RTO Membership Analysis

1 Executive Summary

A cross-functional team was assembled to conduct a high level analysis of the estimated costs and benefits of LG&E-KU ("LKE" or "the Companies") regional transmission organization (RTO) membership, specifically for Midwest Independent Transmission System Operator (MISO) and PJM Interconnection (PJM). The analysis of joining MISO and PJM covered a ten year study period from 2013 through 2022. The analysis was modeled after a similar study, EKPC RTO Membership Assessment[1], performed by Charles River Associates (CRA) for East Kentucky Power Corporation in their consideration of joining PJM.

- **RTO membership is unfavorable.** LKE's RTO Membership Analysis shows an unfavorable ten-year present value for RTO membership ranging from ($103) M for PJM to ($216) M for MISO.
- **Key driver is "backbone" transmission costs.** Allocation of large transmission expansion projects costs across RTO members is the primary cost driver of RTO membership.

2 Methodology

LKE Transmission Strategy and Planning assembled a cross–functional team for the RTO Membership Analysis.[2] The team was comprised of representatives from Transmission Policy & Tariffs, Federal Regulation & Policy, Regulated Trading and Dispatch, and Economic Analysis. The CRA EKPC RTO Membership Assessment was used as a general guideline for this analysis.

- The methodology for the LKE analysis was consistent with the methodology and testimony from the 2006 MISO exit proceedings.
- The methodology took into consideration changes to the tariff structures and business practices of the RTOs since the exit proceedings.

[1] March 2012 http://psc.ky.gov/pscscf/2012%20cases/2012-00169/20120503_ekpc_application_volume%201.pdf, Exhibit RLL-2

[2] The Compliance Department was apprised of all meetings to ensure maintenance of Standards of Conduct between Transmission function and Trading function employees.

The intent of the analysis was to incorporate updated data and information to assess the costs and benefits of RTO membership at a high level, as opposed to an exhaustive analysis. These results were viewed as a threshold to determine if further in-depth study is warranted.

3 Key Assumptions

This analysis was conducted for a ten year horizon, 2013 through 2022, a period identical to the CRA study conducted for EKPC. The following key simplifying assumptions were incorporated into the analysis:

- LKE would continue to maintain its own capacity to meet a target planning reserve margin established consistently with current processes.
- No changes in locational marginal prices (LMP) due to planned RTO transmission expansions
- No impact from Firm Transmission Rights/Auction Revenue Rights (FTR/ARR) and congestion cost
- No impact from allocation of over collection of marginal losses[3]
- No impact from uplifts or make whole payments other than those identified
- No impact from potential transmission cost sharing within alternative, non-RTO Order 1000 regional planning region

4 Cost / Benefit Components

4.1 Allocation of "Backbone" Transmission Expansion Costs

The key driver of the outcome of this analysis was the allocation of "backbone" transmission expansion costs.

- For PJM, transmission expansion costs of $176 million (present value) represent more than half of the estimated absolute cost of RTO membership (excluding the benefits).
- For MISO these costs are $241 million (present value), approximately 60% of the estimated absolute cost of membership (excluding the benefits).

4.1.1 MISO Multi-Value Projects

[3] Both MISO and PJM collect incremental value of financial losses through the locational marginal price (LMP), which results in over–collection. Both have a process to allocate any over–collection back to the load serving entities.

Under current MISO policy, the cost of new transmission projects that address energy policy and/or provide widespread benefits across the footprint are considered "multi-value projects" (MVP). The cost of MVP are allocated 100% "postage stamp" to load, i.e., all load pays the same rate for MVP irrespective of where its located in the footprint, and are recovered under Schedule 26A of the MISO Tariff. LKE's share of the $5.4 billion in MVP projects currently identified in the Midwest ISO Transmission Expansion Planning (MTEP) process is based on the "indicative annual charges for approved MVP" published on the MISO website[4], applied to LKE loads projected per the 2013 Business Plan. As a new member, LKE would most likely be subject to the full cost allocation for expansion without any phase-in period.[5]

4.1.2 PJM Regional Transmission Expansion Planning

Under current PJM policy, the cost of new "backbone" high voltage transmission projects approved under its annual Regional Transmission Expansion Planning (RTEP) process is allocated on a uniform basis to all PJM loads based on the non-coincident annual peak of each PJM transmission zone. These charges are recovered under Schedule 12 of the PJM tariff. "Backbone" facilities comprise "Regional Facilities" that operate above 500 kV and "necessary lower voltage facilities" that operate below 500 kV that must be constructed or strengthened to support new Regional Facilities.[6] As a new member, LKE would most likely be subject to the full cost allocation for expansion without any phase-in period. The allocation to LKE for projects documented in the RTEP within this analysis period has been estimated using PJM's allocation methodology and is a key cost driver for the PJM case.

4.2 Modeled Components

Two components of the analysis, Operating Reserve and Trade Benefits, were estimated by Generation Planning (GP) using the Companies' planning models. Because the models were already developed for other planning purposes, only minimal changes were required to use the models to estimate these components.

4.2.1 Operating Reserve

The reduced operating reserve capacity benefits of joining MISO or PJM were estimated by reducing the Companies' "spinning reserve" requirement from 230 MW to 100 MW, for a present value benefit of $14 M. GP revised the operating reserve input in the

[4] https://www.midwestiso.org/_layouts/MISO/ECM/Redirect.aspx?ID=135589
[5] For discussion of the "unique circumstances" surrounding Entergy joining Midwest ISO that justify Entergy's five year MVP exemption and eight year MVP cost phase-in, see 139 FERC¶ 61,056 at ¶¶ 70,181,213.
[6] CRA Study, p. 12.

Companies' reliability planning software, SERVM, which resulted in a target system planning reserve margin (RM) of 15% (1% lower than the existing target RM of 16%).[7] GP used this new RM to evaluate the impact to the Companies' expansion plan using a spreadsheet model to calculate the expected RM and using Strategist software.

The table below shows the expected RMs with no new capacity after Cane Run 7 in 2015 and the corresponding capacity additions needed with the existing and new target RMs.

	RM w/o New Capacity	**Existing Expansion Plan (16% RM Target)**	**New Expansion Plan (15% RM Target)**
2016	14.7%	165 MW PPA	NA
2017	14.1%	165 MW PPA	NA
2018	12.5%	605 MW CCCT	605 MW CCCT

With the new 15% target RM, the 165 MW Power Purchase Agreements (PPAs) in 2016 and 2017 in the existing expansion plan could be avoided, resulting in an estimated cost savings of $9.6 M each year. However, the absence of the PPAs results in higher expected system production costs of approximately $0.2 M in both 2016 and 2017, as estimated by GP using PROSYM software.

4.2.2 Trade Benefits

The trade benefits of joining MISO or PJM were estimated by GP using PROSYM as lower native load production costs and higher off-system sales (OSS) margins that resulted from the following:

- Reducing the spinning reserve requirement from 230 MW to 100 MW
- Eliminating RTO expenses for OSS and purchases
- Eliminating 3rd party transmission expenses for purchases
- Eliminating LG&E-KU transmission expenses for OSS and purchases
- Eliminating $2 "costless adder" for OSS and purchases

The eliminated LG&E-KU transmission and $2 costless adder expenses were deducted from the total savings because they do not represent actual savings to the Companies. The PJM and MISO analyses used electricity price forecasts specific to each RTO.

[7] With the existing 16% RM target, GP would choose to purchase temporary capacity through a PPA in years with an annual RM between 14% and 15% and would choose permanent capacity in a year with a RM below 14%. With the new 15% RM target, a PPA would be chosen for years with RMs between 13% and 14%; permanent capacity would be chosen below 13%.

- The resulting net trade benefits total between $11 M and $15 M annually over the study period for each RTO
- The present value of trade benefits is approximately $90 M for both PJM and MISO.

4.3 Other Components

4.3.1 Administrative charges

Both MISO and PJM have various tariff schedules to recover the administration cost of operating the markets and providing services to their respective footprints. For MISO, these costs were estimated using $/MWh cost projections contained in the MISO 2011 Budget presentation published on their website[8]. Administrative costs for PJM were estimated based upon the costs noted in the CRA study.

4.3.2 Transmission Revenue

Both MISO and PJM allocate third-party transmission revenues to the transmission owners in their respective footprints. MISO uses a formula based on allocation of plant in service and transmission flows to allocate transmission revenue. This allocation was assumed to be approximately $1 M per year to LKE, estimated based upon prior experience in MISO. The projected allocation to LKE from PJM was estimated using the PJM transmission revenues shown in the CRA study, multiplied by LKE's estimated proportion of PJM's total transmission revenue requirement, which calculated to be approximately 2.7%.

4.3.3 Uplift Costs

Both MISO and PJM have various mechanisms for allocating uplift costs that result from operations of the markets and payments made to others that are not offset by revenues. Typically, for both RTOs, these costs are the result of committing units in real-time that were not committed in the day-ahead market. In MISO these costs are referred to as "revenue sufficiency guarantee" (RSG) costs and, in the PJM market, as "operating and balancing reserve cost". Both RTOs also have other sources of these "revenue insufficient" costs. For MISO, RSG cost was assumed to be a net zero for LKE, but a load ratio share of the historic Revenue Neutrality Uplift cost of $100 million per year was assumed.[9] For this analysis, the PJM allocation of these costs to LKE was assumed to be negligible, which is consistent with the CRA study.

[8] https://www.midwestiso.org/Library/Repository/Meeting%20Material/Stakeholder/BOD/BOD/2011/20111208/20111208%20BOD%20Item%2006%20%20VI.A%202012%20Budget%20Public%20Final.pdf

[9] Load ratio share roughly estimated based on LKE peak load of 7200 and total MISO peak load of ~107,000 or 6.6%

4.3.4 FERC Charges

Under FERC regulations, the annual FERC charge is assessed to all RTO energy for load, and not just "wholesale" load as LKE is assessed outside of an RTO. For this analysis, the current FERC assessment charges were escalated for inflation and applied to LKE Energy for load as given in the 2013 Business Plan.

4.3.5 Net Zero Components

Two components, congestion cost/ARR/FTR and ancillary services market, have been identified that would be considered of net zero benefit. It is expected that the value of the ARR/FTR may equal or exceed the congestion costs; however, the net cost or benefit will not be known with certainly until such rights are issued. A company may choose to self-supply ancillary services and be no worse off than before joining an RTO. While there could be some potential benefit in the RTO market, there is no means to estimate the value of such benefit.[10]

4.3.6 Eliminated Administration Charges

Membership in either PJM or MISO would result in a re-alignment of internal cost for the provision of certain services. For the purposes of this analysis, it was assumed that LKE would no longer need the current Independent Transmission Operator (ITO) or Reliability Coordinator (RC) services provided by TranServ and TVA, respectively. There also likely would be a reduction in cost in the balancing authority services provided by internal staffing. This reduction would be offset to some degree by increases in internal staffing to manage the day to day operations in the RTO, as well as for back office settlement of the RTO statements and invoices on a daily basis.

4.3.7 De-Pancaking

LKE currently pays "depancaking" cost to certain entities as a result of the 2006 MISO exit.[11] It is assumed that all of these payments would cease if LKE were to join either PJM or MISO.

[10] See Charles River Associates EKPC RTO Membership Assessment (March 2012)
[11] LKE pays costs for certain entities to keep them from having to pay more for transmission now than when the Companies were in MISO, known as depancaking costs.

5 MISO Summary

												Present Value Rate
												6.75%
Cost		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	NPV
	MISO Admin Cost ($M)	-11.3	-11.0	-11.0	-11.4	-11.8	-12.2	-12.6	-13.1	-13.5	-14.1	-85.4
	MISO MVP XM Expansion Cost ($M)	-5.9	-12.1	-20.7	-33.0	-37.9	-43.6	-51.1	-56.8	-55.9	-55.3	-241.3
	LKE Internal Staffing/Equipment Cost ($M)	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-3.9
	MISO Congestion Cost/ARR/FTR ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MISO Misc. Uplift Cost ($M) - Revenue Neutrality Uplift	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-46.9
	MISO Ancillary Services Market ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MISO FERC Fees (Incremental of Present) ($M)	-1.5	-1.6	-1.6	-1.7	-1.8	-1.9	-2.0	-2.1	-2.2	-2.3	-13.0
	LKE Lost XM Revenue from 3rd Parties	-3.0	-3.1	-3.2	-3.2	-3.3	-3.4	-3.5	-3.6	-3.7	-3.7	-23.6
	Sum of Cost	-28.8	-34.8	-43.6	-56.6	-62.0	-68.3	-76.3	-82.7	-82.6	-82.7	-414.0

Benefits		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	NPV
	MISO XM Revenue Allocation ($M)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.1
	MISO Trade Benefits (Production Costs) ($M)	11.1	12.3	12.3	11.6	12.1	12.4	13.2	12.7	14.9	15.6	89.7
	MISO Operating Reserve Margin Capacity Benefits ($M)	0.0	0.0	0.0	9.4	9.3	0.0	0.0	0.0	0.0	0.0	13.9
	LKE Elimination of TVA RC Cost ($M)	2	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5	15.7
	LKE Elimination of ITO Cost ($M)	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.7	3.7	23.6
	LKE Elimination of De-Pancaking ($M)	6.8	7.1	6.2	6.1	6.2	6.4	6.5	6.7	6.9	7.1	46.8
	LKE Elimination of TEE Group Admin Charge ($M)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
	Sum of Benefits	24.0	25.6	24.8	33.6	34.3	25.6	26.6	26.5	29.0	30.0	197.5
	Net of Cost + Benefits	-4.8	-9.2	-18.8	-23.0	-27.7	-42.7	-49.7	-56.2	-53.6	-52.7	-216.5

6 PJM Summary

Present Value Rate 6.75%

Cost	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	NPV
PJM Admin Cost ($M)	-11.4	-11.4	-11.6	-12.0	-12.4	-12.8	-13.2	-13.8	-14.2	-14.8	-89.3
PJM Backbone XM Expansion Cost ($M)	0.0	-12.6	-27.0	-27.0	-27.0	-27.0	-27.0	-40.4	-40.4	-40.4	-176.3
LKE Internal Staffing/Equipment Cost ($M)	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-3.9
PJM Congestion Cost/ARR/FTR ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PJM Misc. Uplift Cost ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PJM Ancillary Services Market ($M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PJM FERC Fees (Incremental of Present) ($M)	-1.5	-1.6	-1.6	-1.7	-1.8	-1.9	-2.0	-2.1	-2.2	-2.3	-13.0
LKE Lost XM Revenue from 3rd Parties	-3.0	-3.1	-3.2	-3.2	-3.3	-3.4	-3.5	-3.6	-3.7	-3.7	-23.6
Sum of Cost	-16.4	-29.1	-43.9	-44.5	-45.1	-45.7	-46.3	-60.4	-61.1	-61.9	-306.0

Benefits	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	NPV
PJM XM Revenue Allocation ($M)	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	1.9	12.0
PJM Trade Benefits (Production Costs) ($M)	12.6	12.9	11.7	10.9	11.3	12.2	13.0	14.2	14.6	15.2	90.2
PJM Reduced Operating Reserve Margin Capacity Benefits ($M)	0.0	0.0	0.0	9.3	9.4	0.0	0.0	0.0	0.0	0.0	13.9
LKE Elimination of TVA RC Cost ($M)	2	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5	15.7
LKE Elimination of ITO Cost ($M)	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.7	3.7	23.6
LKE Elimination of De-Pancaking ($M)	6.8	7.1	6.2	6.1	6.2	6.4	6.5	6.7	6.9	7.1	46.8
LKE Elimination of TEE Group Admin Charge ($M)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
Sum of Benefits	26.0	26.8	24.9	33.4	34.2	26.1	27.2	28.8	29.5	30.5	203.0
Net of Cost + Benefits	9.6	-2.3	-19.0	-11.2	-10.9	-19.6	-19.0	-31.6	-31.6	-31.3	-103.0

7 Additional Considerations and Uncertainties

7.1 NERC Compliance Requirements

Since the companies own and operate certain facilities used in interstate commerce or that have the potential to impact the bulk electric system, the Companies are required to comply with Reliability Standards for planning and operating the bulk electric system, as developed by the North American Electric Reliability Corporation (NERC). Under current operations, LG&E/KU Transmission Owner (TO) are responsible for over 1,200 NERC compliance requirements falling under the Reliability Standards. It is estimated that slightly over 300 of these requirements would be performed by an RTO and no longer an internal function if the companies were to join and RTO. While this reduction is noted qualitatively, the study does not estimate a financial cost/benefit related to compliance.

7.2 Regulatory Environments – MISO, PJM

There has been considerable realignment of RTO memberships since 2006. Examples include the departure from MISO of First Energy and Duke-Ohio/Kentucky. Both entities are now PJM transmission owning members. MISO has retained and, with the joining of Entergy, BREC, and Dairyland Power, gained members who operate in non-contestable load areas, while PJM has solidified membership of transmission owners operating in states that have retail access and unbundled utilities.[12] Given this realignment between MISO and PJM membership, it is likely that more of Kentucky's regulatory paradigm and LKE's traditional regulated utility business model would be accommodated in MISO versus PJM. For example, the entities within MISO that had been advocating for capacity markets are simply not as politically strong as they once may have been. Moreover, membership in PJM would almost certainly pit LKE interests against those of the traditional PPL companies on matters of significance to all concerned.

7.3 Future RTO Market/Program Implementation

The costs/benefits of "markets" or "programs" that each RTO may implement in the future are uncertain and so cannot be reflected in this analysis.

8 Conclusion

The results of this threshold analysis reveal that a more in depth study of the cost and benefits of RTO membership is not warranted at this time. Further, the study results

[12] Ameren-Illinois's continued membership in MISO being a notable exception.

confirm the prudency of LKE continuing with the establishment the Southeast Order 1000 Planning Region.