REPORT

Findings and Recommendations: Comparators and Cohorts For Electricity Distribution Rates

for the consideration of:
The Ontario Energy Board

by:
Robert Camfield
Laurits R. Christensen Associates, Inc.

December 2004

INTRODUCTION

This report presents the findings, recommendations, and supporting analysis of Christensen Associates' study[1] of the Comparators and Cohorts mechanism.[2] The study addresses the issue of feasibility of developing cost drivers to determine Cohorts of local distribution companies (LDCs) and developing Comparators, for use by the Ontario Energy Board (the Board) and its staff in assessing LDC rate applications. Second, the report identifies a plausible, though preliminary, set of Comparators and Cohorts. Third, the report defines the necessary data and information to be reported by the LDCs for their rate applications in the 2006 Electricity Distribution Rates (2006 EDR) proceeding,[3] should the Board decide to implement the Comparators and Cohorts mechanism. The report concludes with recommendations for the Board's consideration.

The notion of a *Comparator* refers to a cost dimension or cost indicator associated with the supply of—or, the process of supplying—distribution electricity services. The notion of a *Cohort* refers to a group of local distribution companies selected as reasonably similar based upon defined cost drivers. The purpose of the study is to assess whether or not the Comparators and Cohorts mechanism is feasible for Ontario LDCs—*i.e.,* a proof of concept

---

[1] The study involved key staff members of Christensen Associates including Phillip Schoech, Jon Tepp, and Michael Welsh.

[2] The study draws upon and benefits greatly from the in-depth knowledge, on-going consultation, and advice of Keith Ritchie of the Board staff.

[3] Board File No. RP–2004–0188.

test—and to define the necessary data and information requirements for its practical application, should the mechanism appear feasible.

Under its authority and regulatory mandate, the Board must ensure that the prices for electricity services are fair to consumers, and provide a means for the service provider to recover prudently incurred costs. However, standards of fairness and reasonableness suggest that the Board must ensure that the rates for the electricity distributors are reasonable and are cost justified. The purpose of this report is to assist the Board and its staff to:

1) determine whether Comparators and Cohorts mechanism is feasible and can serve as a practical tool to assist in the processing of rate applications for rebased rates in 2006;
2) determine a basis for the comparison of costs of Ontario's electricity distributors. These cost factors are referred to as Comparators; and,
3) determine the data and information reporting elements, with a focus on data not currently reported.

The determination of comparators for electricity distributors is challenging. As the Board and market participants appreciate, the Province of Ontario has numerous electricity distribution organizations, and the market and business context of them demonstrates large variation. As a result, distributors have substantial differences in costs, particularly as measured in conventional accounting cost terms. Accordingly, it is appropriate for the Board and its staff to understand the main factors that determine costs, and to consider the development of a Comparators and Cohorts mechanism that can serve as a means to help assess and screen key cost elements of the numerous distributors, as revealed within the rate applications. The purpose is to gain efficiency and effectiveness within the regulatory process of determining LDC rates for retail distribution services.

MARKET AND REGULATORY CONTEXT

Ontario's electricity market restructuring reaches back a number of years. In particular, the 1996 Macdonald Report *A Framework for Competition* called for a complete overhaul of Ontario's electricity market, where wholesale prices for energy services are determined through the operation of an hourly spot market operated by the Independent Market Operator (IMO).[4] The new market called for competitively-determine wholesale prices to be passed on to retail consumers by the local distribution companies (LDCs). Retail markets were to be opened to competitive entry such that, as envisioned, retail consumers would face alternative choices of energy supplier. From the start, there was concern about the structure and reform of the LDCs.[5]

Considerable consolidation was expected, and the number of LDCs has declined to about 95 entities since 1999. As the consolidation process has proceeded, some LDCs have collaborated through shared services and the outsourcing of key functions that can include customer bill rendering, call centers, meter reading, and distribution operations and maintenance. We can expect that these changes have given rise to efficiency improvements.[6]

---

[4] Most observers would suggest that market restructuring in Ontario never advanced to a level that might be referred to as workable competition, and some elements of *complete markets* such as hedge services did not develop. For example, weighted-average contemporary prices of wholesale services were passed on directly to retail consumers, and it appears that a forward contract markets never reached fruition.

It could be that concern about the efficacies of competitive or workably competitive markets for energy and reserves weighed heavily on Ontario's path toward market reform. Indeed, reform of electricity markets is daunting. After years of reform of U.S. markets, market failure of various types remains—*e.g.,* inconsistent market rules among regions creating price-related seams, transmission rate pancaking, bid caps with a capacity market overlay, inefficient auction rules for energy and reserves, free riders to transmission expansion resulting from the locational externalities inherent to power networks, market power, impediments to siting transmission, out-of-market prices for POLR and SOS, etc.

Arguably, the harm resulting from these shortcomings may not be great, and the various issues are often moving toward resolution. The relevant questions are twofold. First: Do the dimensions of market failure, in total, cast a sufficient shadow to lead us to doubt contestable markets, as codified by, say, Standard Market Design (SMD)? If we affirm the goal of contestability, the second question is an issue of feasibility: Is the cost of reform—transitioning—large enough to offset the gains in efficiency?

[5] Reference Littlechild, Stephen C. and Yatchew, Adonis, "Hydro One Transmission and Distribution: Should They Remain Combined or Be Separated?" Report to the Electricity Distributors Association, May 6, 2002. The authors present a history/overview of the Ontario electric power market, make reference to other markets, and international privatization actions of LDCs. The authors advocate the separation of transmission and distribution services of Hydro One.

[6] See Brauner, G., Hohenstein, D., Wahi, A., "Network Development for Cost Efficient Distribution," CIRED, 2001. The authors do not appear to have conducted detailed quantitative costing methodology. However, utilizing an intuitive understanding of distribution and heuristic reasoning, suggest and number of actions that can give rise to improvements in LDC cost efficiency.

Furthermore, minimum scale economies[7] may realized at lower levels than previously realized, though other factors can challenge this conclusion.[8]

The Board has initiated a policy process to determine guidelines for rate setting for the LDCs. The collaborative process of the Board involves representative stakeholder groups and coalitions including large industrial consumers, residential consumers, public schools, real estate property managers, labor unions, the LDCs, and Board staff participating in the various 2006 EDR Working Groups. This is all part of a regulatory policy to develop rate setting guidelines through a broad-based and open transparent process.[9, 10]

The importance of the Comparators and Cohorts in the rate setting process is evidenced by the presence of a 2006 EDR Executive and Work Group focused on this particular topic area. Over the course of carrying out its responsibilities, the Comparators and Cohorts Executive has produced working papers that set forth in summary form the consensus view of the EDR stakeholders regarding the delimited role of Comparators and Cohorts, what they are intended to do, and what they are as a matter technical specification.[11, 12]

---

[7] Reference Crew, Michael, A., "Analyzing the Impact of Regulatory Change in Public Utilities," 1985. The author utilizes translog cost functions to estimate the shadow price of electricity for electric utilities and concludes the transmission/distribution functions possess economies of scale.

[8] An excellent technical reference is Yatchew, A., "Scale Economies in Electricity Distribution: A Semiparametric Analysis," *Journal of Applied Econometrics*, Volume 15, 2000. The author utilizes data for 81LDCs in Ontario, and employs semiparametric and parametric models to estimate costs separately for the years 1993, 1994, and 1995. This is an excellent technical study.

[9] As cited by Mr. Wetston, regulation governance implies *goal-oriented regulation* that fits into a larger scheme of regulatory strategy and approach (see page 4 of Mr. Wetston's March 1, 2004 discussion paper).

[10] It is useful to mention on-going electricity restructuring initiatives, in particular Bill 100, the *Electricity Restructuring Act, 2004* (June 15, 2004), which proposes amendments to the *Board Act, 1998*, and the *Electricity Act, 1998*. The legislation, passed on December 9, 2004, dramatically refocuses energy policy toward renewable resources and conservation. Among other things, Bill 100 establishes the Ontario Power Authority, aimed at long-term supply with specific targets for conservation and renewables in Ontario's supply mix. A Renewable Portfolio Standard (RPC) would seem to be implied. Also, the legislation would move key functions of the Independent Electricity Market Operator (IMO) to the Board and the new Ontario Power Authority.

[11] A useful guideline summarizing the perspectives of the Comparators and Cohorts Working Group is contained in a presentation by Colin McLorg entitled *Comparators and Cohorts Workgroup, Update to EDR Stakeholders*, October 25–26, 2004. Available on the Board's website at www.oeb.gov.on.ca.

[12] A plausible list of Potential Comparators and associated cost drivers resides in the working papers of the Comparators and Cohorts Working Group. The list is presented in a cross referencing matrix summarizing cost elements and possible causal factors.

As mentioned above, the purpose of the Comparators and Cohorts mechanism for 2006 is to serve as a tool to screen the rate applications of the LDCs, and to highlight cost anomalies for the consideration of Board staff. The mechanism, should it prove successful, can provide Board staff with the means to realize substantial gains in regulatory process efficiency and effectiveness. Process efficiency means that the Comparators and Cohorts mechanism is a cost effective vehicle to help the Board and its staff review, process, and judge the numerous rate applications that will require simultaneous consideration in the second half of 2005.

The consideration of the Comparators and Cohorts idea is appropriate in view of the sheer magnitude of the task facing the Board and its staff—the expeditious processing of some 95 rate applications.[13] It is not, however, in the overall interest of the Province of Ontario and its citizens to impose a burdensome Comparators and Cohorts filing requirement on the LDCs, such that the total costs of regulation and governance—*i.e.,* the sum of the increased costs incurred by the LDCs minus the gains in processing efficiency—rise. In short, it is necessary that the Comparators and Cohorts mechanism, as a matter of design, serve the general interest as a whole.

ELECTRIC DISTRIBUTION SERVICES

Nature of Distribution Services: Electricity distribution covers key functions and activities of the electricity services industry including transport services (wires and interconnection),[14] settlements (billings and collections), and customer services. The resources employed in distribution include capital recorded as assets, and labor and non-labor inputs recorded as operations and maintenance expenses (O&M). Capital includes wires and connections facilities and equipment, settlements equipment including meters, bill rendering equipment, and information technology associated with the rendering bills and the collection of revenue. Capital also includes equipment and information technology associated with customer

[13] The work associated with processing this number of rate applications falls of course on the shoulders of the applicants and other stakeholders to the regulatory process, in addition to the Board and its staff. Accordingly, Board staff is facilitating and enabling the process with key initiatives including the development of spreadsheet- and internet-based software and filing templates. The Board staff has also developed a complete guide referred to as the Rate Handbook to assist the LDCs in the preparation of applications in the 2006 EDR proceeding. See *Discussion Paper for Issues Conference, 2006 Distribution Rates*.

[14] More precisely*, transport services* refers to the transport of power from power sources (interconnections with transmission networks) to power sinks (facilities of retail consumers).

services of several dimensions such as responding in timely fashion to inquiries, and in providing assistance in energy management. Electricity distributors are linked to meshed and radial transmission networks. These links (load sinks from the perspective of the network) can be a few locations or numerous locations across an entire region.

Distribution facilities consist of underground and overhead transformers and conductors organized as mostly radial and loop circuits operated at a variety of voltages.[15] Facilities include right-of-way, towers, conductor, underground conduits, and series and shunt compensation technologies including capacitors, reactors and, on occasion, static var compensators. Facilities also include circuit switch gear, and monitoring and control technology (SCADA) to maintain power service and reliability in near real time. Distribution involves the key activities of system operations, operations and maintenance of buildings and associated facilities, and planning to extend the system and to maintain power quality and network reliability.[16] Capital invested in equipment includes power line trucks and other vehicles, computer systems, and computer software for power system operations and planning, for bill rendering, for customer service, and for general business and accounting activities. Finally, distribution organizations will maintain the necessary inventory of spare parts of electrical equipment including poles, lines, and transformers.

Costs of Distribution Services: The costs associated with supplying distribution services include operations and maintenance expenses, capital charges, and accounting provisions associated with regulation such as regulatory assets, deferred taxes, categories of investment tax credits, customer deposits, allowance for funds used during construction, and contributions in aid of construction. Capital employed in distribution is sizable, and the costs of capital are large with respect to total costs. The costs used to determine regulated rates are

---

[15] It is useful to mention that distribution systems can be distinguished as having several configurations including meshed networks, interconnected networks, and link arrangements in addition to open loop and radial lines. See Lakervi, E, Holmes, E. J., *Electricity Distribution Network Design*, 2nd edition, 1995, Peter Peregrinus Ltd. publishers.

[16] The analytical procedures for distribution design and planning involve both the technical aspects and economic considerations (*i.e.,* discounted benefits and costs) of the value of reliability improvement and reduced losses. Assessing the benefits is challenging because numerous candidate expansion plan options may exist, and because of uncertainty regarding the evolution of the relevant region and area over long timeframes. See Willis, H. Lee, *Power Distribution Planning Reference Book*, 1997, Marcel Dekker, Inc.

embedded costs, which reflect contemporary O&M expenses, overheads, revenue taxes, and capital charges including return on depreciated assets.

Capital charges include depreciation expenses, property taxes and insurance, income taxes, and rate of return. The rate base usually reflect the vintaged valuation of capital (book costs)—thus the notion of *embedded costs*. Distribution costs used to set rates will likely incorporate certain rate base elements including zero-cost capital components and working capital.[17]

Generally, distribution organizations and companies in North America report cost data organized in a manner that conforms with the Uniform System of Accounts and, along with operating data, provide a good reflection of accounting costs.[18]

Market Context and Distribution Costs: The distribution systems of the LDCs and the electricity markets that they serve are complicated and can vary substantially. As mentioned, electricity distributors provide transport services covering a diverse range of business situations.[19] These situations can give rise to substantial differences in total costs, and costs stated on a unit-of-output (or service) basis—*e.g.,* cost per MWh.[20]

[17] Working capital can be determined in several ways including formula-based methods, static accounting-based methods—*i.e,*. current assets minus current liabilities—and empirical studies of the timing and sequence of cash flows (lead-lag studies).

[18] The exception to this general rule is that, on occasion, distribution cost data may reflect non-electricity utility services including water, sewer, and waste disposal functions.

[19] This report benefits from Christensen Associates' discussions with the Comparators and Cohorts Stakeholder Group, which have been engaging, informative, and instructive.

[20] The output of distribution wires and interconnections service is multi-dimensional, and inadequate definitions of output can confound cost studies. Plausible metrics of the quantity of output—*i.e.,* the *output quantities*—include transport distances such as km and MW-km of lines, peak load (kW) measured as the sum of the non-coincident demands at the transmission interconnection points, the number of customers served, total kVA of transformers at the point of interconnection with consumer facilities, and electricity consumption (kWh).

It is useful to review the main factors that contribute to costs and cost differences.[21] First, electric distributors serve large- and medium-sized urban areas, municipalities, and rural regions. As general rule, urban areas give rise to greater load and customer density which tends to reduce average costs because capital and O&M costs per unit of output decline. In contrast, rural areas generally have low density and often reveal fairly high costs because the amount of conductor and supporting equipment is comparatively large stated on a per customer and peak load basis.

Second, costs vary with regards to facility configuration, distribution technology, and customer mix. As an example, some distribution organizations may have predominantly secondary facilities, while other organizations may have considerable investment in three-phase primary facilities and associated equipment. Some LDC organizations may have a substantial amount of investment in underground facilities, while others do not. While underground facilities are somewhat more costly, they may be less costly to maintain and may provide improved reliability through reduced frequency of service outages.[22] These differences in configuration of facilities can reflect mandates of municipalities and differences in design philosophy, in history, and in differences in customer needs which are mostly a matter of the mix of customers served. Design philosophies, methods, and standards may vary and reflect preferences for specific vendor equipment, as distribution crews, over time, become familiar with the attributes and performance of specific equipment.

---

[21] My experience suggests that the investment costs in distribution wires and interconnection service are strongly related to the number of customers served, load density and, to a lesser extent, peak loads on distribution systems. Despite its inclusion as an explanatory factor in many studies, energy sales plays no role in the determination of the level of resources employed in distribution services. The use of energy as an output variable is undoubtedly a result of its high correlation with the true metrics of output for wires and interconnection. Also, it is useful to mention that the demand for wires and interconnection service is itself a derived demand. Consumes have no demand for transport services in and of itself. Electricity consumers demand energy because only energy has value. Transport services, as with reserve services, are typically bundled in with energy. Also, wires and interconnection is typically priced on a per-unit-of-energy (kWh) basis, rather than on a distance or kW basis, which would appear to be a more rational approach.

It is useful to mention that, as a general rule, overhead facilities are less costly than underground facilities. Also, highly dense areas, such as the Island of Manhattan, may be very costly to serve because of constraints on accessibility. While growth of customers served on existing primary and secondary circuits tends to reduce average costs, growth that gives rise to line extensions may cause average costs to rise, particularly where total costs are stated as embedded cost under conditions of on-going inflation.

[22] The outage costs incurred by retail consumers are related to both the frequency and duration of outage events. While underground facilities may reduce the frequency of outages, the duration of outages may be longer because the time required to restore service may be extended because of problems of accessibility.

Third, differences in load growth within existing service territories and the extension of territory has direct impact on cost differences. Distribution facilities and equipment have exceptionally long lives. For distribution organizations that have little growth over years, the capital base (rate base) may reflect a concentration of early-vintage investment, which tends to reduce costs stated in embedded cost terms. Generally, the maintenance costs of older equipment are higher than that of newer vintage equipment, and there are large differences between the *load-related* marginal costs of wires service and embedded costs of such services, particularly if line extensions are associated with new loads.[23]

Fourth, cost differences will reflect the consolidation of organizations, of distribution functions, and of outsourcing that may have the potential for substantial gains in efficiency due to economies of scale and economies of scope.

Aside from these general considerations, LDCs in Ontario face unique attributes relating to service territory and markets, and as regards to organizational legacy. First, the service territory in total is large with numerous large lakes and a range of geography across this vast terrain. In particular, the Canadian Shield covers the area north of an east-west line from Ottawa, and east of Hudson Bay, which in total constitutes roughly two-thirds of Ontario. This geography is a rather rough and rocky terrain that, arguably, affects the way that distribution services are planned and constructed, and may have a cumulative positive impact on costs vis-à-vis areas of Ontario to the South and Southwest.[24]

---

[23] Reference Woo, Chi-Keung and Lloyd-Zannetti, Debra, "Marginal Capacity Costs of Electricity Distribution and Demand for Distributed Generation," *Energy Journal*, Vol. 16, Issue 2, 1995. The authors describe distribution capacity costs as a function of peak demand. Analyses are based upon area-specific studies of two major U.S. utilities. This is unfortunately not the whole story. That is, capital employed in distribution services is highly indivisible, which confounds the estimation of marginal costs. Specifically, in planning simulation studies to estimate marginal costs, one obtains substantially different cost estimates depending on the size of the load increment.

[24] An interesting application of variables defining topography can be found in Filippini, Massimo and Wild, Jorg, "Regional Differences in Electricity Distribution Costs and their Consequences for Yardstick Regulation of Access Prices," *Energy Economics*, Vol. 23, Issue 4, July 2001. The authors employ GLS and OLS models and random effects models to determine relationships between costs and attributes for Switzerland LDCs over the period 1988–1996. Variables include a) price of capital, b) price of labor, c) high voltage grid, d) show of low voltage sales in total sales, e) load factor, f) share of agricultural land, g) customer density, h) density squared, and i) time series (trend) basis of technology change.

Municipalities may impose electricity service requirements that limit the facility choices of LDCs and that are costly. Large urban areas with high load densities may present accessibility constraints for the servicing LDCs that are manifest as higher operating expenses for maintenance. A number of licensed LDCs described as *virtual utilities* possess assets but out source all or most of the operating responsibilities to other LDCs. Finally, it is useful to mention that some LDCs are characterized as *host LDCs*, which provide transport service to other, presumably smaller, utilities described as *embedded LDCs*, in addition to the host LDC's retail customers.

Fifth, the costs of Ontario's numerous distribution organizations are likely to vary because of differences in efficiency of the process of providing distribution services. Relative cost efficiency has investment and O&M dimensions, and some organizations are likely to be highly efficient, while others are less so. The relative efficiency of Ontario's distribution organizations, after accounting for the relevant factors – including business environment, characteristics of distribution facilities, and market context – is of particular interest. Once understood, efficiency, as manifest in the level of cost per unit of output for the defined unbundled services of LDCs, can serve as an observable mechanism of regulatory governance.[25, 26]

[25] Reference Cronin, Francis J. and Motluk, Stephen A., "The Road Not Taken," *Public Utilities Fortnightly*, March 2004. The authors make the case for so-called Yardstick Competition over Performance-Based Regulation, and mention the Ontario electricity market.

[26] Reference Yatchew, Adonis, "Incentive Regulation of Distributing Utilities Using Yardstick Competition," *The Electricity Journal*, 2001. The author reveals analysis regression results based on 81 municipal distribution utilities ranging from 600 to 220,000 customers in Ontario. This article is a useful and easily accessible guide that nicely characterizes the notion of yardstick competition, and reviews alternative approaches of application. Professor Yatchew employs a number of variables including a) total cost as a function of a) number of customers, b) wage rate of linemen, c) historical cost of physical capital per km of conductor, d) dummy variable if other services are present, e) average load, f) remaining life of assets, g) load factor, h) density. Professor Yatchew suggests strong evidence of increasing returns to scale, with the efficient scale of operation achieved at what appears to be a fairly low size level.

LDC REPORTING REQUIREMENTS

The first issue regarding the implementation of a Comparators and Cohorts mechanism is defining the necessary data and information, then ensuring that such data is provided in a uniform and consistent manner. Here, I define that data and information, which must be organized according to defined distribution unbundled services. Determining the reporting requirements has two aspects:

1. Defining unbundled distribution services; and,
2. Identifying the data and information to be reported separately for each of the three unbundled distribution services.

As mentioned above, the goal is overall regulatory processing efficiency. While the LDCs need to expand their filing with supplemental data and information, much of the data and information appear to be present and readily available, and is currently being filed. However, consistency of definition and in reporting is necessary for the Comparators and Cohorts mechanism to work, and for expedient processing of the rate applications generally. Described below are definitions of unbundled services followed by a listing of the data reporting requirements.

Unbundled Services

The Board needs to ensure that the LDCs organize and report data and information regarding costs, output quantities (MWh of sales, kW of peak demand, numbers of customers, etc.), and service territory and system attributes according to unbundled services. These unbundled services follow naturally from the *modus operandi* of what we have come to refer to as simply *distribution*, and are defined as follows:

Wires and Interconnection Service

Wires and interconnection service is the transport of electricity in reliable fashion to locations where it is received—the interconnection links with transmission facilities—to locations where electricity is consumed by retail consumers (customers). The costs of supplying distribution transport services (inputs to the wires and interconnection service) include the capital costs and operating and maintenance expenses (including outsourcing and shared services) associated with the wires and interconnection, and indirect administrative overheads. Wires and Interconnection Service includes service restoration.

Settlements (Billing and Collections)

Settlements refers to the measurement of and billing for electricity service received by customers, and involves meters, meter reading, billing, and revenue collections. The Settlements function also includes the response to inquiries regarding customer bills, and the collection of delinquent bills. The costs of inputs of *Settlements* include the capital (assets) associated with meters, vehicles, metering and bill rendering equipment, software, and building facilities; skilled labor and management (which are reported as direct expenses), and indirect administrative overheads as allocated. Settlement activities may be outsourced or shared services among several LDCs. It is essential that the costs of out sourced activities for billings and collections be reported as Settlements costs.

Customer Service

This third unbundled service category is not currently reported as a separable service by the LDCs. However, it is likely that some of the functionality and activities of what I refer to as customer service are bundled with and reported as Billings and Collections. These activities will expand, perhaps substantially, as energy conservation and unbundled electricity services proliferate. Customer services cover a gamut of activities, and can include communications regarding service discontinuities, new service connections, service terminations, marketing and promotional activities, assisting customers in the selection of tariff options,[27] special services such as enhanced quality and insurance products, and consultation regarding energy conservation including energy audits. The costs of customer services and sales typically involve the capital associated with vehicles, software, and building facilities; skilled labor and management (which are reported as operating expenses), and indirect administrative overheads as allocated.

Administration costs. Though they are not an unbundled service category, it is perhaps useful to review the nature of administrative expenses, otherwise known as corporate

[27] Recent years have evidenced the emergence of number of new retail products (tariff options) that align marginal retail prices with economic costs of supply thus obtaining gains in market efficiency. These options are also geared to achieve a better match of retail pricing design with the needs and preferences of consumers, and can assume a variety of forms that depart substantially from the conventional fixed price-open quantity structure of retail prices. Examples of tariff options include fixed bill products that hedge price *and* quantity risks, self-designing products, resource portfolio options (green tariffs), critical peak pricing variations of time-of-use, curtailable service with marginal cost-based buy through provisions, and electronic control-based curtailment of end-uses.

overheads. We can think of overheads as ancillary services that support the LDCs' defined unbundled service, and are only indirectly related to the outputs of the unbundled services themselves. Essentially, the demand for administrative services is a derived demand.

Administrative activities that serve the unbundled distribution services described above can include accounting, payroll and corporate finance, corporate management, regulatory affairs, management property and liability insurance, legal and legislative affairs, and human resources and the administration of employee benefits. Because administrative costs are true overheads, such costs are assignable to the unbundled services through cost allocation mechanisms. Studies tend to suggest that overheads are strongly related to the physical capital and expenses including labor and non-labor inputs of unbundled services.

Data and Information Requirements

For each of the unbundled services, the LDC data and information reporting requirements should be as follows:[28]

Costs and Cost Inputs

For Wires and Interconnection Service

Gross Assets and Accumulated Depreciation. For assets employed in Wires and Interconnection, the LDCs should report for the reporting year, *year-end gross assets and accumulated depreciation; and retirements, capital additions, and account transfers within the year*. Other than accumulated depreciation, these accounting measures of capital assets for wires and interconnection service are typically reported in *plant in service* accounts for *distribution plant* and for *general plant* account categories. The distribution plant asset account categories typically include substations, transformers, land and right-of-way, conductor, poles and conduit, relays, reactors, and capacitors. Capital investment (assets) in equipment including SCADA, control room and/or control monitoring equipment is typically recorded in general plant accounts. Capital invested in stores and inventory, buildings, and trucks and other vehicles is also often recorded within general plant account categories.

[28] The term "reporting period" refers to a recent calendar year time frame, such as 2004, used as a test period over which costs are assessed by the Board for the purpose of determining prices for distribution services, or for monitoring and cost surveillance reporting.

The measurement of capital is always a serious issue in economic cost studies of utilities.[29] Thus, we intend to utilize perpetual inventory refunds to value the capital stock in the follow-up analysis.

Operating Expenses. Operating expenses for wires and interconnection service include all expense outlays within the reporting period to cover wages and salaries of labor resources, non-labor expenses such as materials, and other cash expenditures associated with providing wires and interconnection services such as charges for out sourced services. Operating expenses do not include depreciation expense, property taxes, insurance, income taxes, deferred accounting charges, or charges to regulatory asset accounts. Finally, the LDC should report all direct cash outlays for labor including salaries and wages.

For Settlements (Billings and Collections)

Gross Assets and Accumulated Depreciation. For assets employed in Settlements, the LDCs should report, for the reporting year, year-end gross assets and accumulated depreciation; and retirements, capital additions, and account transfers within the year. Capital assets employed in the settlements include customer meters, vehicles, communication equipment, software, buildings or allocated shares thereof,[30] and office equipment and furniture. Other than accumulated depreciation, these accounting measures of capital assets for settlements are typically reported in plant-in-service accounts for meters and customer premises equipment (distribution plant) and for communication equipment, software, buildings or allocated shares thereof, and office equipment and furniture (general plant) account categories.

---

[29] Accounting measures of capital employed in distribution services is not the best metric because the application of original cost accounting procedures under conditions of on-going price inflation can significantly distort the value and worth of capital. As an example, an LDC that is characterized by low growth but has higher demand, energy sales, and number of customers, may have lower accounting measures of capital (Net Capital Stock) than that of an LDC with high growth but lower demand, energy sales, and numbers of customers.

Alternatively, the real capital stock as an indicator of the physical quantity of capital measured in dollars may be inferred through the application of heuristic methods. For the near term deliverables and absent the necessary historical data, ad hoc approaches based upon various notions of growth may be used to make adjustments to the accounting measure of capital. This estimation procedure can hopefully obtain a satisfactory measure of the real capital stock. There are several metrics for the measurement of capital and its worth (and cost), including the value of capital services.

[30] It is highly likely that Settlements and Customer Service will be carried out in general office buildings. Office space will be shared with other corporate functions and activities, and thus it is necessary to allocate the capital costs associated with buildings to the relevant functions. It is necessary to specify allocation protocols and rules.

Expenses. Settlements expenses that should be reported by the LDC include all expense outlays within the reporting period to cover wages and salaries of labor resources, materials, and other cash expenditures associated with providing Settlements such as charges for out sourced services. Operating expenses do not include depreciation expense, property taxes, insurance, income taxes, deferred accounting charges, or charges to regulatory asset accounts. Finally, the LDC should report all direct cash outlays for labor including salaries and wages.

For Customer Service

Gross Assets and Accumulated Depreciation. For assets employed in customer service, the LDCs should report, for the reporting period, year-end gross assets and accumulated depreciation; and retirements, capital additions, and account transfers within the year. Capital employed in the Customer Service function includes buildings, office equipment and furniture, computers, software, and communications equipment, all of which is typically reported in categories of general plant. Other than accumulated depreciation, these accounting measures of capital assets for customer service are typically reported in plant-in-service (general plant) accounts for buildings, office equipment and furniture, computers, software, and communications equipment communication equipment, software, buildings or allocated shares thereof.

Expenses. Customer Service expenses that should be reported by the LDC include all expense outlays within the reporting period to cover wages and salaries of labor resources, materials, and other cash expenditures associated with providing Customer Service such as charges for out sourced services. Operating expenses do not include depreciation expense, property taxes, insurance, income taxes, deferred accounting charges, or charges to regulatory asset accounts. Finally, the LDC should report all direct cash outlays for labor including salaries and wages.

Administration Expenses

Administrative expenses include all expense outlays within the reporting period to cover wages and salaries of administrative labor resources, and other cash expenditures associated with providing administrative support services. Administrative expenses do not include charges for out sourced services *other than services directly related to administrative activities*. Administrative expenses, for the purposes herein, do not include depreciation expense, property taxes, insurance, income taxes, employment taxes, deferred accounting charges, charges to regulatory asset accounts, or cash expenditures for and contributions to employee benefits and benefit plans. Finally, the LDC should report all direct cash outlays associated with administration services, for labor including salaries and wages.

Other Cost Expenditures

Other expenditures to be reported by the LDCs include all expense outlays within the reporting period to cover property taxes, insurance, income taxes, employment taxes, and charges to regulatory asset accounts. Also, the LDCs should provide the depreciation rates for the various categories of capital including transformers, lines, meters, software, computers, and vehicles. .

Labor-Related Inputs and Input Costs

Within the reporting period, the LDC's should report the following two labor-related inputs and costs:

Employees. For each of the unbundled services and for Administration, the number of employees, at the year-end of the reporting period, reported as FTEs.[31]

Employee Benefits. Benefit costs include the cash expenditures for or cash contributions to employee health benefits and plans, insurance plans, safety plans, savings plans, and retirement plans.

Wages and Salaries. For each of the unbundled services and for Administration, the annual total wage and salary compensation paid to employees.

Measures of Output Quantities

For the reporting period, the LDC data and information reporting requirements should be as follows:

[31] The provision of FTE reporting accommodates the situation of small LDCs that may utilize some employees in more than one unbundled service.

MWh Sales by Tariff Category

Sales refers to MWhs of electricity consumption of the major tariff categories (market segments) served, including the residential, general services, large customer, street lighting and signals, and sentinel lighting tariff groups. Sales can also include sales for resale such as full and partial requirements wholesale sales.

MWs of Peak Demand

System-wide sum of the non-coincident maximum peak demands, by season, as measured at the interconnection delivery points with the transmission network or, for embedded LDCs, at the interconnection delivery points with its host LDC.

Number of Customers

Number of customers for each of the major market segments served, including the residential, general services, large customer, street lighting and signals, and sentinel lighting tariff groups.[32]

Total KM of Conductor as a Measure of Transport Services

The LDCs should report total km of conductor, by three phase and single phase conductor type.

Cost Drivers, Attributes

The LDC data and information reporting requirements should be as follows:

*Service Territory Descriptor*s

The defined service territory attributes to be report include total territory served measured in km^2; the designation of urban, municipal or rural descriptors; the population served in the service territory; a designation of northern or southern Ontario locational descriptors; and a

[32] There exists overlap between data and information that serve as *Output Quantities* and data that serve as *Cost Drivers*. The designation is a matter of whether the analyses are to explain differences in total costs, or differences in unit-of-output costs. If the analyses are focused on differences in total costs, some of the data and information inputs referred to herein as Output Quantities may serve as Cost Drivers.

flag for the presence of the Canadian Shield in the service territory as surface topography in the service territory.[33]

Historical MWh Sales, MWs of Peak Demand, and # of Customers by Tariff Group

These recorded measures of output are needed for the ten most recent years.[34]

Composition of Conductor

The composition of conductor, measured as km by phase type and position (overhead or underground) is likely to have substantial impacts. These data are available and have been reported. However, we suggest a slight change in the reporting. Specifically, it would be useful to disclose, if records allow, distribution conductors in terms of: a) km of three phase overhead, b) km of three phase underground, c) km of single phase overhead, and d) km of single phase underground.

Number of Transformers

The LDCs should report the total number of transformers at year end of the reporting period. These data should be reported separately for: 1) the LDC's interconnection with the transmission network; and 2) transformers associated with service at the premises of consumers including, separately, pad mount and pole mount transformers..

Customer Turnover and Service Terminations

The LDCs should report new customers and service terminations.[35]

---

[33] See Wangensteen, Ivar, and Dahl, Eyolf, "An Investigation of Distribution Costs by Means of Regression Analysis," *IEEE Transactions on Power Delivery*, Vol. 5, No. 1, January 199. The analyses cover 300 distribution utilities in Norway over the 12-year period, 1974–1985. The regression analyses estimate capital cost as a function of region, number of customers, and energy sales; costs of losses as function of region, number of customers, and energy sales; operating expenses as function of region, number of customers, and energy.

[34] These data will be used to help determine and measure the quantity of capital inputs. Also, we are inclined to expect that changes in the composition of customers through time may have impacts that are not captured by other variables.

[35] These data can be reported in a number of ways and Board staff should select the approach that is most convenient to the LDCs. For example, if the LDCs normally report total customers annually, then merely reporting new customers within the current year allows one to infer the number (count) of service terminations.

COST ESTIMATION METHODOLOGY

The firm employs resources in order to satisfy the demand for its services. Resources are costly and, optimally, the firm chooses the least cost bundle of resources that satisfy demand, given the price of inputs. The choice of resource bundle is an issue of process efficiency, and the firm can select a range of possible production processes.

The problem can be described as a cost minimization problem, given the business and market environment in which it operates. This problem involves four variables:

Input Prices (***W***)	= factor input prices for resources employed by the firm;
Output Prices (***P***)	= prices that the firm charges for its services (outputs)
Outputs (***Q***)	= quantities of output supplied by the firm in service of the demands for its services
Inputs (***X***)	= quantities of output employed by the firm in the process of providing output

The total cost of providing service can be stated as:

$$\Sigma X_j * W_j = Cost = (Q_i \ldots Q_I; W_j \ldots W_J; Z_m \ldots Z_M) \qquad (1)$$

The set of variables ***Z*** define the set of factors that describe the firm's business and market context. Within the context of electric distribution, the ***Z*** factors can include load density, load factor, an urban service territory, municipal mandates, etc.

Presumably, the vector of output prices, ***P***, are set by the regulators at a level such that total costs are recovered – *i.e.,* ***P*Q = W*X***. Essentially, the regulators set the prices, ***P***, which in turn determines the level of output, ***Q*** – *i.e.,* the level of consumer demand. The firm accepts the level of output as an input parameter. Conditional on output (***Q***) along with the price of inputs, ***W***, and the conditions of the business environment, ***Z***, the firm selects the least cost combination of inputs, ***X***.

The problem facing the firm, then, can be cast as an issue of minimizing costs, given exogenous demand for output and input prices (***Q***, ***W***), and the business and market environment (Z_m). Quantities of output, input prices, and business context are exogenous to and outside the control of the management of the firm. The firm can choose the quantities of the input factors, ***X***, subject to the constraints of the production process and conditions of the business environment. Optimally, the firm will utilize each input factors $\boldsymbol{X_j}$ up to the point where its marginal product is equal to the input price, $\boldsymbol{W_j}$.

We can view this problem a little differently for purposes of cost assessment. That is, we can state costs on a unit cost basis,

$$\boldsymbol{\Sigma X_j{*}W_j/Q = (W_j \ldots W_J; Z_m \ldots Z_M)} \qquad (2)$$

where the unit cost, $\boldsymbol{\Sigma X_j{*}W_j/Q}$, is a function of input prices and the various factors that identify and capture elements of the business environment of the firm. The preliminary analyses used in the Proof of Concept do not employ the approaches outlined by Equations 1 and 2 precisely. As an example, Wires and Interconnection Services estimates gross assets as an equation of the demand for capital. That is, assets are a function of descriptors of the business environment. Although the price for capital is absent from the equation, there would be very little price variation across observations, and therefore price would not play a significant role in the analysis. The equations used in the analysis can be thought of as representing the demands for various inputs, which are related to the unit cost function. The departure from equations 1 and 2 is because the data do not facilitate the measurement of capital inputs with sufficient accuracy, and because capital is not revealed in the case of two of the unbundled services (Settlements and Customer Service.[36, 37, 38] The follow-up analysis

[36] Reference Burns, Philip and Weyman-Jones, Thomas G., "Cost Functions and Cost Efficiency in Electricity Distribution: A Stochastic Frontier Approach," *Bulletin of Economic Research*, 1996. The authors utilize panel data regarding the 12 regional electricity companies of England and Wales, and conduct cross sectional and panel data estimation. The authors find that the costs of distribution systems depend upon: a) maximum demand, b) total number of customers, c) type of consumer (determinant of differing capacity utilization at different times), d) dispersion of customers across the distribution region, e) size of the distribution area, f) energy sales, g) value placed on the system security, h) the km of conductor, and i) transformer capacity (kVA), j) the user cost of capital, and k) cost of labor. The analyses include linear and double log models, and restricted and unrestricted equations.

[37] Papers that develop these methods include D.W. Jorgenson, "The Economic Theory of Replacement and Depreciation," in W. Sellekaerts, ed. *Econometrics and Economic Theory*, (International Arts and Sciences Press, 1974), pp. 189–221 and L.R. Christensen and D.W. Jorgenson, "The Measurement of U.S. Real Capital Input, 1929–1967," *Review of Income and Wealth*, Series 15, Number 4, December 1969, pp. 293–320.

[38] Capital measurement has been extensively studied. Empirical analyses suggest that the approach taken herein provides an excellent approach to determining the underlying economic worth and value of capital. A summary of empirical studies can be found in Charles R. Hulten "The Measurement of Capital," in *Fifty Years of Economic Measurement*, E.R. Berndt and J.E. Triplett, eds., NBER Studies of Income and Wealth Vol. 54, (University of Chicago Press, 1990), pp. 119–152.

will utilize the data and information identified in the report section entitled *LDC Reporting Requirements* will pursue the approach discussed above.

It is useful to mention that the costing of distribution services is distinct from the efficient pricing of distribution services which should have the appropriate balance between and integration financial costs and marginal costs.[39]

PROOF OF CONCEPT

Developing conceptual ideas is one thing; demonstrating usefulness is quite another. Here, we address the issue of whether Comparators and Cohorts can satisfy a standard of practicality and, if so, how they can be applied.

The approach taken is to identify the relationships between cost comparators, and cost drivers including LDC attributes of physical plant and the markets served, and to assess how well such relationships explain cost anomalies worthy of regulatory scrutiny and further investigation. The analysis process is a search for relationships between various dimensions of costs, and causal factors. Intuition and knowledge about electric distribution services help us find such relationships, and can also assist in determining whether identified relationships are plausible.

As detailed above, the Proof of Concept test involves four analysis steps. The *first step is factor analysis and correlation analysis* of the data reported by the LDCs to the Board for the periods 2002 and 2003. Factor analysis and correlation analysis help us understand the pair wise fit of the data. These data include various input costs, inputs quantities, output quantities and cost drivers. A number of alternative transformations of data were performed. The full list of the variable names is presented in Exhibit 1.

The second analysis step is determination of the Cost Drivers with regression analysis. We utilize regression methods including stepwise regression procedures to identify statistically significant explanatory variables. Regression analysis determines the individual explanatory

[39] A useful reference is Camfield, Robert J., and Kirsch, Laurence D., "Developing and Pricing Distribution Services," Pricing in Competitive Electricity Markets, 2000, Kluwer Academic Publishers. The authors set forth the principles for efficient pricing of distribution services. The paper discusses the basis to integrate financial and marginal costs to determine efficient LDC prices of wires and interconnection service.

power of individual variables, in the presence of other explanatory variables. Regression also determines how, together, various cost drivers and output quantities—*i.e.,* the right-hand-side (RHS) explanatory variables—jointly determine costs. The *third analysis step is determination of the Cohorts with statistical clustering* of the LDCs on the explanatory variables defined in step two, regression analysis. Cluster analysis groups the LDCs according to similarity (magnitude) of RHS variables. The *fourth analysis step is an inspection of comparative diagnostics*.

The analyses are performed for the cost categories of the defined unbundled services, as follows:

- *capital (assets)* associated with Wires and Interconnection service;
- *operations and maintenance expenses* associated with Wires and Interconnections service;
- *operating expenses* associated with Settlements (billings and collections); and,
- *operating expenses* associated with Administration.

While the quantitative results are not presented herein, the Factor Analysis and Correlation studies found generally strong correlation among a number of series in the data arrays. This led us to immediately realize that, while data anomalies, data errors, and reporting inconsistency are very much present, inherent relationships exist. We have not found that the reported data are dominated by reporting errors and are of little value and that the LDCs in Ontario are characterized with unique attributes that could not be readily captured. In contrast, these preliminary analyses reveal systematic relationships between costs and RHS variables, and the relationships appear to be intuitively plausible in most cases, though not all.

At this preliminary[40] and Proof of Concept stage, we report the following analysis results for cost categories of the defined unbundled services described above:

a) the regression analysis (Exhibit 2, pages 1–3);

[40] All regressions as reported are of the ordinary least squares (OLS) form and, in view of the press of time, we have not tested for violations of OLS properties and whether generalized least squares (GLS) procedures are better suited to the estimation task at hand. In particular, we are concerned about the presence of correlated error terms. Recognition of and correction for correlated errors with Huber White robust standard errors may reveal that some of the variables are statistically insignificant.

b) plots of the standardized residuals of the regressions (Exhibit 3, pages 1–3);
c) 4- and 10- group clusters of the LDCs (Exhibit 4, pages 1–4); and,
d) cross tabulation of the distribution of the high-cost LDCs within the residuals (Exhibit 5, pages 1–4).

The analysis results for each cost category are described below.

<u>Step 2: Determining the Comparators with Regression Analysis</u>[41]

Cost Analysis of Wires and Interconnection Service

As mentioned, we searched for plausible sets of RHS variables that explain the variation in the levels of capital and operations expenses for the LDCs.

<u>Capital</u>*:* As can be observed on page 1 of Exhibit 2, the regression analysis was conducted in linear and double log form.[42] Variation in the metric for capital, *gross assets*,[43] is explained by six RHS variables including: 1) total number of transformers; 2) km of three phase conductor; 3) total number of customers; 4) the share of km underground conductor as a percent of total km of conductor; 5) the share of transmission transformers, as a percent of total transformers; and 6) load and customer density, which is measured as the ratio of total customers to km of single phase conductor.

All RHS variables have the appropriate direction, as revealed in the coefficient sign. That is, an increase the values for variables 1–5 implies an increase in the accounting measure of gross assets, while an increase in the value of variable 6, density, suggests that gross assets would be lower, holding constant the values of the other RHS variables. The explanatory power of the regression is good, the relationship is statistically significant—as revealed by the F value—and the RHS variables are all statistically significant, as shown by the t statistic attending each of the coefficients of the variables. The standard errors (RMSE) as shown on

---

[41] Please note that, as mentioned, we are not reporting the first step of the Comparators and Cohorts approach, factor analysis and correlation analysis, in the report.

[42] The double log form has the unique property in that the regression coefficients are elasticities. "*Elasticity*" in this context refers to the percentage change in the value of a variable with respect to a one percent change in another variable.

[43] There is an error in variables problem with reported gross assets resulting from consolidation and mergers. As mentioned, considerable consolidation among Ontario's LDCs has taken place, and when one LDC is purchased or is consolidated within another, the net assets—gross assets net of accumulated depreciation—of the acquired LDC may be stated as gross assets on the balance sheets of the acquiring organization.

Exhibit 3, page 1, are, nonetheless, rather large and may reflect errors in variables and poor model specification.

The double-log model reveals less explanatory power, and RHS variable 1, total transformers, fall out of the relationship—*i.e.,* is not statistically significant. This is because, generally speaking, most LDCs report only a very few transformers at the transmission level. Hence, when converted to natural log, the variation in the values across the data panel collapses to a relatively small range.

<u>*Operating Expenses*</u>*:* Page 2 of Exhibit 2 discloses the regression analysis for operating expenses associated with Wires and Interconnection service. Operating Expenses reflect labor and non-labor costs associated with the provision for delivery services. These resources are generally long-run substitutes for capital particularly as capital ages, and may appear to substitute for capital simply because of the way that capital is expressed, in accounting cost terms.[44] The variables that appear to explain operating expenses include attributes of the distribution facilities and markets served, and are as follows: 1) total number of customers; 2) total number of transformers; 3) gross assets; 4) the share of km of underground conductor as a percent of total km of conductor; 5) average compensation of employees; and 6) accumulated depreciation squared.

Interpretation of this result is useful. First, with respect to variable 3, assets the analyses reveal that, as assets increase, operating expenses decline. This suggests substitution between capital and labor, or that the assets variable is merely capturing variation in the age of capital rather than the true factor price of capital—in short, an errors in variables problem.[45] Second, an increase in variable 6, accumulated depreciation, implies that higher operating expenses because older equipment requires greater maintenance.[46]

---

[44] Valuation of the physical capital is a serious measurement issue—and problem—confronting all utility cost studies.

[45] The presence of a measurement issue is a concern. Indeed, in these preliminary analyses, we depart significantly from our formal and theoretically consistent cost framework, where cost is a function of quantities of output, quantities of inputs, and factor input prices, along with various attributes of the service territory and so forth. In short, we are limited to describing the results as intuitively plausible and suggestive that systematic relationships are present.

[46] This analysis result tends to confirm the views presented in the discussions of the Comparators and Cohorts stakeholder group.

The analysis demonstrates good predictive power, the overall regression is statistically significant, and all regressors have the appropriate sign. Nonetheless, the standard errors (RMSE) as shown on Exhibit 3, page 2, are rather large. The analyses for operating expenses have, as with the other variables, been conducted for other sets of RHS variables, and have been conducted with double-logs. The statistical relationship in log form is generally weaker than that of the linear form because of the range of values of some of the variables are compressed sufficiently that meaningful relationships with the LHS tend to vanish, given the LHS variation already explained by the other RHS variables.

Settlements (Billings and Collections)

The reported resource costs for the unbundled distribution service otherwise known as billings and collections is incomplete because, as mentioned earlier, gross assets and accumulated depreciation for capital related to Billings and Collections is not separately reported in the data panel. As discussed, earlier it is important to report capital resources utilized in providing settlements services in the form of hardware, software, vehicles, meters, and bill rendering equipment. Furthermore, it is likely that some LDCs report resource costs of Billings and Collections as Administrative expenses, where the LDC out sources this function or perform parts of it jointly with other LDCs.

Notwithstanding the above issues of resource reporting, we nonetheless have found statistical relationships worthy of reporting, as shown on page 3 of Exhibit 2. The explanatory variables include: 1) share of the service territory that is urban; 2) total population of the service territory; and 3) the number of general service customers.[47] The cost drivers for the billings and collections activity (total number of customers, population, km of service territory, etc.) have high correlation and the variables for them, both individually and in combination, explain variation in costs. As can be seen, the billings and connections regression equation is statistically significant. Exhibit 3, page 2, reveals rather contained standardized errors, with several very large outliers would appear to reflect bad data as

[47] While the overall equation is statistical significant and with rather small standardized errors, variables 1 and 2 individually reveal week statistical relationships, probably as a result of multicollinearity. Also, the variables may be difficult to specify in a consistent manner and without error. How does one define the notion of "urban?" Is urban population observed? Is "urban" defined the same for all reporting LDCs?

reported. Additional research is needed; it would be useful to explore alternative models absence these large outliers.[48]

That variable 3, number of general service customers, contributes to the overall relationship is somewhat surprising. A plausible explanation is that general service customers, which as defined can assume very large size, are much more costly in terms of billing. Hence, the presence of a fairly large number of general service customers within the overall mix of customers adds incrementally to billings and settlements costs, after accounting for the impacts of service territory metrics, which closely follows the total number of customers.

Administrative Costs

The regression analysis for Administrative Expenses is shown on page 3 of Exhibit 2. Administrative Expenses are explained by the following variables: 1) gross assets, 2) total operating expenses, and 3) total expenses for billings and collections. The equation is statistically significant although the standard errors are fairly large, as shown on Exhibit 3, page 3.

It is useful to briefly mention that the analysis tends to confirm the nature of Administration. Namely, the demand for administrative services should be viewed as a derived demand, and thus a support service for the Wires and Interconnection and Settlements services. Also, administrative costs are likely to be positively related to employee benefits.[49]

Step 3: Determining Cohorts with Cluster Analysis

Exhibit 4, pages 1–4, presents the Cohorts, which are shown for four and ten cluster groupings for each cost category. Given the large number of very small LDCs, we should not be surprised to find that most the LDCs reside within the first Cohort. And we more or

---

[48] We have in fact found alternative solutions for Settlements costs that are worthy of consideration. These results are not include in the report as they only became available at the eleventh hour and could not be incorporated.

[49] There may be an issue about specification of the Employee Benefits equation. That is, we would expect that administrative expenses, as far as benefits are concerned, are more closely related to the number of total employees than benefits measured in dollars.

less observe a consistent story across the LDC panel, which includes the 2002 and 2003 data as reported.

This outcome also reflects the overall choice of model, which is a *Total Cost* approach, rather than a *Unit Cost* approach. A Unit Cost model normalized for levels of output for the unbundled distribution services—*e.g.,* energy sales, customers, MW-kilometers of conductor, MW of peak, etc.—would tend to significantly spread out the distribution of LDCs among the cohorts. The unit cost approach is worthy of later consideration. However, its successful application requires that *capital* be adequately measured as a factor of production, which includes the quantity of capital, the real capital stock, and the price of capital.

Step 4: Inspection of Comparative Diagnostics

Step 4 involves a placement of the standardized residuals within the Cohorts determined by the Cluster Analysis of Step 3. This final step helps us gauge, overall, the feasibility of Comparators and Cohorts. Essentially, we randomly select several members of the data panel (LDCs) that have been highlighted by standard errors as potentially having fairly high costs. Once selected, we then assess cost performance of the LDCs with reference to the average performance for cost indicators. The cost indicators include: a) the number of full time equipments (FTEs)/kWh, b) average labor compensation, c) expenses/kWh, and d) expenses/customer. This cost indicator analysis is performed for Wires and Interconnection operating expenses, and for expenses for Administration. The test results of the Step 4 analysis (test) are as follows:

Wires and Interconnection Services, Operating Expenses

LDC Identification Number	FTE per MWh Served	Average Employee Compensation	FTEs per Customer	Annual Operating Expenses per kWh Served	Annual Operating Expenses per Customer
120	0.000186	72855	0.0022	0.0150	181.9
123	0.000046	86072	0.0018	0.0017	66.7
Average Across All LDCs	0.000086	63197	0.0019	0.0036	78.4

Administration Expenses

LDC Identification Number	FTE per MWh Served	Average Employee Compensation	FTEs per Customer	Annual Operating Expenses per kWh Served	Annual Operating Expenses per Customer
10	0.000033	78914	0.0013	0.0003	11.5
78	0.000220	73638	0.0041	0.0073	136.8
Average Across All LDCs	0.000096	62994	0.0021	0.0035	78.0

Here, we demonstrate a comparison of cost indicators (Comparative Diagnostics) for operating expenses. For Wires and Interconnection Service, LDC 120 has a comparatively high level for the cost indicator *FTE/kWh*, whereas LDC 123 is comparatively low, with reference to all LDCs in the panel. However, the cost indicator *compensation per employee* for both the selected LDCs is above that of the panel. We observe a similar pattern for Administration Expenses.

This Step 4 test demonstrates that for various cost indicators (Comparative Diagnostics), comparisons can be performed and are useful. However, the test reveals that not necessarily does a high cost indicator, which are narrow definitions of cost, reveal high costs for cost area (*e.g.,* operating expenses) or the unbundled service as a whole.

CONCLUSIONS

This study of the Comparators and Cohorts began by gaining an understanding of historical background regarding the institutional context and market reform path of the Province of Ontario. This understanding has been deepened considerably by participation in discussions with the Comparators and Cohorts stakeholder group. We have gathered the LDC reported data for 2002 and 2003, and used this data in a Proof of Concept test of the feasibility of the Comparators and Cohorts mechanism. Our study results, as reported herewith, are accompanied with a definition of the LDC reporting requirements.

In total, the analyses of our proof of concept trial suggest that plausible explanatory relationships exist among the data panel for the LDCs. We have found that significant relationships exist among the reported information, though considerable data inconsistencies exist. Our studies lead us to find that the Comparators and Cohorts mechanism is feasible for the task as described, and can be developed and implemented to practical advantage to the Ontario Energy Board, its staff, and the LDCs as whole. However, we caution that complete and unambiguous data, as reported, is necessary in order for the Comparators and Cohorts mechanism to achieve its full advantage in facilitating the gains in efficiency of the regulatory process.

The report identifies the information needs for the Comparators and Cohorts mechanism in the report section entitled *LDC Reporting Requirements*. It is our intention that, once this information has been received by the Board, it will be compiled, formatted, and then used to determine Comparators and Cohorts, for use by Board staff to help assess the LDC rate applications.

FINDINGS AND RECOMMENDATIONS

We summarize the findings of our study and offer the following recommendations for consideration by the Board.

The Comparators and Cohorts mechanism, for purposes of highlighting cost anomalies within the LDC rate applications within the 2006 EDR, is viable. We have been successful in finding statistically significant relationships between cost indicators and cost drivers. While the 2002–2003 LDC panel data are limited both by inconsistency in reported information and by data omissions, and limited in the range of information, it is clear that underlying relationships exist and indeed have been discovered in the exploratory proof of concept analyses presented herewith.

The Board should pursue development of the Comparators and Cohorts to assist Board Staff in the processing of LDC rate applications. Should the Board and its Staff pursue the development of Comparators and Cohorts for application in the 2006 EDR, it is necessary that specific data and information elements be provided by the LDCs. The reporting requirements are defined in the body of the report.

LDC costs should be organized and reported for unbundled distribution services, and the Comparators and Cohorts mechanism, should it be pursued, should be implemented for each service, Unbundled services include Wires and Interconnection Service, Settlements (billing and collections), and Customer Service categories. Organizing the costs of distribution in terms of these unbundled services will be necessary to gauge LDC performance and to identify the costs of possibly expanded customer service activities of the LDCs in the future.

The data and information as currently filed are incomplete and inaccurate, and need to be augmented with key data. The supplemental data should be filed by the LDCs in coordination with their rate applications. The data must be accurate. Currently, the reported data appear to contain considerable noise, though it has not seriously impaired the success of the Proof of Concept test and we have sufficient confidence that the Comparators and Cohorts mechanism is indeed feasible. The overall objective of course is to streamline the overall regulatory process and improve efficiency of regulation. And while it is necessary to augment the data as filed, the requested data as listed and discussed within the body of this report does not appear to be burdensome for the LDCs.

Exhibit 1

List of Variables In Data Panel

Number of part -time employees
Number of full time equivalent employees
Wages
Salaries
Benefits
Wages for line crews beginning of period
Date for change in line crew wages
Wages for line crews end of period
Labor Capitalized
Gross assets
Accumulated depreciation
Amortization
Capital additions - total
Capital additions – labor
Capital additions in overheads
Capital additions - equipment
Capital additions - other
Retirements
Capital Total
Operations expense total
Operations expense labor
Billing expense total
Billing expense labor
Admin expense total
Admin expense labor
Wholesale revenues
kWh Wholesale
kWh Retail
kWh losses
Customers total – revised
Customer total
Customers residential
Customers general service
Customer large
Customer street lighting – revised
Customer street lighting
Customers sentinel lighting
kWh total
kWh residential customers
kWh general service customers
kWh large customers
kWh street lighting customers

Exhibit 1 (continued)

List of Variables In Data Panel

kWh sentinel lighting customers
Demand total
Demand residential customers
Demand general service customers
Demand large customers
Demand street lighting customers
Demand sentinel lighting customers
Revenue total
Revenue residential customers
Revenue general service customers
Revenue large customers
Revenue street lighting customers
Revenue sentinel lighting customers
Area served total
Area served rural
Area served urban
Population of service area
Population municipal
Population seasonal
Maximum demand annual
Maximum demand winter
Maximum demand summer
Average load
Average load factor
Kilometers of distribution line
Kilometers of distribution line overhead
Kilometers of distribution line underground
Kilometers of distribution line 3 phase
Kilometers of distribution line 2 phase
Kilometers of distribution line 1 phase
Transformers at transmission level - revised
Transformers at transmission level
Transformers at sub-transmission level
Transformers at distribution level
Net Assets
Share of distribution lines that are underground
Total customer per kilometer of single phase distribution line
Capital per unit of maximum annual demand
Transformers total
Share of total transformers at the transmission level
Density of customers per kilometer of total distribution line
Total compensation divided by number of FTE employees

Exhibit 1 (continued)

List of Variables In Data Panel

Number of customers per transformer at the distribution level
Accumulated depreciation per unit of gross assets
Presence of a control center
Operations expense per unit of gross assets
Total customers weighted residential weight =1, gs customers =3 and large customers=30
Operations and billing expense total
Accumulated depreciation squared
Depreciation squared
Average Energy
Share of Urban Population/Total Population
Share of municipal
Kilometers of conductor * Annual Peak Demand

Exhibit 2

Results of Regression Analysis

Wires & Interconnection Service

Dependent Variable and Comparator: Gross Assets

Summary Statistics	
Number of obs	164
F(6, 157)	1417.14
Prob > F	0
R-squared	0.9819
Adj R-squared	0.9812
Root MSE	1.70E+07

Model - Linear

Variable	Coefficient	Standard Error	t value
Total Transformers	8927	1046	8.53
Kilometers of 3 Phase Service	33392	1861	17.94
Total Customers	918	137	6.72
Share of distribution lines underground	47700000	8257081	5.78
Share of Transformers at Transmission level	17600000000	4250000000	4.14
Density of Customer per Kilometer of Phase 1 Line	-10950	5546	-1.97
Constant	-16800000	2625800	-6.39

Dependent Variable and Comparator: Gross Assets

Summary Statistics	
Number of obs	161
F(6, 157)	487.380
Prob > F	0.000
R-squared	0.950
Adj R-squared	0.948
Root MSE	0.368

Model – Double Log

Variable	Coefficient	Standard Error	t value
Total Transformers	0.033	0.045	0.732
Kilometers of 3 Phase Service	0.450	0.071	6.379
Total Customers	0.601	0.090	6.639
Share of distribution lines underground	0.069	0.040	1.725
Share of Transformers at Transmission level	0.018	0.007	2.688
Density of Customer per Kilometer of Phase 1 Line	-0.066	0.047	-1.412
Constant	9.579	0.504	18.996

Exhibit 2 (continued)

Results of Regression Analysis

Wires & Interconnection Service

Dependent Variable and Comparator: Operations Expense

Summary Statistics

Number of obs	152
F(6, 157)	1317.200
Prob > F	0.000
R-squared	0.982
Adj R-squared	0.981
Root MSE	800,000

Model - Linear

Variable	Coefficient	Standard Error	t value
Total Customers	54.05389	6.4933	8.325
Total Transformers	464.32	49.7956	9.325
Gross Assets	-0.014783	0.0020735	-7.129
Share of distribution lines underground	-910106.7	419042.4	-2.172
Average Compensation	10.43038	4.518839	2.308
Accumulated Depreciation Squared	1.30E-11	2.24E-12	5.824
Constant	-533656.5	290810.5	-1.835

Exhibit 2 (continued)

Results of Regression Analysis

Settlements
Dependent Variable and Comparator: Expenses of Billings and Collections

Summary Statistics	
Number of obs	171
F(6, 157)	298.090
Prob > F	0.000
R-squared	0.843
Adj R-squared	0.840
Root MSE	1700000

Model - Linear

Variable	Coefficient	Standard Error	t value
Share Urban	-335774.400	352181.900	-0.953
Population	6.230	4.235	1.471
General Service Customers	220.746	133.743	1.651
Constant	203796.100	299442.600	0.681

Administration

Dependent Variable and Comparator: Administrative Expenses

Summary Statistics	
Number of obs	169
F(6, 157)	382.620
Prob > F	0.000
R-squared	0.874
Adj R-squared	0.872
Root MSE	0.483

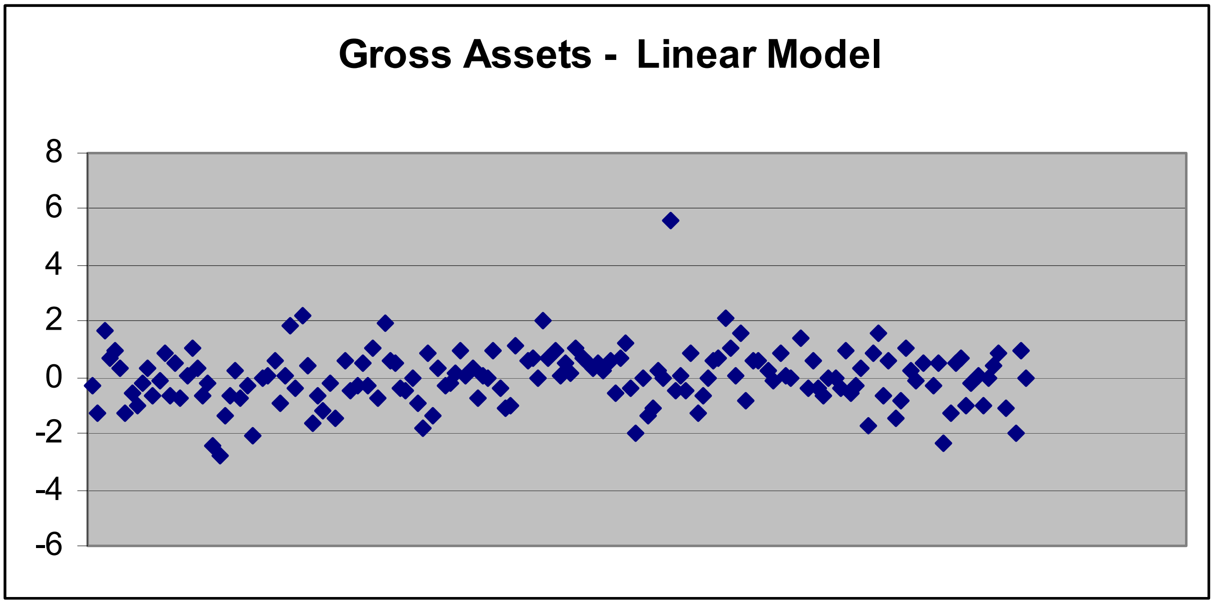
Model – Double Log

Variable	Coefficient	Standard Error	t value
Gross Assets	0.411	0.077	5.343
Operations Expense	0.244	0.083	2.934
Billing Expense	0.137	0.079	1.727
Constant	1.588	0.403	3.939

Exhibit 3

Plot of Standardized Residuals of Regression Equations

Wires & Interconnection Service



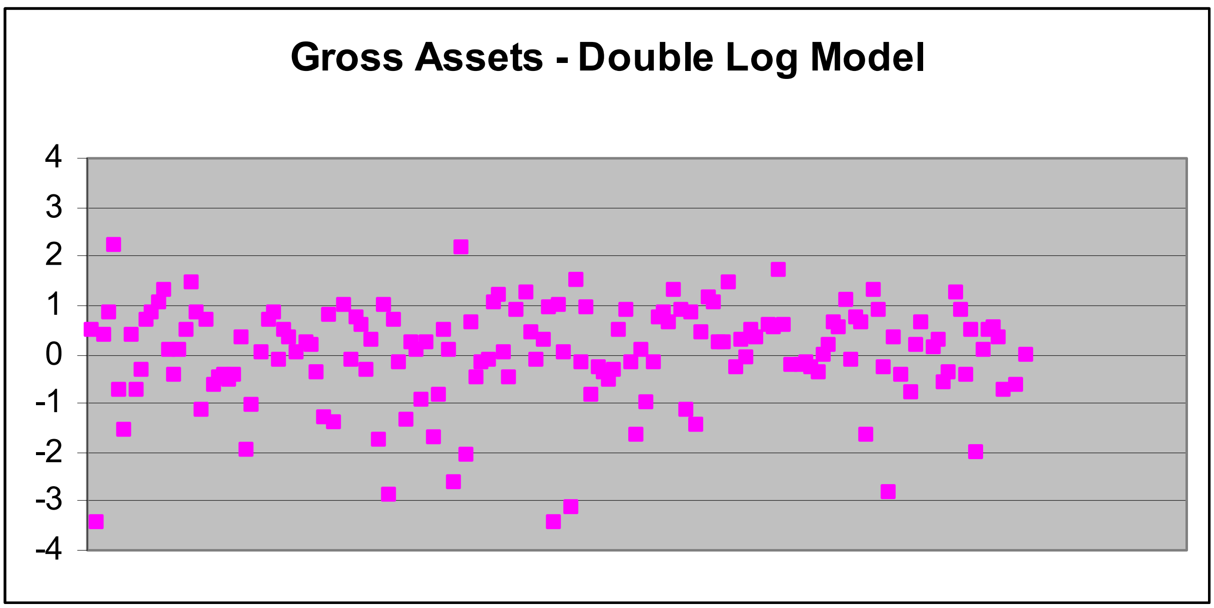
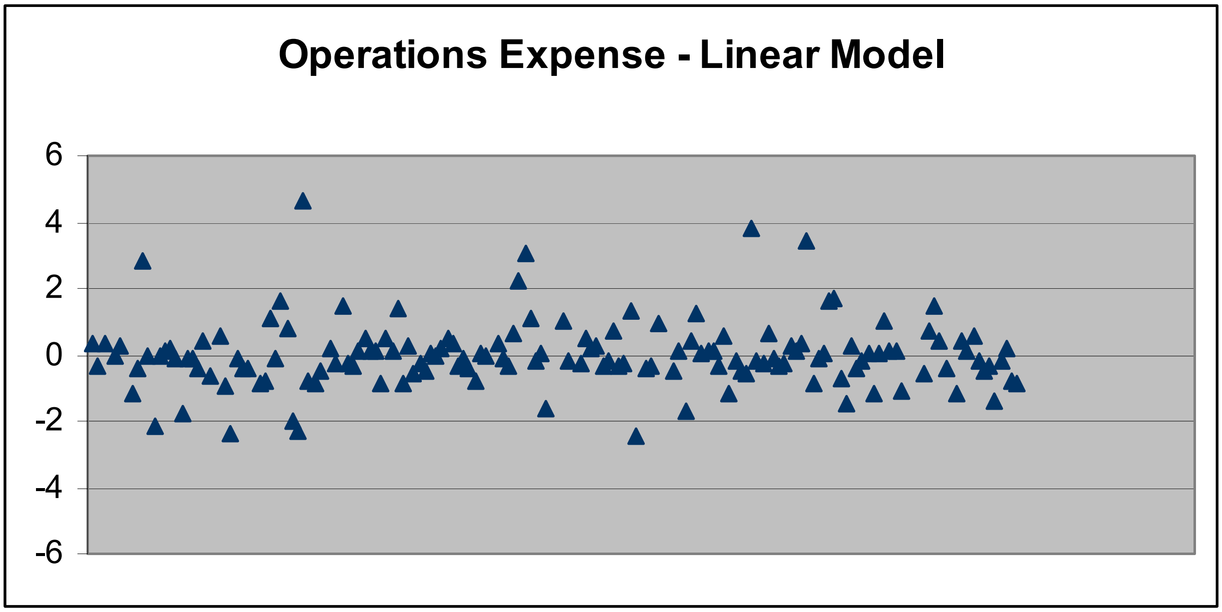


Exhibit 3 (continued)

Plot of Standardized Residuals of Regression Equations

Wires & Interconnection Service



Settlements

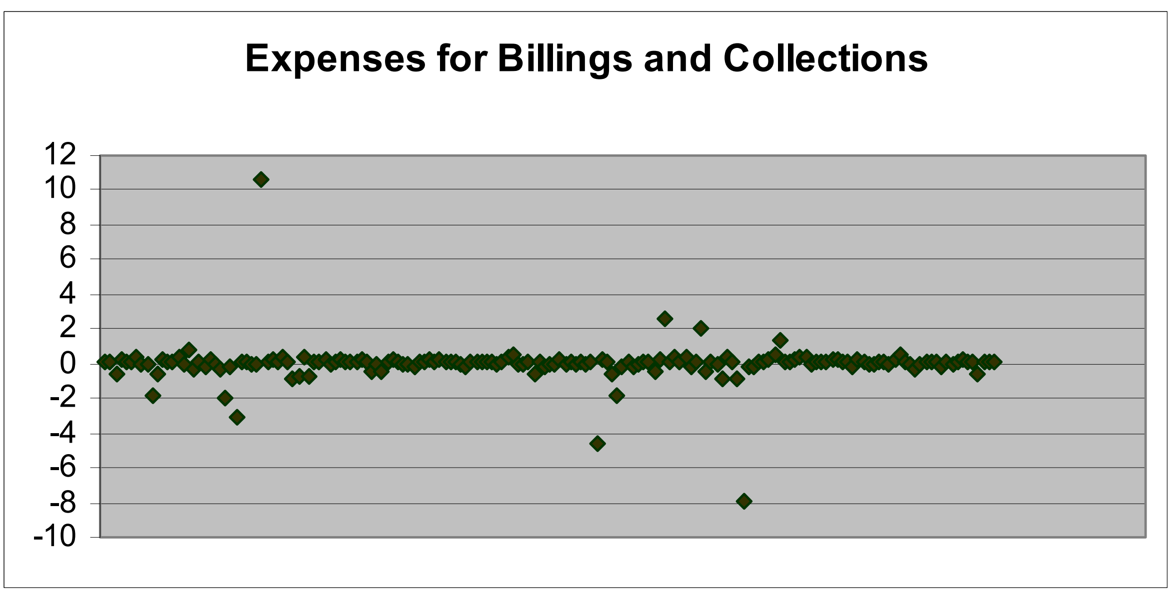


Exhibit 3 (continued)

Plot of Standardized Residuals of Regression Equations

Administration

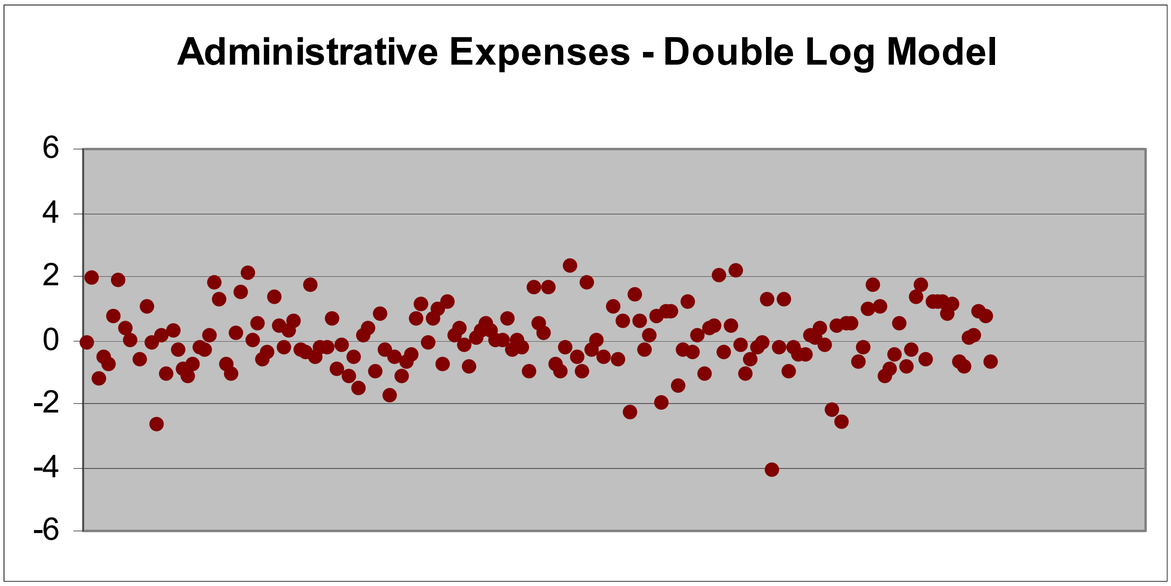


Exhibit 4

Cohorts Determined with Cluster Analysis

Wires & Interconnection Service

Gross Assets – 4 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	145	84.8	88.4	88.4
	2	11	6.4	6.7	95.1
	3	6	3.5	3.7	98.8
	4	2	1.2	1.2	100
	Total	164	95.9	100	
	Missing	7	4.1		
Total		171	100		

Gross Assets – 10 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	103	60.2	62.8	62.8
	2	6	3.5	3.7	66.5
	3	4	2.3	2.4	68.9
	4	4	2.3	2.4	71.3
	5	2	1.2	1.2	72.6
	6	4	2.3	2.4	75
	7	24	14	14.6	89.6
	8	2	1.2	1.2	90.9
	9	14	8.2	8.5	99.4
	10	1	0.6	0.6	100
	Total	164	95.9	100	
	Missing	7	4.1		
Total		171	100		

Exhibit 4 (continued)

Cohorts Determined with Cluster Analysis

Wires & Interconnection Service

Operations Expense – 4 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	146	85.4	96.1	96.1
	2	4	2.3	2.6	98.7
	3	1	0.6	0.7	99.3
	4	1	0.6	0.7	100
	Total	152	88.9	100	
	Missing	19	11.1		
Total		171	100		

Operations Expense – 10 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	131	76.6	86.2	86.2
	2	11	6.4	7.2	93.4
	3	2	1.2	1.3	94.7
	4	1	0.6	0.7	95.4
	5	1	0.6	0.7	96.1
	6	1	0.6	0.7	96.7
	7	1	0.6	0.7	97.4
	8	2	1.2	1.3	98.7
	9	1	0.6	0.7	99.3
	10	1	0.6	0.7	100
	Total	152	88.9	100	
	Missing	19	11.1		
Total		171	100		

Exhibit 4 (continued)

Cohorts Determined with Cluster Analysis

Settlements

Expenses for Billing and Collections – 4 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	149	87.1	87.1	87.1
	2	16	9.4	9.4	96.5
	3	4	2.3	2.3	98.8
	4	2	1.2	1.2	100
	Total	171	100	100	
Total		171	100		

Settlements (Billing and Collections) - 10 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	110	64.3	64.3	64.3
	2	8	4.7	4.7	69
	3	15	8.8	8.8	77.8
	4	2	1.2	1.2	78.9
	5	4	2.3	2.3	81.3
	6	2	1.2	1.2	82.5
	7	24	14	14	96.5
	8	2	1.2	1.2	97.7
	9	2	1.2	1.2	98.8
	10	2	1.2	1.2	100
	Total	171	100	100	
Total		171	100		

Exhibit 4 (continued)

Cohorts Determined with Cluster Analysis

Administration

Administrative Expenses – 4 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	161	94.2	94.2	94.2
	2	4	2.3	2.3	96.5
	3	4	2.3	2.3	98.8
	4	2	1.2	1.2	100
	Total	171	100	100	
Total		171	100		

Administrative Expenses – 10 Cluster Solution

		# of LDCs	Percent	Valid Percent	Cumulative Percent
Cohort	1	100	58.5	58.5	58.5
	2	5	2.9	2.9	61.4
	3	33	19.3	19.3	80.7
	4	18	10.5	10.5	91.2
	5	5	2.9	2.9	94.2
	6	3	1.8	1.8	95.9
	7	2	1.2	1.2	97.1
	8	2	1.2	1.2	98.2
	9	2	1.2	1.2	99.4
	10	1	0.6	0.6	100
	Total	171	100	100	
Total		171	100		

Exhibit 5

Distribution of Extreme Residuals, by Cohort

<u>Wires & Interconnection Service:</u> Gross Assets

<u>Gross Assets – Linear Model</u>

Cohort	# of Extreme Residuals	# of LDCs
1	5	145
2	3	11
3		6
4	1	2
	9	164

<u>Gross Assets – Linear Model</u>

Cohort	# of Extreme Residuals	# of LDCs
1	1	103
2	2	6
3		4
4		4
5		2
6		4
7	4	24
8	1	2
9		14
10	1	1
	9	164

Exhibit 5 (continued)

Distribution of Extreme Residuals, by Cohort

Wires & Interconnection Service: Gross Assets Double Log Model

Gross Assets – Double Log Model

Cohort	# of Extreme Residuals	# of LDCs
1	14	145
2		11
3		6
4		2
	14	164

Gross Assets – Double Log Model

Cohort	# of Extreme Residuals	# of LDCs
1	13	103
2		6
3		4
4		4
5		2
6		4
7	1	24
8		2
9		14
10		1
	14	164

Exhibit 5 (continued)

Distribution of Extreme Residuals, by Cohort

Wires & Interconnection Service: Operating Expenses

Operations – Linear Model

Cohort	# of Extreme Residuals	# of LDCs
1	23	145
2	4	11
3	1	6
4	1	2
	29	164

Operations – Linear Model

Cohort	# of Extreme Residuals	# of LDCs
1	13	103
2	1	6
3	3	4
4		4
5		2
6	1	4
7	10	24
8	1	2
9		14
10		1
	29	164

Exhibit 5 (continued)

Distribution of Extreme Residuals, by Cohort

Settlements: Expenses for Billings and Collections

Settlements – Linear Model

Cohort	# of Extreme Residuals	# of LDCs
1		145
2	1	11
3	3	6
4	1	2
	5	164

Settlements – Linear Model

Cohort	# of Extreme Residuals	# of LDCs
1		103
2		6
3	1	4
4		4
5		2
6	3	4
7		24
8	1	2
9		14
10		1
	5	164

Exhibit 5 (continued)

Distribution of Extreme Residuals, by Cohort

<u>Administration:</u> Administrative Expenses

<u>Admin. Expense – Double Log Model</u>

Cohort	# of Extreme Residuals	# of LDCs
1	7	145
2	2	11
3		6
4	1	2
	10	164

<u>Admin. Expense – Double Log Model</u>

Cohort	# of Extreme Residuals	# of LDCs
1	4	103
2		6
3	2	4
4		4
5		2
6		4
7	2	24
8	1	2
9	1	14
10		1
	10	164

Exhibit 6

LDC Reporting of Assets, U.S.

Account	Balance Beginning of Year	Additions	Balance at End of Year**
Wire & Interconnection Service			
(360) Land and Land Rights	15,905,014	688,187	16,565,134
(361) Structures and Improvements	20,624,832	592,790	21,169,669
(362) Station Equipment	243,181,116	22,114,155	262,398,058
(363) Storage Battery Equipment			
(364) Poles, Towers, and Fixtures	261,027,983	14,016,822	272,151,683
(365) Overhead Conductors and Devices	389,333,549	48,976,510	435,613,506
(366) Underground Conduit	121,660,586	3,963,399	125,612,829
(367) Underground Conductors and Devices	744,199,222	40,532,924	781,372,290
(368) Line Transformers	363,827,811	18,715,523	380,627,230
(369) Services*	151,322,421	7,520,330	158,133,892
(370) Meters*	95,688,123	18,363,534	108,476,317
(371) Installations on Customer Premises	9,801,435	302,395	9,810,285
(372) Leased Property on Customer Premises	20,640		16,683
(373) Street Lighting and Signal Systems	16,179,637	907,078	16,897,853
(374) Asset Retirement Costs for Distribution Plant			
TOTAL Distribution Plant	2,432,772,369	176,693,647	2,588,865,429
General Plant			
(389) Land and Land Rights	1,531,813	9,776	1,541,588
(390) Structures and Improvements	20,443,001	1,516,732	21,949,658
(391) Office Furniture and Equipment	2,612,064	4,504	2,630,316
(392) Transportation Equipment	70,155,110	7,907,489	71,464,238
(393) Stores Equipment			
(394) Tools, Shop and Garage Equipment			
(395) Laboratory Equipment	7,775,279	27,821	7,807,636
(396) Power Operated Equipment	7,653,626	86,165	6,617,881
(397) Communication Equipment	912,431	39,508	951,937
(398) Miscellaneous Equipment			
TOTAL	111,083,324	9,591,995	112,960,254

*Assets associated with Settlements (Billings and Collections).

**Year End Balances reflect retirement and account transfers not shown.

Exhibit 6 (continued)

LDC Reporting of Expenses, U.S.

Account	Amount for Current Year	Amount for Previous Year
<u>Wire & Interconnection Service</u>		
Operation		
(580) Operation Supervision and Engineering	2,657,523	190,512
(581) Load Dispatching	6,277,060	5,583,013
(582) Station Expenses	1,609,904	1,748,068
(583) Overhead Line Expenses	5,765,475	5,868,068
(584) Underground Line Expenses	2,403,444	2,333,833
(585) Street Lighting and Signal System Expenses	1,115,559	1,061,358
(589) Rents	45,635	45,616
(588) Miscellaneous Expenses	9,039,255	10,295,841
TOTAL Operation	28,913,855	27,126,309
Maintenance		
(590) Maintenance Supervision and Engineering	40,539	90,004
(591) Maintenance of Structures	238,902	309,781
(592) Maintenance of Station Equipment	5,397,826	5,302,279
(593) Maintenance of Overhead Lines	28,446,829	30,296,072
(594) Maintenance of Underground Lines	3,289,468	3,273,778
(595) Maintenance of Line Transformers	368,014	-156
(596) Maintenance of Street Lighting and Signal Systems	1,106,958	1,049,944
(598) Maintenance of Miscellaneous Distribution Plant	6,001	24,681
TOTAL Maintenance	38,894,537	40,346,383
TOTAL Wire & Interconnection Service	67,808,392	67,472,692

Account	Amount for Current Year	Amount for Previous Year
<u>Settlements</u>		
Operation		
(901) Supervision	391,578	560,269
(902) Meter Reading Expenses	6,528,563	5,984,192
(903) Customer Records and Collection Expenses	15,578,101	14,335,573
(904) Uncollectible Accounts	11,484,879	17,806,381
(905) Miscellaneous Customer Accounts Expenses	114,372	99,625
(586) Meter Expenses	4,499,069	3,764,332
(587) Customer Installations Expenses	116,253	20,873
(597) Maintenance of Meters		
TOTAL Settlements	38,712,815	42,571,245

Exhibit 6 (continued)

LDC Reporting of
Expenses, U.S.

Account	Amount for Current Year	Amount for Previous Year
<u>Customer Service Expenses</u>		
Operation		
(907) Supervision	517,714	490,695
(908) Customer Assistance Expenses	32,140,484	29,778,399
(909) Informational and Instructional Expenses	3,980,901	5,909,371
(910) Miscellaneous Customer Service and Information Exp	86,591	166,463
(912) Demonstrating and Selling Expenses		
(913) Advertising Expenses		11,240
(916) Miscellaneous Sales Expenses		
TOTAL Cust. Service and Sales Expenses	36,725,690	36,356,168

Exhibit 6 (continued)

LDC Reporting of Expenses, U.S.

Account	Amount for Current Year	Amount for Previous Year
Administration and General Expenses		
Operation		
(920) Administrative and General Salaries	48,564,692	56,498,863
(921) Office Supplies and Expenses	26,100,192	28,959,571
(less) (922) Administrative Expenses Transferred-Credit	7,029,888	19,760,411
(923) Outside Services Employed	11,648,071	8,797,953
(924) Property Insurance	1,741,423	-643,608
(925) Injuries and Damages	-6,170,773	18,408,821
(926) Employee Pensions and Benefits	83,188,173	54,338,306
(927) Franchise Requirements		
(928) Regulatory Commission Expenses	3,790,913	2,460,241
(929) (Less) Duplicate Charges-Cr.	2,362,721	2,420,347
(930.1) General Advertising Expenses	113,377	52,935
(930.2) Miscellaneous General Expenses	10,293,546	7,884,006
(931) Rents	500	4,889
TOTAL Operation	169,877,505	154,581,219
Maintenance		
(935) Maintenance of General Plant	3,235,362	2,300,552
TOTAL Administration and General Expenses	173,112,867	156,881,771
TOTAL Elec Op and Maint Expn	1,245,805,424	1,118,824,617