

3rd Generation IRM for Electric Distributors

Frank Cronin
Expert Consultant
to the
Power Workers' Union

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Sustainable IR

- Robust, fair, sector/firm-specific IR parameters
- Adequate risk mitigation mechanisms
- Long-term framework which incorporates robust, correct benchmarking, adequate adaptive periods, and socially optimal costs for electric distribution

IR Parameters Must Be

- Robust: based on appropriate methodologies and data
- Fair: gains must be shared; comparisons must be based on total costs including appropriately calculated capital costs
- Sector specific: parameters (e.g., inflation index) must be based on Ontario distributor performance, e.g., input price changes (i.e., an IPI, or “input price index”)
- If firm specific: productivity/cost benchmarks must be based on unbiased measures appropriately calculated

Adequate Risk Mitigation Mechanisms

- Capable of handling likely/probable/undesirable outcomes that would undermine the long-term support for the IR among stakeholders
- IPI-TFP
- ESM
- SQR
- Rate Design

Achievable Long-term Framework

- Benchmarking must be based on correctly calculated measures that adequately account for the joint nature of LDC output and interrelationship among LDC inputs
- Terms must be long enough for LDCs to adjust costs/cost structure
- Regulatory objective should be to find levels/tradeoffs of LDC operating costs and customer interruption costs that minimize the total social costs of distribution

Reliability and thus Costs Vary across LDCs

- “The reliability of distribution services provided by utilities varies widely. Better reliability generally comes at a higher cost. The cost impact of quality is thus a valid issue in distribution benchmarking.” (PEG Benchmarking Report, April, 2007, pp30 – 31)
- Since reliability varies, higher reliability LDCs will have higher costs; if cost differences are simply observed through OM&A differences, we will mistakenly identify higher cost LDCs as being less efficient, when they actually have higher, unaccounted for, output or quality
- Such IR schemes could incent high-reliability LDCs to reduce OM&A expenses to improve benchmarking scores
- Research finds that improperly structured IR does reduce O&M and that this reduction reduces reliability
- Regulators in the U.S. and Europe have instituted somewhat alternative versions of service quality regulation in response to performance IR induced network degradations

Rate Adjustment Mechanism: IPI

- Input Price Index plays critical, multi-dimensional role:
 - ❖ sets automatic adjustments for LDC cost changes
 - ❖ obviates need to hold frequent COS proceedings
 - ❖ mirrors COS process by adjusting LDC rates on prudency basis, but uses experience of sector average as prudency test
 - ❖ mitigates likely hood that mistakes in RAM associated with macroeconomic price index will over/undercompensate LDCs
 - ❖ establishes yardstick competition among Ontario LDCs , with better performers holding down costs
 - ❖ provides proper incentive signals to LDCs and customers

Rate Adjustment Mechanism: IPI

- IPI developed in 1st generation was rigorously examined and evaluated
- Input weights developed in the 1st G for Ontario distributors were extensively tested
- These weights would be preferable to the weights suggested by PEG which may be based on gas LDCs or possibly US data
- The Staff report presents a detailed discussion on the price index options. The IPI 1st G framework should be implemented for 3rd G

Rate Adjustment Mechanism: TFP

- Background information on prior research findings on Ontario LDCs:
- 1st G found 10 yr growth rate of about 1 percent for TFP
 - ❖ low incentive period: low/negative TFP growth
 - ❖ higher incentive period: stronger growth (2%)
- Subsequent research on total costs, frontier analysis
 - ❖ frontier firms increased TFP in both periods
 - ❖ less efficient firms had negative productivity growth in first period, stronger TFP growth in second, although still less than frontier
 - ❖ research results consistent with those in Norway

PEG's Benchmarking Methods are Flawed

- PEG uses multiple, unrelated , flawed benchmarking approaches:
 - ❖ 1. OM&A data to benchmark cost level inefficiencies suffers substantial biases in cost/rankings from partial cost comparisons
 - ❖ 2. OM&A data plus a *proxy* measure for capital to estimate TFP trends suffers *substantial errors* in K, TFP associated with proxies
 - ❖ 3. US LDC data to derive TFP trends without justification
- PEG current methodologies are flawed and unacceptable as the basis for an IR, now or in the future. A short-term framework needs to be instituted (e.g. baseline PF with menu) while a more rigorous IRM is developed with the decades of continuous LDC data held by the OEB.

Productivity Targets

- For the short-run, PEGs recommended baseline PF is within the range of Ontario experience and acceptable as a starting point, particularly with a PF- ROE menu
- 1st Gen research found higher TFP growth under higher incented regulatory frameworks like IR and subsequent research on this data found initial, more efficient firms had higher subsequent TPF growth than did less efficient
- A PF-ROE menu would create greater consumer benefits and capture range of self-revealed TFP performance by LDCs. Such a menu was developed and proposed by Board Staff in 1st Gen as a way of providing greater benefits to consumers and examining the range of potential TFP growth. The 3rd Gen should build on this work and incorporate a menu structured to reflect the current conditions.
- PEG's recommended OM&A-based inefficiency analysis and the "consumer dividend" produces rankings that differ substantially from rankings based on total costs; individual LDCs are found inefficient when they are efficient, and found efficient when they are inefficient

1st Generation Staff ROE-PF Menu

Table 4-1 THE RELATION BETWEEN PF AND ROE CEILING		
Selection	Productivity Factor (percent change per year)	ROE Ceiling (percent)
A	1.25	10
B	1.50	11
C	1.75	12
D	2.00	13
E	2.25	14
F	2.50	15

PEG's OM&A Benchmarking Analysis

- PEG's benchmarking of distributor costs is used to set inefficiency penalties or Consumer Dividend
- This analysis judges whether an LDC is inefficient based on a comparison of OM&A costs
- PEG recommends gross book value as a proxy for capital cost; in fact, no variable representing capital, either correct or proxy, appears to be used by PEG in the actual analysis
- PEG acknowledges (Sept. stakeholder conference on April report) the lack of a control for capital in the benchmarking analysis

Ranking 48 LDCs by OM&A v Total Cost

Utility	OM&A Ranking	Total Cost Ranking	Difference in Rankings	Percent Difference in Ranking
1	3	43	-40	-0.83
2	7	30	-23	-0.48
3	8	24	-16	-0.33
4	10	35	-25	-0.52
5	11	33	-22	-0.46
6	12	39	-27	-0.56
7	15	45	-30	-0.63
8	18	11	7	0.15
9	20	6	14	0.29
10	21	7	14	0.29
11	22	10	12	0.25
12	24	41	-17	-0.35
13	25	42	-17	-0.35
14	28	46	-18	-0.38
15	31	47	-16	-0.33
16	31	47	-16	-0.33
17	33	9	24	0.50
18	37	3	34	0.71
19	38	18	20	0.42
20	42	23	19	0.40
21	45	14	31	0.65
22	46	21	25	0.52
23	47	25	22	0.46

Partial v Total Cost Benchmarking

- OM&A benchmarking produces inaccurate, misleading data/rankings
- Such results would distort incentives for costs, allocations, quality and reliability
- Dissimilar allocations of L between K and OM&A can produce similar cost/rankings.
- Accurate benchmarking requires comprehensive costs (e.g., capital) and reliability data.
- Benchmarking on total costs makes differences in labor capitalization irrelevant
- OEB has the data needed to undertake comprehensive cost benchmarking
 - ❖ In 1999, 1st Gen collected
 - operating/cost/fin data from 1988 – 1997
 - capital costs from early 1970s to 1997
 - ❖ in 2000, LDCs filed operating/cost/fin/capital data for 1998 & 1999
 - ❖ annual PBR filings collected data for 2000 – 2006/7
- **OEB has continuous data from 1987 to 2006/7 with capital from 1970s**

OM&A & Cost Shares among Ontario LDCs

- The PEG report focuses mainly on OM&A for benchmarking cost levels:
 - “Regulators considering the appropriate revenue requirement of a company often have special interest in certain subsets of the total cost of service. Examples include OM&A expenses (sometimes called “opex”) and even more “micro” categories such as distribution labour expenses. The interest in these expenses is due in part to the fact that they are subject to greater control by utilities in the short run than are capital costs.” (PEG Benchmarking report, p. 5)
- PEG reports using labor cost shares of 35 percent for OM&A.
- If so, labor as share of total costs would equal 13 - 17 percent
 - ❖ if so why has there been so much concern and attention paid to the issue of labor costs
 - ❖ capital has about twice the share of labor
 - ❖ overcapitalization has often been found to be an issue for regulated firms
- 1999 Board Staff Report calculated labor to equal 69 percent of OM&A*
- This equaled 29 percent of total costs including line losses and 34 percent without losses.

Range of Cost Shares across LDCs

Range of Annual Cost Shares for Ontario Distributors 1988 - 1997

	Capital	Line Losses	Combined	Labour	Materials	Combined
Minimum	33.1	5.1	38.2	18.8	8.0	26.8
Maximum	63.2	10.0	73.2	44.4	17.4	61.8

Source: Data examined in 1999 Staff report.

Labor Capitalization and Perceived Costs

- LDCs allocate varying amounts/shares of labor between OM&A and capital; such varying allocations can make some LDCs appear less efficient and others more efficient when judged solely on OM&A
- For LDCs using the same *total labor*, differences of 15 percentage points in the share capitalized can produce differences of 20 percent in labor assigned to OM&A and more than 12 percent differences in OM&A costs.
- The actual share of labor capitalized ranges from less than 10 to 50 percent or more, and can account for 45 percent differences in reported OM&A cost
- LDCs with significantly different reported OM&A can have nearly identical costs when capitalized labor is added to OM&A for comparisons

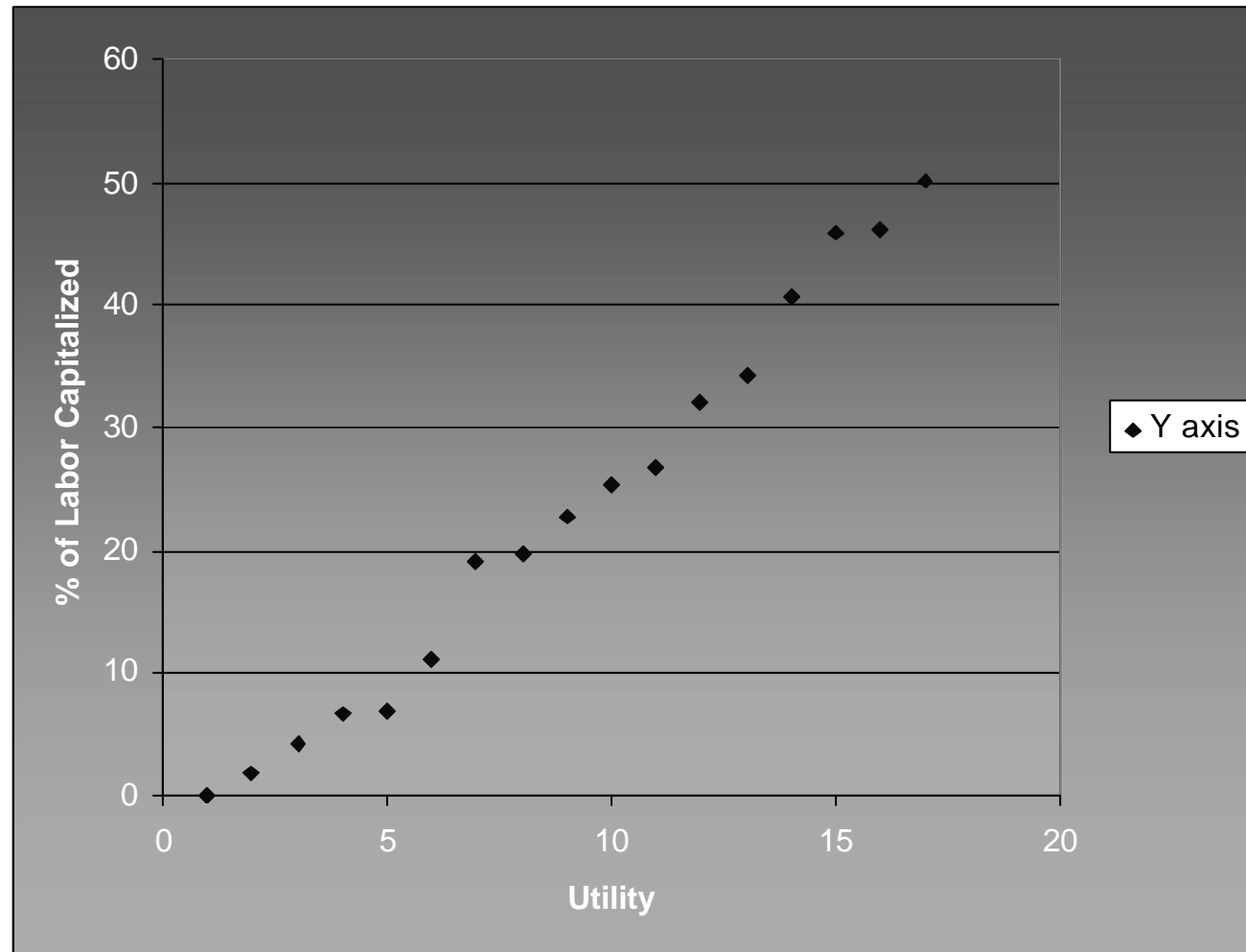
The Impact of Varying Labor Capitalization on OM&A Costs

Comparing 2 Illustrative Utilities with the Same Costs but Differing Labor Capitalization

Capitalization Policy	Total Costs Per customer	Total Labor Costs @ 29 percent	Percent Labor Capitalized	Labor Assigned To OM&A	Reported OM&A Expenses
High Capitalization Utility	\$500	\$145	30	\$102	\$167
Low Capitalization Utility	\$500	\$145	15	\$123	\$188

Source: Ontario Energy Board, 1999 PBR filing and author calculations.

Ontario LDCs' Capitalized Labor Ranges from 0 to 50%



Capitalized Labor Biases OM&A Benchmarking

OEB PBR Filing OM&A Costs with and without Capitalized Labor per Customer

Utility	OM&A per Customer	OM&A + Capitalized Labor per Customer	Capitalized Labor per Customer
1	206	220	14
2	146	186	39
3	160	219	59
4	179	192	12
5	130	182	51
6	154	186	32

Gross Book Value is a Biased Estimator of Net Real Capital

Illustrative Comparison of PEG's Capital Variable (Gross Book Value) to the Correctly Calculated Capital Stock Variable (Net Real Capital) and Capital Expenses (millions of dollars)

	Gross Book Value	Net Real Capital	GBV/NRC (approx)	Capital Expenses	GBV/CE
Utility 1	150	115	1.3	15	10
Utility 2	105	75	1.4	12	10
Utility 3	195	120	1.6	18	9
Utility 4	245	95	2.6	16	16

Source: Illustrative example similar to LDCs situation in the initial PBR in 1997.

PEG's Ontario TFP Trend Analysis

- PEG uses OEB filings from 2002- 2006 to estimate TFP changes

- As PEG indicates, economists usually use decades of capital data
 - ❖ 1st Gen had about 37 years of actual capital, much by detailed type of capital addition
 - ❖ PEG's analysis of US LDC data mentions 40 years

- Estimating LDC capital on such short periods produces large errors in the resulting capital data and in the productivity data that varies by LDC

- PEG acknowledges the below standard aspect of this analysis and cautions regarding the findings

- The Board now has over 45 years of actual, continuous capital by LDC and 20 years of operating data should base any cost/TFP analysis on this information

PEG's Ontario TFP Trend Analysis

- PEG's Benchmarking Report (April 07) discusses the joint nature of LDC output with respect to service reliability and connections/kWh
- Increased efforts to improve reliability would most probably be found to decrease TFP since such efforts would most likely increase costs
- More accurate and fairer comparisons of individual LDC performance would account for a broader notion of LDC output since the examined costs include each LDC's efforts with respect to reliability
- Any Board analysis/comparison of LDC performance, e.g., costs/TFP should include reliability. The OEB should propose how it will incorporate reliability in its future benchmarking or comparisons.

PEG's US LDC TFP Analysis

- As stated in the PEG report (p.60): “PEG therefore believes the long-run TFP trend for US distributors is the most appropriate estimate of the productivity factor for 3rd Generation IRM.”
- While the experience of some of the two thousand municipal LDCs in the US might be relevant to the Ontario LDCs, the sample selected by PEG is not
- Clearly, regulatory decisions/parameters can be informed by the experiences in other jurisdictions (e.g., Norway)
- Norway's experience is far more relevant than are those of large, multi-output, US LDCs
 - ❖ Norway had/has hundreds of LDCs
 - ❖ much more comparable size distribution & locational characteristics
 - ❖ cost structures of Ontario and Norwegian LDCs are identical

PEG's US LDC TFP Analysis

- Ontario and Norwegian research findings very similar : both
 - ❖ examined large sample over 10 years or more
 - ❖ looked at low versus higher incentive regimes
 - ❖ analyzed TFP as well as frontier frameworks
 - ❖ employed alternative productivity formulations, e.g., Malmquist

- Ontario research also examined frontier stability, influence on peer groups, and relative performance of interior firms (technical efficiency of Ontario LDCs was found to be higher than found for Norwegian LDCs)

- Board has following information on Ontario LDCs: to use for IR
 - ❖ over 45 years of actual, continuous capital by LDC
 - ❖ 20 years of operating/cost/fin data
 - ❖ a body of research already done comparable to Norway

LDC Benchmarking Must Reflect Operations

- The most important, overriding issue in the Board's evolving benchmarking is the failure to "model or benchmark" the integrated operation of distribution utilities with comprehensive data reflecting:
 - ❖ the joint nature of LDC output
 - ❖ the substitution relationships among an LDC's inputs
- Joint output means that just and reasonable rates cannot be determined unless costs are assessed jointly with reliability and service quality; failure to reflect all LDC outputs seriously biases the assessments in favor of LDCs with lower reliability
- Input substitution with varying allocations makes meaningless an examination of one input in isolation from the rest; failure to benchmark with capital measured correctly seriously biases assessments in favor of LDCs with high labor capitalization (e.g., say 50 percent of total labor capitalized) versus LDCs with low capitalization (e.g., say 6, 10 or even 20 percent).

IRM - Recommendations

- PEG's current methodologies are flawed and unacceptable as the basis for an IR. The Board should institute a short-term framework while a more rigorous IRM is developed with the decades of Ontario LDC data held by the OEB.

- Short-term framework:
 - ❖ IPI. Staff report presents a discussion of the price index options including IPI. Detailed analyses were undertaken on IPI for 1st Gen. The IPI 1st G framework should be implemented for all LDCs asap.
 - ❖ ROE - PF Menu. 1st G research found higher TFP growth with higher incented regulation; subsequent research found initially efficient firms had higher subsequent TPF growth. A ROE - PF menu would allow LDCs to select ROE - PF combination based on their circumstances, create greater consumer benefits, and capture range of self-revealed TFP performance. Such a menu was developed and proposed by Board Staff in 1st Gen. 3rd Gen should build on this work and incorporate a menu structured to reflect the current conditions.

IRM - Recommendations

- ❖ Existing research on Ontario LDCs or comparable jurisdictions/circumstances (e.g., Norway) should be used to set a baseline PF: for example,
 - 1st G found 10 yr growth rate of about 1 percent for TFP
 - low incentive period: low/negative TFP growth
 - higher incentive period: stronger growth (2%)
 - subsequent research on total costs, frontier analysis
 - research results consistent with those in Norway
 - recent TFP growth may well have been negative

- ❖ Board, LDCs and stakeholders review and set baseline PF

IRM - Recommendations

- No methodology will overcome the problem of missing or inadequate data
- **OEB has continuous data from 1987 to 2006/7 with capital from 1970s**
 - ❖ In 1999, 1st Gen collected
 - operating/cost/fin data from 1988 – 1997
 - capital costs from early 1970s to 1997
 - ❖ in 2000, LDCs filed operating/cost/fin/capital data for 1998 & 1999
 - ❖ annual PBR filings collected data for 2000 – 2006/7
- OEB has the data needed to undertake comprehensive cost benchmarking

IRM - Recommendations

- OEB should outline long-term (e.g., 15 year) framework with staged approach for elimination of any inefficiencies and integration of reliability/customer interruption costs into planning process.

- Benchmarking must be based on correctly calculated measures that adequately account for the joint nature of LDC output and interrelationship among LDC inputs. Benchmarking must be based on:
 - ❖ total costs, including
 - ❖ capital costs, and reflect
 - ❖ reliability/ service quality aspects of operations , and measure
 - ❖ total inefficiency, including allocative.

IRM - Recommendations

- Benchmarking should establish:
 - ❖ long- term baseline PF, based on secular growth in TFP
 - ❖ schedule of PF-inefficiency factors for LDCs off frontier

- Staged approach:
 - ❖ terms must be long enough for LDCs to adjust costs/cost structure to assigned PFs (e.g., 5 yrs)
 - ❖ OEB should require only a portion of inefficiency to be eliminated each term, say 30 – 40 percent
 - ❖ 2nd, 3rd term would recalculate inefficiencies, assign new PFs

- Regulatory objective should be to find levels/tradeoffs of LDC operating costs and customer interruption costs that minimize the total social costs of distribution subject to constraints on reliability

Appendixes

- Background Information
- SQR in US and Europe

For More Information:

- Cronin, F. J. and Motluk, S. A., 2007. “Flawed Competition Policies: Designing 'Markets' with Biased Costs and Efficiency Benchmarks,” *Review of Industrial Organization*. Originally, “The (Mis)Specification of Efficiency Benchmarks among Electric Utility Peer Groups.” Presented at the North American Productivity Workshop II, Union College, NY, 2002.
- Cronin, F. J. and Motluk, S. A., 2007. “Agency Costs of Third-Party Financing and the Effects of Regulatory Changes on Utility Costs and Factor Choices,” *Annals of Public and Cooperative Economics*, 78, No.4.
- Frank J. Cronin and Stephen A. Motluk, “Inter-Utility Differences in Technical and Allocative Efficiency.” presented at the Canadian Economics Association 35th Annual Meeting at McGill University, Montreal, Quebec in June 2001.
- Frank Cronin and Stephen Motluk, “The Road Not Taken: PBR with Endogenous Market Designs,” *Public Utilities Fortnightly*, March 2004. An earlier version of this paper *Restructuring Monopoly Regulation With Endogenous Market Designs* was presented at the Michigan State University, Institute for Public Utilities, *Annual Regulatory Conference*, Charleston, S.C. December, 2003.
- F. Cronin, “*Restructuring Monopoly Providers or Regulation through Revelation*,” invited seminar, 46th Annual Regulatory Studies Program (Camp NARUC), Michigan State University, Institute for Public Utilities, August 2004.

SQR in the US: LDC Responses to IR

- One study has examined the US experience of IR for electric distribution.*
- This study employed data from 78 LCDs from 23 states over 1993 to 1999
- The study finds that IR is associated with a reduction in O&M expenses; this reduction is associated with a reduction in reliability. LDCs:
 - on IR without standards reduce expenses throughout the period.
 - on IR with standards/penalties increased O&M every year rising
 - without standards had 64 percent rise in SAIDI, 13 percent rise in SAIFI.
 - with s/p had 26 percent decline in SAIDI, 23 percent decline in SAIFI.
- Because of these perverse SQ results, it is common for LDCs under IR to have explicit and strict SQIs; 70 percent of the LDCs with IR had such standards/penalty schemes.
- The study concludes that the incorporation of strict standard/penalty schemes can offset the incentive of IR plans to imprudently cut critical O&M activities.

*Ter-Martirosyan, A., “The Effects of Incentive Regulation on Quality of Service in Electricity Markets,” Working Paper, 2002.

Service Quality Regulation in Europe

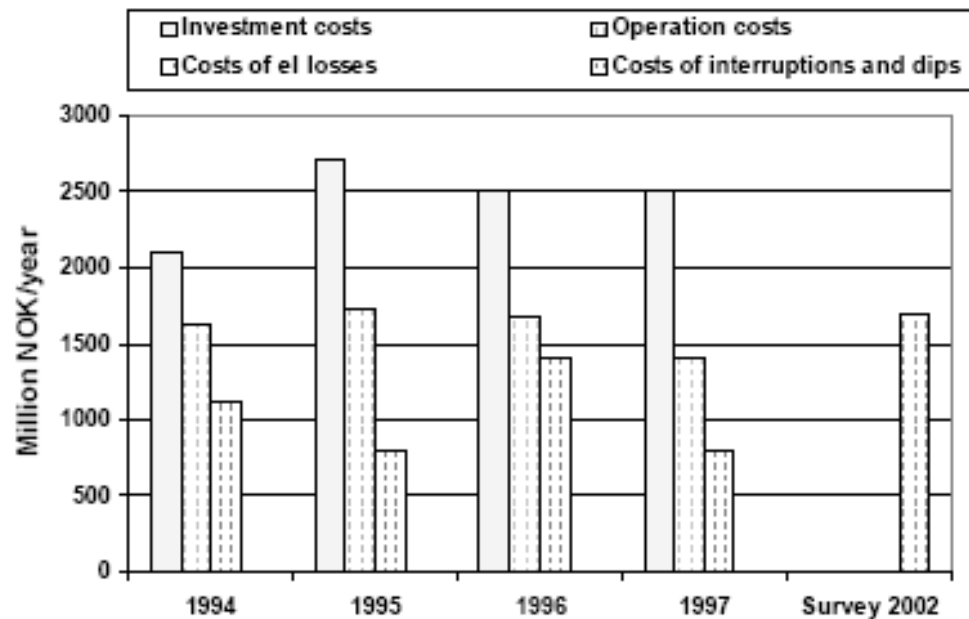
- In Europe, regulators such as the Council of European Energy Regulators (CEER) have documented and encouraged the adoption of service/reliability quality regulation (SQR) which combines system-wide standards with incentive/penalty schemes as well as single-customer guarantees with monetary payments for nonperformance. Some regulators have used willingness to pay (WTP) studies to gauge the value customers place on reliability and the amount they would be willing to pay for service improvements or interruption avoidance.

Benchmarking Should Include Customer Interruption Costs

- CEER notes that regulators should ensure that utilities “evaluate their investment and management decisions not only in light of their costs but also ... the effects on actual quality levels” i.e., on the customers affected by the O&M or investment decisions.
- Regulators in Italy, Sweden, Norway , and the U.K. among others have broadened their considerations of reliability to encompass the consequences on customers from interruptions or other aspects of lessened quality
- European regulators have estimated the extent/type of interruptions and the associated costs of interruptions to customers
- Regulators like OFGEM have used WTP estimates as parameters in their IR mechanisms for establishing single customer payments
- Norway has pioneered the application of these techniques to address the question of just how regulators define the correct level of reliability and its associated O&M and infrastructure

NVE's Estimate of Cost of Energy Not Supplied

Figure 6.2: Norway Utilities Internal investment and OM&A costs and Electrical Losses



Sand, et al, Quality of Supply Regulation – Status and Trends

NVE Benchmarking

- Norway and other European regulators employed frontier techniques.
- Norway, which had over 200 LDCs, used a multi-period frontier technique to establish system-wide X factors based on secular growth performances of frontier firms.
- Subsequently, NVE employed individual X factors based on calculated inefficiencies relative to a peer-based frontier; LDCs off the frontier were expected to eliminate a certain percentage of inefficiency during the term of the plan.
- Individual X factors ranged from 0 to 3 percent with 0 percent used for frontier firms and 3 percent used for LDCs with more than 20 percent inefficiency; during the second term, LDCs were required to eliminate another certain percentage.