ComEd Ex. 1.0

STATE OF ILLINOIS

ILLINOIS COMMERCE COMMISSION

COMMONWEALTH EDISON COMPANY	:	
	:	
Application of Commonwealth Edison Company for a Certificate of Public Convenience and Necessity, pursuant to Section 8-406 of the Act, to install, operate and maintain a new 138,000 kilovolt electric transmission line and a new substation in Will and Cook Counties, Illinois.	: : : : : :	No. 12-

Direct Testimony of

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Distribution Capacity Planning Department

Commonwealth Edison Company

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I. Executive Summary and Introduction

A. Identification of Witness

Q. **Please state your name and business address.**

A. My name is Frank A. Luedtke, P.E. My business address is Three Lincoln Centre, Oakbrook Terrace, Illinois 60181.

Q. **By whom and in what position are you employed?**

A. I am employed by Commonwealth Edison Company ("ComEd") as Manager, Regional Capacity Planning in the Distribution Capacity Planning Department.

B. Purpose of Testimony

Q. **What is the purpose of your testimony?**

A. My testimony addresses the transmission and distribution planning associated with the project to increase area capacity and distribution circuit reliability to southwest communities, primarily the City of Lockport, ("Lockport") and the Villages of Homer Glen ("Homer Glen") and New Lenox ("New Lenox"), along the southern extension of Interstate 355 ("I-355"), also known as Veterans Memorial Tollway. I also explain that without this system reinforcement, the existing electrical supply system in this area will suffer a number of overload conditions as early as 2014. Finally, I discuss how ComEd determined how best to meet the need for the proposed project in a manner that will ensure adequate, efficient, and reliable electric service at the least cost.

C. Summary of Testimony

Q. **Would you please summarize your conclusions in this testimony?**

A. My conclusion is that the best method to provide additional electrical capacity for the long-term needs in this study area would be to build a new 138 -12.5 kV substation, tentatively called Veterans Substation, along with the 138 kV transmission line to connect the substation to the existing 138 kV system.

D. Background and Qualifications

Q. What are your duties as Manager Regional Capacity Planning?

A. I am responsible for supervising the day-to-day activities along with providing technical support and direction to a group of professional engineers and planners who are responsible for the evaluation and planning of modifications, reinforcements, upgrades, and expansions to ComEd's distribution network and to the portions of ComEd's transmission system which supply it. This process includes the analysis of reported and forecast loads on various portions of ComEd's system including both transmission substations and the transmission-distribution centers and distribution centers that supply electricity to the lower-voltage distribution system in order to assess whether there is, or will be, a need to add to or change the system in order to better serve our customers. I have held this position since 2007.

Q. What other professional experience do you have?

A. Prior to becoming Manager Regional Capacity Planning, I was a Consulting Engineer from 2001 to 2007. As a Consulting Engineer, I was assigned to major projects or initiatives, to manage and lead the engineers involved in planning enhancements to ComEd's system for increased capacity and reliability. During this time, I was named acting Planning Manager for ComEd's Southern Region Distribution Planning group.

From 2004 through 2006, I was the acting Capacity Planning Manager for ComEd's Chicago Region. Prior to becoming a Consulting Engineer, I was a Substation Planning manager from 1998 to 2001. I supervised and managed the planning of substation projects, which included managing the professional engineers and planners responsible for the evaluation and planning of modifications, reinforcements, upgrades, and expansions to ComEd's distribution network and to the portions of ComEd's transmission system which supply it, system-wide. That process included the analysis of reported and forecast loads on various portions of ComEd's system including both transmission substations and the transmission-distribution centers and distribution centers that supply electricity to the lower-voltage distribution system in order to assess whether there is, or will be, a need to add to or change the system in order to better serve our customers.

I have also been a Regional Planning Supervisor for four of ComEd's regions. I also held positions as a substation planner, an area engineer, a district engineer, a distribution feeder planner, and a field engineer. During my over 29-year career at ComEd, all of my work has been in the transmission and distribution area, mostly in planning and design engineering. Altogether, I have approximately 23 years of experience in the planning of transmission and distribution facilities.

Q. **What experience do you have with the design and construction of electrical transmission and distribution systems?**

A. For a number of years, I have been involved on a day-to-day basis with the evaluation, planning, design, and construction of many components of ComEd's system, including numerous 138 kV lines. I have analyzed many actual and proposed 138 kV systems, including lines and substations, and have designed and planned many of ComEd's 138 kV lines now in operation. I have also been involved with, and supervised, the planning, design, and construction of a wide variety of distribution lines and systems.

Q. **What is your education background?**

A. I have a Bachelor's Degree in Electrical Engineering from the Massachusetts Institute of Technology, and a Master's Degree in Electrical Engineering from the University of Illinois at Urbana-Champaign.

Q. **Are you a Licensed Professional Engineer?**

A. Yes, I have been licensed in Illinois since 1988.

Q. **Do you participate in any electric power engineering groups?**

A. Yes, I am a member of the Power and Energy Society of the Institute of Electrical and Electronics Engineers.

E. Itemized Attachments to Testimony

Q. **Do you have any exhibits attached to your testimony?**

A. Yes. The following exhibits are attached to my testimony:

- ComEd Exhibit ("Ex.") 1.01 is ComEd's Electric Distribution Capacity Planning Guidelines;
- ComEd Ex. 1.02 is the map of the study area including existing 138 kV and 34 kV facilities;
- ComEd Ex. 1.03 is the map of the service areas of substations in 2012;
- ComEd Ex. 1.04 is the estimated peak load growth in the study area;

- ComEd Ex. 1.05 is the map of the service areas of substations in 2030;
- ComEd Ex. 1.06 is one line diagram of the 34 kV Alternative project;
- ComEd Ex. 1.07 is the spreadsheet of new facility details and costs for proposed 138 kV project;
- ComEd Ex. 1.08 is the spreadsheet of new facility details for 34 kV Alternative project;
- ComEd Ex. 1.09 is the spreadsheet of new facility details and costs for the proposed 138 kV plan (50% load growth scenario);
- ComEd Ex. 1.10 is the spreadsheet of new facility details for 34 kV Alternative project (50% load growth scenario); and

II. <u>ComEd's Petition</u>

Q. **Are you familiar with the Petition filed in this proceeding?**

A. Yes.

Q. **How have you become familiar with the Petition?**

A. The department in which I work, the Distribution Capacity Planning Department, is responsible for monitoring ComEd's distribution system and the transmission facilities that supply it, in order to determine when new or reinforced facilities are required in order to maintain adequate, efficient, and reliable service. Engineers and planners working with me on this project are also responsible for analyzing alternative ways of meeting that need.

Q. **Please briefly describe what ComEd is proposing to construct.**

A. The proposed project includes the installation of a 138 kilovolt ("kV") transmission line, approximately 4.8 miles in length, extending from just north of 135^{th} Street and I-355 near Lemont, Illinois to 167th Street and I-355 in Lockport, Illinois, where Veterans Substation will be installed.

III. ComEd's Transmission and Distribution System

Q. Please explain the role of ComEd's transmission and distribution system in delivering electrical power to customers.

A. ComEd distribution system customers receive electricity from a variety of generation sources, which is delivered through the transmission and distribution system at the voltage and the quantity required. A network of 765, 345 and 138 kV transmission-voltage lines form the backbone of ComEd's transmission system. These lines move "bulk" power from the various sources of supply to the areas of ComEd's service territory where customer demand exists. They are the most reliable form of power line, as well as the most electrically efficient. They are capable of moving power with little energy loss or voltage drop. These transmission-voltage lines, in turn, supply power to various types of substations or centers. At these facilities the power is converted by a transformer, or "stepped down," from transmission voltages to the lower voltages used for distribution to ComEd's customers. In some cases the voltage is stepped down directly from transmission voltages to the voltages (typically 12.5 kV, but in some cases 4 kV) used for local distribution lines or "feeders." Alternatively, the voltage may first be stepped down to an intermediate level, typically 69 kV in Chicago and Rockford, and 34 kV elsewhere, for further distribution to other substations, where the voltage is either stepped down to supply the local distribution lines, or supplied directly to large customers. Once stepped-down to distribution voltages, electricity is delivered, or "distributed," to customer transformers through the distribution system. This system consists of distribution lines, transformers, switches, breakers, and other electrical equipment that ComEd uses to deliver power from the various substations to the customer. Distribution lines are the most limited in both length and capacity, and generally have the highest losses.

Q. **What factors must be considered in operating and maintaining an adequate, efficient, and reliable transmission and distribution system?**

A. A transmission and distribution plan must provide capacity to meet projected needs, under both normal and appropriate and foreseeable outage (or "contingency") conditions. Effects on the existing system must be considered. ComEd has developed planning guidelines which assure that its system can adequately respond to outages. For example, the system must be able to continue to serve customers if a single line or substation transformer fails. A level of reliability must be maintained appropriate to the number of customers at risk to possible system failures, balanced by providing service at a reasonable cost. The plan should avoid equipment damage and lengthy, widespread service outages in case events more severe than planned occur. ComEd has developed planning guidelines which assure that its system can adequately respond to unplanned and planned outages. A suitably robust plan should also consider long-range, area-wide requirements for system operation and future growth. It should be adaptable, with a minimum of wasted effort, to changed conditions such as load levels or load locations, without requiring costly and time-consuming acquisition of new substation sites or line rights-of way.

Q. **How do you determine that a plan has the capacity to meet the projected needs with required voltage levels?**

A. This requires an engineering evaluation of the system as a whole as well as critical individual system components (transformers, lines, switchgear), under both system normal and contingency conditions. Each component of a feasible plan must be able to operate at projected peak loads, under both system normal conditions and under outage contingency conditions. Apart from providing adequate capacity to transmit and distribute power, the system must also maintain adequate voltage levels at supply points. Determining the ability of a system to meet capacity and voltage requirements requires technical studies of the capability of each critical component under varying load flows corresponding to normal operation and to the various contingency conditions.

Q. **You mention that ComEd has developed planning guidelines. Has ComEd adopted any of this methodology as a specific set of principles?**

A. Yes. These principles are set forth in a document called "Electric Distribution Capacity Planning Guidelines," to which I will refer in my testimony as the Capacity Planning Guidelines. A copy is attached to my testimony as ComEd Ex. 1.01. These are guidelines adopted as best practices for use by ComEd.

IV. ComEd's Planning Methodology

Q. **Does your department regularly assess the adequacy of existing facilities to transmit and distribute power to customers?**

A. Yes.

Q. **How does it do that?**

A. ComEd constantly collects data on the load on various portions of its system, from which data ComEd identifies the yearly actual peak loads experienced by various components of ComEd's system, including substations and transmission and distribution lines. ComEd's planners also forecast the likely peak loads to be experienced in the future, at design weather conditions, over a time horizon which varies in length depending upon the portion of the system being studied. In arriving at these forecasts, ComEd's planners may take into account past growth, new development plans and other planned customer expansion (both publicly announced and known to ComEd's New Business and construction staff), and forecasts by consultants or local and regional governments. Planners within ComEd then analyze this data to determine where load is likely to place strain on the system. In the case of the distribution system and the portions of the transmission system that directly supply it, that function is performed by the Distribution Capacity Planning Department, of which I am a part. The system is evaluated under both current and forecasted peak load conditions. It is also evaluated under both normal operating conditions and under a variety of planning contingencies, which again vary with the type of equipment and its relationship to the system as a whole, such as the inevitable outages of facilities, whether planned or unplanned. These assessments permit ComEd to determine when, and to what extent, reinforcement of the system is needed.

Q. **What actions are taken based on such an assessment?**

A. When the data shows that an area requires supply reinforcement, ComEd employees in both the planning and design engineering areas identify feasible alternatives consistent with long-range plans and sound engineering and system planning practices. Depending on the size and nature of the need, there may be many alternatives or few alternatives which are technically feasible, legal, and potentially cost-effective. We then determine what option or options are consistent with our obligations to provide reliable service to our customers. If there is more than one such option, we assess reliability and cost advantages to the various alternatives, and select as the proposed plan the option that would provide adequate, efficient, and reliable service to customers at the least cost.

V. The Proposed Transmission Project

Q. **Has ComEd studied the electrical supply system in Will County?**

A. Yes.

Q. **What did the study show?**

A. There has been development of residential and commercial uses in Lockport, Homer Glen, and New Lenox in Will County. This development has led to an increase in the loading of substation transformers and feeder circuits to the point that service reliability will be compromised unless significant capacity additions are undertaken in the near future.

A. Study Area

Q. **Please describe the area that you studied.**

A. The study area is shown on ComEd Ex. 1.02 attached to my testimony. Geographically, the study area boundaries are roughly the Will County and Cook County line on the east, Farrell Road on the west, Interstate 80 ("I-80") on the south, and 151st Street on the north. This area is approximately a five mile by five mile square area.

Electrically, the study area includes the areas currently supplied by the southern part of the area served by Bell Road Transmission Distribution Center ("TDC") 416, the southwest part of the area served by Archer TDC 487 and northern part of the area served by New Lenox TDC 406. The study area also includes an area currently supplied by three 34 kV lines:

- Line 1863 supplying Bruce Road Distribution Center ("DC") J19
- Line 1865 supplying Gougar Road DC J49
- Line 0951 supplying Homer Township DC J62

Q. **Please identify ComEd Exhibits 1.02 and 1.03.**

A. ComEd Ex. 1.02, to which I referred above, is a map showing the 138 kV and 34 kV facilities currently existing in the study area. ComEd Ex. 1.03 depicts the approximate geographic coverage, or service area, of each of the existing substations in the study area.

Q. **How did you determine what areas to study?**

A. The I-355 extension was completed in late 2007 linking Interstate 55 ("I-55") with I-80. The route of this new highway was through a relatively undeveloped area which is surrounded by more densely developed suburban area. It is our expectation that there is a likelihood of higher growth in the area resulting from this highway extension.

B. <u>Existing Supply System</u>

Q. **What are the current facilities serving Lockport, Homer Glen, and New Lenox?**

A. There are 34 kV facilities coming from Will County Station 18 and South Joliet TDC 409. Will County Station 18 supplies two 34 kV lines, L1863 and L1865, into this area from the north. TDC 409 supplies one 34 kV line, L0951, from the south into the area.

These 34 kV lines supply three 34-12.5 kV distribution centers in the area: Homer Township DC J62, Gougar Road DC J49, and Bruce Road DC J19. Also in this area are 12.5 kV feeders from neighboring TDCs: Bell Road TDC 416, Archer Road TDC 487, and New Lenox TDC 406.

Q. **What expansion possibilities are there on the present system?**

A. Future expansion possibilities on the present system are limited due to Will County Station 18 being at its ultimate design capacity and the other facilities being a large distance from the anticipated load centers. The three DCs (Bell Road, Archer Road, and New Lenox) are not readily expandable.

Q. **Do the transformers in this area have cooling fans, or can those be added to increase their capacity?**

A. Yes, the transformers in the area already have cooling fans.

Q. **Do the transformers have automatic load tap changing equipment?**

A. Yes.

Q. **What loads has ComEd experienced in the study area in recent years?**

A. Table 1 shows the weather-adjusted peak system loads over the past three summers. For the existing substations supplied at 138 kV, the table shows relatively flat load growth. These substations serve an area that is considerably larger than our study area and includes many areas of little or no growth, including established cities. The 34 kV lines and 12.5 kV lines, which serve much more directly the study area, show loads that are growing.

Table 1

2009-2011 Weather-Adjusted Peak Area Loads (MVA)

Transmission Substations 138KV- 34KV (MVA)

Station	2009	2010	2011
409 South Joliet	108.1	107.4	107.7
18 Will County	94.1	93.9	97.7
Total	202.3	201.3	205.4

Transmission Distribution Centers 138KV- 12KV (MVA)

Station	2009	2010	2011
416 Bell Road	120.9	117.7	117.0
487 Archer	56.5	55.6	54.7
406 New Lenox	68.6	70.3	72.6
Total	245.9	243.7	244.3

34KV Lines (MVA)

Line	2009	2010	2011
L0951	27.9	26.0	26.1
L1863	17.9	26.0	23.5
L1865	24.4	30.2	29.7
Total	70.2	82.2	79.3

12KV Feeders (MVA)

Feeders	2009	2010	2011
J625	10.0	8.7	8.3
J495	7.2	5.5	5.1
J496	0.0	6.2	7.6
J196	6.5	6.6	7.7
J0631	0.0	0.0	4.4
J8774	8.1	8.5	8.6
J1679	7.6	7.5	7.7
J1681	7.2	7.3	7.7
J1683	8.1	8.2	8.3
J1684	9.8	10.0	8.1
Total	64.5	68.5	73.4

Q. **What do you mean by weather-adjusted peak loads?**

A. Weather-adjusted means that we have taken our actual loads, and multiplied them by appropriate factors to calculate what the load would be if we faced summer weather likely to occur one in every ten summers. We use these loads for analyzing facilities for planning purposes in accordance with Section 6.1.1 of our Capacity Planning Guidelines, ComEd Ex. 1.01.

C. <u>System Reinforcement Needs</u>

Q. **Please describe the need for reinforcement in the study area.**

A. As I mentioned above, absent reinforcement, the existing electrical supply system in the area we studied will suffer a number of overload conditions as early as 2014. These overloads are expected during normal conditions, when all equipment is in service, and also during emergency or contingency conditions, when a line or transformer is out of service.

Q. **What are the consequences of these overloads?**

A. These overloads will threaten ComEd's ability to continue to provide adequate and reliable service to customers in the study area, unless supply reinforcement is provided.

Q. **What steps has ComEd taken in recent years to avoid overload conditions?**

A. ComEd has undertaken the following recent reinforcements to the distribution system in the area:

- In 2010, a new 9375 kVA Transformer at Gougar Road DC J49 and new 12.5 kV feeder J496 were installed.
- In 2011, a new 12.5 kV feeder J0631 from New Lenox TDC 406 was installed.

Q. **To what extent can ComEd continue to expand the current system in the area?**

A. There is only so much we can do without an additional 138 kV source. Will County Station 18 is at its ultimate design capacity and the other sources supplied by 138 kV, South Joliet TDC 409 (supplies 34 kV) and TDCs 416, 406 and 487 (supply 12.5 kV), are all a greater distance away from the load center. In 2012, switching was performed to transfer load from Homer Township DC J62 and feeder J625 to Briggs Street TDC 474 feeder J7483 and to Joliet Substation 450 feeder J505. In 2013, installation of a 1200 kVAr capacitor is planned on feeder J496 from Gougar Road DC J49 and installation of a 1200 kVAr capacitor is planned on feeder J8774 from Archer Road TDC 487. However, these actions and the other recent reinforcement that I discussed earlier will not alleviate the overloads expected in 2014.

Q. **How does ComEd analyze its system for overloads?**

A. First, allowable substation ratings are determined using individual transformer normal and emergency ratings. We then compare those ratings to actual or expected loads, under system-normal (everything in operation) or contingency (one piece of equipment not in operation).

So, for this study area, which is served in part by 138 kV – 34 kV transformers and 34 kV lines, we check for overloads on each of those pieces of equipment under normal and contingency conditions. As to 34 kV – 12.5 kV transformers, we check for overloads during system normal conditions, but we do not check for overloads during contingency conditions on these lower voltage transformers two or more years in advance.

Q. What did you find as to 138 kV – 34 kV substations?

A. Absent construction of the proposed line and substation, Table 2 shows the projected loading in 2014 at each of the substations under contingency operating conditions.

Table 2

Component	Facility Equipment	Rating (MVA)	Load (MVA)	% Loading before Proposed Project
Will County Station 18	2-60 MVA TR's	103	109	106
Joliet South TDC409	2-60 MVA TR's	115	115	100

Q. Did you find overloads on 34 kV lines in the area?

A. Yes. 34 kV line L1865 will be overloaded under system normal conditions in 2014. Line L1863 will exceed the emergency ratings in the event of a single outage condition. Table 3 summarizes the 34 kV overloads under system normal conditions and Table 4 summarizes the 34 kV line overloads under contingency conditions.

Table 3

Component	Rating (MVA)	Load (MVA)	% Loading before Proposed Project
L1865	33	34	103

Table 4

Component	Contingency	Emergency Rating (MVA)	Load (MVA)	% of Rating
L1863	L1865 between DCJ49 & ESS J336	33	36	109

Q. **Please describe the loads on 34-12.5 kV transformers and the 12.5 kV TDC fed circuits in the study area that in 2014 will exceed allowable loading limits absent construction of the proposed line and substation.**

A. Under system normal conditions, loads on two 34-12.5 kV transformers and three TDC fed circuits that serve the study area will exceed allowable limits in 2014. Table 5 shows the loads on these 34-12.5 kV transformers and 12.5 kV TDC fed circuits under system normal conditions.

Table 5

Component	Rating (MVA)	Load (MVA)	% Loading before Proposed Project
DC J62 TR1	8.2	9.7	118
DC J49 TR2	8.2	9.4	115
J1683 (TDC416)	8.2	8.8	107
J1684(TDC 416)	8.2	8.7	106
J8774 (TDC487)	8.2	8.9	109

Q. **Please describe the significance of these overloads.**

A. The consequences of loading a transformer in excess of its allowable rating is to reduce its usable life, in some cases requiring its premature replacement, and to increase the risk of that transformer failing. In addition, a transformer overload can result in an immediate failure of the overloaded equipment or in increased susceptibility to later failure if the transformer is subjected to another stressful event, such as a lightning strike. Moreover, because of the loading levels in the study area, if a transformer is unavailable, system operators may be forced to delay restoration of service, and would potentially be forced to institute rolling blackouts, until the transformer was replaced or repaired, or until load was otherwise reduced. Transformer overload conditions and the resulting inability to take a transformer out of service limits ComEd's ability to conduct required maintenance.

An overload of an overhead line causes the conductor to heat up and sag, often resulting in an unacceptable distance from the conductor to lower conductors or nearby public or privately owned structures, which can result in violation of safety standards and may cause permanent damage to the conductor resulting in immediate or increased risk of failure in the future.

Q. **Is overloading the only problem that the area will experience?**

A. No. The 34 kV lines L1865 and L0951 will experience low voltage in 2014 during system normal conditions, as shown in Table 6.

Table 6

Component	**Location**	**Voltage (kV)**	**% of Minimum before Proposed Project**
L1865	DCJ49 TR1	32.7	99
L1865	DCJ49 TR2	32.7	99
L1865	ESS J336	32.7	99
L0951	DCJ62	32.5	99

The 34 kV line L1863 will experience low voltage during contingency on L1865 near DC J49 and Electric Service Station ("ESS") J336, as shown in Table 7.

Table 7

Component	**Contingency**	**Voltage (kV)**	**% of Minimum before Proposed Project**
L1863	L1865 between DCJ49& ESS J336	31.5	99

Q. **Can ComEd build additional facilities at the existing substations to avoid these overloads?**

A. No, TDC 416 and TDC 487 are already at their ultimate design. Although TDC 406 could be expanded, it is approximately 6 miles from the southern part of the study area. Extending multiple distribution feeders of sufficient length to reach into the heart of the study area would be impractical and very expensive due to the need to use lower rated feeders to maintain adequate voltage as well as provide reasonable contingency capability in the area.

Q. **Were energy efficiency and demand side management efforts considered in determining whether an overload existed in ComEd's study?**

A. Yes. Based on reasonable assumptions about new homes utilizing more energy efficient lighting and appliances than existing homes, we assumed new residential customers in this area would demand about 0.8 kW less per home than the existing customers. ComEd has also recently attempted to sign up residential customers in this area for our residential air conditioning cycling program. Although the recent attempts have only produced a take rate of about 1%, we assumed newer customers would have a significantly higher take rate of 6% and therefore reduced average per house demand by an additional 0.2 kW.

D. <u>Area Load Forecast</u>

Q. **Did ComEd conduct a long-term forecast for the study area?**

A. Yes.

Q. **How did ComEd forecast the projected loads on the system in the study area?**

A. We considered the loads on the system for recent years, looked at Chicago Metropolitan Agency for Planning ("CMAP") and Economy.com projections for the study area, ComEd's system load forecasts, housing forecast from Metrostudy, and ComEd's own new business information. All the information was then compiled and a consensus estimate developed.

Q. **How did you use the data from these various studies to project loads?**

A. The growth in the area will be comprised of new residential customers and new non-residential customers. For residential customers, we used the projected growth in households, as shown in the second column of ComEd Ex. 1.04, from the present through 2030. We then multiplied the number of new households by a per-household amount of load.

Q. **What amount of load per new residential customer did you assume?**

A. We used 3.0 kW of peak load per residential customer. By applying a typical residential power factor, that comes out to about 3.2 kVA per residential customer.

Q. **Is that assumption reasonable?**

A. Yes. We reviewed feeders currently serving this area and found coincidental residential peak load information in the range from about 3 kW to 6 kW per customer, with the average about 4 kW. We then applied the energy efficiency and demand side management reductions discussed earlier, resulting in 3.0 kW per new home.

Q. **Where are your results shown?**

A. ComEd Ex. 1.04 is entitled Estimated Growth in Study Area. The first column shows the year, the second column shows the number of new houses in each year, and the third column shows the estimated growth in residential peak load, the fourth column shows estimated growth in non-residential peak load, and the fifth column shows the total estimated growth.

Q. **How did you forecast non-residential growth?**

A. We started with what we know today. For the next four years, we know of certain pending projects from our New Business engineering department. These projects total to between 1-4 MVA per year and average about 3 MVA per year. We also know that there will be other smaller currently unannounced projects.

Q. **Do you have any way to check whether this is reasonable?**

A. Yes. For 2009-2011, we know that the peak load in this area has increased by about 2 MVA per year. Going forward, our estimate of between 1-4 MVA per year appears reasonable.

Q. **How did you use this to forecast future years?**

A. For the next two years, we already have advance notice of a number of new businesses. So, again using ComEd's new business records, we can calculate some of the non-residential load that we know will come onto the system. For the period 2012 to 2014, we know of 10.8 MVA of new non-residential load.

Q. **What was the process for years after 2014?**

A. For the years after 2014, a greater portion of the load is unknown, and beyond 2016 none of it is based on actual notices of new customers. We expect growth in non-residential load as various shopping malls, schools, hospitals, and big box stores are built to serve the new customers moving into the area.

Q. **What are your results of your long-term forecast for the area?**

A. The final column of ComEd Ex. 1.04, on the far right, shows the total growth expected for the area for each year from 2012 to 2030.

Q. **Are your long-term forecasts reasonable?**

A. Yes. The compound growth rate in our study area from 2012 through 2030 is 3.9% per year. This seems reasonable for an area transitioning from rural to suburban.

Q. **Did you compare your results to other information that ComEd has?**

A. Yes. We compared our results to the other information we have, but much of the available data does not match our specific study area and time period. We reviewed data available from CMAP. CMAP's published data, which is town by town, did not exactly correlate to our specific study area and study period. We reviewed CMAP's data, which covers 2010 to 2040, for Lockport, Homer Glen and New Lenox. The CMAP data includes portions of all three towns that are already established whereas our study looks primarily at those areas that are currently undeveloped. Over this time period, the compound annual growth rate for households was 2% and the compound annual growth for employment was 2.4%. Given the differences in area and time, this is not inconsistent with our results.

We also reviewed data regarding total households and total non-farm payroll employment published by economic consultants, Economy.com. The data they publish, however, includes all of Will County. This area is considerably larger than our study area and includes many areas of little or no growth, including established cities and farm areas not seeing any growth in the foreseeable future. Data for total households shows a compound annual growth rate of 1.4% over the period 2005-2030. Employment data shows a compound annual growth rate of 1.9%.

Given the availability of land in our study area along with recently added major infrastructure, such as the I-355 extension, we feel the growth rate we are using is quite reasonable.

Q. **How did you use this forecast?**

A. We used this forecast for two purposes. First, we used it to confirm that ComEd's plan was sufficient to meet the study area's needs both initially and well into the future as the area matures and growth flattens out. Second, we used it to compare the cost of the proposed plan to an alternative system plan that would not include the construction of a transmission line.

E. <u>ComEd's Plan is Efficient and Effective</u>

Q. **How does the proposed plan fit into ComEd's long-term plan to meet area service needs?**

A. While the initial installation of Veterans Substation would consist of one 40 MVA transformer, the substation is being designed for an ultimate of four transformers. We are also evaluating the installation of an additional transmission line, potentially to the south, which would be the next most feasible direction to connect to the existing 138 kV system.

Q. **How and when will the facilities proposed in the Petition enter service?**

A. The completion of the 138 kV transmission line and Veterans Substation is scheduled for 2014.

Q. **Has a diagram been prepared which shows the proposed transmission project?**

A. Yes. See Exhibit A to the Petition.

Q. **What load will the new line and substation serve?**

A. ComEd Ex. 1.05 depicts the proposed service territory in 2030 of the substations serving the study area including the Veterans Substation, TDC 480.

F. <u>Customer Needs Are Met</u>

Q. **Will ComEd's proposed project supply adequate, efficient, and reliable service to ComEd's customers in the study area?**

A. Yes. ComEd's proposal provides the needed system reinforcement efficiently and reliably.

Q. **What effect does the proposed construction have on the overloads you identified for 2014?**

A. Each of the overloads I identified earlier will be avoided. Tables 8 through 11 show the load projections once the proposed transmission line and Veterans Substation are in service.

Table 8 shows the effects on the 138-34 kV transformers at Will County Station 18 and South Joliet TDC 409 under contingency conditions in 2014.

Table 8

Component	Facility Equipment	Rating (MVA)	Load (MVA)	% Loading after Proposed Project
Will County Station18	2-60 MVA TR's	103	100	97
Joliet South TDC409	2-60 MVA TR's	115	114	99

Table 9 shows the effects on the 34 kV L1865 in this area under normal conditions in 2014.

Table 9

Component	Rating (MVA)	Load (MVA)	% Loading after Proposed Project
L1865	33	26	79

Table 10 shows the effects on the 34 kV L1863 under contingency conditions in 2014.

Table 10

Component	Contingency	Emergency Rating (MVA)	Load (MVA)	% of Rating
L1863	L1865 between DCJ49 & ESS J336	33	31	94

Table 11 shows the effects on the previously overloaded 34 – 12.5 kV transformers and 12.5 kV TDC fed circuits in 2014.

Table 11

Component	Rating (MVA)	Load (MVA)	% Loading after Proposed Project
J625	8.2	8.1	99
J496	8.2	7.8	95
J1683	8.2	5.2	63
J1684	8.2	2.0	24
J8774	8.2	5.5	67

Q. **How does the proposed 138 kV line and new substation address the overloads identified?**

A. As I stated earlier, this plan will address existing overloads and any new loads on the existing Substations. By providing an additional source of supply directly from the 138 kV system, load on existing 138-34 kV transformers, 34 kV lines, 34-12.5 kV transformers and 12.5 kV feeders can be greatly reduced, eliminating each of the overload conditions that the area would otherwise experience. As shown in Tables 8 through 11, with the proposed project in place, all forecast overloads will be alleviated.

Q. **What effect will the proposed project have on low voltage situations projected for 2014?**

A. As shown in Table 12, the sharing of the load will result in better voltage regulation on portions of the 34 kV system in 2014, allowing ComEd to keep the system within regulatory limits.

Table 12

Component	Location	Voltage (kV)	% of Minimum after Proposed Project
L1865	DCJ49 TR1	34.1	104
L1865	DCJ49 TR2	34.1	104
L1865	ESS J336	34.1	104
L0951	DCJ62	32.8	100

Table 13 shows the effect of the project on voltages during contingency situations in 2014.

Table 13

Component	Contingency	Voltage (kV)	% of Minimum after Proposed Project
L1863	L1865 between DCJ49& ESS J336	33	103

Q. **What are the reliability features of ComEd's proposal?**

A. The proposed line uses proven designs with an excellent track record of long-term reliability. Its electrical design incorporates features that enhance reliability, such as high basic insulation level static wires with superior shielding. A steel-pole transmission line is also built to structural standards that reduce the risk of outage caused by physical component failure.

VI. <u>Cost Estimate and Source of Funds</u>

Q. **What is the estimated cost of the proposed project, including the 138 kV line and the Veterans Substation?**

A. The estimated cost of the proposed project is $17 million in 2012 dollars. That includes construction of the certificated line itself, the distribution line work and construction of the Veterans Substation. That amount is exclusive of land acquisition costs.

Q. **Where will the funds come from to pay for the construction of the line and the substation?**

A. Construction funds will be provided from ComEd's construction budget. ComEd is capable of financing the construction of the line and substation without adverse consequences for ComEd or its customers.

Q. **Will ComEd's plant construction budget provide for construction of the line and substation?**

A. Yes. Our capital expenditure budgets for 2013 and 2014 are not finalized at this point, but the project will be included. The 2013 and 2014 budgets are expected to be roughly the same as for 2012. For comparison purposes, the $17 million in estimated costs for the proposed project would be less than 3% of ComEd's total plant construction expenditures for 2012.

Q. **Are the proposed lines least cost?**

A. Yes. I believe that the proposed solution is the best and least cost means of providing the needed reinforcement of ComEd's transmission and distribution systems in the study area, consistent with the requirements of safety and reliability.

VII. Comparison to System Alternatives

Q. Did ComEd study any alternative means of meeting electrical supply needs in this area?

A. Yes.

Q. What factors did ComEd consider when it studied the alternatives?

A. ComEd's evaluation was conducted in accordance with Capacity Planning Guidelines that I discussed earlier in my testimony for developing an adequate, efficient, and reliable electric supply system.

A feasible alternative must also meet requirements unrelated to electrical design. For example, it must use facilities which can, as a practical matter, be constructed and it cannot require real estate that is unavailable at a reasonable cost.

Q. What alternatives did ComEd consider?

A. ComEd investigated all practical methods of meeting the area's needs, including transmission and distribution supply reinforcement and the use of demand-side resources.

We considered alternative transmission voltage solutions. However, as I stated earlier in my testimony, other sources of transmission voltage power are not as close to this study area. To the south, the nearest 138 kV lines are approximately seven miles away. To the east, they are approximately 10 miles away. To the west, the nearest 138 kV line is approximately five miles away, but there are many obstructions, including two railroads and three bodies of water. Therefore, we believe we have selected the most feasible transmission voltage solution.

We also considered adding 34 kV lines and transformers as the load in the area grows ("34 kV Alternative project"). To provide adequate and reliable service to the area, the 34 kV Alternative project would ultimately require the construction of a new 138-34 kV substation and five new 34-12.5 kV distribution substations, along with four new 34 kV lines. We did conclude that this would be a feasible alternative, however, and I refer to this as the 34 kV Alternative project.

Finally, we considered continuing to use the existing substations in the area to supply long 12.5 kV feeders into the study area, however, as stated earlier, distribution lines of such length are prohibitively expensive, difficult to properly regulate voltage, and increase exposure. Therefore, it was not a feasible alternative.

Q. **Describe the 34 kV Alternative project.**

A. In the 34 kV Alternative project, we were able to design a feasible reinforcement scheme that would use new 34 kV lines but not involve building a 138 kV transmission line. The 34 kV Alternative project would involve building a 138-34 kV substation on the right-of-way for 138 kV lines 1811 and 1808. The substation would contain two 138-34 kV 40 MVA transformers and would be the source for four 34 kV lines. Five new 34-12.5 kV distribution substations would also be required, one of which would be at the proposed Veterans substation site. The other four substations would be constructed at various locations in the area. The 34 kV lines would be constructed using conventional wood distribution poles where practical. ComEd Ex. 1.06 is a one-line diagram depicting the 34 kV Alternative project.

Q. **What did you conclude about this alternative?**

A. It is not least cost.

Q. How did you compare the cost of the alternative project to the proposed 138 kV project?

A. We compared the costs of the projects based on the net present value of our expected investments in each project over time, in accordance with industry accepted methods which the Illinois Commerce Commission has approved in numerous instances. We did this by analyzing, year by year, what investments ComEd would need to make, from 2014, when construction would begin, through 2030, when the load growth in the area is projected to taper off. We used the long-term forecast I described previously to indicate how much additional load there would be in the study area, and what additional lines and transformers would be needed to satisfy those needs in a reliable way.

Q. What did you find?

A. ComEd Exs. 1.07 and 1.08 are two spreadsheets showing the details of the new facilities needed over time for each of the alternative projects, 138 kV and 34 kV, respectively. ComEd's proposed project had a significantly lower cost, with a net present value of $38 million, as compared to $57 million for the 34 kV Alternative project.

Q. Have you considered whether ComEd's project would be least cost if the load growth is not as large as you have forecasted?

A. Yes. The determination of what facilities will be needed in which years is dependent in large part on the amount of load growth over time. Accordingly, we conducted a similar comparative analysis, but assumed that the long-term load growth would be only half of what we are forecasting. We call this a sensitivity analysis, because it checks our calculations to see how sensitive they are to forecasting errors.

Q. **What did you find?**

A. Using 50% of our forecast long-term load growth, ComEd's proposed project would still be least cost, with a net present value of $31 million as compared to $34 million for the 34 kV Alternative project. ComEd Exs. 1.09 and 1.10 are spreadsheets showing the details of the new facilities needed over time for each of the two alternative projects, 138 kV and 34 kV, respectively, assuming 50% of forecast long-term load.

Q. **Other than cost, how else does the 34 kV Alternative project compare to the proposed 138 kV project?**

A. The 34 kV Alternative project would require the construction of many more miles of lines than the proposed 138 kV project. While most of these lines would be built along existing roads, in much of this area, adjacent landowners actually own to the centerline of the road, presumably having provided easements for roadway purposes (only) many years ago. In these cases, ComEd would also have to obtain easements for our facilities. This creates an increased risk of not being able to build our facilities, or having to take longer or more expensive routes. Additionally, compared to the proposed plan, this system would be more susceptible to momentary outages from lightning due to the inherently lower basic insulation level of the structures used with 34 kV distribution lines.

Q. **Does this conclude your direct testimony?**

A. Yes.