.4	4.8%	4.9%	84.2	-2.3%	82.7	-2.5%	166.4	4.8%	112.7	1.4%	112.7	1.4%	74.7	-3.6%	79.5	-3.5%
2007	80.0	-2.6%	11.4%	174.0	4.6%	4.9%	82.2	-2.3%	80.7	-2.6%	174.0	4.6%	114.2	1.4%	114.2	1.4%	72.0	-3.6%	76.6	-3.5%
2008	78.0	-2.7%	10.4%	181.6	4.4%	4.9%	80.2	-2.3%	78.7	-2.7%	181.6	4.4%	115.7	1.4%	115.7	1.4%	69.4	-3.6%	73.8	-3.5%
2009	76.0	-2.8%	9.4%	189.2	4.2%	4.9%	78.2	-2.3%	76.7	-2.8%	189.2	4.2%	117.2	1.4%	117.2	1.4%	66.9	-3.6%	71.1	-3.5%

Average Annual Growth Rates

2000-2009		-3.4%		-1.5%		4.9%		-2.3%		-3.2%		4.2%		1.4%		1.4%		-3.4%		-3.4%

>>> Different output indexes for different cost categories

Output indexes for O&M & TFP differ slightly

Productivity trends are much lower

Use of Indexing in Regulation

Index logic provides basis for design of revenue caps & cost caps

Gaz Metro Current Approach

Growth Revenue

= *growth Cost*

= *growth Input Prices* + *growth Inputs*

= *growth Input Prices* – (*growth Throughput* – *growth Inputs*)

+ *growth Throughput*

Alternative Revenue Cap Approach

According to Denny, Fuss, & Waverman,

growth Cost = growth Input Prices
- growth Productivity + growth Output

Output index elasticity-weighted

Rearranging terms,

growth Cost - growth Output
= growth *Unit* Cost
= growth Input Prices - growth Productivity

Alternative Revenue Cap Approach

If growth Output = growth Customers,

growth Cost/Customer
= growth Input Prices – growth Productivity

This has provided basis for several *revenue/customer* caps

growth Revenue/Customer = growth Inflation - X

e.g. Enbridge Gas Distribution, Southern California Gas

Cost Caps

Indexing also provides basis for cost target escalators

e.g. Gaz Metro proposes separate, index-based cost caps for O&M and capital expenses

growth "Dépenses"^{Exploitation}/Client = growth Inflation – X

growth "Dépenses"^{Capital}/Client = growth Inflation - X

Precedents Enbridge Gas Distribution, Gazifere
BC Gas, Fortis Alberta, Vermont Gas System

Advantages:

Sidesteps need to measure Gaz Metro's TFP
Theoretical foundation

X Factors

X = Productivity Base + Stretch Factor

Dividende client shares benefits of accelerated productivity growth

Several possible sources for Base Productivity Target

1. Gaz Metro's Input Price Index

Pro: May reflect local business conditions
Regie labor policy preferences

Con: Weakens performance incentives in repeated use

Historical trend may be too slow, too fast

X Factors

2. Econometric Productivity Target

Pro: Better incentives
Tailored to local business conditions

Con: Requires econometrics

Input Price Index Recommendations

Total Cost $GDPIPI^{FDD}$

O&M

Weighted average of Quebec salary & wage index, $GDPIPI^{FDD}$

Capex

Cost-weighted average of three price indexes

- Capital stock price index, engineering structures, gas & water
- Software
- $GDPIPI^{FDD}$

Stretch Factor

Stretch factor guarantees customers benefit of faster productivity growth

Common range [0, 1], with 0.50 mean

PEG Research Methodology

Share 50% of expected change in productivity growth

New regulatory system vs. prevalent system of peer distributors

Use Incentive Power Model to measure incentives

No acceleration expected if Gaz Metro data used

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Incentive Power Research Results

Gaz Metro

- *Symmetric* 50/50 sharing
- 7 year term
- No cap on gains or losses

US Sample

- 3 year rate cycle
- No sharing

Results

>>> 40 basis point acceleration in productivity growth

43/2 = 22

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Summing Up

O&M Expenses

growth Cost/Customer = growth Input Prices – X

Input Price Subindexes

Labor
$GDPIPI^{FDD}$

X = Productivity Target + Stretch

Productivity Target = [0.75, 1.55]
Stretch Factor = [0.20, 0.50]
X = [0.95, 2.05]

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Summing Up

Capex

growth Cost = growth Input Prices – X + growth Outputs

Input Price Subindexes

- Power distribution construction cost index
- Software
- $GDPIPI^{FDD}$

X = Productivity Target + Stretch

Productivity Target = [1.92, 2.38]
Stretch Factor = [0.20, 0.50]
X = [1.12, 2.88]

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Appendix

Table 1

Calculation of Cost-Based Output Indexes

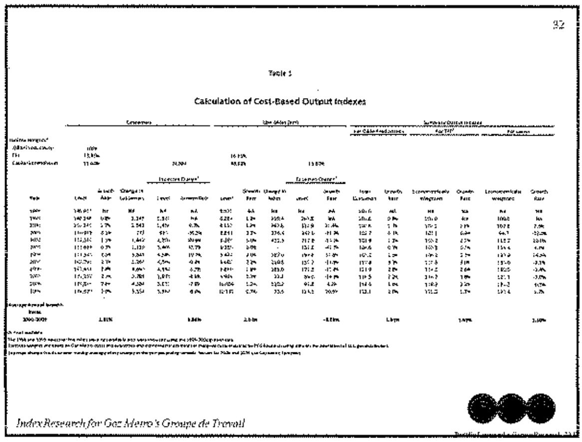

Table 2

Gaz Metro O&M Input Quantity Indexes

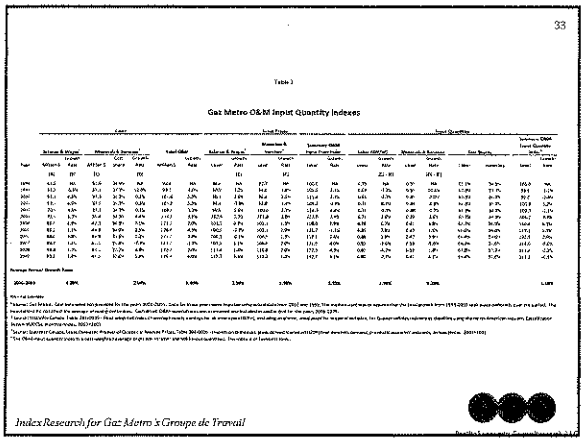

Table 4

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Comparison of Productivity Trends

	Total Cost Efficiency Metrics (TEM[a])				MFP, Private Business Sector			
	Gaz Metro		US Gas Distributors[b]		US[c]		Canada[d]	
Year	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1998	NA	NA	1.000	NA	87.898	NA	95.7	NA
1999	100.0	NA	1.027	2.7%	89.509	1.8%	97.6	2.0%
2000	103.2	3.1%	1.030	0.3%	91.042	1.7%	99.8	2.2%
2001	101.1	-2.0%	1.065	3.7%	91.749	0.8%	99.5	-0.3%
2002	102.9	1.7%	1.078	0.8%	93.942	2.4%	100.0	0.5%
2003	101.1	-1.7%	1.071	-0.7%	96.428	2.6%	99.5	-0.5%
2004	100.8	-0.3%	1.066	-0.5%	98.864	2.6%	98.8	-0.7%
2005	101.0	0.0%	1.041	-2.3%	100.900	1.9%	99.0	0.2%
2006	103.8	2.7%	1.111	6.8%	100.517	0.5%	98.3	-0.7%
2007	109.0	4.9%	1.112	0.1%	101.025	0.5%	97.7	-0.6%
2008	114.5	4.7%	1.125	1.1%	102.118	0.5%	95.5	-2.3%
2009	118.0	3.0%	NA	NA	101.906	0.8%	93.4	-2.2%
Average Annual Growth Rates								
1999-2008	NA		1.18%		1.40%		-0.02%	
2000-2009	1.86%		NA		1.39%		-0.44%	
2009-2008	1.48%		1.03%		1.36%		-0.24%	

NA = Not available

[a] Source: Mark Newton Lowry and David Hovde (2010), *Productivity Research for Southern California Gas*, page 6, filed as Exhibit SCG-37 in Application 10-12-006 before the California Public Utilities Commission.

[b] Source: US Bureau of Labor Statistics.

[c] Source: Statistics Canada, Table 383-0021.

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Table 5

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Productivity Index for Capital Expenditures

	Outputs		Inputs						Productivity of Capital Expenditures		
	Summary Output Index		Value of Plant Additions[a]		Capex Price Index[b]		Plant Addition Quantities				
Year	Level	Growth Rate (A)	$ Million	Growth Rate (B)	Level	Growth Rate (C)	Level	Growth Rate [D] = [A-C]	Level	Level (1999=100)	Growth Rate [A] - [D]
1998	100.0	NA	84.83	NA	100.0	NA	100.0	NA	1.000	100.0	NA
2000	107.5	7.5%	85.76	1.0%	102.1	1.8%	99.2	-0.9%	1.087	108.7	8.3%
2001	94.7	-13.0%	92.17	7.2%	102.5	0.4%	106.2	6.9%	0.891	89.1	-19.8%
2002	101.7	20.0%	98.87	7.0%	102.9	0.4%	113.4	6.6%	1.070	107.0	13.4%
2003	118.4	8.1%	104.76	5.8%	102.0	-0.9%	122.3	6.7%	0.984	98.4	-2.5%
2004	137.8	14.3%	132.29	23.3%	105.6	3.3%	147.8	18.4%	0.933	93.3	-5.4%
2005	135.0	-2.1%	133.52	0.9%	110.5	4.5%	142.6	-3.5%	0.946	94.6	1.4%
2006	130.5	-3.4%	126.40	-5.3%	116.1	4.8%	128.5	-10.4%	1.014	101.4	7.8%
2007	121.7	-7.0%	146.75	14.9%	121.4	4.5%	142.8	10.4%	0.852	85.2	-17.4%
2008	121.3	-0.3%	107.74	-35.7%	122.8	1.2%	98.8	-38.8%	1.228	122.8	36.5%
2009	123.4	1.7%	104.98	2.2%	123.8	0.8%	100.1	1.4%	1.232	123.2	0.3%
Average Annual Growth Rates											
2000-2009		2.10%		2.12%		2.10%		0.02%			2.08%

NA = Not available

[a] The 1998 value for line miles was not available and was imputed using the 1999-2000 growth rate

[b] Source: Gaz Metro

[c] Source: Statistics Canada. Table 383-0025 - Canadian Natural Gas Distribution, Water, and Other Systems Capital Stock Price Index, 2002=100, 1994-2007. Where this index was not available (in 2008-2009), values were imputed using the growth rates in the comprehensive electric utility construction price index. Source: Statistics Canada. Table 327-0011

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Table 7

X Factor Reflective of Past Gaz Metro Experience

TFP[c]	Output Differential	X
[A]	[B]	[A + B]
1.656%	-1.655%	0.001%

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Table 8

Calculating Industry-Specific Input Price Indexes

	Costs			Input Price Indexes									
	Labor[1]	Materials & Services[1]	Capital[1]	Labor[2]		Materials & Services[3]		All OM&M		Capital[4]		All Inputs	
				Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
Year	Million $	Million $	Million $										
1988	61.5	17.9	189.8	86.6	NA	92.7	NA	190.0	NA	100.0	NA	100.0	NA
1989	61.2	17.1	180.0	90.5	3.2%	94.0	1.4%	185.1	1.1%	99.3	-0.7%	101.3	1.3%
2000	64.5	17.3	179.6	96.3	3.6%	96.4	2.5%	113.4	1.7%	99.4	0.0%	101.5	2.1%
2001	62.5	17.3	185.2	98.4	-3.8%	97.8	1.4%	109.3	-3.9%	100.9	1.5%	101.8	0.3%
2002	70.8	17.1	189.6	99.9	1.6%	100.6	2.2%	114.3	4.4%	102.0	1.1%	104.1	2.3%
2003	73.5	19.4	194.6	102.6	2.7%	101.8	1.2%	117.0	2.4%	103.0	0.9%	104.7	1.4%
2004	80.0	21.5	201.8	103.2	0.7%	102.3	0.5%	118.0	0.9%	106.4	3.3%	110.3	2.4%
2005	83.1	21.8	210.3	106.5	-2.5%	103.5	1.1%	116.7	-1.1%	109.3	2.7%	112.7	2.1%
2006	84.4	24.8	216.8	106.3	-0.1%	105.5	1.9%	117.3	0.4%	109.9	0.5%	113.2	0.4%
2007	85.7	23.3	226.3	110.5	3.9%	106.6	1.0%	121.0	3.1%	111.8	1.6%	115.8	2.3%
2008	90.4	23.3	230.2	113.4	2.6%	110.8	2.0%	123.3	1.9%	115.3	3.1%	120.0	3.6%
2009	91.9	25.5	239.6	117.1	3.3%	112.3	1.3%	122.7	-0.5%	118.9	3.2%	123.6	2.9%
Average Annual Growth Rate 2000-2009					2.58%		1.74%		1.32%		1.80%		1.99%

NA = Not Available

Source: Gaz Métro

Source: Statistics Canada, Table 281-0039 - Employment, payroll and business locations by industry, annual (number unless otherwise specified), CANSIM (database). For Quebec, adjusted to be consistent with the North American Industry Classification System (NAICS). Where necessary values were estimated for 2004-2009 using the growth rate in the nearest series where data were available.

All growth rates calculated logarithmically.

Source: Statistics Canada, Gross Domestic Product (GDP) of Quebec at Basic Prices, Table 384-0038 - Implicit price indexes, GDP, final domestic demand, provincial economic accounts, annual.

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Table 9

How Selected Macroeconomic Price Indexes Compared to Gaz Metro Input Price Indexes

	Quebec Price Indexes				Summary Gaz Metro Input Price Indexes					
	Consumer Price Index[1]		GDP Implicit Price Index - Final Domestic Demand[2]		Operating & Maintenance		Capital Expenditures[3]		Total	
	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1997	92.1	NA	92.7	NA	100.0	NA	100.0		100.0	NA
1998	93.8	1.8%	94.0	1.4%	105.2	5.1%	100.3	0.3%	103.3	1.3%
2002	95.8	2.4%	96.4	2.5%	111.4	5.7%	102.1	1.8%	105.5	2.1%
2003	98.0	2.3%	97.8	1.4%	109.2	-1.0%	102.5	0.4%	105.8	0.3%
2004	100.0	2.0%	100.0	2.2%	114.1	4.4%	102.8	0.3%	108.1	2.1%
2005	102.3	2.3%	102.8	1.8%	117.6	2.9%	102.0	-0.9%	107.7	1.4%
2006	104.5	1.9%	105.1	2.3%	118.0	0.3%	105.8	3.5%	110.3	2.4%
2007	106.9	2.3%	106.1	1.0%	116.3	-1.4%	110.5	4.3%	111.7	1.5%
2008	108.7	1.7%	108.5	1.3%	117.1	0.4%	115.1	4.1%	112.2	0.4%
2007	110.4	1.6%	109.6	2.0%	121.9	4.0%	122.4	6.5%	115.8	2.5%
2008	112.7	2.1%	110.9	1.0%	127.3	4.3%	127.8	1.2%	120.0	3.6%
2009	113.4	0.6%	112.3	1.3%	132.7	4.1%	128.8	0.8%	123.6	2.9%
Average Annual Growth Rate 2003-2009		1.8%		1.7%		2.1%		1.1%		1.9%

NA = Not Available

Source: Statistics Canada, Table 326-0021 - Consumer Price Index (CPI) of Quebec, 2005 Basket, annual (index, 2002=100)

Source: Statistics Canada, Table 384-0038 - Implicit price indexes, gross domestic product, final domestic demand (GDP-FDD) of Quebec, provincial economic accounts, annual (index, 2000=100)

Source: Statistics Canada, Table 303-0025 - Canadian Natural Gas Transmission, Water, and Other Systems Capital Stock Price Index, 1900=100, 1990-2007.

Where the index was not available (i.e. 2008-2009), values were imputed using the growth rates in the similar utility construction price index. Source: Statistics Canada, Table 327-0011

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Table 10

Calculating External Productivity Targets for Gaz Metro: Standard Elasticities

	Estimated Trend Effect	Scale Economy Effect								Forward Productivity Growth Target
		Estimated Elasticity Weight	Forecasted Output Growth[1]					SUM Elasticities	Scale Economy Effect	
			Total Customers	Change in Customers	Line Miles	Change in Line Miles	Summary Output Index			
	[A]						[B]	[C]	[D=B*(1-C)]	[A+D]
O&M Expenses	1.18%	Gaz Metro Elasticity Share:	100.0%							
			2.00%				2.00%	0.60	0.80%	1.98%
Capex	1.82%	Gaz Metro Elasticity Share:	11.60%	24.20%	46.32%	18.87%				
			2.00%							
				2.00%						
					1.80%					
						1.80%				
							1.87%	0.95	0.10%	1.92%
Rate/ Cost	0.81%	Gaz Metro Elasticity Share:	73.85%		26.15%					
			2.00%							
					1.80%		1.95%	0.85	0.30%	1.11%

Forecasts prepared by Gaz Métro

Figure 1

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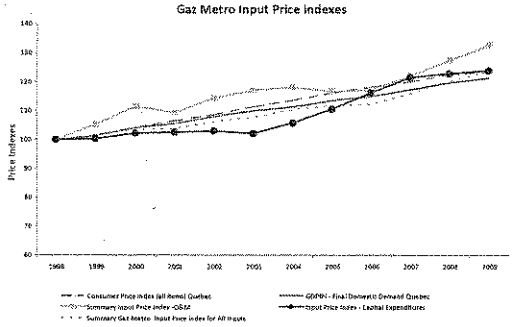
How Selected Macroeconomic Price Indexes Compared to Gaz Metro Input Price Indexes



Index Research for Gaz Metro's Groupe de Travail

Figure A-2

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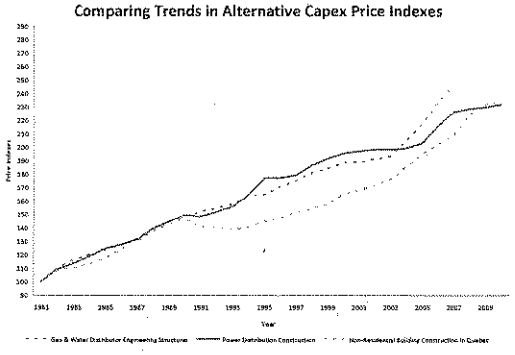
Comparing Trends in Alternative Capex Price Indexes



Index Research for Gaz Metro's Groupe de Travail

Table A-1

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SAMPLE OF GAS DISTRIBUTORS USED IN THE EMPIRICAL RESEARCH

Baltimore Gas and Electric
Boston Gas
Brooklyn Union Gas
Cascade Natural Gas
Central Hudson Gas & Electric
Connecticut Natural Gas
Consolidated Edison Company of New York
East Ohio Gas
Gaz Metro
Louisville Gas and Electric
Madison Gas and Electric
New Jersey Natural Gas
Niagara Mohawk Power
North Shore Gas
Northern Illinois Gas
Northwest Natural Gas
Orange and Rockland Utilities
Pacific Gas and Electric
PECO Energy
Peoples Gas Light and Coke
Peoples Natural Gas
Public Service Electric and Gas
Public Service Company of Colorado
Public Service Company of North Carolina
Puget Sound Energy
Questar Gas
Rochester Gas and Electric
San Diego Gas & Electric
Southern California Gas
Southern Connecticut Gas
Washington Gas Light
Wisconsin Gas
Wisconsin Power and Light

Number of companies: 35

Econometric sample includes most large US gas distributors

Index Research for Gaz Metro's Groupe de Travail

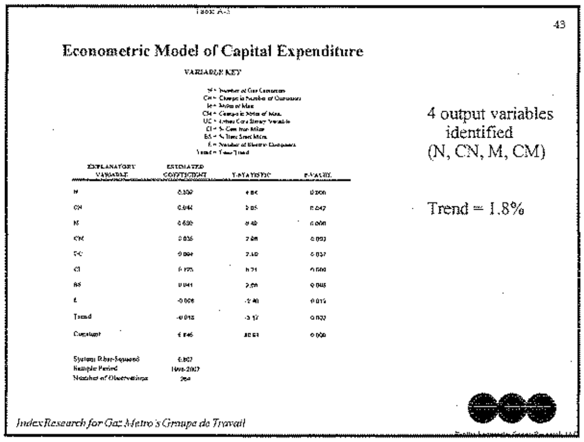

Table A-3

43

Econometric Model of Capital Expenditure

VARIABLE KEY

N = Number of Gas Customers
CN = Change in Number of Customers
M = Miles of Main
CM = Change in Miles of Main
UC = Urban Core Binary Variable
CI = % Cast Iron Mains
BS = % Bare Steel Mains
E = Number of Electric Customers
Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC	P-VALUE
N	0.339	4.84	0.000
CN	0.044	2.05	0.042
M	0.630	8.48	0.000
CM	0.035	2.08	0.003
UC	0.094	2.10	0.037
CI	0.175	6.21	0.000
BS	0.041	2.00	0.045
E	-0.008	-2.40	0.015
Trend	-0.018	-3.17	0.002
Constant	4.846	20.51	0.000

System Rbar-Squared 0.807
Sample Period 1998-2007
Number of Observations 260

4 output variables identified (N, CN, M, CM)

Trend = 1.8%

IndexResearch for Gaz Metro's Groupe de Travail

Pacific Economics Group Research, LLC

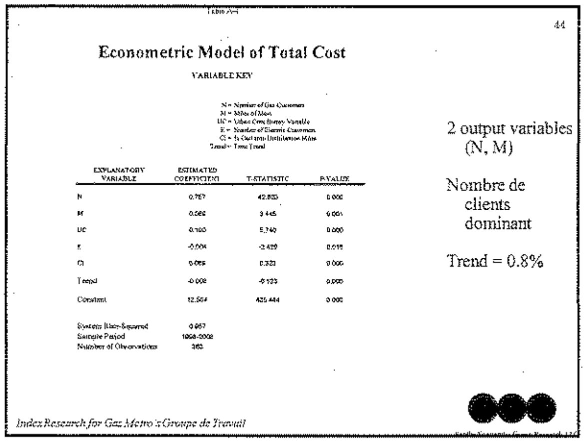

Table A-4

44

Econometric Model of Total Cost

VARIABLE KEY

N = Number of Gas Customers
M = Miles of Main
UC = Urban Core Binary Variable
E = Number of Electric Customers
CI = % Cast Iron Distribution Mains
Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC	P-VALUE
N	0.757	42.835	0.000
M	0.066	3.445	0.001
UC	0.100	5.740	0.000
E	-0.004	-2.420	0.015
CI	0.066	0.320	0.000
Trend	-0.008	-9.123	0.000
Constant	12.504	425.444	0.000

System Rbar-Squared 0.957
Sample Period 1998-2002
Number of Observations 362

2 output variables (N, M)

Nombre de clients dominant

Trend = 0.8%

IndexResearch for Gaz Metro's Groupe de Travail

Pacific Economics Group Research, LLC

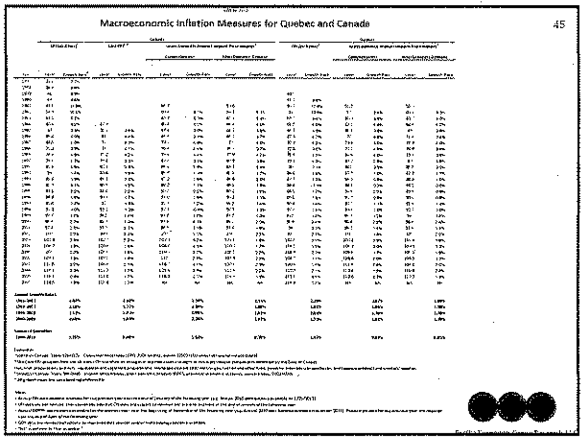

Table A-5

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Macroeconomic Inflation Measures for Quebec and Canada

Pacific Economics Group Research, LLC

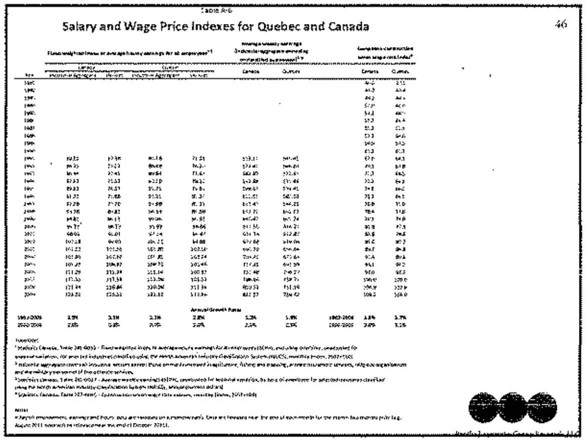
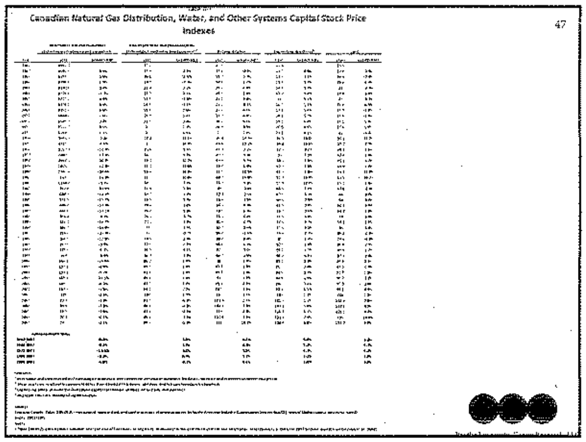
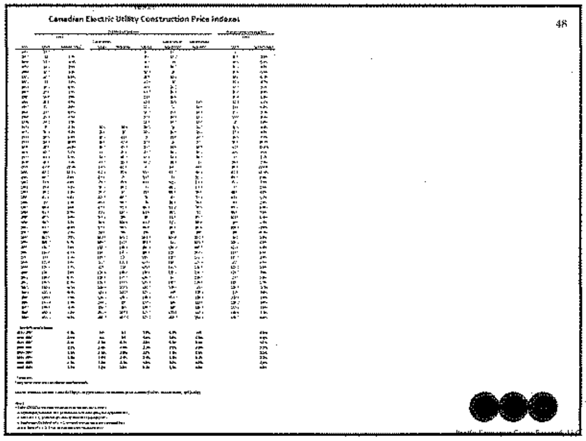


Table A-6

Salary and Wage Price Indexes for Quebec and Canada



Canadian Natural Gas Distribution, Water, and Other Systems Capital Stock Price Indexes



Canadian Electric Utility Construction Price Indexes

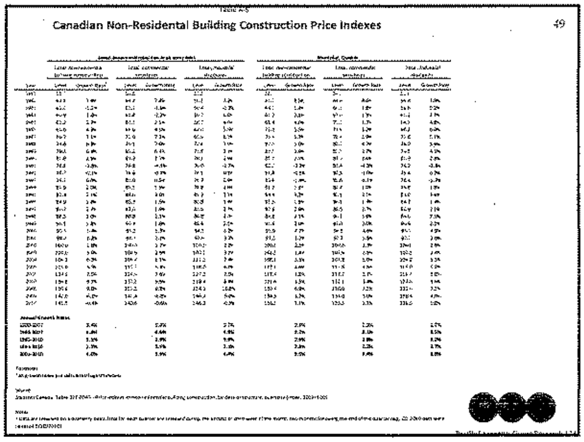
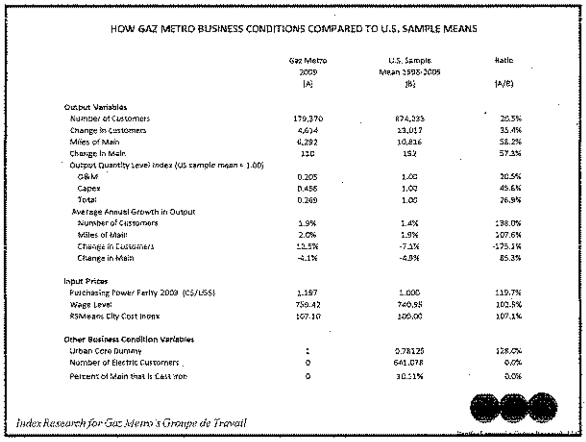


Table A-5

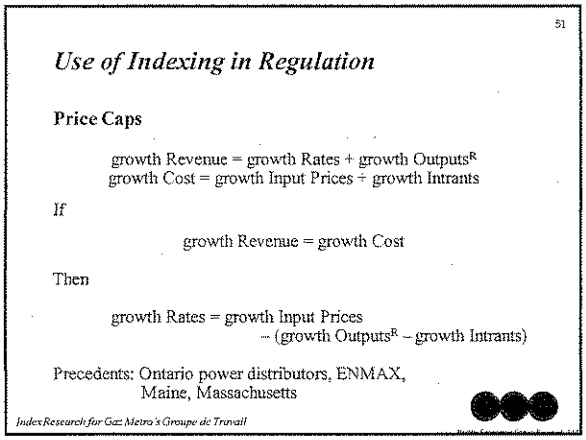
Canadian Non-Residental Building Construction Price Indexes



HOW GAZ METRO BUSINESS CONDITIONS COMPARED TO U.S. SAMPLE MEANS

	Gaz Metro 2009 (A)	U.S. Sample Mean 1998-2005 (B)	Ratio (A/B)
Output Variables			
Number of Customers	179,370	874,235	20.5%
Change in Customers	4,614	13,017	35.4%
Miles of Main	6,292	10,816	58.2%
Change in Main	110	192	57.3%
Output Quantity Level Index (US sample mean = 1.00)			
O&M	0.205	1.00	20.5%
Capex	0.456	1.00	45.6%
Total	0.269	1.00	26.9%
Average Annual Growth in Output			
Number of Customers	1.9%	1.4%	138.0%
Miles of Main	2.0%	1.9%	107.6%
Change in Customers	12.5%	-7.1%	-175.1%
Change in Main	-4.1%	-4.8%	85.3%
Input Prices			
Purchasing Power Parity 2009 (C$/US$)	1.197	1.000	119.7%
Wage Level	759.42	740.95	102.5%
RSMeans City Cost Index	107.10	100.00	107.1%
Other Business Condition Variables			
Urban Core Dummy	1	0.78125	128.0%
Number of Electric Customers	0	641,078	0.0%
Percent of Main that is Cast Iron	0	10.11%	0.0%

Index Research for Gaz Metro's Groupe de Travail



Use of Indexing in Regulation

Price Caps

growth Revenue = growth Rates + growth Outputs^R
growth Cost = growth Input Prices + growth Intrants

If

growth Revenue = growth Cost

Then

growth Rates = growth Input Prices
− (growth Outputs^R − growth Intrants)

Precedents: Ontario power distributors, ENMAX,
Maine, Massachusetts

Index Research for Gaz Metro's Groupe de Travail

Summing Up

Total Cost

Growth Cost = growth GDPIPI^{FDD} – X + growth Output

X = Productivity Target + Stretch

Inflation measure: Quebec GDPIPI^{FDD}

Productivity Target = [1.11, 1.67]

Stretch = [0.20, 0.50]

X = [1.21, 2.17]

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Index Research for Gaz Metro's Groupe de Travail

Dr. Mark Newton Lowry, *President*
PEG Research LLC

Montreal, QC
24 Novembre 2011

PEG
Pacific Economics Group Research, LLC

Plan of Presentation

Introduction

The Gaz Metro Group de Travail has proposed a new "mécanisme incitatif"

The mécanisme has escalation formulas for O&M and capital expenses which have X factors

Pacific Economics Group ("PEG") Research LLC was retained by the Task Force to measure Gaz Metro's productivity and help choose X

A report on our research was completed in March

This presentation discusses our research

Credentials

PEG Research LLC

Leading North American consultancy on incentive regulation (IR)

50+ man years of experience

Multinational practice, many Canadian projects

Diverse clientele
- Utilities
- Trade Associations
- Regulators
- Consumer groups

Services
- IR plan design
- Empirical (*e.g.* productivity) recherche

Mark Newton Lowry

President, PEG Research

20+ years experience as regulatory economist

Testified 30+ times on IR issues

Previously Assistant Professor, Pennsylvania State University
Visiting Professor, HEC Montreal

PhD Applied Economics, University of Wisconsin

Mandate

1. Calculated productivity trends of Gaz Metro 2000-2009
   - TFP, O&M, and capital expense ("capex") productivity
   - Excluded costs (*e.g.* pensions & benefits) that would not be subject to indexing in mechanisme incitatif
2. Considered suitable inflation measures
3. Considered appropriate stretch factors

Productivity Research Results

Research on productivity trends widely used in North America to design IR plans

- Price Caps
- Revenue Caps
- Cost Targets

Two methodologies used

- Productivity indexes
- Econometric productivity targets

Productivity Research Results

	Productivity Growth (%)		
	O&M	Capex	TFP
Productivity Indexes			
Gaz Metro (2000-2009)	0.73	2.08	1.66
Enbridge (2006-2010)	NA	NA	1.07
Union (2006-2010)	NA	NA	1.65
USA (1999-2008)	NA	NA	1.18
Econometric Productivity Target	1.55	1.92	1.11

Basic Concepts

Productivity Indexes

Productivity is a measure of enterprise efficiency

Conventionally measured using indexes

An index makes comparisons using ratios

e.g. $\text{Inflation } P^{gasoline} = (P^{gasoline}_{2011} / P^{gasoline}_{2010}) - 1$

Indexes can summarize multiple comparisons by taking weighted averages

e.g. $\text{IPC d'Ensemble}^{Quebec}$

Basic Concepts

Productivity Indexes

Productivity index is ratio of output & input quantity indexes

Productivity = Outputs/Inputs

Thus,

Growth Productivity = growth Outputs – growth Inputs

Output quantities: *e.g.* number of customers, miles of line

Input quantities: *e.g.* number of employees, number of vehicles

Productivity Indexes (cont'd)

Indexes can measure trends in *multiple* quantities using weighted averages

e.g. Input Price & Quantity Indexes

With *cost share* weights, calculus shows that they measure impact of input price & quantity growth on cost

e.g. Output Indexes

With *cost elasticity* weights, calculus shows that they measure impact of *output* growth cost

Basic Concepts (cont'd)

Input Quantity Indexes

Input indexes vary in scope of costs considered

Labor cost	Labor productivity
All O&M expenses	O&M productivity
Capex	Capex productivity
Total cost	Total factor productivity ("TFP")

Input Quantity Indexes (cont'd)

How to calculate multi-category input quantity indexes?

When input price and quantity indexes have *cost share* weights

growth Cost = growth Input Prices + growth Input Quantities

and

growth Input Quantities = growth Cost – growth Input Prices

For example,

$$\text{growth Labor Quantity}^{\text{GasMetro}} = \text{growth Labor Cost}^{\text{GasMetro}} - \text{growth Labor Price Index}^{\text{Quebec}}$$

Capital Quantity Indexes

TFP indexes require measures of capital cost & quantity

$$\text{Cost}^{\text{Capital}} = \text{Price}^{\text{Capital}} \times \text{Quantity}^{\text{Capital}}$$

This concept has confused many regulators and stakeholders

PEG Research has developed method for decomposing capital cost that mirrors the cost accounting in regulation

- Cost = Depreciation + Return on Plant
- Historical valuation of plant

Resultant capital prices is quite stable

Frequently used in Ontario

Capital Quantity Indexes (cont'd)

Capital quantity based on many years of plant additions

$$\text{Quantity}_t = f\left(\frac{\text{Additions}_t}{\text{Price}}, \frac{\text{Additions}_{t-1}}{\text{Price}}, \frac{\text{Additions}_{t-2}}{\text{Price}}, \ldots\right)$$

Need additions, construction cost index for 35+ past years

Gaz Metro has additions data only since 1995 (*15* years)

Need to guess additions in earlier years

>>> Difficult to measure Gaz Metro's *total* factor productivity accurately

One argument for focus on capex productivity

Elasticity-Weighted Output Indexes

Cost Elasticity = % change in Cost from 1% change Output
= Marginal Cost /Average Cost

Elasticities & marginal costs can be estimated *econometrically*

e.g. Given econometric model

$$\ln \text{Cost} = a_0 + = a_1 \ln \text{Customers} + a_2 \ln \text{Line Km} + a_3 \text{Trend}$$

a_1 and a_2 are elasticities

We search for best output specification in our models

Table A-2

Econometric Model of O&M Expenses

VARIABLE KEY

N = Number of Gas Customers
E = Number of Electric Customers
UC = Urban Core Binary Variable
CI = % Cast Iron Distribution Miles
Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC	P-VALUE
N	0.800	66.19	0.000
E	-0.014	-8.69	0.000
UC	0.147	6.75	0.000
CI	0.090	13.29	0.000
Trend	-0.012	-4.70	0.000
Constant	6.883	175.56	0.000

System Rbar-Squared	0.939
Sample Period	1998-2008
Number of Observations	363

1 output variable identified (N)

Trend = 1.2%

Basic Concepts (cont'd)

Econometric Productivity Targets

Denny, Fuss, and Waverman found that

growth TFP = Scale Effect + Business Condition Effects + Trend Effect

Econometric model can be used to estimate these effects

Can be tailored to local business conditions (*e.g.* customer growth)

Precedent: California

Table 3

Productivity Indexes for Cost Efficiency Measurement

	Costs								Input Quantity Index						Cost-Based Output Indexes				Productivity			
	O&M			Capital			Total Cost		O&M		Capital[1]		Summary Input Quantity Index		O&M Productivity		TFP[E]		O&M Productivity		TFP[E]	
Year	Million $	Growth Rate	Cost Share	Million $	Growth Rate	Cost Share	Million $	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1998	94.4	NA	34.3%	180.8	NA	65.7%	275.2	NA	100.0	NA	NA	NA	NA	NA	100.0	NA	NA	NA	100.0	NA	NA	NA
1999	98.3	4.0%	35.3%	180.0	-0.5%	64.7%	278.3	1.1%	98.9	-1.1%	100.0	NA	100.0	NA	100.8	0.8%	100.0	NA	101.9	1.9%	100.0	NA
2000	101.6	3.3%	36.1%	179.6	-0.2%	63.9%	281.2	1.0%	96.6	-2.4%	99.7	-0.3%	99.0	-1.0%	102.6	1.7%	102.1	2.1%	106.2	4.1%	103.2	3.1%
2001	105.0	3.3%	36.2%	185.3	3.1%	63.8%	290.3	3.2%	101.8	5.2%	101.4	1.6%	101.9	2.9%	102.7	0.1%	103.1	0.9%	100.9	-5.1%	101.1	-2.0%
2002	108.6	3.4%	36.4%	189.6	2.3%	63.6%	298.2	2.7%	100.7	-1.1%	102.6	1.3%	102.3	0.4%	103.8	1.1%	105.2	2.1%	103.1	2.1%	102.9	1.7%
2003	114.9	5.6%	37.1%	194.6	2.6%	62.9%	309.5	3.7%	104.1	3.3%	104.4	1.7%	104.7	2.3%	104.6	0.7%	105.8	0.5%	100.5	-2.6%	101.1	-1.7%
2004	123.2	7.0%	37.9%	201.8	3.7%	62.1%	325.0	4.9%	110.6	6.1%	104.7	0.3%	107.3	2.5%	107.2	2.5%	108.3	2.3%	96.9	-3.6%	100.9	-0.1%
2005	128.9	4.5%	38.0%	210.2	4.1%	62.0%	339.1	4.3%	117.1	5.7%	106.1	1.3%	110.6	3.0%	110.8	3.3%	111.6	3.0%	94.6	-2.4%	101.0	0.0%
2006	133.2	3.3%	39.2%	206.8	-1.6%	60.8%	340.0	0.3%	120.5	2.9%	103.9	-2.1%	110.4	-0.2%	113.9	2.8%	114.5	2.6%	94.5	-0.1%	103.8	2.7%
2007	131.2	-1.5%	38.5%	209.3	1.2%	61.5%	340.5	0.1%	114.0	-5.6%	102.4	-1.5%	107.1	-3.1%	116.5	2.2%	116.7	1.8%	102.2	7.8%	109.0	4.9%
2008	133.9	2.0%	38.9%	210.3	0.5%	61.1%	344.2	1.1%	111.4	-2.3%	99.8	-2.6%	104.4	-2.5%	119.6	2.6%	119.3	2.3%	107.4	4.9%	114.3	4.7%
2009	139.4	4.0%	39.9%	209.6	-0.3%	60.1%	349.0	1.4%	111.3	-0.1%	97.3	-2.5%	102.8	-1.5%	122.1	2.0%	121.3	1.7%	109.7	2.1%	118.0	3.2%
Average Annual Growth Rates																						
2000-2009		**3.49%**			**1.52%**			**2.27%**		**1.18%**		**-0.27%**		**0.28%**		**1.91%**		**1.93%**		**0.73%**		**1.66%**

NA = Not Available

[1]The summary input quantity index for capital is calculated as a cost share weighted average of the input quantities for three asset categories. The results were produced using the COS method.

>>> Different output indexes for different cost categories

Output indexes for O&M & TFP differ slightly

Productivity trends are much lower

Use of Indexing in Regulation

Index logic provides basis for design of revenue caps & cost caps

Gaz Metro Current Approach

- *Growth Revenue*

  = *growth Cost*

  = *growth Input Prices* + *growth Inputs*

  = *growth Input Prices* – (*growth Throughput* – *growth Inputs*)

  + *growth Throughput*

Alternative Revenue Cap Approach

According to Denny, Fuss, & Waverman,

growth Cost = growth Input Prices
- growth Productivity + growth Output

Output index elasticity-weighted

Rearranging terms,

growth Cost - growth Output
= growth *Unit* Cost
= growth Input Prices - growth Productivity

Alternative Revenue Cap Approach

If growth Output = growth Customers,

growth Cost/Customer
= growth Input Prices – growth Productivity

This has provided basis for several *revenue/customer* caps

growth Revenue/Customer = growth Inflation - X

e.g. Enbridge Gas Distribution, Southern California Gas

Cost Caps

Indexing also provides basis for cost target escalators

e.g. Gaz Metro proposes separate, index-based cost caps for O&M and capital expenses

growth "Dépenses"^{Exploitation}/Client = growth Inflation – X

growth "Dépenses"^{Capital}/Client = growth Inflation - X

Precedents Enbridge Gas Distribution, Gazifere
BC Gas, Fortis Alberta, Vermont Gas System

Advantages:

Sidesteps need to measure Gaz Metro's TFP
Theoretical foundation

X Factors

X = Productivity Base + Stretch Factor

Dividende client shares benefits of accelerated productivity growth

Several possible sources for Base Productivity Target

1. Gaz Metro's Input Price Index

Pro: May reflect local business conditions
Regie labor policy preferences

Con: Weakens performance incentives in repeated use

Historical trend may be too slow, too fast

X Factors

2. Econometric Productivity Target

Pro: Better incentives
Tailored to local business conditions

Con: Requires econometrics

Input Price Index Recommendations

Total Cost GDPIPI^{FDD}

O&M

Weighted average of Quebec salary & wage index, GDPIPI^{FDD}

Capex

Cost-weighted average of three price indexes

- Capital stock price index, engineering structures, gas & water
- Software
- GDPIPI^{FDD}

Stretch Factor

Stretch factor guarantees customers benefit of faster productivity growth

Common range [0, 1], with 0.50 mean

PEG Research Methodology

Share 50% of expected change in productivity growth

New regulatory system vs. prevalent system of peer distributors

Use Incentive Power Model to measure incentives

No acceleration expected if Gaz Metro data used

Incentive Power Research Results

Gaz Metro

- *Symmetric* 50/50 sharing
- 7 year term
- No cap on gains or losses

US Sample

- 3 year rate cycle
- No sharing

Results

>>> 40 basis point acceleration in productivity growth

43/2 = 22

Summing Up

O&M Expenses

growth Cost/Customer = growth Input Prices – X

Input Price Subindexes

- Labor
- $GDPIPI^{FDD}$

X = Productivity Target + Stretch

Productivity Target = [0.75, 1.55]
Stretch Factor = [0.20, 0.50]
X = [0.95, 2.05]

Summing Up

Capex

growth Cost = growth Input Prices – X + growth Outputs

Input Price Subindexes

- Power distribution construction cost index
- Software
- $GDPIPI^{FDD}$

X = Productivity Target + Stretch

Productivity Target = [1.92, 2.38]
Stretch Factor = [0.20, 0.50]
X = [1.12, 2.88]

Appendix

Table 1

Calculation of Cost-Based Output Indexes

	Customers					Line Miles (km)					Summary Output Indexes					
											For O&M Productivity		For TFP[E]		For Capex	
Elasticity Weights[2]																
O&M Productivity	100%															
TFP	73.85%					26.15%										
Capital Expenditures	11.60%			24.20%		48.33%			15.87%							
				Expected Change[3]					Expected Change[3]							
Year	Level	Growth Rate	Change in Customers	Level	Growth Rate	Level[1]	Growth Rate	Change in Miles	Level	Growth Rate	Total Customers	Growth Rate	Econometrically Weighted	Growth Rate	Econometrically Weighted	Growth Rate
1998	146,955	NA	NA	NA	NA	8,030	NA	NA	NA	NA	100.0	NA	NA	NA	NA	NA
1999	148,198	0.8%	1,243	1,321	NA	8,289	3.2%	259.4	267.8	NA	100.8	0.8%	100.0	NA	100.0	NA
2000	150,741	1.7%	2,543	1,456	9.7%	8,557	3.2%	267.8	331.9	21.4%	102.6	1.7%	102.1	2.1%	107.8	7.5%
2001	150,918	0.1%	177	981	-39.5%	8,833	3.2%	276.4	242.6	-31.3%	102.7	0.1%	103.1	0.9%	94.7	-13.0%
2002	152,565	1.1%	1,647	2,202	80.9%	9,285	5.0%	451.5	212.8	-13.1%	103.8	1.1%	105.2	2.1%	115.7	20.0%
2003	153,684	0.7%	1,119	3,409	43.7%	9,285	0.0%	-	132.6	-47.3%	104.6	0.7%	105.8	0.5%	119.4	3.1%
2004	157,525	2.5%	3,841	4,589	29.7%	9,472	2.0%	187.0	193.6	37.8%	107.2	2.5%	108.3	2.3%	137.9	14.5%
2005	162,791	3.3%	5,266	4,569	-0.4%	9,682	2.2%	210.8	155.7	-21.8%	110.8	3.3%	111.6	3.0%	135.0	-2.1%
2006	167,451	2.8%	4,660	4,342	-5.1%	9,865	1.9%	183.0	125.5	-21.6%	113.9	2.8%	114.5	2.6%	130.5	-3.4%
2007	171,232	2.2%	3,781	3,973	-8.9%	9,939	0.7%	73.2	89.0	-34.3%	116.5	2.2%	116.7	1.8%	121.7	-7.0%
2008	175,816	2.6%	4,584	3,675	-7.8%	10,059	1.2%	120.2	92.8	4.2%	119.6	2.6%	119.3	2.3%	121.3	-0.3%
2009	179,370	2.0%	3,554	3,362	-8.9%	10,132	0.7%	73.6	114.1	20.6%	122.1	2.0%	121.3	1.7%	123.4	1.7%
Average Annual Growth Rates 2000-2009		**1.91%**			**9.34%**		**2.01%**			**-8.53%**		**1.91%**		**1.93%**		**2.10%**

NA = not available

[1] The 1998 and 1999 values for line miles were not available and were imputed using the 1999-2000 growth rate.

[2] Elasticity weights are based on Gaz Metro costs and quantities and econometric estimates of marginal costs prepared by PEG Research using data on the operations of U.S. gas distributors.

[3] Expected change is a three year moving average of the change in the corresponding variable. Values for 2008 and 2009 use Gaz Metro forecasts.

Table 2

Gaz Metro O&M Input Quantity Indexes

	Costs							Input Prices				Input Quantities									
	Salaries & Wages[1]		Materials & Services[1]			Total O&M		Salaries & Wages[2]		Materials & Services[3]		Summary O&M Input Price Index		Labor (SW/W)		Materials & Services		Cost Shares		Summary O&M Input Quantity Index[4]	
Year	Million $	Growth Rate	Million $	Cost Share	Growth Rate	Million $	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Labor	materials	Level	Growth Rate
	[A]	[B]	[C]		[D]				[E]		[F]				[B] - [E]		[D] - [F]				
1998	61.5	NA	32.9	34.9%	NA	94.4	NA	84.6	NA	92.7	NA	100.0	NA	0.73	NA	0.35	NA	65.1%	34.9%	100.0	NA
1999	61.2	-0.5%	37.1	37.7%	12.0%	98.3	4.0%	90.9	7.2%	94.0	1.4%	105.2	5.1%	0.67	-7.7%	0.39	10.6%	62.3%	37.7%	98.9	-1.1%
2000	64.3	4.9%	37.3	36.7%	0.5%	101.6	3.3%	98.1	7.6%	96.4	2.5%	111.4	5.7%	0.66	-2.7%	0.39	-2.0%	63.3%	36.7%	96.6	-2.4%
2001	67.5	4.9%	37.5	35.7%	0.5%	105.0	3.3%	94.4	-3.8%	97.8	1.4%	109.3	-1.9%	0.71	8.7%	0.38	-0.9%	64.3%	35.7%	101.8	5.2%
2002	70.9	4.9%	37.7	34.7%	0.5%	108.6	3.3%	99.9	5.6%	100.0	2.2%	114.3	4.4%	0.71	-0.7%	0.38	-1.7%	65.3%	34.7%	100.7	-1.1%
2003	75.5	6.3%	39.4	34.3%	4.4%	114.9	5.6%	102.6	2.7%	101.8	1.8%	117.0	2.4%	0.74	3.6%	0.39	2.6%	65.7%	34.3%	104.1	3.3%
2004	80.9	6.9%	42.3	34.3%	7.1%	123.2	7.0%	103.2	0.7%	103.1	1.3%	118.0	0.9%	0.78	6.2%	0.41	5.8%	65.7%	34.3%	110.6	6.1%
2005	85.1	5.1%	43.8	34.0%	3.5%	128.9	4.5%	100.5	-2.7%	105.1	1.9%	116.7	-1.1%	0.85	7.8%	0.42	1.6%	66.0%	34.0%	117.1	5.7%
2006	88.4	3.8%	44.8	33.6%	2.3%	133.2	3.3%	100.3	-0.1%	106.5	1.3%	117.1	0.4%	0.88	3.9%	0.42	0.9%	66.4%	33.6%	120.5	2.9%
2007	89.7	1.5%	41.5	31.6%	-7.7%	131.2	-1.5%	105.5	5.1%	108.6	2.0%	121.9	4.0%	0.85	-3.6%	0.38	-9.6%	68.4%	31.6%	114.0	-5.6%
2008	90.8	1.2%	43.1	32.2%	3.8%	133.9	2.0%	111.4	5.4%	110.8	2.0%	127.3	4.3%	0.82	-4.2%	0.39	1.8%	67.8%	32.2%	111.4	-2.3%
2009	93.9	3.4%	45.5	32.6%	5.4%	139.4	4.0%	117.7	5.5%	112.3	1.3%	132.7	4.1%	0.80	-2.1%	0.41	4.1%	67.4%	32.6%	111.3	-0.1%
Average Annual Growth Rates																					
2000-2009		**4.28%**			**2.04%**		**3.49%**		**2.58%**		**1.78%**		**2.32%**		**1.70%**		**0.26%**				**1.18%**

NA = not available

[1] Source: Gaz Metro. Cost data were not provided for the years 2000-2001. Data for these years were imputed using actual data from 2002 and 1999. The method used was to assume that the total growth from 1999-2002 took place uniformly over the period. The imputations do not affect the average annual growth rates. Capitalized O&M expenditures were removed and included in capital cost for the years 2008-2009.

[2] Source: Statistics Canada. Table 281-0039 - Fixed weighted index of average hourly earnings for all employees (SEPH), excluding overtime, unadjusted for seasonal variation, for Quebec utilities industry as classified using the North American Industry Classification System (NAICS), monthly (index, 2002=100)

[3] Source: Statistics Canada, Gross Domestic Product of Quebec at Market Prices, Table 384-0036 - Implicit price indexes, gross domestic product (GDP) final domestic demand, provincial economic accounts, annual (index, 2002=100)

[4] The O&M input quantity index is a cost-weighted average of growth in labor and M&S input quantities. The index is of Tornqvist form.

Comparison of Productivity Trends

	Total Cost Efficiency Metric (TFP[c])				MFP, Private Business Sector			
	Gaz Metro		US Gas Distributors[1]		US[2]		Canada[3]	
Year	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1998	NA	NA	1.000	NA	87.898	NA	95.7	NA
1999	100.0	NA	1.027	2.7%	89.509	1.8%	97.6	2.0%
2000	103.2	3.1%	1.030	0.3%	91.042	1.7%	99.8	2.2%
2001	101.1	-2.0%	1.069	3.7%	91.749	0.8%	99.5	-0.3%
2002	102.9	1.7%	1.078	0.8%	93.942	2.4%	100.0	0.5%
2003	101.1	-1.7%	1.071	-0.7%	96.429	2.6%	99.5	-0.5%
2004	100.9	-0.1%	1.066	-0.5%	98.966	2.6%	98.8	-0.7%
2005	101.0	0.0%	1.041	-2.3%	100.000	1.0%	99.0	0.2%
2006	103.8	2.7%	1.111	6.5%	100.517	0.5%	98.3	-0.7%
2007	109.0	4.9%	1.112	0.1%	101.025	0.5%	97.7	-0.6%
2008	114.3	4.7%	1.125	1.1%	101.119	0.1%	95.5	-2.3%
2009	118.0	3.2%	NA	NA	101.906	0.8%	93.4	-2.2%
Average Annual Growth Rates								
1999-2008	**NA**		**1.18%**		**1.40%**		**-0.02%**	
2000-2009	**1.66%**		**NA**		**1.30%**		**-0.44%**	
2000-2008	**1.48%**		**1.01%**		**1.36%**		**-0.24%**	

NA = Not available

[1] Source: Mark Newton Lowry and David Hovde (2010), *Productivity Research for Southern California Gas*, page 9, filed as Exhibit SCG-37 in Application 10-12-006 before the California Public Utilities Commission.

[2] Source: US Bureau of Labor Statistics.

[3] Source: Statistics Canada, Table 383-0021.

Table 5

Productivity Index for Capital Expenditures

	Outputs		Inputs						Productivity of Capital Expenditures		
	Summary Output Index		Value of Plant Additions[2]		Capex Price Index[3]		Plant Addition Quantities				
	Level	Growth Rate	$ Million	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Level (1999=100)	Growth Rate
Year		[A]		[B]		[C]		[D] = [B-C]			[A] - [D]
1999	100.0	NA	84.93	NA	100.3	NA	100.0	NA	1.000	100.0	NA
2000	107.8	7.5%	85.76	1.0%	102.1	1.8%	99.2	-0.9%	1.087	108.7	8.3%
2001	94.7	-13.0%	92.17	7.2%	102.5	0.4%	106.2	6.9%	0.891	89.1	-19.8%
2002	115.7	20.0%	98.87	7.0%	102.9	0.4%	113.4	6.6%	1.020	102.0	13.4%
2003	119.4	3.1%	104.76	5.8%	102.0	-0.9%	121.3	6.7%	0.984	98.4	-3.5%
2004	137.9	14.5%	132.29	23.3%	105.6	3.5%	147.9	19.8%	0.933	93.3	-5.4%
2005	135.0	-2.1%	133.52	0.9%	110.5	4.5%	142.8	-3.5%	0.946	94.6	1.4%
2006	130.5	-3.4%	126.40	-5.5%	116.1	4.9%	128.6	-10.4%	1.014	101.4	7.0%
2007	121.7	-7.0%	146.75	14.9%	121.4	4.5%	142.8	10.4%	0.852	85.2	-17.4%
2008	121.3	-0.3%	102.74	-35.7%	122.8	1.2%	98.8	-36.8%	1.228	122.8	36.5%
2009	123.4	1.7%	104.98	2.2%	123.8	0.8%	100.2	1.4%	1.232	123.2	0.3%
Average Annual Growth Rates											
2000-2009		**2.10%**		**2.12%**		**2.10%**		**0.02%**			**2.08%**

NA = Not Available

[1] The 1998 value for line miles was not available and was imputed using the 1999-2000 growth rate.

[2] Source: Gaz Metro

[3] Source: Statistics Canada. Table 383-0025 - Canadian Natural Gas Distribution, Water, and Other Systems Capital Stock Price (index, 2002=100). 1998-2007.
Where this index was not available (in 2008-2009), values were imputed using the growth rates in the comprehensive electric utility construction price index.
Source: Statistics Canada. Table 327-0011

Table 7

X Factor Reflective of Past Gaz Metro Experience

TFP[C]	Output Differential	X
[A]	[B]	[A + B]
1.656%	-1.655%	0.001%

Table 8

Calculating Industry-Specific Input Price Indexes

	Costs			Input Price Indexes									
	Labor[1]	Materials & Services[1]	Capital[1]	Labor[2]		Materials & Services[4]		All O&M		Capital		All Inputs	
year	Million $	Million $	Million $	Level	Growth Rate[3]	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1998	61.5	32.9	180.8	84.6	NA	92.7	NA	100.0	NA	100.0	NA	100.0	NA
1999	61.2	37.1	180.0	90.9	7.2%	94.0	1.4%	105.2	5.1%	99.3	-0.7%	101.3	1.3%
2000	64.3	37.3	179.6	98.1	7.6%	96.4	2.5%	111.4	5.7%	99.4	0.0%	103.5	2.1%
2001	67.5	37.5	185.3	94.4	-3.8%	97.8	1.4%	109.3	-1.9%	100.9	1.5%	103.8	0.3%
2002	70.9	37.7	189.6	99.9	5.6%	100.0	2.2%	114.3	4.4%	102.0	1.1%	106.1	2.3%
2003	75.5	39.4	194.6	102.6	2.7%	101.8	1.8%	117.0	2.4%	102.9	0.9%	107.7	1.4%
2004	80.9	42.3	201.8	103.2	0.7%	103.1	1.3%	118.0	0.9%	106.4	3.3%	110.3	2.4%
2005	85.1	43.8	210.2	100.5	-2.7%	105.1	1.9%	116.7	-1.1%	109.3	2.7%	111.7	1.3%
2006	88.4	44.8	206.8	100.3	-0.1%	106.5	1.3%	117.1	0.4%	109.9	0.5%	112.2	0.4%
2007	89.7	41.5	209.3	105.5	5.1%	108.6	2.0%	121.9	4.0%	112.8	2.6%	115.8	3.2%
2008	90.8	43.1	210.3	111.4	5.4%	110.8	2.0%	127.3	4.3%	116.3	3.1%	120.0	3.6%
2009	93.9	45.5	209.6	117.7	5.5%	112.3	1.3%	132.7	4.1%	118.9	2.2%	123.6	2.9%
Average Annual Growth Rates 2000-2009					**2.58%**		**1.78%**		**2.32%**		**1.80%**		**1.99%**

NA = Not Available

[1] Source: Gaz Metro

[2] Source: Statistics Canada. Table 281-0039 - Fixed weighted index of average hourly earnings for all employees (SEPH), excluding overtime, unadjusted for seasonal variation, for Quebec utilities industry as classified using the North American Industry Classification System (NAICS). Where this index was not available (in 2008-2009), values were imputed using the growth rates in the comprehensive electric utility construction price index. Source: Statistics Canada. Table 327-0011

[3] All growth rates calculated logarithmically.

[4] Source: Statistics Canada, Gross Domestic Product (GDP) of Quebec at Market Prices, Table 384-0036 - Implicit price indexes, GDP final domestic demand, provincial economic accounts, annual

Table 9

How Selected Macroeconomic Price Indexes Compared to Gaz Metro Input Price Indexes

	Quebec Price Indexes				Summary Gaz Metro Input Price Indexes					
	Consumer Price Index[1]		GDP Implicit Price Index - Final Domestic Demand[2]		Operation & Maintenance		Capital Expenditures[3]		Total	
	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1998	92.1	NA	92.7	NA	100.0	NA	100.0		100.0	NA
1999	93.5	1.5%	94.0	1.4%	105.2	5.1%	100.3	0.3%	101.3	1.3%
2000	95.8	2.4%	96.4	2.5%	111.4	5.7%	102.1	1.8%	103.5	2.1%
2001	98.0	2.3%	97.8	1.4%	109.3	-1.9%	102.5	0.4%	103.8	0.3%
2002	100.0	2.0%	100.0	2.2%	114.3	4.4%	102.9	0.4%	106.1	2.3%
2003	102.5	2.5%	101.8	1.8%	117.0	2.4%	102.0	-0.9%	107.7	1.4%
2004	104.5	1.9%	103.1	1.3%	118.0	0.9%	105.6	3.5%	110.3	2.4%
2005	106.9	2.3%	105.1	1.9%	116.7	-1.1%	110.5	4.5%	111.7	1.3%
2006	108.7	1.7%	106.5	1.3%	117.1	0.4%	116.1	4.9%	112.2	0.4%
2007	110.4	1.6%	108.6	2.0%	121.9	4.0%	121.4	4.5%	115.8	3.2%
2008	112.7	2.1%	110.8	2.0%	127.3	4.3%	122.8	1.2%	120.0	3.6%
2009	113.4	0.6%	112.3	1.3%	132.7	4.1%	123.8	0.8%	123.6	2.9%
Average Annual Growth Rate 2000-2009		**1.93%**		**1.78%**		**2.32%**		**2.10%**		**1.99%**

NA = Not Available

[1] Source: Statistics Canada. Table 326-0021 - Consumer Price Index (CPI) of Quebec, 2005 baskets, annual (index, 2000=100)

[2] Source: Statistics Canada. Table 384-0036 - Implicit price index, gross domestic product, final domestic demand (GDP FDD) of Quebec, provincial economic accounts, annual (index, 2000=100)

[3] Source: Statistics Canada. Table 383-0025 - Canadian Natural Gas Distribution, Water, and Other Systems Capital Stock Price (index, 2000=100). 1998-2007.

Where this index was not available (in 2008-2009), values were imputed using the growth rates in the electric utility construction price index. Source: Statistics Canada. Table 327-0011

Table 10

Calculating External Productivity Targets for Gaz Metro: Standard Elasticities

	Estimated Trend Effect	Scale Economy Effect							Forward Productivity Growth Target
		Estimated Elasticity Weight	Forecasted Output Growth[1]				SUM Elasticities	Scale Economy Effect	
			Total Customers	Change in Customers	Line Miles	Change in Line Miles	Summary Output Index		
	[A]						[B]	[C]	[D=B*(1-C)]	[A+D]
		Gaz Metro Elasticity Share:	100.0%							
O&M Expenses	1.16%		2.00%				2.00%	0.80	0.39%	1.55%
		Gaz Metro Elasticity Share:	11.60%	24.20%	48.33%	15.87%				
Capex	1.82%		2.00%							
				2.00%						
					1.80%					
						1.80%				
							1.87%	0.95	0.10%	1.92%
		Gaz Metro Elasticity Share:	73.85%		26.15%					
Total Cost	0.81%		2.00%							
					1.80%		1.95%	0.85	0.30%	1.11%

[1] Forecasts prepared by Gaz Metro

Figure 1

How Selected Macroeconomic Price Indexes Compared to Gaz Metro Input Price Indexes

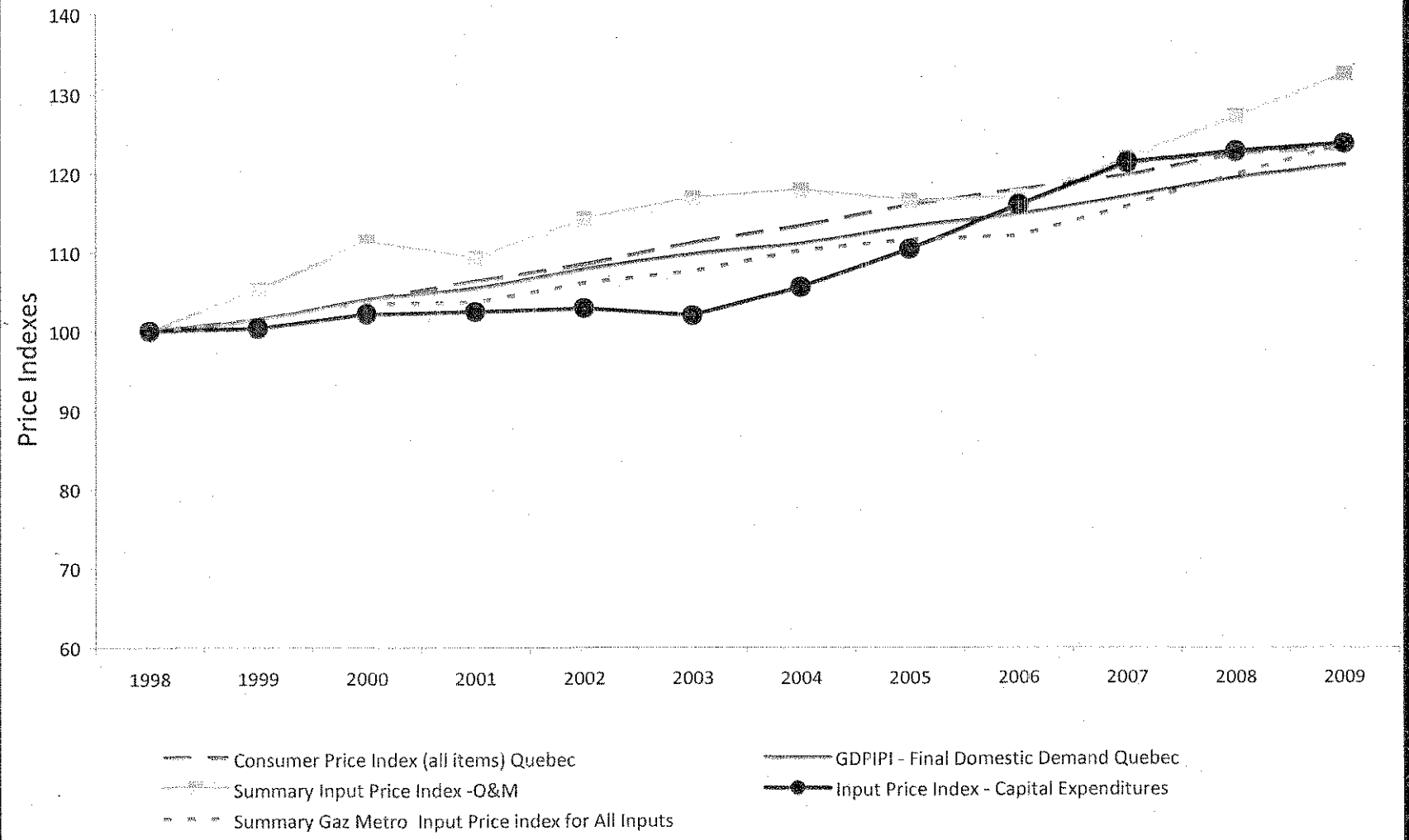

Figure A-1

Comparing Trends in Alternative Capex Price Indexes

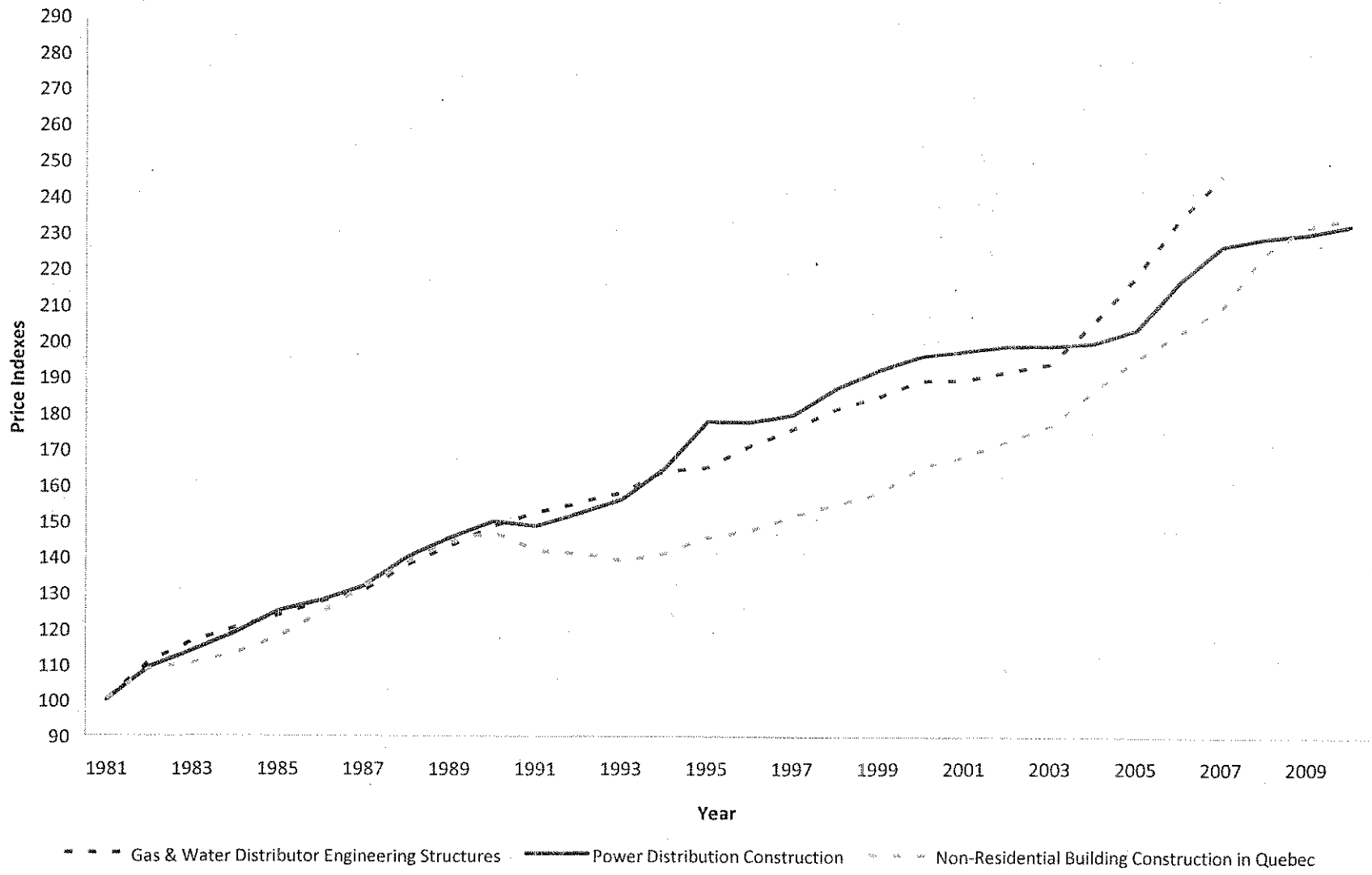

Table A-1

SAMPLE OF GAS DISTRIBUTORS USED IN THE EMPIRICAL RESEARCH

Baltimore Gas and Electric
Boston Gas
Brooklyn Union Gas
Cascade Natural Gas
Central Hudson Gas & Electric
Connecticut Natural Gas
Consolidated Edison Company of New York
East Ohio Gas
Gaz Metro
Louisville Gas and Electric
Madison Gas and Electric
New Jersey Natural Gas
Niagara Mohawk Power
North Shore Gas
Northern Illinois Gas
Northwest Natural Gas
Orange and Rockland Utilities
Pacific Gas and Electric
PECO Energy
Peoples Gas Light and Coke
Peoples Natural Gas
Public Service Electric and Gas
Public Service Company of Colorado
Public Service Company of North Carolina
Puget Sound Energy
Questar Gas
Rochester Gas and Electric
San Diego Gas & Electric
Southern California Gas
Southern Connecticut Gas
Washington Gas Light
Wisconsin Gas
Wisconsin Power and Light

Number of companies: 33

Econometric sample includes most large US gas distributors

Table A-3

Econometric Model of Capital Expenditure

VARIABLE KEY

N = Number of Gas Customers
CN = Change in Number of Customers
M = Miles of Main
CM = Change in Miles of Main
UC = Urban Core Binary Variable
CI = % Cast Iron Miles
BS = % Bare Steel Miles
E = Number of Electric Customers
Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC	P-VALUE
N	0.339	4.64	0.000
CN	0.044	2.05	0.042
M	0.530	6.49	0.000
CM	0.035	2.96	0.003
UC	0.094	2.10	0.037
CI	0.123	5.21	0.000
BS	0.041	2.66	0.008
E	-0.008	-2.49	0.013
Trend	-0.018	-3.17	0.002
Constant	6.846	80.91	0.000

System Rbar-Squared	0.807
Sample Period	1998-2007
Number of Observations	264

4 output variables identified (N, CN, M, CM)

Trend = 1.8%

Table A-4

Econometric Model of Total Cost

VARIABLE KEY

N = Number of Gas Customers
M = Miles of Main
UC = Urban Core Binary Variable
E = Number of Electric Customers
CI = % Cast Iron Distribution Miles
Trend = Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC	P-VALUE
N	0.757	42.623	0.000
M	0.089	3.445	0.001
UC	0.100	5.740	0.000
E	-0.004	-2.429	0.016
CI	0.069	6.323	0.000
Trend	-0.008	-6.123	0.000
Constant	12.504	435.444	0.000

System Rbar-Squared	0.957
Sample Period	1998-2008
Number of Observations	363

2 output variables (N, M)

Nombre de clients dominant

Trend = 0.8%

Table A-5

Macroeconomic Inflation Measures for Quebec and Canada

	Canada								Quebec					
	CPI (all items)[1]		Core CPI[1 2]		Gross Domestic Product Implicit Price Indexes[3]				CPI (all items)[1]		Gross Domestic Product Implicit Price Indexes[3]			
					Comprehensive		Final Domestic Demand				Comprehensive		Final Domestic Demand	
Year	Level	Growth Rate[4]	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1977	33.6	7.7%												
1978	36.6	8.6%												
1979	40	8.9%							40.5					
1980	44	9.5%							44.7	9.9%				
1981	49.5	11.8%			55.7		53.6		50.2	11.6%	51.9		55.2	
1982	54.9	10.4%			60.4	8.1%	58.7	9.1%	56	10.9%	57	9.4%	60.6	9.3%
1983	58.1	5.7%			63.7	5.3%	61.9	5.3%	59.1	5.4%	60.3	5.6%	63.7	5.0%
1984	60.6	4.2%	62.9		65.8	3.2%	64.4	4.0%	61.5	4.0%	63.1	4.5%	66.4	4.2%
1985	63	3.9%	65.1	3.4%	67.8	3.0%	66.7	3.5%	64.2	4.3%	65.4	3.6%	69	3.8%
1986	65.6	4.0%	68	4.4%	69.9	3.1%	69.2	3.7%	67.3	4.7%	70	6.8%	71.4	3.4%
1987	68.5	4.3%	71	4.3%	73.1	4.5%	72	4.0%	70.2	4.2%	73.6	5.0%	74.3	4.0%
1988	71.2	3.9%	74	4.1%	76.4	4.4%	74.7	3.7%	72.8	3.6%	77.2	4.8%	76.9	3.4%
1989	74.8	4.9%	77.2	4.2%	79.8	4.4%	77.9	4.2%	75.9	4.2%	80.8	4.6%	79.9	3.8%
1990	78.4	4.7%	79.8	3.3%	82.4	3.2%	80.9	3.8%	79.2	4.3%	83.2	2.9%	83	3.8%
1991	82.8	5.5%	82.1	2.8%	84.8	2.9%	83.7	3.4%	85	7.1%	86.5	3.9%	85.8	3.3%
1992	84	1.4%	83.6	1.8%	85.9	1.3%	85.1	1.7%	86.6	1.9%	87.9	1.6%	87.3	1.7%
1993	85.6	1.9%	85.3	2.0%	87.2	1.5%	86.8	2.0%	87.7	1.3%	88.3	0.5%	88.6	1.5%
1994	85.7	0.1%	86.9	1.9%	88.2	1.1%	88.1	1.5%	86.6	-1.3%	88.9	0.7%	89.1	0.6%
1995	87.6	2.2%	88.8	2.2%	90.2	2.2%	89.2	1.2%	88.1	1.7%	90.9	2.2%	89.9	0.9%
1996	88.9	1.5%	90.3	1.7%	91.6	1.5%	90.2	1.1%	89.5	1.6%	91.7	0.9%	90.6	0.8%
1997	90.4	1.7%	92	1.9%	92.7	1.2%	91.5	1.4%	90.8	1.4%	92.7	1.1%	91.8	1.3%
1998	91.3	1.0%	93.2	1.3%	92.3	-0.4%	92.7	1.3%	92.1	1.4%	93.6	1.0%	92.7	1.0%
1999	92.9	1.7%	94.5	1.4%	93.9	1.7%	93.9	1.3%	93.5	1.5%	94.7	1.2%	94	1.4%
2000	95.4	2.7%	95.7	1.3%	97.8	4.1%	96.1	2.3%	95.8	2.4%	96.8	2.2%	96.4	2.5%
2001	97.8	2.5%	97.7	2.1%	98.9	1.1%	97.8	1.8%	98	2.3%	98.2	1.4%	97.8	1.4%
2002	100	2.2%	100	2.3%	100	1.1%	100	2.2%	100	2.0%	100	1.8%	100	2.2%
2003	102.8	2.8%	102.2	2.2%	103.3	3.2%	101.5	1.5%	102.5	2.5%	102.6	2.6%	101.8	1.8%
2004	104.7	1.8%	103.8	1.6%	106.6	3.1%	103.2	1.7%	104.5	1.9%	104.7	2.0%	103.1	1.3%
2005	107	2.2%	105.5	1.6%	110.1	3.2%	105.5	2.2%	106.9	2.3%	106.5	1.7%	105.1	1.9%
2006	109.1	1.9%	107.5	1.9%	113	2.6%	107.9	2.2%	108.7	1.7%	108.6	2.0%	106.5	1.3%
2007	111.5	2.2%	109.8	2.1%	116.7	3.2%	110.4	2.3%	110.4	1.6%	111.4	2.5%	108.6	2.0%
2008	114.1	2.3%	111.7	1.7%	121.4	3.9%	112.9	2.2%	112.7	2.1%	112.8	1.2%	110.8	2.0%
2009	114.4	0.3%	113.6	1.7%	118.8	-2.2%	114.4	1.3%	113.4	0.6%	113.6	0.7%	112.3	1.3%
2010	116.5	1.8%	115.6	1.7%	NA	NA	NA	NA	114.8	1.2%	NA	NA	NA	NA
Annual Growth Rates														
1988-2007		**2.44%**		**2.18%**		**2.34%**		**2.14%**		**2.26%**		**2.07%**		**1.90%**
1998-2007		**2.10%**		**1.77%**		**2.30%**		**1.88%**		**1.95%**		**1.84%**		**1.68%**
1990-2009		**2.12%**		**1.93%**		**1.99%**		**1.92%**		**2.01%**		**1.70%**		**1.70%**
2000-2009		**2.08%**		**1.84%**		**2.35%**		**1.97%**		**1.93%**		**1.82%**		**1.78%**
Standard Deviation														
1990-2010		**1.20%**		**0.48%**		**1.52%**		**0.70%**		**1.52%**		**0.86%**		**0.81%**

Footnotes

[1] Statistics Canada. Table 326-0021 - Consumer Price Index (CPI), 2005 basket, annual (2002=100 unless otherwise noted) (table).

[2] The Core CPI excludes from the all-items CPI the effect of changes in indirect taxes and eight of the most volatile components identified by the Bank of Canada: fruit, fruit preparations and nuts; vegetables and vegetable preparations; mortgage interest cost; natural gas; fuel oil and other fuels; gasoline; inter-city transportation; and tobacco products and smokers' supplies.

[3] Statistics Canada. Table 384-0036 - Implicit price indexes, gross domestic product (GDP), provincial economic accounts, annual (index, 2002=100).

[4] All growth rates are calculated logarithmically.

Notes:

- Annual CPI data become available for the previous year near the end of January of the following year (e.g. Annual 2010 data became available on 1/25/2011).
- CPI data are not revised. Only seasonally adjusted CPI data are subject to revision and are also available at the end of January of the following year.
- Annual GDPIPI data become available for the previous year near the beginning of November of the following year (e.g. Annual 2010 data become available November 2011). Preliminary data for the previous year are released near the end of April of the following year.
- GDP data are revised periodically as improved data sources and/or methodology become available.
- "NA" is defined as "Not available."

Table A-6

Salary and Wage Price Indexes for Quebec and Canada

Year	Fixed weighted index of average hourly earnings for all employees[1 2]				Average weekly earnings (Industrial aggregate excluding unclassified businesses)[2 3]		Composite construction union wage rate index[4]	
	Canada		Quebec					
	Industrial Aggregate	Utilities	Industrial Aggregate	Utilities	Canada	Quebec	Canada	Quebec
1981							40.0	37.1
1982							43.7	40.4
1983							49.2	44.9
1984							51.0	46.6
1985							52.2	48.0
1986							53.7	49.4
1987							55.2	52.1
1988							57.2	54.6
1989							59.9	57.5
1990							63.2	60.3
1991	82.02	67.38	85.18	71.51	553.15	545.45	67.0	64.1
1992	84.71	70.17	88.48	74.20	572.41	566.03	70.1	67.8
1993	86.44	72.41	89.84	77.67	582.87	572.63	71.7	68.5
1994	87.63	73.23	90.19	78.22	592.88	575.46	73.2	69.1
1995	89.62	74.57	91.71	79.62	598.67	579.41	74.6	69.1
1996	91.73	75.88	93.21	81.30	611.01	585.52	75.3	69.1
1997	92.28	77.70	93.98	81.31	623.43	594.29	76.8	71.9
1998	93.78	80.83	94.39	84.58	632.72	602.17	78.4	73.8
1999	94.81	86.13	94.06	90.93	640.47	605.74	79.7	74.8
2000	96.73	88.73	95.98	98.08	655.55	616.25	81.8	77.3
2001	98.03	95.01	97.14	94.43	656.74	622.83	83.8	78.8
2002	100.18	99.90	100.15	99.88	672.68	639.04	87.0	83.7
2003	103.13	105.16	102.83	102.56	690.79	656.64	89.3	86.8
2004	105.90	107.02	105.81	103.24	709.41	673.69	91.4	89.6
2005	109.23	108.92	108.73	100.46	737.29	695.58	94.1	94.3
2006	112.09	111.24	111.14	100.33	755.48	708.27	97.0	97.3
2007	117.25	117.38	117.08	105.53	788.06	738.73	100.0	100.0
2008	121.34	118.86	120.08	111.39	810.52	751.19	104.9	102.9
2009	125.02	125.52	123.62	117.66	823.53	759.42	109.2	106.0
				Annual Growth Rates				
1992-2009	**2.3%**	**3.5%**	**2.1%**	**2.8%**	**2.2%**	**1.8%**	**1982-2009** **3.6%**	**3.7%**
2000-2009	**2.8%**	**3.8%**	**2.7%**	**2.6%**	**2.5%**	**2.3%**	**1990-2009** **3.0%**	**3.1%**

Footnotes

[1] Statistics Canada. Table 281-0039 - Fixed weighted index of average hourly earnings for all employees (SEPH), excluding overtime, unadjusted for seasonal variation, for selected industries classified using the North American Industry Classification System (NAICS), monthly (index, 2002=100)

[2] Industrial aggregate covers all industrial sectors except those primarily involved in agriculture, fishing and trapping, private household services, religious organisations and the military personnel of the defence services.

[3] Statistics Canada. Table 281-0027 - Average weekly earnings (SEPH), unadjusted for seasonal variation, by type of employee for selected industries classified using the North American Industry Classification System (NAICS), annual (current dollars)

[4] Statistics Canada. Table 327-0045 - Construction union wage rate indexes, monthly (index, 2007=100)

Notes

• Payroll employment, earnings and hours data are released on a monthly basis. Data are released near the end of each month for the month two months prior (e.g. August 2011 data will be released near the end of October 2011).

Table A-7

Canadian Natural Gas Distribution, Water, and Other Systems Capital Stock Price Indexes

	Information and communication technologies machinery and equipment[1]		Non-information and communication technologies machinery and equipment[2]		Building structures		Engineering structures[3]		Land	
Year	Level	Growth Rate[4]	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1961	3091.7		17.5		17.9		12.6		35.4	
1962	3102.6	0.4%	17.9	2.3%	17.8	-0.6%	12.7	0.8%	32.8	-7.6%
1963	3165.2	2.0%	20.1	11.6%	18.2	2.2%	13.1	3.1%	30.4	-7.6%
1964	3205.4	1.3%	18.7	-7.2%	18.4	1.1%	13.6	3.7%	28.6	-6.1%
1965	3282.6	2.4%	19.3	3.2%	19.2	4.3%	14.4	5.7%	28	-2.1%
1966	3226.8	-1.7%	19.7	2.1%	20.5	6.6%	15.2	5.4%	27.9	-0.4%
1967	3312.1	2.6%	19.5	-1.0%	21.3	3.8%	16	5.1%	27	-3.3%
1968	3325.9	0.4%	19.4	-0.5%	21.2	-0.5%	16.2	1.2%	25.8	-4.5%
1969	3353.1	0.8%	19.8	2.0%	22.2	4.6%	17.1	5.4%	25.7	-0.4%
1970	3408.4	1.6%	20.9	5.4%	23.3	4.8%	18.1	5.7%	25.6	-0.4%
1971	3505.1	2.8%	21.5	2.8%	24.6	5.4%	19.3	6.4%	26.1	1.9%
1972	3522.7	0.5%	22	2.3%	26.9	8.9%	20.5	6.0%	27.6	5.6%
1973	3564.8	1.2%	23	4.4%	29	7.5%	21.8	6.1%	31	11.6%
1974	3466.6	-2.8%	26.2	13.0%	35.4	19.9%	26.1	18.0%	36.1	15.2%
1975	3606.7	4.0%	31	16.8%	40.4	13.2%	30.8	16.6%	39.7	9.5%
1976	3213.5	-11.5%	32.8	5.6%	41.3	2.2%	33.4	8.1%	40.9	3.0%
1977	2807.1	-13.5%	36.2	9.9%	42.2	2.2%	36	7.5%	43.4	5.9%
1978	2060.2	-30.9%	40.5	11.2%	43.8	3.7%	38.8	7.5%	45.2	4.1%
1979	1826.7	-12.0%	45.2	11.0%	46.9	6.8%	42.7	9.6%	49.9	9.9%
1980	1347.4	-30.4%	50.4	10.9%	52.1	10.5%	47.1	9.8%	56.7	12.8%
1981	1139	-16.8%	56.2	10.9%	60.4	14.8%	52.2	10.3%	62.8	10.2%
1982	1108.6	-2.7%	60.7	7.7%	65.3	7.8%	57.9	10.4%	65.2	3.8%
1983	793.6	-33.4%	61.8	1.8%	64	-2.0%	60.8	4.9%	63.6	-2.5%
1984	688.1	-14.3%	64.7	4.6%	62.7	-2.1%	62.8	3.2%	64	0.6%
1985	576.5	-17.7%	68.5	5.7%	63.9	1.9%	64.6	2.8%	64	0.0%
1986	486.4	-17.0%	70.6	3.0%	66.5	4.0%	66.5	2.9%	66.2	3.4%
1987	409.9	-17.1%	70.6	0.0%	70.8	6.3%	68.2	2.5%	69.3	4.6%
1988	373.8	-9.2%	70.1	-0.7%	75.2	6.0%	71.9	5.3%	74	6.6%
1989	316.2	-16.7%	72.2	3.0%	80.4	6.7%	74.6	3.7%	78.2	5.5%
1990	286.2	-10.0%	74	2.5%	83.2	3.4%	77.5	3.8%	81	3.5%
1991	230.6	-21.6%	72	-2.7%	80.4	-3.4%	79.6	2.7%	80.3	-0.9%
1992	204.5	-12.0%	74.8	3.8%	80.4	0.0%	81	1.7%	79.8	-0.6%
1993	197.5	-3.5%	77.8	3.9%	80.6	0.2%	82.5	1.8%	81.8	2.5%
1994	185.6	-6.2%	81.5	4.6%	82.2	2.0%	85.6	3.7%	84.5	3.2%
1995	169	-9.4%	84.7	3.9%	84.7	3.0%	86.1	0.6%	87.1	3.0%
1996	146.3	-14.4%	86.3	1.9%	86	1.5%	89.2	3.5%	89.8	3.1%
1997	135.1	-8.0%	87.5	1.4%	87.7	2.0%	91.7	2.8%	91.3	1.7%
1998	122.6	-9.7%	93.3	6.4%	89.3	1.8%	94.6	3.1%	92.7	1.5%
1999	109.7	-11.1%	94.8	1.6%	91	1.9%	96.4	1.9%	94.7	2.1%
2000	105.2	-4.2%	95.7	0.9%	95.6	4.9%	98.7	2.4%	97.2	2.6%
2001	103.6	-1.5%	98.3	2.7%	98.5	3.0%	98.8	0.1%	98.1	0.9%
2002	100	-3.5%	100	1.7%	100	1.5%	100	1.2%	100	1.9%
2003	92.5	-7.8%	93.3	-6.9%	102.6	2.6%	101.1	1.1%	103.9	3.8%
2004	85.8	-7.5%	89.6	-4.0%	108.7	5.8%	107.2	5.9%	112.9	8.3%
2005	79.5	-7.6%	87.6	-2.3%	114	4.8%	113.9	6.1%	123.2	8.7%
2006	76.3	-4.1%	85.6	-2.3%	122.8	7.4%	122.1	7.0%	137	10.6%
2007	74.7	-2.1%	84.5	-1.3%	136	10.2%	128.4	5.0%	151.2	9.9%
Annual Growth Rates										
1962-2007		**-8.1%**		**3.4%**		**4.4%**		**5.0%**		**3.2%**
1968-2007		**-9.5%**		**3.7%**		**4.6%**		**5.2%**		**4.3%**
1978-2007		**-12.1%**		**2.8%**		**3.9%**		**4.2%**		**4.2%**
1988-2007		**-8.5%**		**0.9%**		**3.3%**		**3.2%**		**3.9%**
1998-2007		**-5.9%**		**-0.3%**		**4.4%**		**3.4%**		**5.0%**

Footnotes

[1] Information and communication technologies machinery and equipment consists of computer hardware, software and telecommunication equipment.

[2] Those assets are machinery equipment other than computer hardware, software and telecommunication equipment.

[3] Engineering assets provide the foundation capital for railways, utilities, oil and gas, and pipelines.

[4] All growth rates are calculated logarithmically.

Sources:

Statistics Canada. Table 383-0025 - Investment, capital stock and capital services of physical assets, by North American Industry Classification System (NAICS), annual (dollars unless otherwise noted) (index, 2002=100)

Notes

- Table 383-0025 data become available near the end of December or beginning of January for the year three years or four years prior, respectively (e.g. Data for 2007 became available on December 24, 2010)

Table A-8

Canadian Electric Utility Construction Price Indexes

	Distribution Systems							Transmission line systems	
	Total							Total	
Year	Level	Growth Rate[1]	Total direct costs	Materials	Labour	Construction equipment	Construction indirects	Level	Growth Rate
1956	17.7				8.3	17.3		20	
1957	18	1.7%			8.6	18.3		20.6	3.0%
1958	17.4	-3.4%			9.3	19		19.5	-5.5%
1959	18.1	3.9%			9.8	24.7		20.1	3.0%
1960	18.7	3.3%			10.4	20		19.8	-1.5%
1961	18.7	0.0%			10.9	20.3		18.6	-6.3%
1962	19	1.6%			11.4	20		19.3	3.7%
1963	19.1	0.5%			11.9	20.2		19.7	2.1%
1964	19.5	2.1%			12.3	20.4		20.4	3.5%
1965	19.9	2.0%			12.9	20.5		21.4	4.8%
1966	20.9	4.9%			13.5	20.9	14.5	22.3	4.1%
1967	21.7	3.8%			15.1	22	15.6	22.5	0.9%
1968	21.5	-0.9%			16.2	22.5	16.8	22.2	-1.3%
1969	22.4	4.1%			17.5	23.3	18.1	22.9	3.1%
1970	24.1	7.3%			18.9	24.7	19.6	25	8.8%
1971	25	3.7%	25.6	29.8	20.8	26	21.2	26.1	4.3%
1972	26.1	4.3%	26.6	30	22.1	26.9	23.2	27.3	4.5%
1973	28.5	8.8%	29.1	32.6	25	27.9	24.7	29.3	7.1%
1974	34.3	18.5%	35.6	42.3	27.4	32	27.7	35.5	19.2%
1975	38.5	11.6%	39.7	45.7	32.5	34.8	31.9	41.6	15.9%
1976	40.7	5.6%	41.7	45.5	37.2	39.1	35.2	44.6	7.0%
1977	43.4	6.4%	44.4	46.7	41.4	43.3	38.3	47	5.2%
1978	46.6	7.1%	47.7	50.3	44.2	48.3	41	50.6	7.4%
1979	52.9	12.7%	54.5	60.3	47	54.2	44.5	56.5	11.0%
1980	60.3	13.1%	62.3	70.6	51.6	61.7	49.4	63.3	11.4%
1981	65.7	8.6%	67.8	75	57.5	74	55.2	69.7	9.6%
1982	71.8	8.9%	73.7	79.9	64.5	82.1	62.3	75.1	7.5%
1983	74.8	4.1%	76.2	79.1	71	86.2	67.2	77	2.5%
1984	78.1	4.3%	79.4	83	73.6	88.9	70.9	80.6	4.6%
1985	82.1	5.0%	83.7	88.7	76	93	74.1	81.6	1.2%
1986	84	2.3%	85.5	90.7	78	90.4	76.5	84	2.9%
1987	86.6	3.0%	87.9	93.3	80.7	91.3	79.5	89.2	6.0%
1988	91.9	5.9%	93.6	101.7	83.6	89.5	83	96.5	7.9%
1989	95.5	3.8%	97.3	105	88	91.9	85.7	102.6	6.1%
1990	98.5	3.1%	99.9	106.9	91.3	97.2	90.8	104	1.4%
1991	97.7	-0.8%	97.9	98.5	96.9	98.4	96.8	100.4	-3.3%
1992	100	2.3%	100	100	100	100	100	100	-0.4%
1993	102.5	2.5%	102.5	102.1	102.7	104.8	102.3	103	3.0%
1994	108.2	5.4%	109.1	112.5	104.3	111	103.3	108.1	4.8%
1995	116.7	7.6%	118.7	128.1	106.1	120.3	105.5	112.8	4.3%
1996	116.6	-0.1%	118.2	126.1	106.6	125.7	107.9	113.5	0.6%
1997	118	1.2%	119.3	125	110.1	129.8	111.1	115.7	1.9%
1998	122.8	4.0%	123	125.4	117.6	138.1	121.4	121	4.5%
1999	126.1	2.7%	126	126	123.6	141.5	126.9	122.2	1.0%
2000	128.7	2.0%	129.1	128.6	128.8	135.3	126.7	124.7	2.0%
2001	129.6	0.7%	129.8	127.7	130.7	142	128.9	127	1.8%
2002	130.5	0.7%	130.6	127.6	132.3	145.5	129.9	129.2	1.7%
2003	130.6	0.1%	130.9	127.8	132.7	145.5	129	126.4	-2.2%
2004	131.1	0.4%	131.3	132.5	127.2	148	129.9	129	2.0%
2005	133.6	1.9%	134.2	138.2	125.3	157.7	130.4	130.9	1.5%
2006	142.4	6.4%	144.2	155	127.5	160	132.6	136.2	4.0%
2007	148.8	4.4%	150.7	165	130.3	160	138.4	142.6	4.6%
2008	150.3	1.0%	151.9	167.6	127.7	173.8	141.4	148.8	4.3%
2009	151.1	0.5%	150.7	167.4	127.2	158.7	153.4	149.7	0.6%
Annual Growth Rates									
1962-2007		**4.5%**	**NA**	**NA**	**5.4%**	**4.5%**	**NA**		**4.4%**
1968-2007		**4.8%**	**NA**	**NA**	**5.4%**	**5.0%**	**5.5%**		**4.6%**
1978-2007		**4.1%**	**4.1%**	**4.2%**	**3.8%**	**4.4%**	**4.3%**		**3.7%**
1988-2007		**2.7%**	**2.4%**	**2.4%**	**2.2%**	**2.9%**	**2.6%**		**2.3%**
1998-2007		**2.3%**	**2.3%**	**2.8%**	**1.7%**	**2.1%**	**2.2%**		**2.1%**
1980-2009		**3.5%**	**3.4%**	**3.4%**	**3.3%**	**3.6%**	**4.1%**		**3.2%**
1990-2009		**2.3%**	**2.2%**	**2.3%**	**1.8%**	**2.7%**	**2.9%**		**1.9%**
2000-2009		**1.8%**	**1.8%**	**2.8%**	**0.3%**	**1.1%**	**1.9%**		**2.0%**

Footnotes

[1] All growth rates are calculated logarithmically.

Source: Statistics Canada. Table 327-0011 - Electric utility construction price indexes (EUCPI), annual (index, 1992=100)

Notes:

- Table 327-0011 release schedule is as follows for a year *t*:
  In September/October of *t*, preliminary first-half data are released for *t*;
  In April of *t* + 1, preliminary annual data are released for *t*;
  In September/October of *t* + 1, revised annual data are released for *t*;
  and in April of *t* + 2, final annual data are released for t.

Table A-9

Canadian Non-Residental Building Construction Price Indexes

	Seven census metropolitan area composite						Montréal, Quebec					
	Total, non-residential building construction		Total, commercial structures		Total, industrial structures		Total, non-residential building construction		Total, commercial structures		Total, industrial structures	
Year	Level	Growth Rate[1]	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate	Level	Growth Rate
1981	58.3		59.8		52.5		58.0		59.5		55.0	
1982	62.8	7.4%	64.4	7.4%	56.5	7.2%	63.2	8.5%	64.9	8.6%	59.4	7.8%
1983	62.0	-1.2%	63.2	-1.9%	56.4	-0.2%	64.1	1.4%	66.1	1.8%	59.6	0.3%
1984	60.9	-1.9%	61.8	-2.3%	56.3	0.0%	65.7	2.5%	67.6	2.3%	61.2	2.7%
1985	62.2	2.2%	63.1	2.1%	58.7	4.0%	68.4	4.0%	70.2	3.7%	64.3	4.8%
1986	65.0	4.3%	66.0	4.5%	62.0	5.5%	72.2	5.5%	73.9	5.2%	68.2	6.0%
1987	69.7	7.1%	71.0	7.2%	65.9	6.1%	76.4	5.7%	78.4	5.9%	71.8	5.1%
1988	74.6	6.8%	76.1	7.0%	70.6	7.0%	80.3	5.0%	82.2	4.7%	76.0	5.6%
1989	79.5	6.4%	81.1	6.4%	75.8	7.1%	83.5	3.9%	85.3	3.7%	79.5	4.5%
1990	81.8	2.9%	83.3	2.7%	78.1	2.9%	85.3	2.1%	87.0	2.0%	81.3	2.3%
1991	78.8	-3.8%	79.8	-4.3%	76.0	-2.7%	82.2	-3.7%	83.4	-4.3%	79.2	-2.6%
1992	78.7	-0.1%	79.6	-0.2%	76.1	0.1%	81.8	-0.5%	82.5	-1.0%	79.4	0.2%
1993	79.2	0.6%	80.0	0.5%	76.7	0.9%	80.6	-1.4%	81.6	-1.1%	78.4	-1.2%
1994	80.9	2.0%	81.5	1.9%	78.8	2.6%	81.7	1.3%	82.4	1.0%	79.8	1.8%
1995	83.4	3.1%	84.0	3.0%	81.2	3.1%	84.4	3.2%	85.1	3.1%	83.0	3.9%
1996	84.9	1.8%	85.3	1.5%	82.8	1.9%	85.5	1.3%	86.1	1.3%	84.2	1.4%
1997	86.7	2.2%	87.0	1.9%	85.0	2.7%	87.9	2.9%	88.5	2.7%	86.9	3.1%
1998	88.5	2.0%	88.8	2.1%	86.8	2.0%	89.8	2.1%	90.2	1.9%	89.0	2.5%
1999	90.1	1.8%	90.4	1.8%	88.6	2.1%	91.6	2.0%	92.0	2.0%	90.9	2.1%
2000	95.1	5.4%	95.3	5.3%	94.3	6.2%	95.9	4.7%	96.3	4.6%	95.5	4.9%
2001	98.2	3.2%	98.3	3.1%	97.9	3.7%	97.5	1.7%	97.7	1.5%	97.5	2.0%
2002	100.0	1.8%	100.0	1.7%	100.0	2.2%	100.0	2.5%	100.0	2.3%	100.0	2.6%
2003	103.0	3.0%	102.9	2.9%	103.1	3.1%	102.5	2.4%	102.6	2.5%	102.5	2.4%
2004	109.7	6.3%	109.4	6.1%	111.1	7.4%	108.1	5.3%	107.8	5.0%	109.2	6.3%
2005	115.9	5.5%	115.5	5.4%	118.0	6.1%	113.1	4.6%	112.8	4.5%	115.0	5.2%
2006	124.9	7.5%	124.6	7.6%	127.3	7.5%	117.4	3.8%	117.1	3.7%	119.4	3.8%
2007	136.8	9.1%	137.3	9.6%	138.4	8.4%	121.6	3.5%	121.1	3.4%	123.8	3.6%
2008	150.9	9.8%	151.3	9.8%	154.2	10.8%	130.4	6.9%	130.0	7.1%	132.9	7.1%
2009	142.0	-6.0%	141.4	-6.8%	146.7	-5.0%	134.5	3.2%	134.0	3.0%	138.4	4.0%
2010	141.5	-0.4%	140.6	-0.6%	146.2	-0.3%	136.1	1.1%	135.5	1.1%	139.5	0.8%
Annual Growth Rates												
1988-2007		**3.4%**		**3.3%**		**3.7%**		**2.3%**		**2.2%**		**2.7%**
1998-2007		**4.6%**		**4.6%**		**4.9%**		**3.2%**		**3.1%**		**3.5%**
1982-2010		**3.1%**		**2.9%**		**3.5%**		**2.9%**		**2.8%**		**3.2%**
1991-2010		**2.7%**		**2.6%**		**3.1%**		**2.3%**		**2.2%**		**2.7%**
2001-2010		**4.0%**		**3.9%**		**4.4%**		**3.5%**		**3.4%**		**3.8%**

Footnotes
[1] All growth rates are calculated logarithmically.

Source:
Statistics Canada. Table 327-0043 - Price indexes of non-residential building construction, by class of structure, quarterly (index, 2002=100)

Notes
• Data are released on a quarterly basis. Data for each quarter are released during the second or third week of the month two months following the end of the quarter (e.g. Q1 2010 data were released 5/18/2010)

HOW GAZ METRO BUSINESS CONDITIONS COMPARED TO U.S. SAMPLE MEANS

	Gaz Metro 2009 [A]	U.S. Sample Mean 1998-2009 [B]	Ratio [A/B]
Output Variables			
Number of Customers	179,370	874,233	20.5%
Change in Customers	4,614	13,017	35.4%
Miles of Main	6,292	10,816	58.2%
Change in Main	110	192	57.3%
Output Quantity Level Index (US sample mean = 1.00)			
O&M	0.205	1.00	20.5%
Capex	0.456	1.00	45.6%
Total	0.269	1.00	26.9%
Average Annual Growth in Output			
Number of Customers	1.9%	1.4%	138.0%
Miles of Main	2.0%	1.9%	107.6%
Change in Customers	12.5%	-7.1%	-175.1%
Change in Main	-4.1%	-4.9%	85.3%
Input Prices			
Purchasing Power Parity 2009 (C$/US$)	1.197	1.000	119.7%
Wage Level	759.42	740.95	102.5%
RSMeans City Cost Index	107.10	100.00	107.1%
Other Business Condition Variables			
Urban Core Dummy	1	0.78125	128.0%
Number of Electric Customers	0	641,078	0.0%
Percent of Main that is Cast Iron	0	10.11%	0.0%

Use of Indexing in Regulation

Price Caps

$$\text{growth Revenue} = \text{growth Rates} + \text{growth Outputs}^R$$
$$\text{growth Cost} = \text{growth Input Prices} + \text{growth Intrants}$$

If

$$\text{growth Revenue} = \text{growth Cost}$$

Then

$$\text{growth Rates} = \text{growth Input Prices} - (\text{growth Outputs}^R - \text{growth Intrants})$$

Precedents: Ontario power distributors, ENMAX, Maine, Massachusetts

Summing Up

Total Cost

Growth Cost = growth $GDPIPI^{FDD}$ – X + growth Output

X = Productivity Target + Stretch

Inflation measure: Quebec $GDPIPI^{FDD}$

Productivity Target = [1.11, 1.67]

Stretch = [0.20, 0.50]

X = [1.21, 2.17]