



**The Application of East Kentucky Power
Cooperative, Inc. for a Certificate of Public
Convenience and Necessity for the Construction
of a 161 kV Electric Distribution Substation and
Tap in Spencer County, Kentucky**

Technical Appraisal

**Prepared by:
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February 15, 2005

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SECTION 1: INTRODUCTION

ICF Resources LLC (“ICF”) was engaged by the Public Service Commission of the Commonwealth of Kentucky and East Kentucky Power Cooperative on January 27, 2005 to assist the Kentucky Public Service Commission (“KPSC”) with a technical review and assessment of East Kentucky Power Cooperative Inc.’s¹ (“EKPC”) application for a Certificate of Public Convenience and Necessity (CPCN) for the construction of a 161 kV line and 161 kV electric distribution substation in Spencer County, Kentucky. The project comprises:

- A new 12/16/20 MVA, 161 kV/12.47 kV distribution substation to be constructed in the Little Mount area of northeast Spencer County at the end of Miller Road, approximately 4.6 miles along KY Highway 44 east of its intersection with KY Highway 55.
- A single radial 161 kV line from a tap on the EKPC 161 kV line segment between Bullitt and Shelby. A rough location of the tap is estimated to be 68 feet south of Structure No. LR-72 and approximately 0.75 mile south of KY Highway No. 1169 (See Exhibit 1.1).

According to EKPC’s CPCN filing, this project is intended to address power distribution problems in one of its member systems - Salt River Electric Cooperative Corporation² (SRECC). This report provides a summary of ICF’s technical appraisal of the project.

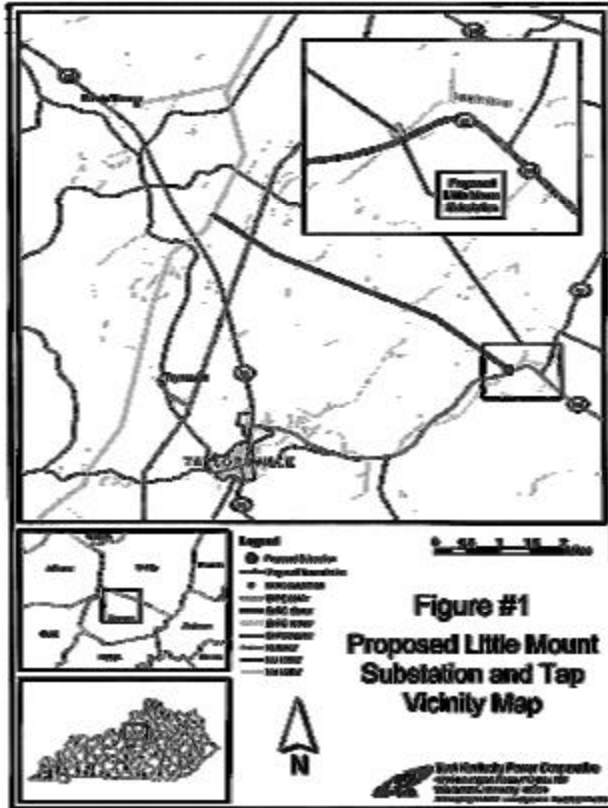
The Kentucky bulk power transmission system comprises a primary backbone of 345 kV lines and a secondary system of 161 kV, 138 kV and 69 kV lines. The power system interconnects neighboring systems in Indiana, Illinois, Tennessee, Ohio, Virginia and West Virginia, (See Exhibit 1.2). EKPC is one of four major transmission companies that provide high voltage power transmission services in the Commonwealth of Kentucky. EKPC’s service territory covers the greater portions of central and eastern Kentucky (See Exhibit 1.3).

EKPC provides bulk power generation and transmission services on behalf of its sixteen member systems including SRECC. The member systems receive bulk power from EKPC at high voltage bulk power distribution substations and then distribute the power to their customers.

¹ 16 member cooperatives established East Kentucky Power Cooperative (EKPC) as a not-for-profit generation and transmission utility. Founded in 1941, EKPC’s purpose is to generate energy and transmit it to co-ops that subsequently distribute the power to retail customers. EKPC provides wholesale energy and services to 16 distribution cooperatives through its power plants (including peaking units and hydro power) and more than 2,500 miles of transmission lines. Together, EKPC and its member cooperatives are known as Kentucky’s Touchstone Energy Cooperatives. The distribution cooperatives supply energy to about 468,000 Kentucky homes, farms, businesses and industries across 89 Counties.

² Salt River Electric Cooperative Corporation is one of 16 cooperatives that own EKPC. SRECC is based in Bardstown, Kentucky and serves 40,000 customers in ten Counties across central Kentucky. Its aim is to provide their members with reliable, affordable electric service.

Exhibit 1.1: - Proposed 161 kV line and 161 kV/ 12.47 kV Little Mount Substation



SRECC currently receives bulk power at twenty-seven delivery points from EKPC for distribution at 12.47 kV to customers across its service territory in ten Counties. The proposed Little Mount distribution substation would be the twenty-eighth bulk power delivery point. Exhibit 1.4 shows the 27 current delivery points and the proposed.

The bulk of SRECC's customers are in four Counties – Bullitt, Nelson, Spencer and Washington. The Little Mount distribution substation will be located in Spencer County. Exhibit 1.5 shows the number of customers served in each county and the number of EKPC bulk power substations in each of the Counties.

According to EKPC and SRECC, the Little Mount area of the SRECC system has in recent years experienced extreme load growth due new subdivisions and influx of

construction activity. The increased demand is causing stresses on the existing power distribution infrastructure. The major problems include heavy line loading and declining voltage conditions associated with the heavy line loading. Without reinforcement to the distribution system, the effect to customers could be periodic supply reliability problems.

Exhibit 1.2: Interconnected Control Areas in the State of Kentucky

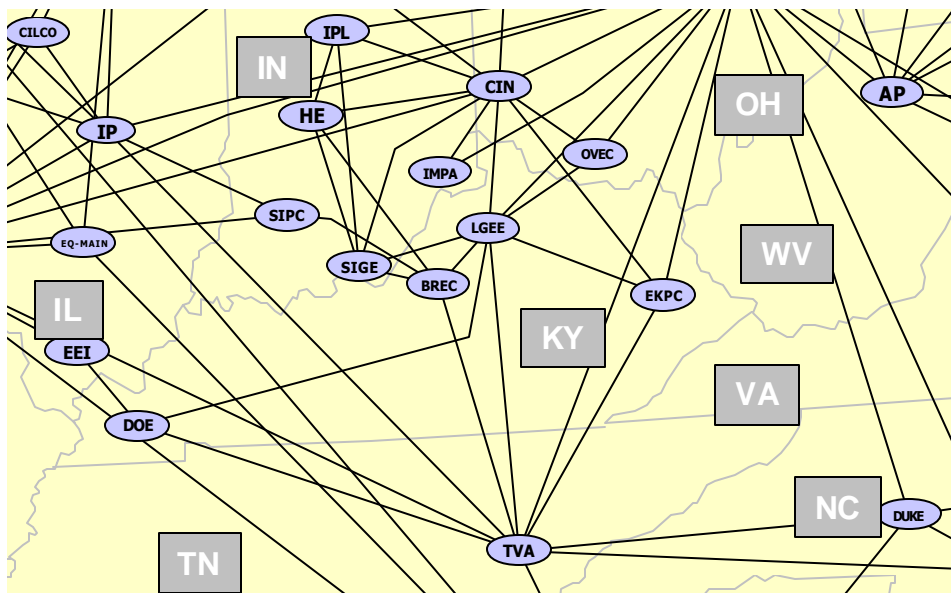
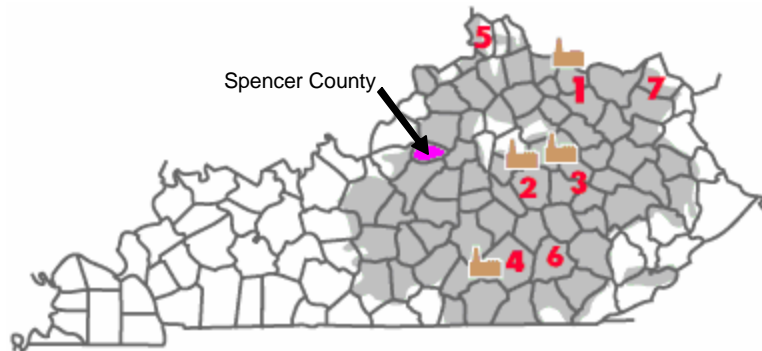


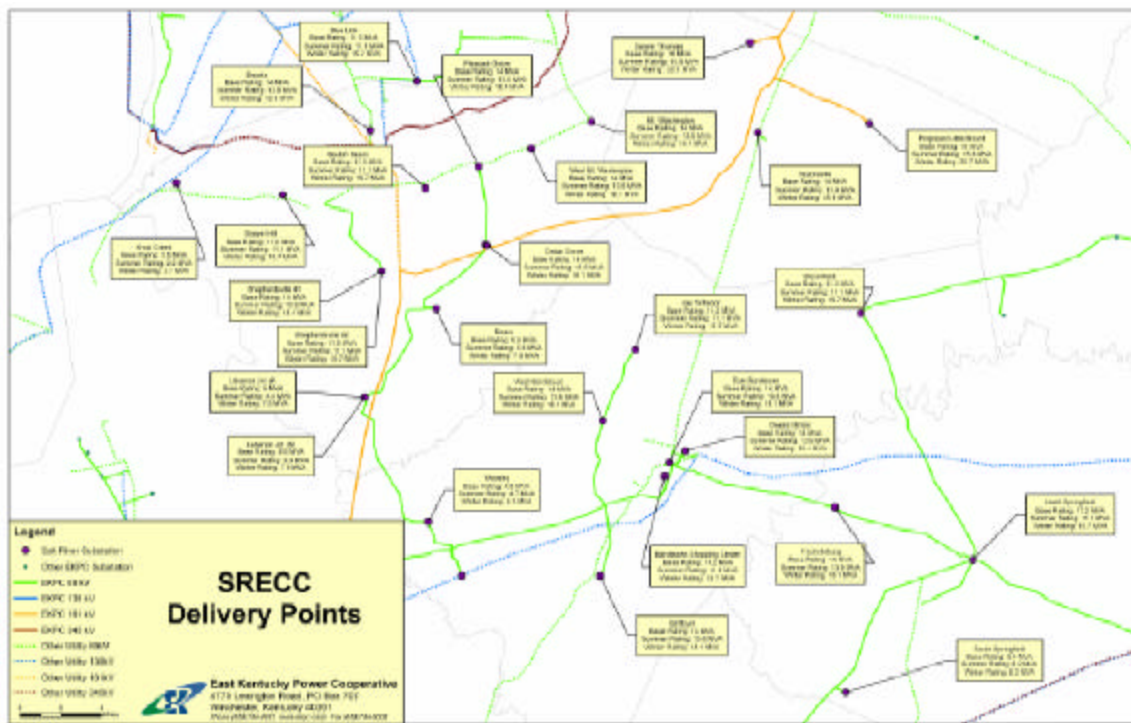
Exhibit 1.3: EKPC Service Territory and the Location of Spencer County



The Little Mount area has three existing power supply options. Under normal conditions, the area is served by a 10 mile, 12.5 kV, three-phase radial feeder from the Taylorsville substation. Under contingency conditions, two alternate supply options are available from the Darwin

Thomas substation and the Bloomfield substation but on a limited basis due to thermal capacity limitations of the conductors. Thus, supply from these two alternative sources is limited by load conditions (See Exhibit 1.6).

Exhibit 1.4: Bulk Power Delivery Points in SRECC Distribution Service Territory



Source: SRECC / EKPC response to ICF data request.

In January 2005, EKPC filed an application with the KPSC for a CPCN for the construction of a 12/16/20 MVA 161 kV electric power distribution substation and a six-mile 161 kV line tap in Spencer County, Kentucky ("the Project"). The Project was submitted as the best of four alternatives that EKPC and SRECC considered to improve the power supply situation in the Little Mount area.

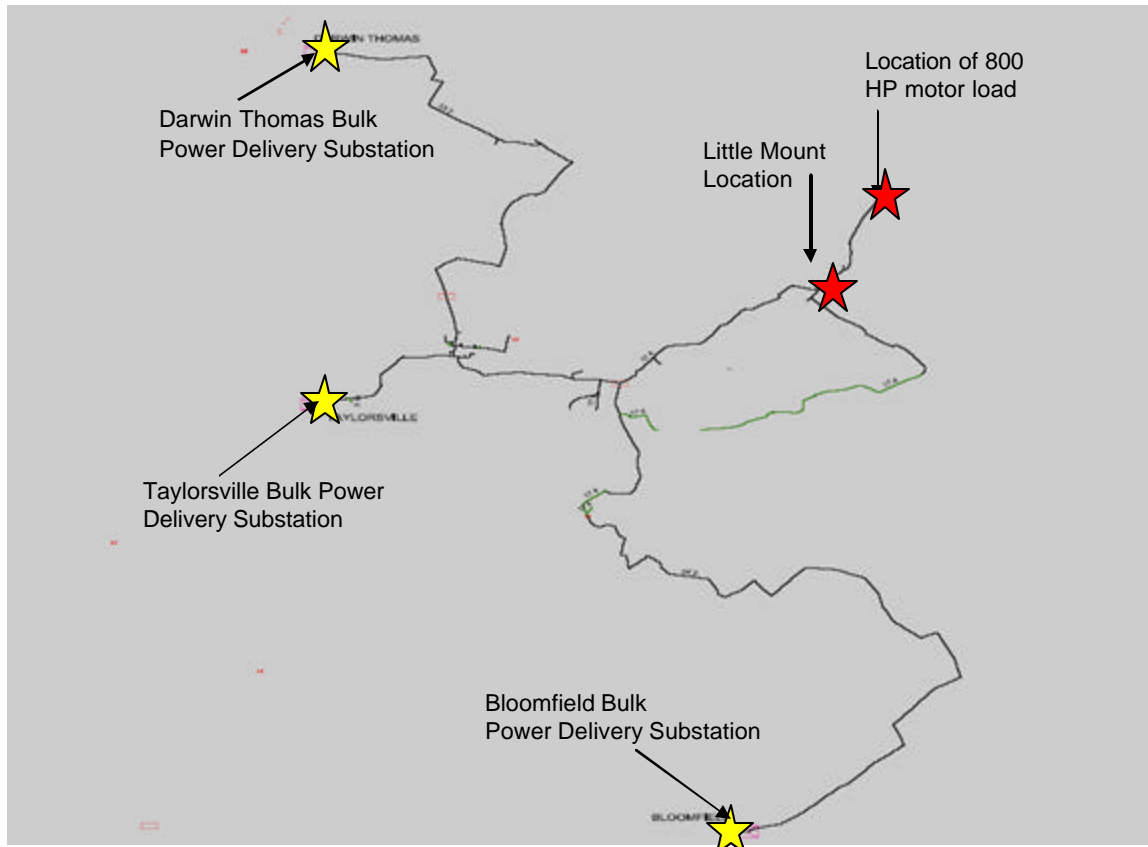
Exhibit 1.5: Number of SRECC Customers, Bulk Power Delivery Points and Total Delivery Capacity By County

	Number of Members	Number of Bulk Power Substations	Total Capacity (MVA)	Population ¹
Bullit County	19,000	13	133.5	47,567
Nelson County	12,000	8	94.4	29,710
Spencer County	4,200	2	30	6,801
Washington County	4,000	3	31.6	10,441

¹ Source: <http://www.uky.edu/KentuckyAtlas/kentucky-counties.html>

The remainder of this report presents ICF’s technical appraisal of EKPC’s filing. In preparing this assessment, ICF relied solely on documents provided by EKPC and responses by EKPC to ICF’s data requests (See Appendix I). No on-site field visits and/or surveys were made by ICF in providing this appraisal.

Exhibit 1.6: Existing Power Supply Options to the Little Mount Area



SECTION 2: DISTRIBUTION PLANNING AND ASSESSMENT OF NEED

The purpose of distribution planning is to provide consumers with the electrical energy they require, reliably and as economically as possible, while maintaining their supply voltage within reliability limits. It is therefore essential that in planning distribution systems, resources are not spent without justification and not before it is essential to do so.

The first step in any planning process is to determine existing load conditions and voltage levels, then check and confirm sources and magnitudes of new loads to be connected. The most economic design that conforms to established reliability and security criteria should be selected with due regard to :

- Safety
- Supply reliability and security
- Minimum capital cost
- Ease of maintenance
- Capability of easy and economical expansion to meet load growth
- Standardization

As load increases, it is good utility practice to reduce the feeding distance on an existing circuit to maintain acceptable voltage conditions. This means that load increases should generally be met by providing more points of supply on existing circuits rather than larger points of supply. For example, in the case of low voltage distribution lines, reinforcement should be in the form of erection of additional pole mounted substations along the length of the low voltage lines, rather than reconductoring with larger conductors and increasing the capacity of existing substations.

It is also important to take reasonable precautions to limit the system fault level over a long period in order to avoid premature obsolescence of existing equipment. This should be taken into consideration when system expansions are being planned. To limit fault levels, the distribution system should be divided into independent sections to restrict the installed transformer capacity connected to each section.

It is along these general distribution planning principles and guidelines that ICF has assessed EKPC's CPCN filing for the proposed new Little Mount Substation and transmission line.

Assessment of Existing Power Supply Conditions in the Little Mount Area:

Taylorville Feeder 4 currently provides power to the Little Mount area. This is a three-phase radial power supply of about 10 miles and mostly of 1/0 copper conductor. The Little Mount location is at approximately 7.5 miles from the Taylorville substation. The capacity of this feeder is 530 Amps for the first 3 miles and reduces to approximately 310 Amps for the next 5 miles to the Little Mount area. The remaining 2 miles of the feeder are beyond the proposed Little Mount substation and the capacity of this segment of the feeder is 234 Amps (See Exhibit 2.1). According to EKPC, approximately 68 percent of the entire sub feeder load is located beyond 5 miles from

the Taylorsville substation. Also, at the end of this sub feeder line is an 800 HP³ motor load.

Exhibit 2.1: Taylorsville Sub Feeder 4

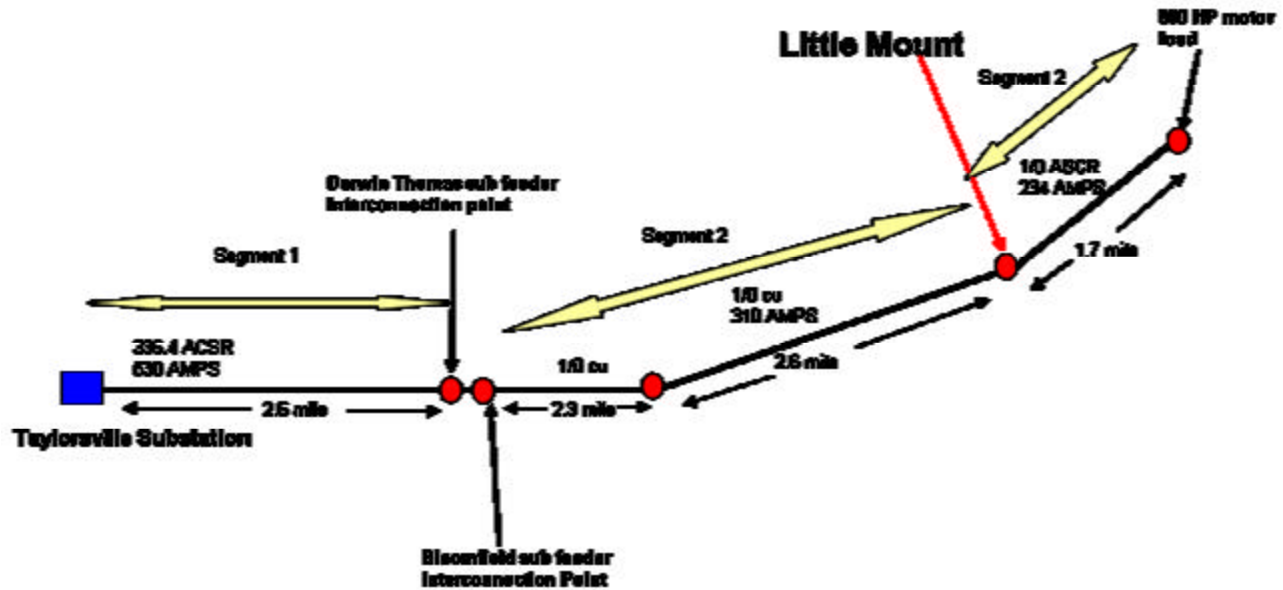
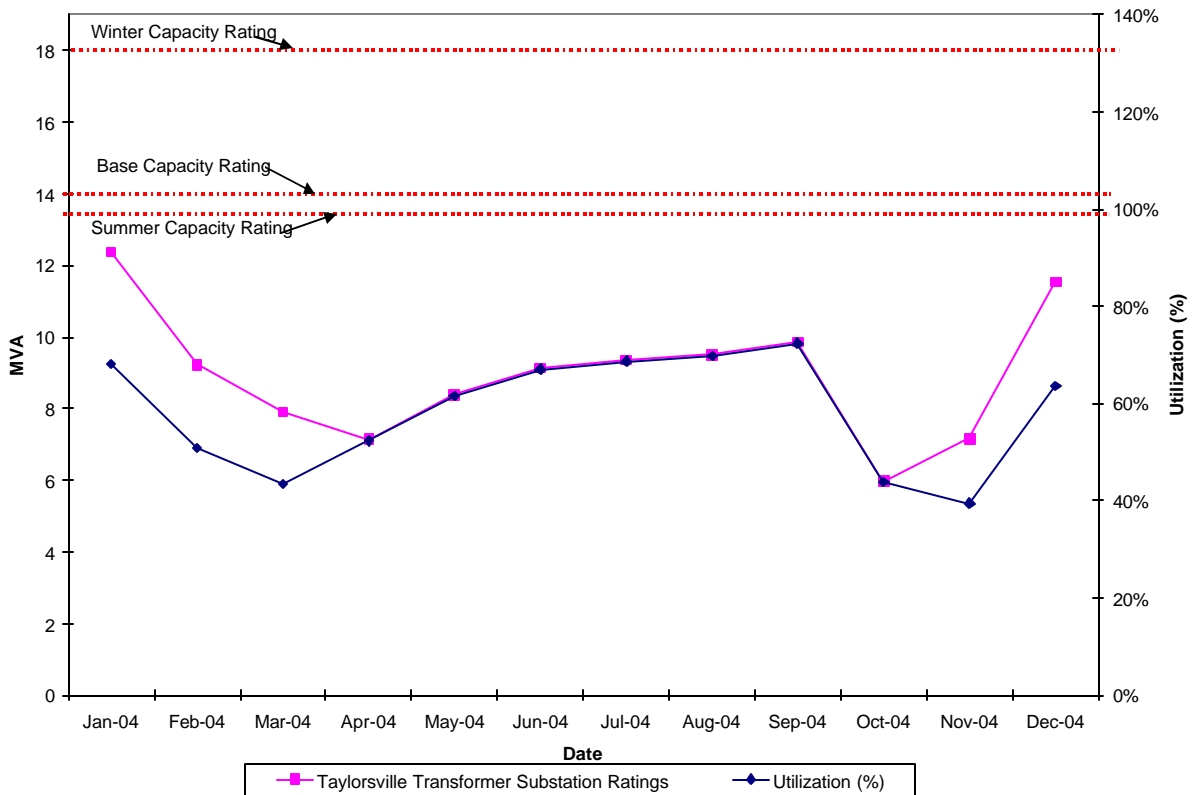


Exhibit 2.2 shows 2004 historical monthly peak loading on the Taylorsville substation and the percent utilization (as a percent of the peak summer or winter rating) by month. The Base rating of the substation is 14 MVA, with a winter and summer rating of 18.1 MVA and 14 MVA respectively. The months of November through March are assumed to be winter months and all other months are assumed to be summer months. Over the period from January 2004 through December 2004, the maximum loading was approximately 12.4 MVA which occurred in January 2004. This represents approximately 68 percent capacity utilization compared to the winter rating of the substation. The highest percent utilization was 72 percent which was in September 2004. Exhibit 2.2 shows that there is at least 28 percent extra capacity available at the Taylorsville substation for future demand growth based on 2004 demand conditions.

³ 1 HP is approximately 746 Watts.

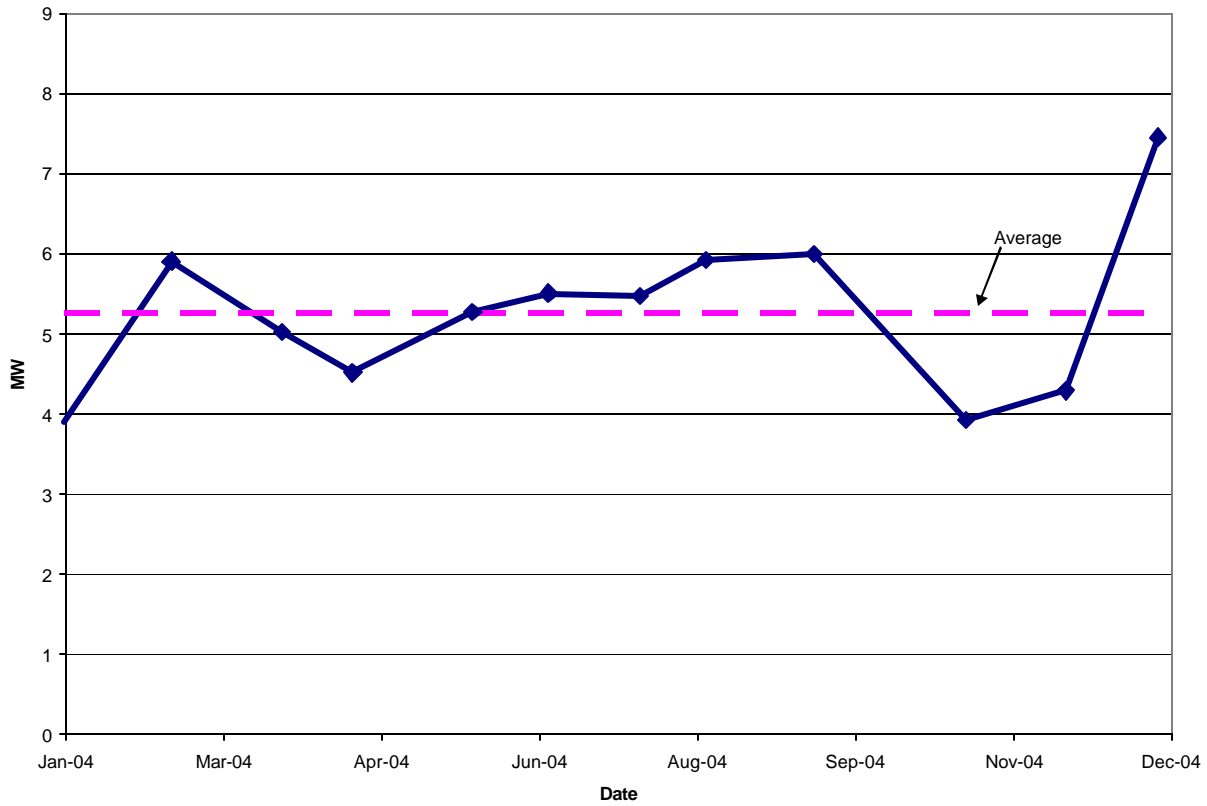
Exhibit 2.2: 2004 Monthly Peak Loading and Utilization of the Taylorsville Bulk Power Distribution Substation



Note: Summer ratings are used in the utilization calculation for April to October; Winter ratings are used in all other months.

Exhibit 2.3 shows the 2004 monthly peak loading on the Taylorsville sub feeder to the Little Mount area measured from the sending end of the sub feeder. In contrast to the substation, the peak load of approximately 7.5 MW on this sub feeder occurred in December 2004. The average of the monthly peaks was 5.3 MW.

Exhibit 2.3: 2004 Monthly Peak loading of the Taylorsville Sub Feeder

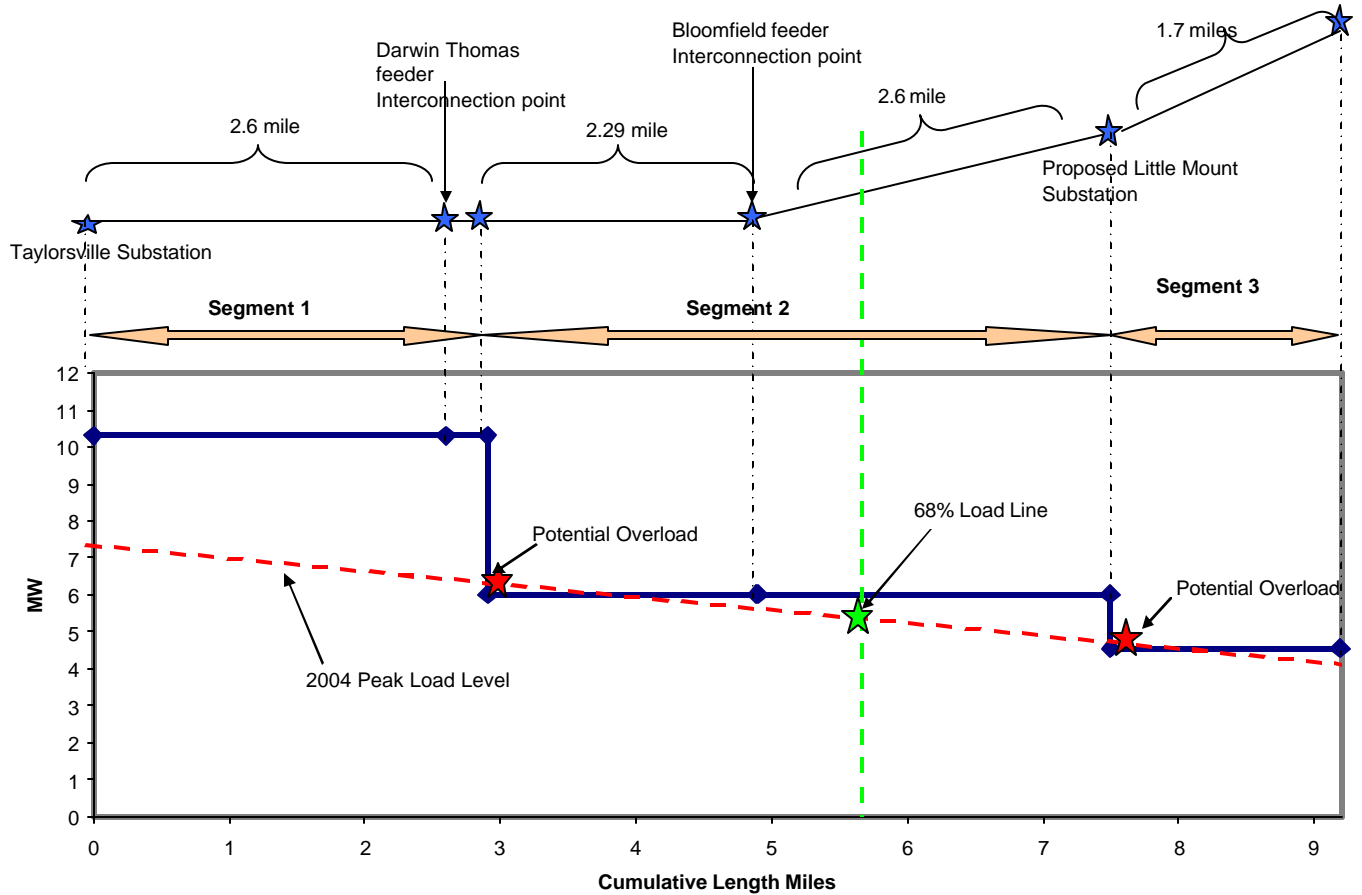


Since this sub feeder varies in capacity along its length, the percent utilization is best analyzed by segment. There are three distinct capacity segments of this sub feeder as shown in Exhibit 2.4. Segment 1 is the portion from the Taylorsville substation to the interconnection point with the Darwin Thomas sub feeder which is approximately 3 miles. The capacity of this segment is approximately 530 Amps which is equivalent to 11.45 MVA (approximately 10.3 MW assuming 90 percent power factor).

Segment 2 is the next 5 mile length from the interconnection point of the Darwin Thomas sub feeder through the point where the Bloomfield sub feeder interconnects to the location of the proposed Little Mount Substation. The capacity of this segment is 310 Amps which is equivalent to 6.7 MVA (approximately 6 MW assuming 90 percent power factor).

Segment 3 is the approximately 2 mile length from the Little Mount substation to the end of the sub feeder. The capacity of this segment is 234 Amps which is also equivalent to 5.1 MVA (approximately 4.6 MW assuming 90 percent power factor).

Exhibit 2.4: Taylorsville Sub Feeder Capacity and Capacity Utilization by Sub Feeder Segment



Because there are connected loads at various locations along the length of the sub feeder, the loading of the feeder will vary along its length with the highest loading at the sending end and declining towards the receiving end. The decline in the loading from the sending end to the receiving end depends on the magnitude and location of connected loads along the sub feeder. A detailed power flow analysis to examine the loading at each point along this sub feeder is beyond the scope of this technical appraisal however since EKPC provided the full load of the feeder, the loading at the sending end could be accurately estimated for each of the monthly peak data.

EKPC/SRECC indicated in discussions at the Commission, that 68 percent of the load on this feeder is located beyond the first 5 miles from the Taylorsville substation. Therefore the loading at the 5-mile location was estimated at 68 percent of the loading at the sending end of the sub feeder, With the loading at these two locations determined, a linear curve could be fitted to estimate the loading along the entire sub feeder.

Exhibit 2.4 provides a linearized estimate of loading of the Taylorsville Sub Feeder 4 based on the highest 2004 monthly peak loading of approximately 7.5 MW which occurred in January 2004. The chart indicates that based on the January 2004 monthly peak load, the loading of Segments 2 and 3 were close to or at their maximum capacities. This observation indicates an immediate need for some power distribution upgrades. However it is not conclusive as to what type of upgrade is needed until additional parameters such as line voltage and capital costs of potential upgrade options are reviewed. It is conceivable that the upgrade could be in the form of reconductoring of the last two segments or a reconfiguration of the distribution network to move some loads onto existing or new substations.

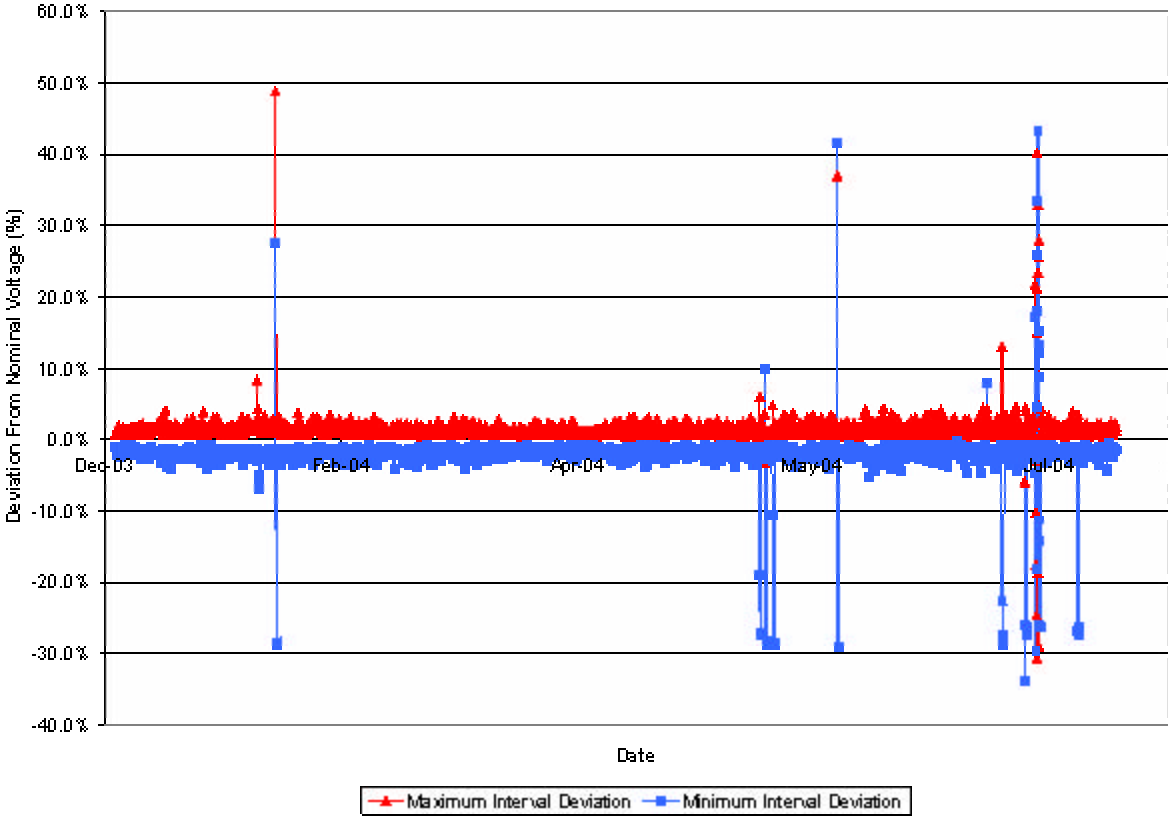
Sub Feeder Line Losses and Line Voltages:

It is good utility practice to maintain low line losses. Line losses generally increase non-linearly with increased line loads and line lengths. As line loss increases, voltages at receiving ends of a line also decline which could affect supply reliability. To maintain supply reliability, the power industry requires voltages to be within ± 5 percent of their nominal voltages. For example, at the 12.47 kV distribution level, operators are required to maintain voltages within 11.85 kV and 13.1 kV to maintain reliability. When voltages at receiving-ends of a line fall outside the ± 5 range, reactive power compensation schemes would have to be used to provide voltage regulation.

According to Mr Sharpe's testimony, problems in the Little Mount area include low voltage conditions due to high loading of the Taylorsville sub feeder. The existing Taylorsville sub feeder has three installed voltage regulators. The first of these regulators is at the Taylorsville substation, the second is close to the intersection with the Darwin Thomas sub feeder and the last is mounted at the intersection with the Bloomfield sub feeder. An additional Static VAR Compensator (SVC) has been installed to minimize "brown outs" from large electric motor starting currents.

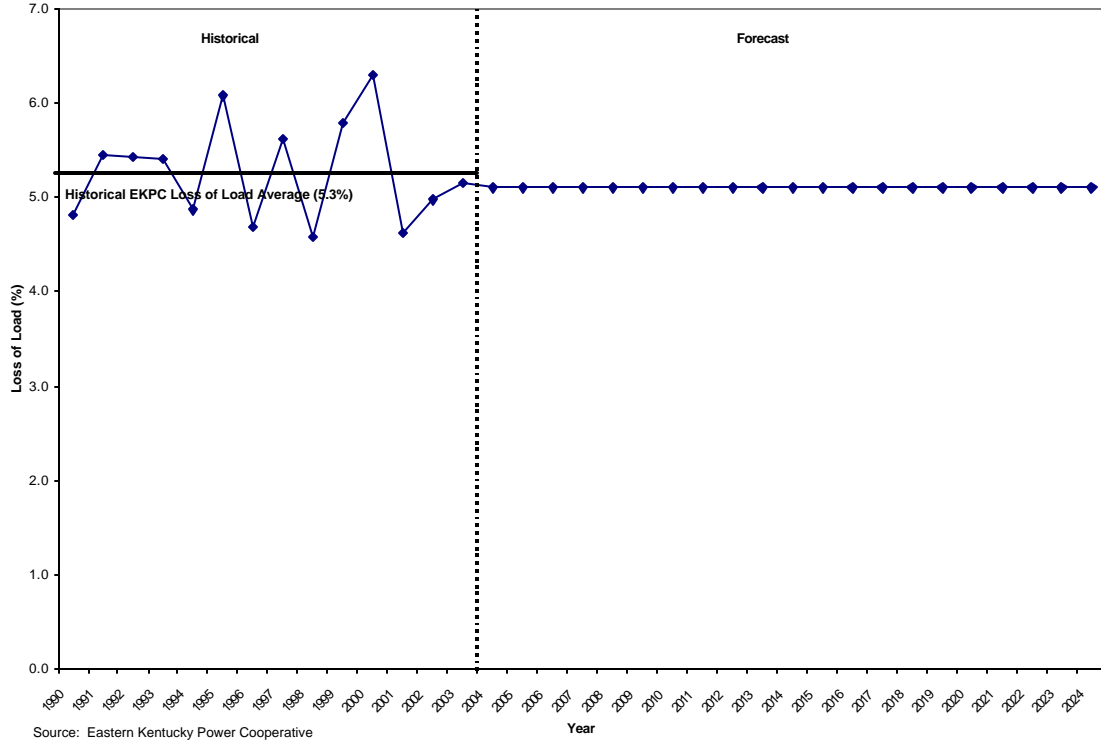
In response to ICF's questions on voltage conditions EKPC and SRECC provided historical voltage profiles taken at the receiving end of the Taylorsville feeder at the Little Mount location for the period from January 1, 2004 through July 30, 2004 in roughly 2 to 3 hour intervals. These voltage profiles were taken with all three regulators in operation. Exhibit 2.5 shows the deviations of the voltages from their nominal levels. The mean of the deviations is above nominal is 1.6 percent and below nominal is 2.2 percent which is within the ± 5 percent range. However there are hours where voltage deviations were in excess of the ± 5 percent range. Baring any data errors in the submission, the deviations shown albeit in very few of the hours are significant given the fact that grid collapse are low probability but high impact events. Without the active operation of the voltage regulators, it is conceivable that voltage conditions could fall outside of this range in many more hours. According to Mr Sharpe's testimony, under peak conditions with reactive power compensation, per phase voltage drops were about 5 percent which is at the threshold level.

Exhibit 2.5: Voltage Profile of the Taylorsville Sub Feeder at the Little Mount Location with All Voltage Regulators in Operation.



Overall SRECC system line loss is approximately 5.3 percent which is reasonable for a distribution operation (See Exhibit 2.6).

Exhibit 2.6: Historical and Forecast SRECC System Losses

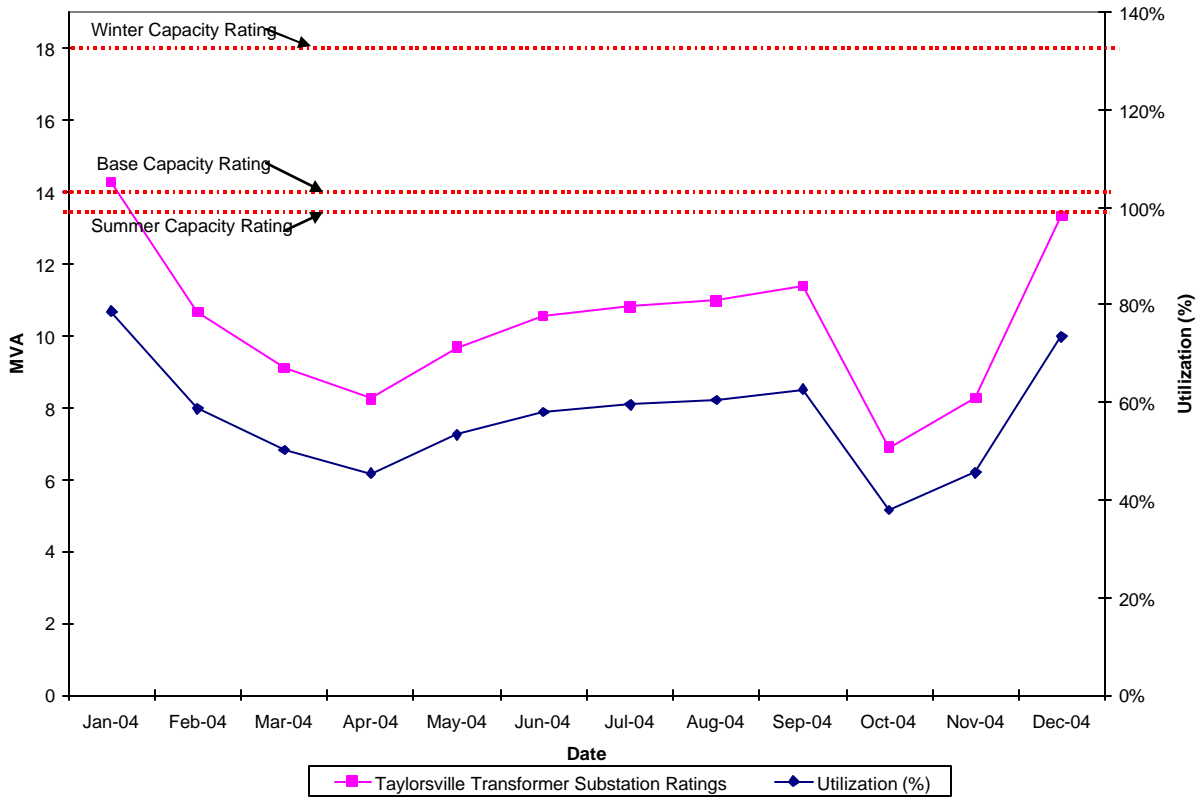


SRECC does not track line loss by sub feeder so ICF could not provide exact detail about the extent of line losses on the Taylorsville sub feeder. Based on power flow simulations provided by SRECC, the line losses along the feeder is reasonably within the system loss estimate shown in Exhibit 2.6 above.

Assessment of 2008 Conditions Assuming No Change in Existing 2004 Distribution Infrastructure at the Taylorsville Substation and Taylorsville Sub Feeder:

The historical 2004 monthly peak loading of the Taylorsville substation shown in Exhibit 2.2 was scaled to create a 2008 view of monthly peak loading as shown in Exhibit 2.7. The scale factor used was derived from the projected 2008 total Taylorsville load (assuming Little Mount is not built) and the 2004 actual load provided by EKPC/SRECC. The 2008 load used was 16.3 MW and the 2004 load used was 14.2 MW.

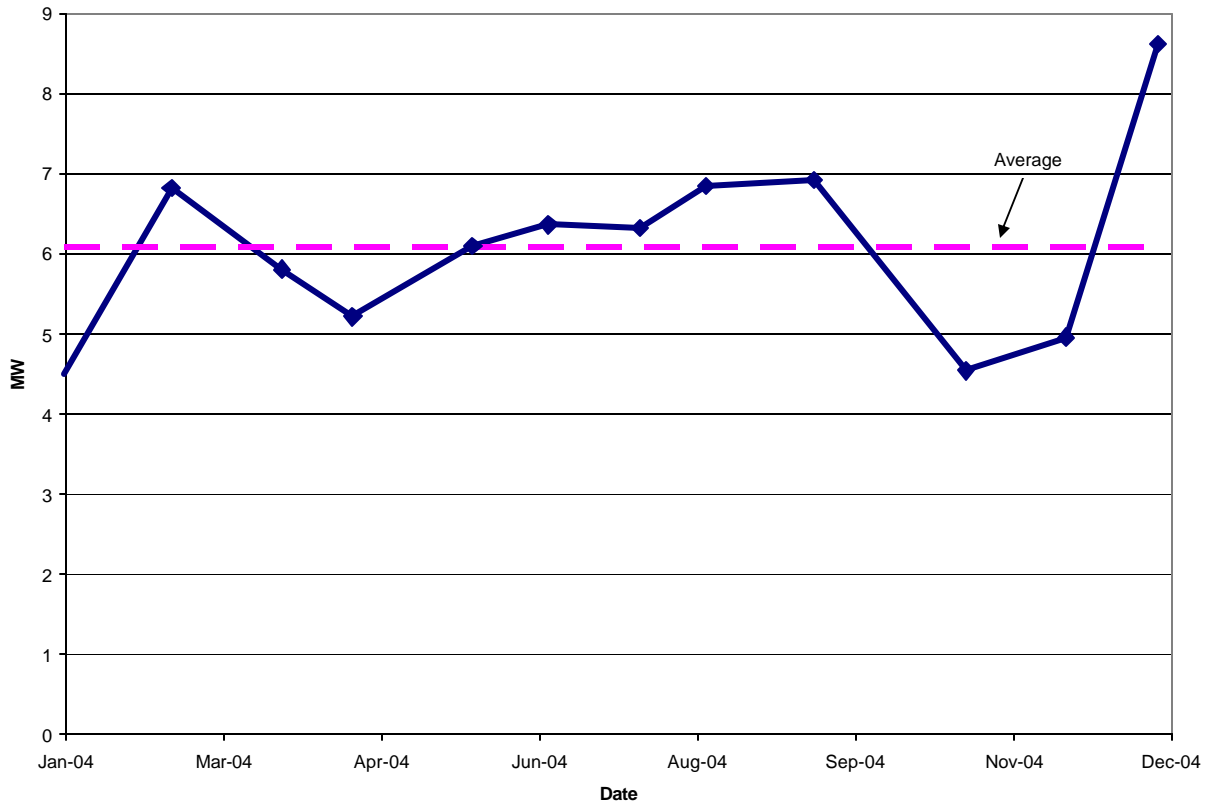
Exhibit 2.7: Illustrative 2008 Taylorsville Monthly Peak Substation Loading and Utilization



Note: Summer ratings are used in the utilization calculation for April to October; Winter ratings are used in all other months.

Under these assumptions, the Taylorsville substation exceeds its Base rating only in January 2008. However since the rating of the substation is higher in the winter months the projected January 2008 loading is well within the Winter rating. From a utilization perspective, the 2008 monthly peak utilization is projected at 79 percent in January 2008. Therefore ICF concludes the Taylorsville substation should be able to accommodate the expected 2008 load and that Taylorsville substation would not need an upgrade until well beyond 2008 based on assumptions on demand growth.

Exhibit 2.8: Illustrative 2008 Taylorsville Monthly Peak Sub Feeder Loading

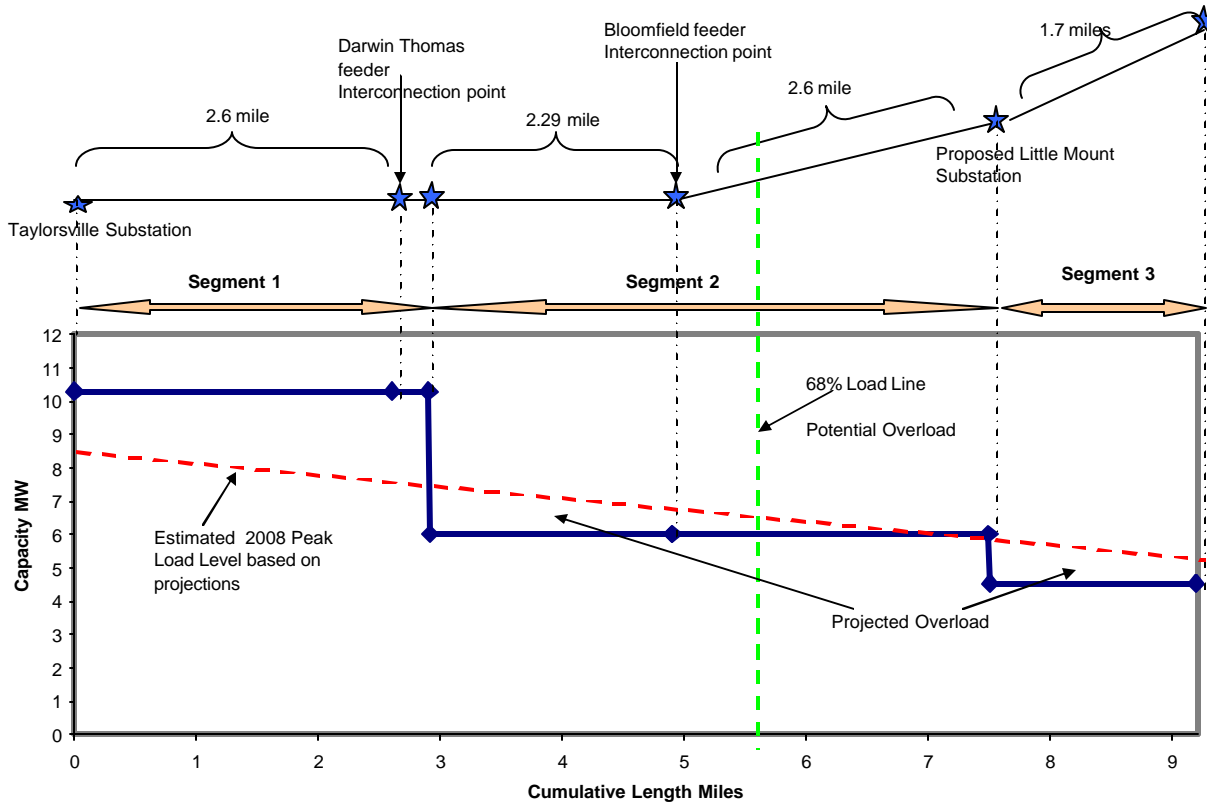


Similarly, the data shown in Exhibit 2.3 was used to estimate sub-feeder loading in 2008 as shown in Exhibit 2.8. In 2008, demand at the Taylorsville substation is projected to be 16.3 MW⁴. At this load level, ICF assumed that the same realized 2004 monthly peak load profile would occur in 2008. Exhibit 2.8 shows the expected 2008 monthly peak load profile. Based on this projection, the peak sub feeder load is expected to be 8.6 MW.

ICF scaled the 2004 monthly peak loading on the Taylorsville sub feeder to project 2008 loading. This was done in a similar way to the scaling done for the Taylorsville substation shown in Exhibit 2.8. The same scale factor used for Exhibit 2.8 was used to scale the 2004 monthly peak loads to obtain the 2008 monthly peak loads. The largest monthly peak load of approximately 8.5 MW (which occurred in January 2008) was used to estimate the loading on the Taylorsville sub feeder along the same lines used to develop Exhibit 2.4. Exhibit 2.9 shows the projected 2008 peak loading on the sub feeder. This assumes no upgrades to the feeder or the distribution system through 2008. Within the limits of assumptions used to develop Exhibit 2.9, the chart shows significant overload of the capacity of the sub feeder especially along the Segments 2 and 3. This level of thermal overload would cause power supply interruptions and would pose serious reliability risks. Thus, it is conclusive at this stage that some form of system upgrade or reinforcement is required to improve supply reliability to the Little Mount area.

⁴ 16.3 MW is the sum of the projected load of 8.2 MW at Taylorsville if Little Mount substation is constructed and 8.1 MW at the proposed Little Mount substation.

Exhibit 2.9: Illustrative 2008 Taylorsville Sub Feeder Utilization



Power Flow Analyses of Existing Supply Conditions

SRECC submitted power flow simulations of existing conditions as part of responses to Staff data requests. These power flow simulations were performed using the Milsoft program for existing and future load conditions and under various conditions of voltage support from installed voltage regulators. The simulations for existing load conditions demonstrated some low voltage and extremely high line loading conditions especially on the A-phase of the Taylorsville Sub Feeder 4 and to a lesser extent on the C-phase. If power supply to the Little Mount area was switched from Taylorsville to the Bloomfield Sub Feeder 02 or to Darwin Thomas Sub Feeder 02, voltage conditions and line loadings were even worse. Obviously, the supply conditions worsened under projected 2010 load conditions. These findings from analytical exercises corroborate the historical account of problems with power supply to the Little Mount area.

Demand

EKPC expects significant demand growth activity in the SRECC service territory. The historical energy growth rate derived from total sales over the period from 1994 through 2004 indicates an average of 4.6 percent growth. Peak load growth over the same period has been 4 percent for SRECC. Load factors have been around 50 percent and are projected to remain unchanged. Compared to an overall US energy and peak growth of about 2.0 percent over the same period, the SRECC load has grown quickly and is expected to continue to do so going forward.

ICF has reviewed the Salt River Electric 2004 Load Forecast prepared by SRECC and EKPC in September 2004 and found the projections to be reasonable based on several factors including:

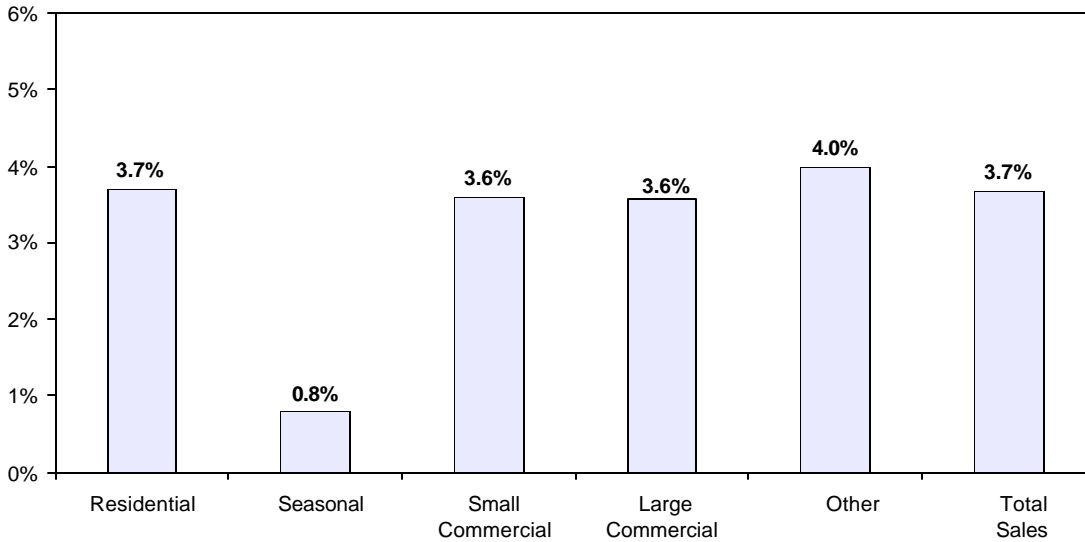
1. Comparison to historical growth levels;
2. Review of local development activity projected by SRECC and other agencies including the Kentucky Transportation Cabinet and the economic development groups for Bullitt and Nelson counties; and
3. Comparison to the larger electric reliability area performance.

In reviewing local growth expectations, the focus was on confined to a review of local development in the geographic area spanned by the SRECC service territory. SRECC has a certified service boundary within Kentucky and hence its service territory is stable and any projections for load growth are concentrated within the known service territory. EKPC is the power supplier supporting SRECC's load requirements, and as such, EKPC supports the growth expectations for the SRECC service area.

SRECC's service territory encompasses the following ten counties in the north central region of Kentucky: Bullitt, Nelson, Spencer, Washington, Anderson, Jefferson, Larue, Marion, Mercer and Shelby. The total annual load requirement is nearly 900 GWh with a load factor of approximately 50 percent. The majority of members are concentrated in Bullitt County, followed by Nelson County – these two counties account for over half of SRECC's total members. Spencer and Washington Counties each have roughly a 10 percent of SRECC members, while the remaining six counties have a limited number of members.

SRECC and EKPC have jointly prepared a load forecast for this area for the period 2004 through 2024. Overall, the projections indicate an annual average load growth of roughly 3.7 percent for load (see Exhibit 2.10) and 3.5 percent for peak. These projections incorporate a declining growth rate over time; in particular, a faster growth rate is anticipated in the next 5 years with a continuously declining growth rate thereafter. The long-term load factor projections remain flat at roughly 50 percent. This is consistent with the current load factor as well as the 10 year average historical load factor (1993-2003). Likewise, long-term projections for load and peak growth are consistent with the ten-year average since 1993 of 4.4 and 4.1 percent respectively.

Exhibit 2.10: EKPC Annual Average Growth in Sales (2004 – 2024)



Source: Salt River Electric 2004 Load Forecast, East Kentucky Power Cooperative, Inc. Market Research Department September 2004.

The SRECC / EKPC load projections for the near-term are largely tied to expected economic development in the service territory. Bullitt County has seen positive economic growth in the recent past (including manufacturing facilities at Brooks Interchange and Cedar Grove) and is expecting new industries to locate in the area with expansion at existing manufacturers. The major transportation corridor in Bullitt County is Interstate 65, which runs North / South through the heart of the county connecting with Jefferson County to the North and Hardin County to the South. Continued growth is expected along this corridor, including convenience stores, hotels/motels, and restaurants. In addition, the active six year plan of projects for the Kentucky Transportation Cabinet include major widening of KY 61 in Bullitt County near the Jefferson County border. This roadway expansion is in anticipation of increased residential development in this area and improved traffic flow. Likewise, highway development activity is expected to occur in northeast Bullitt County and the adjacent areas of Nelson and Spencer Counties along Route US 31E. Further east in Nelson County, Highway 555 is being extended (about 15 miles) through Spencer County. This route follows the eastern boundary of the SRECC territory and gives way to potential development for residential, commercial and seasonal customers.

The expectation of residential growth in Bullitt County is further supported by the completed acquisition by the Louisville Water Company of the facilities in Bullitt County. This acquisition places the company in a position to provide water service to the central and southern areas of Bullitt County.

SRECC and EKPC's expectation of growth in the customer base is consistent with projections of the Kentucky Transportation Cabinet. The Nelson County Economic Development Agency also supports the positive near-term growth outlook. Development in Nelson County in 2004 topped \$110 million, up 41 percent from the previous year. A good chunk of that investment was in commercial development, as the area is poised for additional retail and professional office growth. The Nelson County Economic Development Agency projects expansion due to developments in areas including:

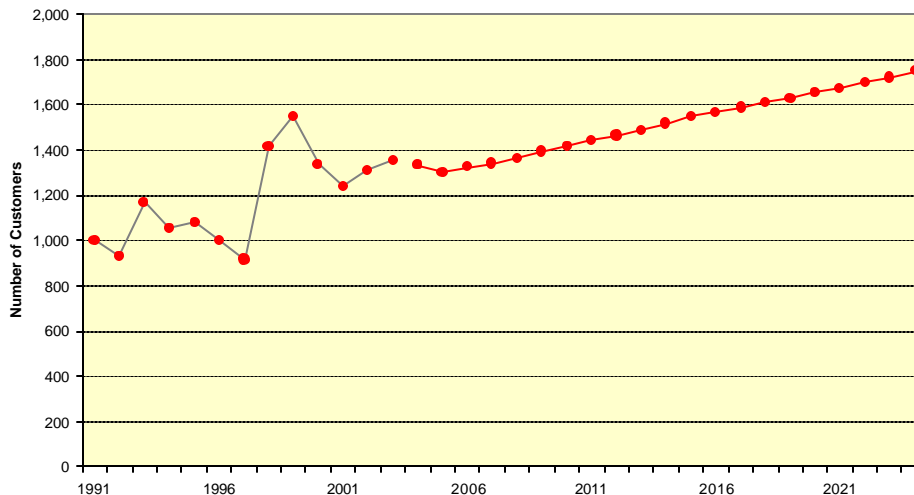
- Small scale strip malls constructed in 2004
- The Flaget Hospital which is on course to open in 2005

- Opening of Wal-Mart SuperCenter on KY 245 opening
- Expansion on US 150
- Expansion off the Blue Grass Parkway
- Expansion at churches, professional buildings and residential development

Bullitt County similarly has a positive growth outlook and includes expanded tourism as another growth area. Other counties served by Salt River anticipate similar growth. Spencer County, for example, was one of the fastest growing counties in Kentucky throughout the 1990s and continues to expand. In fact, Spencer County was named the 10th fastest growing county in the US in number of housing units from 2001-2002 with a 6.4 percent growth (US Census). In addition, the school board has recently indicated the need for expanding schools to serve the Spencer County population.

The growth suggested in the SRECC and EKPC projections (see Exhibit 2.11) are consistent with other available public sources.

Exhibit 2.11: SRECC Annual Change in Residential Customers



Source: Salt River Electric 2004 Load Forecast, East Kentucky Power Cooperative, Inc. Market Research Department September 2004.

SRECC and EKPC further provide specific expansions that will affect growth:

- The bourbon distillery industry is expected to grow due to expanded export trade to Europe and the Far East
- Local extensions on existing natural gas pipelines will be added to accommodate the Mt. Washington and Shepherdsville communities
- A new industrial park is expected to soon come on-line in Nelson County
- Several new industrial parks have begun commercial operation in Bullitt and Washington Counties
- Four new schools are currently under construction in the SRECC service territory: two in Bullitt County, one in Spencer County, and one in Nelson County
- Air conditioning units will be added to existing schools that are not air-conditioned
- Three new residential developments are currently under construction, two in Bullitt County and one in Nelson County.
- As expansion of a commercial center will include a Lowe's store in 2005

ICF further reviewed the growth projections provided by SRECC and EKPC against those of the broader East Central Area Reliability Council (ECAR) area. ECAR is a regional power market area covering the east central area of the US including the EKPC area.

Exhibit 2.12: Comparison to Larger Area Projections

Year	EKPC / SRECC	ECAR
5 Year Load Growth Rates		
1993-1998	3.2	2.3
1998-2003	5.1	0.4
2004-2009	4.8	1.7
2009-2014	3.5	1.5
2014-2019	3.2	NA
2019-2024	3.1	NA
10 Year Load Growth Rates		
1993-2003	4.1	1.4
2004-2014	4.2	1.6
2014-2024	3.2	NA
Sources: SRECC Electric 2004 Load Forecast, East Kentucky Power Cooperative, Inc. Market Research Department September 2004 and NERC ES&D.		

As seen in this comparison, SRECC and EKPC have historically experienced a faster growth than the broader electric area in which it participates. In part this is expected because ECAR market covers a fairly broad territory encompassing several already developed areas that would not anticipate strong growth and other areas with little near-term development potential. Growth in the SRECC area is expected to continue at levels consistent with history and at levels consistently above the larger market area. Further, the declining trend in the SRECC projections is consistent with a maturing of the development opportunities over time.

In conclusion, the SRECC EKPC growth projections are reasonable and consistent with historical growth and the projections of other agencies.

SECTION 3: ASSESSMENT OF FEASIBLE ALTERNATIVES

In Section 2, ICF concluded there was a need for some infrastructure upgrades to maintain reliable power supplies to the Little Mount area. The upgrades could be in the form of reconductoring the existing cable with larger cables, reconfiguring the network to shift loads onto other feeders, or some other form of distribution system reinforcement. In this Section, ICF assesses the feasible alternatives offered by EKPC.

An alternative that provides the most economy and efficiency is certainly preferable; therefore the approach to assessing each of these alternatives is based on the following criteria:

- Technical Feasibility: Each proposed alternative must be technically feasible and should adequately address the potential overload and voltage problems identified in Section 2. The key factors under technical feasibility will be to examine if each alternative achieves the minimum reliability and security standard. Security of supply comes at a cost and the higher the level of security, the higher the cost. Unless the customer is willing to pay for security, the level of security to be provided is often a matter of subjective judgement. In this case, it should be recognized that the existing circuit to the Little Mount area was radial and probably at the low end of supply security. As a general principle the level of supply security should reflect the nature of the load. Demands of up to 1.5 MVA supply can be radial with no alternative supply – restoration time is generally the repair time. Demands between 1.5 MVA and 8 MVA should at a minimum be on an open ring circuit with a maximum restoration time of two hours. Demands of between 8 MVA and 40 MVA must have alternative supplies with a maximum restoration time of 15 minutes. Demands in excess of 40 MVA require firm supplies with no supply interruptions for single contingency faults.
- Ease of Expansion: Each technically feasible alternative must be capable of expansion for future load growth.
- Capital Cost: A technically feasible alternative that provides ease of expansion at a minimum cost is certainly preferable.
- Ease of Maintenance: An alternative that minimizes the cost of maintenance is desirable and so is a design based on proven technology with known going - forward maintenance costs.
- Standardization: Standardization of technology and equipment minimizes operational, training and inventory costs. For example, in the area of power distribution, simple and well proven designs of equipment should be used because these are likely to achieve economical, reliable and easily maintainable systems. There must be compelling reasons to switch to a new distribution voltage recognizing that with a new distribution voltage comes the need to maintain new lines of inventory, and personnel training.

EKPC presented the following four alternatives out of which they selected Alternative C as the best option. ICF has used the criteria outlined above to perform our own assessment of these four alternatives to select the most preferable.

Alternative A: Upgrade Distribution System and Construct Taylorsville #2 Substation in 2008

– SRECC would upgrade its distribution system by replacing 8.4 miles of three-phase 1/0 conductor with 795 ACSR conductor. SRECC would also convert 6.1 miles of existing single-phase line sections to three-phase 1/0 ACSR. In 2008, EKPC would construct a new 11.2/14 MVA, 69-12.47 kV substation (“Taylorsville #2”) adjacent to the existing Taylorsville Substation for additional substation capacity. In 2013, SRECC would be required to reconductor 1.6 miles with 795 ACSR and convert 10.5 miles to three-phase 1/0 ACSR. EKPC would continue to pay transmission wheeling to LGE Energy (“LGEE”) for transmission service to the Taylorsville Substation load.

Alternative B: Construct New Little Mount 11.2/14 MVA, 69-12.47 kV Substation Served from LGEE 69 kV

– EKPC would construct a new 11.2/14 MVA, 69-12.47 kV distribution substation (“Little Mount”) adjacent to KY HWY 44 near the community of Little Mount, Kentucky. EKPC would also construct a new 6.4 mile, 69 kV transmission tap line from LGEE’s Bardstown-Finchville 69 kV line. SRECC would convert 2.9 miles to three-phase 1/0 ACSR. EKPC would continue to pay transmission wheeling to LGEE for transmission service to Taylorsville and Little Mount Substations.

Alternative C: Construct New Little Mount 12/16/20 MVA, 161-12.47 kV Substation from EK 161 kV

– EKPC would construct a new 12/16/20 MVA, 161-12.47 kV distribution substation (“Little Mount”) adjacent to KY HWY 44 near the community of Little Mount, Kentucky. EKPC would also construct a new 6.3 mile, 161 kV transmission tap line from EKPC’s Bullitt County – Shelby County 161 kV line. SRECC would convert 2.9 miles to three-phase 1/0 ACSR.

Alternative G: Construct New 12.47 kV, 795 ACSR Distribution Feeder from Darwin Thomas Substation

– SRECC would offload the existing distribution system by constructing a new 5.8 mile, 336 ACSR feeder from Darwin Thomas Substation to the Little Mount area. SRECC would also convert 1.4 miles to three-phase 1/0 ACSR and install two voltage regulator banks. EKPC would construct a new Little Mount Substation in year 2011.

Review of Alternatives:

Assessment of Alternative A: Upgrade Distribution System and Construct Taylorsville #2 Substation in 2008

Alternative A is essentially an upgrade of the existing Taylorsville sub feeder to a larger conductor to minimize line loading. By upgrading the conductor size, additional power can be safely and reliably transmitted to load. This alternative provides modest gains in lower line currents and lower voltage drops, thus receiving-end voltages are modestly improved. Although this alternative suggests an upgrade of the Taylorsville substation in 2008, based on data provided to ICF on demand growth at Taylorsville and existing substation capacity, ICF concludes that the upgrade of the Taylorsville substation even under the assumption of no new Little Mount Substation will not become necessary until well after 2008.

One of the weaknesses of this option is that, although reliability is improved by the upgrade, supply security remains unchanged mainly because the Little Mount area would continue to be fed from a radial feeder. Therefore any outage due to a fault beyond the interconnection with Bloomfield Sub Feeder 02 will mean supply restoration will continue to be based on repair time.

Another weakness of this alternative is that it does not provide sufficient flexibility for future expansion. Conceptually one cannot continue to upgrade the capacity of this sub feeder as load continues to increase. At some point, there may be a need to either increase the distribution voltage, to drop a bulk power substation, or to perform some other form of system reinforcement other than upgrade the conductor size of this sub feeder.

Alternative A does not pose any maintenance or standardization concerns. The proposed 795 ACSR conductor is a very familiar and time tested conductor and it is probably not new to the EKPC/SRECC distribution system or to their line maintenance personnel.

The capital cost in present dollars of this alternative is estimated by EKPC at \$5,135,242. As it is often the case with reconductoring projects considered among other alternatives, it is the most expensive of the four alternatives. This alternative also entails some variable costs for power wheels through the LGEE transmission system

Overall this alternative is technically feasible, maintains the same supply security, provides minimal flexibility for future expansion, and has no adverse maintenance or standardization concerns.

Assessment of Alternative B: Construct New Little Mount 11.2/14 MVA, 69 kV/12.47 kV Substation Served from LGEE

In contrast to Alternative A, Alternative B provides a new power delivery point at the Little Mount location from the 69 kV LGEE transmission system located approximately 6.5 miles away. This implies that Alternative B would require a new 69 kV transmission

line tap from the LGEE 69 kV system to feed this new delivery point. As a general matter, a new power delivery point is preferable to reconductoring because it provides more flexibility for future expansion. It is also preferable because, together with the existing circuit from Taylorsville, it provides a “looped” system such that power can be fed to the Little Mount area from Taylorsville or from this new facility. These factors make Alternative B technically more superior than Alternative A. From a supply security point of view, restoration of power under fault conditions will not be dependent on repair time. Indeed “looped” distribution systems are more reliable than radial systems.

The main disadvantage of this alternative is that it is fed from a 69 kV transmission line rather than from a higher voltage transmission line. The capacity of a 69 kV transmission line is much lower than lines at higher voltages (assuming the same conductor size). Therefore the expansion opportunity of this option would be limited to the maximum power that can be fed to the substation from the 69 kV system.

Alternative B does not pose any maintenance or standardization concerns. Distribution substations from 69 kV systems are common in many distribution systems.

The capital cost in present dollars of Alternative B is \$4,476,813, which although less than Alternative A, is significantly higher than the next two alternatives. Similar to Alternative A, this alternative also entails some variable operating costs for power wheels through the LGEE transmission system and for distribution losses.

Overall, Alternative B is technically superior to Alternative A and it is also less expensive. It provides better opportunities for future expansion to meet load growth in the Little Mount area and it also provides better supply security.

Assessment of Alternative C: Construct New Little Mount 12/16/20 MVA, 161 kV/12.47 kV Substation Served from EKPC 161 kV

Alternative C has all the essential features of Alternative B but is technically superior because the New Little Mount Substation would be supplied from a 161 kV transmission voltage which has a higher transmission capacity than the 69 kV transmission system of Alternative B. The distance from the existing transmission systems is practically identical in both alternatives, i.e. 6.4 miles in the case of Alternative B to the existing 69 kV line and 6.3 miles to the existing 161 kV line in the case of Alternative C.

Similar to Alternative B, Alternative C does not pose any maintenance or standardization concerns.

The capital cost in present dollars of Alternative C is \$3,937,437, which is significantly less than the capital costs of Alternatives A and B. Alternative C has the lowest variable operating costs for transmission losses and wheeling.

Assessment of Alternative G: Construct New 12.47 kV, 795 ACSR Distribution Feeder from Darwin Thomas Substation

Alternative G is basically a delayed implementation of Alternative C. Rather than constructing the new 161 kV/ 12.47 kV Little Mount Substation immediately as proposed in Alternative C, Alternative G delays the full implementation until 2011. In the interim period the Little Mount area load is switched from the Taylorsville substation to the Darwin Thomas substation by constructing a new sub feeder from Darwin Thomas. Although the Darwin Thomas substation is physically as close to the Little Mount area as the Taylorsville substation, the path of the existing sub feeders from Darwin Thomas is less direct (looped) and therefore makes it electrically more distant from Little Mount than the sub feeder from Taylorsville. The new sub feeder from Darwin Thomas to Little Mount would be more direct and less costly than an upgrade of the existing sub feeder.

The supply security in the period before the construction of the substation will be reasonably good since it will also be a looped system with the potential to feed power from either side of the loop in the event of an unplanned outage. Both Alternative C and Alternative G provide reasonable supply security and ease of future expansion.

Similar to all the other alternatives, Alternative G poses no maintenance or standardization risks.

The capital cost in present terms of Alternative G is \$3,823,290, which is the lowest of all the alternatives presented by EKPC.

The choice between Alternative C and G is relatively close. In the absence of any load surprises, ICF would rank both options equal in terms of technical feasibility. Note that after 2011 when the substation is built, the Little Mount area would have a higher level of supply security with alternative B compared to Alternative C. The reason for this result is that the construction of the substation in 2011 adds another loop to the loop previously enabled by the construction of the new sub feeder from Darwin Thomas. If there is a need to defer capital investments, then Alternative G would be preferable to Alternative C. Should other intangible factors, such as right-of-way risks for the construction of the substation and the 161 kV line exist, it may be best to implement Alternative C over Alternative G. Likewise, Alternative C will ultimately have a lower environmental impact than Alternative G because it requires less land-use, has a smaller environmental footprint and is therefore less disruptive.

Review of EKPC Cost Calculations and Assumptions:

In reviewing the capital costs associated with the four project alternatives, EKPC utilized consistent methodology in their examination. The discount rate employed in the analysis was based on a long-term fixed interest rate of 6.35 percent based on the Federal Financing Bank (FFB) Guaranteed Funds and considered a Times Interest Earned Ratio of 1.15 percent. The resulting discount rate used in EKPC's analysis was 7.30 percent. This level is consistent with current discount rates and the weighted average cost of capital for many companies in the utility sector.

EKPC further developed fixed charge rates for new transmission, reconductor, distribution substation, substation tap, and distribution coop that were used to determine the annual levelized costs (the annuitized value of the project based on the lifetime and fixed charge rate, i.e. the annual carrying charge) for the line item investments considered in each alternative considered. Costs for investments were appropriately adjusted to reflect the nominal annual charges in the years investment activity was expected to occur.

The fixed charge rate determination for new transmission was based on the following reconductor, distribution substation, and substation tap, as shown in Exhibit 3.1.

Exhibit 3.1: East Kentucky Power Fixed Charge Rate Determination

EAST KENTUCKY POWER COOPERATIVE

Fixed Charge Rate (October 1999)

	Transmission		Distribution			
	New Facilities	Line Reconductor	Substations		Related Transmission(1)	
			Insured Rate(2)	CFC Rate(3)	Insured Rate(2)	CFC Rate(3)
Interest Rate	6.35	6.35	5.25	8.60	5.25	8.60
Margins	0.95	0.95	0.79	1.29	0.79	1.29
Sinking Fund Depreciation	1.19	1.19	1.44	0.79	1.44	0.79
Taxes + Insurance	0.53	0.53	0.16	0.16	0.53	0.53
Replacements & Renewals	0.30	0.00	0.30	0.30	0.30	0.30
O & M	3.25	0.00	2.00	2.00	3.25	3.25
Total:	12.57	9.02	9.94	13.14	11.56	14.76
Weighted Average:			10.90	12.52		

Notes:

- (1) Transmission tap lines
- (2) Applicable to first 70% of EKPC total annual distribution expenses
- (3) Applicable to last 30% of EKPC total annual distribution expenses

Although interest inputs appear to be based on 1999 data, the interest values are within a reasonable range to consider for long-term investments. As shown, fixed charges for distribution are derived as the weighted average of a 70 / 30 split in the investment costs. The larger share of investment is considered to have a lower interest or return rate and lower margins while the sinking fund for depreciation is higher for the initial 70 percent. The key difference between distribution substations and distribution substation taps is based on the tax and insurance payments and O&M charges where the transmission portions receive a higher share. Fixed charge rates were also provided for the distribution cooperative charges at 0.1819; this represents the highest fixed charge of the categories considered. Sufficient detail on the derivation of this value was not available for review. The value was consistently used to value all distribution cooperative options across the cases, and although a bias may be introduced in cases with the highest distribution cooperative charges, the relative order of the cost of the

projects does not change. However, should this fixed charge estimate be high or low, the magnitude of differences across the alternatives may change.

SECTION 4: CONCLUSION

After a detailed review of EKPC's CPCN filing and relevant supporting materials, ICF Resources' concludes that:

1. The condition of the existing power supply infrastructure to the Little Mount area is close to its design capacity and could pose a reliability risk. Thermal overloads from supporting technical analyses provided by EKPC/SRECC appear significant and low voltages are prevalent even under existing load conditions. Additional load growth will only exacerbate the situation. Therefore there exists a need for an upgrade of the distribution infrastructure to the Little Mount area.
2. Growth in Spencer County and the surrounding areas has historically been strong and is expected to continue. Spencer County, in fact, has been one of the ten fastest growing Counties in the US.
3. Load factors for SRECC have been around 50 percent historically and are projected to remain at those levels because the existing SRECC customer mix is not forecasted to change.
4. Historical load growth and peak demand growth in the SRECC system and specifically at the Taylorsville substation support the future projections of peak demand and load. This minimizes any large uncertainty about the likelihood of new loads in the Little Mount area. This implies that the distribution infrastructure upgrade needs in the Little Mount area are unlikely to diminish.
5. All four alternatives proposed by EKPC are technically feasible. Alternatives B, C and G are preferable to Alternative A because they are less costly and they provide better future expansion flexibility and they also provide better supply security.
6. Alternatives C and G are technically superior to Alternative B because, whereas they all propose a new bulk power delivery substation, Alternative B is fed from a 69 kV transmission line tap that is a low capacity transmission line relative to the proposed 161 kV transmission line tap proposed in both Alternatives C and G. Additionally they are less costly than Alternative B.
7. Alternatives C and G have almost equal technical merits. Indeed Alternative G is a delayed implementation of Alternative C. Although Alternative G has a slightly lower cost in present dollars when compared to Alternative C, the cost differential is minimal and likely of little significance. The choice between the two will depend on the risk of faster than expected load growth or on the need to defer capital investments. If there is likelihood of even faster load growth than projected or of growth spikes, then Alternative C is preferable; if there is a need to defer capital investments then Alternative G is preferable. Also, if acquisition of rights-of-way is problematic then it may be preferable to implement Alternative C since that requires acquisition of rights-of-way for only the substation and the line tap unlike Alternative G that would require the same right-of-way for Alternative C in addition to a right-of-way for the new sub feeder from Darwin Thomas.
8. ICF believes that Alternatives C and G address the need for a distribution system upgrade, as identified by EKPC.

APPENDIX I: LIST OF DOCUMENTS REVIEWED

Notice of Intent to File Application, Little Mount Distribution Tap, Spencer Co.
CPCN Application for Substation and Tap in Spencer County
Request for Information Regarding Public Hearing Information (James E. Ransdell)
Letter to James E. Ransdell, Announcement of Public Hearing date of March 3, 2005 (PSC KY)
Letter of Complaint (Roswell A. Harris)
Response to Letter of Complaint from Roswell A. Harris (PSC KY)
Responses of East Kentucky Power Cooperative, Inc. to Commission Staff Requests Dated Jan 18, 2005
Item 1: Salt River Distribution System Map
Item 1: EKPC Transmission System Map
Item 2: SRECC Delivery Points
Item 2: SRECC Subsections of the Distribution System
Item 4: Salt River Electric 2004 Load Forecast
Item 8: Monthly Peaks - Taylorsville, Bloomfield, Darwin Thomas (Jan-Dec 2004)
Item 8: Ratings - Taylorsville, Bloomfield, Darwin Thomas
Item 9: Length of Existing Feeders to the Little Mount/Spencer County Area
Item 10: History for Voltage Monitor # 17_4 (1 Jan 2004 - 30 Jul 2004)
Item 10: History for Voltage Monitor # 17_4 (31 Jul 2004 - 21 Jan 2005)

Avoided Capacity & Avoided Energy Charge for Distribution Losses
Derivation of Discount Rate for Present Value Analysis
Fixed Charge Rate
Recommended Inflation Rates for Capital Improvements
Template for Determining Fixed Charge Rate (Carrying Charge)
Transmission Wheeling for Taylorsville Load on Kentucky Utilities
Distribution Losses: Alternatives B, C, A, G
Salt River Substation Forecast - 1998
Salt River Substation Forecast – 2002

Packet 1: Taylorsville FDR 04, Existing Load, No Corrections, Two Sets of Regulators
Packet 2: Taylorsville FDR 04, Existing Load, No Corrections, One Set of Regulators
Packet 3: Bloomfield FDR 02, Existing Load, No Corrections
Packet 4: Darwin Thomas FDR 02, Existing Load, No Corrections
Packet 5: Taylorsville FDR 04, 2010 Load Level, Before Corrections
Packet 6: Taylorsville FDR 04, 2015 Load Level, Before Corrections
Packet 7: Little Mount Fed from Bloomfield FDR 02, Existing Load Level
Packet 8: Little Mount Fed from Darwin Thomas FDR 02, Existing Load Level
Packet 9: Taylorsville FDR 04, 2010 Load Level, After Corrections
Packet 10: Taylorsville FDR 04, 2015 Load Level, After Corrections
Packet 11: Taylorsville FDR 04, 2025 Load Level, 3 Sets of Regulators
Packet 12: Little Mount Fed from Darwin Thomas, 2025 Load Level
Packet 13: Little Mount Fed from Darwin Thomas, 2015 Load Level
Packet 14: Little Mount Fed from Darwin Thomas, 2025 Load Level, 5 Sets of Regulators
Packet 15: With Little Mount Substation, 2005 Load Level
Packet 16: With Little Mount Substation, 2010 Load Level, 1 Single Phase Regulator
Packet 17: With Little Mount Substation, 2015 Load Level
Packet 18: With Little Mount Substation, 2025 Load Level, 1 Single Phase Regulator

Proposed Little Mount Tap
Phase I Archaeological Survey for the Proposed Little Mount Electrical Substation, Spencer County, KY
Categorical Exclusion from National Historical Preservation Act
Exhibits to Application for CPCN: Proposed Little Mount 161kV Tap
Exhibit VIII:

- Proposed Little Mount Tap, Final Route, Sheet 1 of 3
- Proposed Little Mount Tap, Final Route, Sheet 2 of 3
- Proposed Little Mount Tap, Final Route, Sheet 3 of 3

Exhibit IX: Transmission Line Easement
Exhibit X: Affidavit of Bruce E. Murrey, Jr.
Exhibit XI: Property Owner Listing
Exhibit XII: Letters Announcing Open House
Exhibit XIII: Letters to Property Owners Proposed Little Mount Tap (map)
Exhibit XIV: Open House Newspaper Advertisement
Exhibit XV: Transmission Line Siting Data List, Little Mount Tap Open House
Exhibit XVI:

- Environmental Findings as of Dec 4, 2004 for the Proposed Little Mount Transmission Line
- Letter to Sara Hines, KY Nature Preserves Commission, Enclosing Map & Data Request Form (EKPC)
- Letter to Joe Settles, EKPC, Responding to Data Request (KY State Nature Preserves Commission)
- Letter to Jeff Hohman, EKPC, Enclosing Categorical Exclusion from National Historical Preservation Act (Kentucky Heritage Council)
- Letter to Kurt D. Mason, District Conservationist, Enclosing Topographic Quadrangle (EKPC)
- Proposed Little Mount Tap, Topographic Quadrangle Map
- Letter to Joe Settles, EKPC, Enclosing Color Coded Soils Map (USDA, National Resources Conservation Service)
- Letter to Lee Andrews, US Fish & Wildlife Service, Enclosing Environmental Impact Information (EKPC)

2003 Loading (Load Level 1), Conversion of Existing System Without Little Mount Substation

2003 Loading (Load Level 1), With Little Mount Substation

Salt River ECC, Printout of Substation Growth Rates That Are Significantly Different Than The System

Letter to Maria Scheller, Announcement of Public Hearing date of March 3, 2005 (PSC KY)

Proposed Little Mount 161kv Transmission Line, Proposed and Alternate Routes

SRECC Distribution System Map From Bloomfield, Taylorsville and Darwin Thomas

Letter to Paul C. Atchinson, EKPC, RUS Approval of Three-Year Work Plan (USDA, Rural Utilities Service)

Soil Survey, Bullitt and Spencer Counties (USDA, NRCS)

Confirmation of Data Request (KY State Nature Preserves Commission)

Letter to Lee Andrews, US Fish & Wildlife Service, Enclosing Environmental Impact Information (EKPC)

Letter to Joe Settles, EKPC, Environmental Impact (US Fish & Wildlife Service)