



OFFICE OF INTERNAL AUDIT

Stan Sewell, City Auditor

MEMORANDUM

To: City Council
From: Stan Sewell, City Auditor
Date: April 25, 2014
Re: Energy Efficient Lighting Cost Recovery

Background

Global Green Lighting, LLC (Global) has designed, developed, produced and deployed its Urban Connection Light system in the Chattanooga downtown area. Global indicates it is a one-of-a-kind technology that manages, measures and reports energy usage to the local utility for billing purposes.

The City of Chattanooga (City) entered into an agreement (3/29/12) with Global for the purchase of energy efficient lighting (lighting luminaries). Resolution 27032 (3/20/12) approved the purchase of up to 27,000 lights. However, the initial purchase amount was limited to \$6 Million. As of March 2014, \$136,165 remains unspent for the initial purchase order.

Per the agreement, the estimated total project is for 26,551 lighting luminaries (\$18,139,418) with the commitment to purchase the luminaries within three (3) years (by 3/29/15). However, the agreement states the commitment is subject to funding approval and acceptable performance of the equipment.

The agreement also allows for access and monitoring fees at the per unit rate published in Global's Municipal Price List. The price list attached to the agreement indicates the access fee will be \$.29 per light each month and the monitoring fee will be \$.86 per light each month. As an incentive for the City to place the anticipated orders within 18 months and for the City to pay 30% within five days of the order, Global provided a discount of 15% on the access fee and waived the monitoring fee. In addition, Section 3.2 of the contract between Global and the City specifies an express warranty of "eight (8) years from the date of delivery".

Historically, and in accordance with industry standards, the Electric Power Board (EPB) has charged the City for streetlight electricity usage based on a standard rate schedule. As a result of the City's agreement with Global and the ability to meter each light, the City has also entered into an additional agreement with EPB. The Meter Reading Agreement, dated April 1, 2013, sets forth the terms for billings related to the street lights purchased from Global with a device capable of metering electric usage. This agreement also stipulates EPB will install the lights.

Global has expressed their desire to proceed with the City’s commitment to purchase additional lighting luminaries. In a letter dated February 25, 2014, Mayor Berke notified Global he has a team of individuals working with Global and other partners performing due diligence. This team will present recommendations to the Mayor no later than May 10, 2014.

The Office of Internal Audit (OIA) has previously reviewed the City’s obligation as it relates to the agreement with Global. Subsequent to the review, City Council members requested OIA perform an additional review of the related financial projections and their estimated cost recovery periods. Members of the Council also requested OIA review warranty replacement history.

Financial Projections

A projection is a type of prospective financial information prepared based on known facts, hypothetical assumptions and actions which may or may not take place. A projection illustrates the possible results as of the date the information is prepared, if these facts, assumptions and actions were to occur (a “what-if” scenario). Actual results will differ from the projection since assumptions and actions do not always occur as expected.

From the inception of the lighting project, there have been various financial projections related to the estimated cost recovery period. In Exhibit 1 below, we have summarized assumptions and results from the projections.

Exhibit 1: Summary of Assumptions and Results¹

	Original	Current	City	OIA
Inflation	3%	3%	1.5%	4%
Energy Savings	75%	71%	60%	68.8%
Warranty Period (Years)	8	8	15	13
Cost Recovery (Years)	8	9	14.9	13.2

Note: The City Cost Recovery period would be 12.9 years without a 15 year extended warranty

Based on our examination of the evidence supporting the assumptions and analytical procedures performed, we believe the approximate cost recovery would be 13.2 years. Global has stated they will extend the warranty to thirteen years at no additional cost to the City. The primary causes of the difference between the *Original* cost recovery period and our cost recovery period are (in order of impact):

1. Less savings on the EPB Facilities Charge post implementation;
2. The inclusion of costs associated with retiring existing assets prior to the expiration of their useful lives (stranded assets);
3. Lack of anticipated savings from “additional maintenance” on City owned assets; and,
4. Higher than anticipated debt service (interest rate).

¹ Original column represents the projection developed by City Administration and Global prior to the approval of the agreement. The Current column represents the current projection provided to OIA by Global. The City column represents Administration’s recent projection. The OIA column represents the current projection by the Office of Internal Audit.

A detailed discussion of the assumptions is attached (Appendix 1). A copy of the projections we reviewed and the OIA projection are attached (Appendix 2 through 5).

Warranty Replacement History

A summary of work orders related to the Energy Efficient Lighting project was provided to Administration by EPB. This summary indicated there were 728 work orders related to repairs or maintenance of the new lighting. This summary included 60 duplicate reports (when two crews were dispatched for the same work order). In addition to light fixture replacements, the summary included activations, pole resets and alarm clearings. EPB records indicate 406 lights were replaced since the project began. Global indicates 401 lights have been replaced since the project began. This immaterial discrepancy appears to be related to some lighting installed for the Parks and Recreation Department prior to the current project. The detail records of both EPB and Global appear to be accurate and a fair representation of light replacements. Of the 401 lights replaced, 309 were related to a faulty relay damaged during the manufacturing process of the first 500 lights. Global represents any damaged relays will fault within six months of being placed in service. There are only a small portion of the suspect lights remaining with less than six months of service.

The issues discussed in this memorandum are not the result of an audit performed in accordance with generally accepted government auditing standards. Had we performed such an audit, additional issues might have been reported. The purpose of this memorandum is to provide information that may be useful.

cc: Audit Committee
 Mayor Andy Berke
 Daisy Madison, Finance Officer
 Jeff Cannon, Chief Operating Officer
 Greg Eaves, EPB
 Don Lepard, Global Green Lighting

Attachments.

Appendix 1:

City of Chattanooga Energy Efficient Lighting Cost Recovery Projection Assumptions

1. Number of Lights and Total Project Cost

Section 5.1(a) of the agreement between the City and Global sets forth the assumption of 26,551 lighting luminaries with an estimated total cost of \$18,139,418. Based on the initial assumptions and estimates set forth in the agreement, the projection assumptions of 26,500 lights with an estimated total cost of \$18 Million appear reasonable.

2. Baseline EPB Charges

EPB charges consist of the EPB energy charge (currently \$.04745 per kWh), the Tennessee Valley Authority (TVA) fuel cost adjustment (currently \$.023 per kWh), and the EPB facility charge (currently 12.3% of the installed cost of the lighting).

During deployment of the new lights, discrepancies were discovered in EPB's street light billing classifications. The *Original*, *Current* and *City* projections all appear to be based on energy charges prior to these billing discrepancies being corrected. The kWh charge has been corrected to more appropriately reflect the actual kWh usage of the existing lighting. As a result of a review of billings and classification changes, we have factored a reduction of 12.4% to the *Current* energy cost projection in our analysis.

3. Inflation

The *Original* and *Current* projections use an estimated 3% inflation rate to project increases in EPB charges. The *City* projection uses 1.5%.

Overall outdoor lighting energy rates (per kWh) for EPB/TVA have increased an average of 6% over the last five years. In addition, the Consumer Price Index (CPI) for electricity has increased 3.8% for the twelve months ended February 2013. Current TVA costs are up 4.2% compared to last year. Based on these historical increases, the inflation rate assumption of 3% appears conservative. We believe a 4% inflation rate more accurately reflects what might happen in the future and have factored this into our projection with regard to energy costs.

The *Original*, *Current* and *City* projections apply the same inflation adjustment to the facility charges as are applied to the energy charges. Due to their long life and infrequent replacements, it does not appear facility charges change materially based on inflation and therefore we have not applied an inflation factor on this amount in our projection.

Appendix 1:

4. Savings

A Department of Energy assessment report¹ indicates energy reductions range from 50% to 70% over the current high-pressure sodium systems. Global's *Current* savings assumption of 71% is based on the total kWh from the September 2011 EPB billing compared to Global's estimate of total kWh when the lighting project is complete. The Global estimate is based on actual (based on current installed lighting) metered kWh by type of light and the projected mix of new lighting to be installed. After reviewing EPB billings (adjusting for lighting type errors) and the kWh actually used by the new lighting, we believe a savings assumption of 68.8% more accurately reflects what might happen in the future and have factored this into our projection.

5. Access and Monitoring Fee

The agreement between the City and Global allows for access and monitoring fees at the per unit rate published in Global's Municipal Price List. The price list attached to the agreement indicates the access fee will be \$.29 per light each month and the monitoring fee will be \$.86 per light each month. As an incentive for the City to place the anticipated orders within 18 months and for the City to pay 30% within five days of the order, Global provided a discount of 15% on the access fee and waived the monitoring fee.

Based on the terms set forth in the agreement, the assumption of the discounted \$2.96 per year per light for access fees is reasonable. Even though the City has not met the threshold order amount in 18 months, Global has stated to OIA they will continue to honor the access fee discount and waiver of monitoring fees. Therefore, we have maintained this assumption in our projection. If the City chooses to appropriate additional funds for this project, the agreement should first be amended to reflect the continued discount.

6. Installation Cost

EPB's installation cost for Phase 1 of the lighting project totaled \$462,000 for 4,312 lights, with an average of \$107 per light. We have factored EPB's actual installation cost for Phase 1 into our projection. Phase 1 involved implementation of the project in the downtown area. System design issues in this area resulted in a higher installation cost than is expected for the remaining phases of the project.

Global represents their initial proposal included an offer to install each light for \$70. As EPB's installation cost has been greater than this amount, Global represents they are willing to take over installation for \$70 per light. Further, EPB feels confident the remaining lights can be installed for \$70 per light. However, EPB stressed this could only be accomplished if there were no delays caused by the City or Global (i.e. light fixtures will need to be available to keep crews moving consistently and they must not have to wait for agents of Global to activate lights). We have based our projection on an assumption the remaining lights can be installed at a cost of \$70 each.

¹ LED Street Lighting, Prepared for the U.S. Department of Energy and Pacific Gas & Electric by Energy Solutions, December 2008

Appendix 1:

7. Post Implementation Facility Charge

As mentioned above in the discussion of EPB charges, there is an industry standard facility charge based on 12.3% of the installed cost of the lighting (Poles, Arms, Fixtures, etc.). The 12.3% is an estimate to cover the following main factors: Operations and maintenance, administration and general, payment in lieu of taxes, contribution to capital, and depreciation. As light fixtures are removed (replaced by Global lights), the asset base (installed cost) is reduced (lowering the amount of the traditional facility charge).

EPB also charges the City for these discarded assets. The assets discarded consists of bracket arms, lighting fixtures and bulbs removed during the installation of the new lights. In a memo dated May 31, 2011 to the City, EPB notified the Mayor of the need to be reimbursed for any assets discarded before their useful life expires. It does not appear Global was made aware of the additional facility charge.

Global's *Current* projection for the City's new lighting system does not include the traditional facility charge nor the charge for discarded assets. It is Global's contention the traditional facility charge is inaccurate; the additional facility charge was not contemplated and is also inaccurate; and the facility charge rate of 12.3% is inaccurate. Global asserts the average age of discarded assets appears to be 10 years, with the conclusion the majority of the discarded assets should be almost fully depreciated.

EPB acknowledges both the traditional facility charges and the discarded assets charges are estimates. The estimates are necessary because EPB does not specifically identify the cost of assets and uses the "composite" method of depreciating assets. The "composite" method is customary for Utilities and Power Companies and is considered a generally accepted accounting principle (GAAP).

We have reviewed EPB's records and we agree their method of accounting meets industry standards and is acceptable. We estimate after the lighting project is complete, the facility charge on the remaining assets that support the lights is estimated to be \$483,000 annually. The remaining assets that support the lights consists of poles, conductors, wires, transformers, etc.

If the traditional facility charges and discarded assets charges were included in Global's calculation of the cost of new lighting, the *Current* Global projection cost recovery period would increase by approximately 2.6 years.

8. Interest Expense

The *Original* projection assumed a 2% interest rate for debt. The *Current* and *City* projections assume 3%. The City financed the initial purchase of lighting for 15 years at the annual rate of 2.7538%. Accordingly, our projection assumes the borrowing of \$18 Million at this actual interest rate over 15 years.

Appendix 1:

9. Additional Warranty

The *City* projection includes an additional warranty totaling \$324,000 per year. Without the additional warranty cost assumption, the *City* cost recovery period would be 12.9 years. Global has represented to OIA it will extend the warranty period to 13 years at no additional cost to the City. If the City chooses to appropriate additional funds for this project, the agreement should first be amended to reflect this new warranty period.

Appendix 2: Original ROI based on full deployment of 26,500 Street Lights in the City of Chattanooga

Current Operating Costs for 26,500 Lights (if left unchanged)															15 year		
	Year 1	2	3	4	Year 5	6	7	8	9	10	11	12	13	14	Year 15	Totals	Annual Avg
EPB facility charges, pole/transformer/new equipment installation (2)	1,074,285	1,106,493	1,139,697	1,173,878	1,209,094	1,245,367	1,282,728	1,321,310	1,360,848	1,401,672	1,443,722	1,487,033	1,531,644	1,577,594	1,624,922	19,880,155	1,322,010
EPB Additional Maintenance Costs (3)	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	414,196	4,970,352	324,689
EPB Energy Cost (4)	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	1,228,645	14,743,735	952,915
EPB Energy Fuel adjustment (4)	772,335	795,505	819,370	843,851	869,270	895,348	922,209	949,875	978,371	1,007,722	1,037,854	1,068,692	1,101,165	1,134,200	1,168,828	14,364,594	957,640
Total Operating Cost for Existing 26,500 lights (if left unchanged)	3,469,441	3,544,839	3,621,098	3,698,670	3,778,770	3,860,356	3,944,777	4,031,925	4,122,038	4,214,516	4,310,077	4,408,876	4,511,165	4,617,016	4,725,646	55,392,010	3,322,467
Full deployment of 26,500 GGL/FlexNet Street Lighting & Energy Management System.															15 year		
	Year 1	2	3	4	Year 5	6	7	8	9	10	11	12	13	14	Year 15	Totals	Annual Avg
GGL Operating system Access / fees paid annually (\$2.88 per/foot (26,500) annual)	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	76,467	1,147,003	76,467
GGL Monitoring, Programming, and Maintenance service Fee paid annually (\$10.32 per/foot (26,500) annual)	429,706	442,597	455,876	469,551	483,638	498,147	513,091	528,484	544,326	560,624	577,378	594,587	612,251	630,370	648,944	6,832,511	455,500
EPB facility charges, pole/transformer/new equipment installation (2)	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	103,549	1,242,588	82,839
EPB Additional Maintenance Costs (3)	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	307,161	3,685,932	245,728
EPB Energy Cost (4)	193,084	198,876	204,843	210,988	217,317	223,837	230,552	237,469	244,593	251,931	259,488	267,273	275,291	283,550	292,057	3,391,149	226,076
EPB Energy Fuel adjustment (4)	1,109,987	1,128,650	1,147,895	1,167,716	1,188,132	1,209,161	1,230,820	1,253,130	1,276,101	1,299,821	1,324,298	1,349,529	1,375,512	1,402,246	1,429,732	17,111,163	1,140,744
Total Operating cost of a full deployment/retrofit of 26,500 GGL/FlexNet Street Lighting & Energy Management System.	2,079,474	2,116,188	2,154,004	2,192,954	2,233,073	2,274,395	2,316,957	2,360,795	2,405,937	2,452,416	2,500,273	2,549,529	2,600,205	2,652,322	2,705,900	32,111,163	2,140,744
Total gross operating +/- cost of 26,500 GGL/FlexNet Street Lighting & Energy Management System.	2,079,474	2,116,188	2,154,004	2,192,954	2,233,073	2,274,395	2,316,957	2,360,795	2,405,937	2,452,416	2,500,273	2,549,529	2,600,205	2,652,322	2,705,900	32,111,163	2,140,744
Equipment financing Cost options for 26,500 GGL/FlexNet Lights @ a cost of \$18,139,440															15 year		
	Year 1	2	3	4	Year 5	6	7	8	9	10	11	12	13	14	Year 15	Totals	Annual Avg
10 year 2% Capital Bond for 26,500 GGL/FlexNet Lights @ \$18,139,440. (Debt recorded)	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	2,009,574	20,095,740	1,339,716
Total Turnkey Equipment, installation and operating cost for full 26,500 deployment, paid for with Bonds	3,119,641	3,138,224	3,157,489	3,177,280	3,197,706	3,218,738	3,240,394	3,262,704	3,285,689	3,309,259	3,333,414	3,358,164	3,383,519	3,409,484	3,436,059	40,032,903	2,668,860
Net Annual Operating +/- Savings after paying for equipment using Capital Bond Financing	389,800	399,614	444,430	483,380	523,499	564,821	607,383	651,222	696,462	743,090	791,125	840,576	891,451	943,771	1,000,000	1,140,744	76,467
10 year Operating Lease for 26,500 GGL/FlexNet lights @ \$18,139,440 (No Debt Recorded)	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	2,878,028	34,536,336	2,302,422
Total Turnkey Equipment, installation and operating cost for full 26,500 deployment, paid for monthly with a lease	3,787,995	3,806,678	3,825,923	3,845,744	3,866,160	3,887,189	3,908,848	3,931,158	3,954,129	3,977,770	4,002,091	4,027,002	4,052,513	4,078,634	4,105,365	48,473,443	3,231,563
Net Annual Operating +/- Savings after paying for equipment using Operating equipment lease Financing	3,108,527	3,127,143	3,146,044	3,165,276	3,184,832	3,204,713	3,224,924	3,245,466	3,266,339	3,287,554	3,309,120	3,331,047	3,353,334	3,376,000	3,400,000	40,362,222	2,690,815

Footnotes:

- (1) 3% annual inflation factor applied to base line cost, except the kWh rate offered by EPB is set at 0% increase over the next 15 years.
 - (2) EPB Facility charges drop to 40% during the warranty period, then back to 90% after 8-year Warranty, recognizing the savings from more durable lights. The installation cost will be paid for by EPB and amortized into the remaining facility charges.
 - (3) Additional Maintenance Costs at 40% for savings on non-warranted maintenance anticipated with new lights and monitoring system.
 - (4) Assuming 75% energy savings through equipment selection, i.e. higher energy efficiency Rated LED (92%) and Induction Lights (98%), versus Mercury Vapor Arc (20%), High Pressure Sodium (60%) Metal Halide (85%), 25% energy savings, (total 75%) achieved from using the GGL FlexNet
- Notes:
 The cost to do nothing is \$14 to \$21 million over the next 15 years
 Partial or spread out deployment will result in lost savings for operating costs. The sooner the lights can be retrofit, the sooner the \$ savings begin
 While saving millions, the city will take benefit to multiple collateral features including but not limited to safety, environmental and the economy
 One of few capital projects that will actually pay for itself.

Appendix 3: Global Current ROI based on a full deployment of 26,500 Street lights in the City of Chattanooga

See Note

1	Energy savings Multiplier	Monthly cost estimates	Year 1	Year 2	Year 3
2	Current City Lighting System				
3	EPB Energy cost (3% annual increase)	101,969	1,223,632	1,260,341	1,298,151
4	TVA Fuel cost adjustment (3% incr)	62,302	747,628	770,057	793,159
5	Facility charges (3% incr)	89,213	1,070,556	1,102,673	1,135,753
6	Total operating cost	253,485	3,041,817	3,133,071	3,227,063
7	New City Lighting System with Added GGL Lights				
8	EPB Energy cost (3% annual increase)	29,571	354,853	365,499	376,464
9	TVA Fuel cost adjustment (3% incr)	18,068	216,812	223,317	230,016
10	Facility / EPB Pole Charges (3% incr.)		-	-	-
11	GGL maintenance /warranty/ 8 years		-	-	-
12	Annual Access Fee	6,545	78,540	78,540	78,540
13	Total projected operating cost	54,184	650,206	667,356	685,020
14	Total projected annual operating cost savings	199,301	2,391,611	2,465,715	2,542,043
15	Cumulative project annual operating cost savings		2,391,611	4,857,326	7,399,370
16	The ROI of the total cost of deployment paid for by the operating cost savings				
17	Projected Deployment Cost:				
18	Total capital cost	100,001	1,200,017	1,200,017	1,200,017
19	Installation cost (\$70 per light x 26,500)	10,306	123,667	123,667	123,667
20	Additional install. Cost (\$20/light x 26,500)		-	-	-
21	Stranded Plant Charges. Amortized over Fifteen years.		-	-	-
22	Total capital equipment cost	110,307	1,323,684	1,323,684	1,323,684
23	Interest charges for a 15 yrs. 3% bond	22,030	264,365	264,365	264,365
24	Total projected deployment cost	132,337	1,588,049	1,588,049	1,588,049
25	Net annual savings based on 15 full years of operating cost for 26,546 lights)	66,964	803,562	877,667	953,994
26	Accumulative Net Savings starting the first year of full deployment		803,562	1,681,229	2,635,223
27	Addition Cost Factors that were not included in the original ROI statement.				
28	EPB Pole Charges (3% incr.)	11,745	140,599	159,070	178,095
29	GGL maintenance /warranty/ increased to 15years	26,500	318,000	318,000	318,000
30	Additional Install. Cost (\$20/light x 26,546)	2,949	35,387	35,387	35,387
31	Stranded plant charges. Five years.	15,556	186,672	186,672	186,672
		56,750	680,658	699,129	718,154

Appendix 3: Global Current ROI based on a full deployment of 26,500 Street lights in the City of Chattanooga

See Note

1	Energy savings Multiplier			
		Year 4	Year 5	Year 6
2	Current City Lighting System			
3	EPB Energy cost (3% annual increase)	1,337,096	1,377,209	1,418,525
4	TVA Fuel cost adjustment (3% incr)	816,954	841,462	866,706
5	Facility charges (3% incr)	1,169,825	1,204,920	1,241,068
6	Total operating cost	3,323,875	3,423,591	3,526,299
7	New City Lighting System with Added GGL Lights			
8	EPB Energy cost (3% annual increase)	387,758	399,391	411,372
9	TVA Fuel cost adjustment (3% incr)	236,917	244,024	251,345
10	Facility / EPB Pole Charges (3% incr.)	-	-	-
11	GGL maintenance /warranty/ 8 years	-	-	-
12	Annual Access Fee	78,540	78,540	78,540
13	Total projected operating cost	703,214	721,955	741,257
14	Total projected annual operating cost savings	2,620,661	2,701,637	2,785,042
15	Cumulative project annual operating cost savings	10,020,030	12,721,667	15,506,709
16	The ROI of the total cost of deployment paid for by the operatin			
17	Projected Deployment Cost:			
18	Total capital cost	1,200,017	1,200,017	1,200,017
19	Installation cost (\$70 per light x 26,500)	123,667	123,667	123,667
20	Additional install. Cost (\$20/light x 26,500)	-	-	-
21	Stranded Plant Charges. Amortized over Fifteen years.	-	-	-
22	Total capital equipment cost	1,323,684	1,323,684	1,323,684
23	Interest charges for a 15 yrs. 3% bond	264,365	264,365	264,365
24	Total projected deployment cost	1,588,049	1,588,049	1,588,049
25	Net annual savings based on 15 full years of operating cost for 26,546 lights)	1,032,612	1,113,588	1,196,993
26	Accumulative Net Savings starting the first year of full deployme	3,667,835	4,781,423	5,978,416
27	Addition Cost Factors that were not included in the original ROI s			
28	EPB Pole Charges (3% incr.)	197,691	217,875	238,664
29	GGL maintenance /warranty/ increased to 15years	318,000	318,000	318,000
30	Additional Install. Cost (\$20/light x 26,546)	35,387	35,387	35,387
31	Stranded plant charges. Five years.	186,672	186,672	186,672
		737,750	757,933	778,723

Appendix 3: Global Current ROI based on a full deployment of 26,500 Street lights in the City of Chattanooga

See Note

1	Energy savings Multiplier				
		Year 7	Year 8	Year 9	Year 10
2	Current City Lighting System				
3	EPB Energy cost (3% annual increase)	1,461,081	1,504,913	1,550,061	1,596,562
4	TVA Fuel cost adjustment (3% incr)	892,707	919,489	947,073	975,486
5	Facility charges (3% incr)	1,278,300	1,316,649	1,356,148	1,396,833
6	Total operating cost	3,632,088	3,741,051	3,853,282	3,968,881
7	New City Lighting System with Added GGL Lights				
8	EPB Energy cost (3% annual increase)	423,713	436,425	449,518	463,003
9	TVA Fuel cost adjustment (3% incr)	258,885	266,652	274,651	282,891
10	Facility / EPB Pole Charges (3% incr.)	-	-	-	-
11	GGL maintenance /warranty/ 8 years	-	-	-	-
12	Annual Access Fee	78,540	78,540	78,540	78,540
13	Total projected operating cost	761,139	781,617	802,709	824,434
14	Total projected annual operating cost savings	2,870,949	2,959,434	3,050,573	3,144,447
15	Cumulative project annual operating cost savings	18,377,658	21,337,093	24,387,666	27,532,113
16	The ROI of the total cost of deployment paid for by the operatin		19,855,261	23,820,733	
17	Projected Deployment Cost:				
18	Total capital cost	1,200,017	1,200,017	1,200,017	1,200,017
19	Installation cost (\$70 per light x 26,500)	123,667	123,667	123,667	123,667
20	Additional install. Cost (\$20/light x 26,500)	-	-	-	-
21	Stranded Plant Charges. Amortized over Fifteen years.	-	-	-	-
22	Total capital equipment cost	1,323,684	1,323,684	1,323,684	1,323,684
23	Interest charges for a 15 yrs. 3% bond	264,365	264,365	264,365	264,365
24	Total projected deployment cost	1,588,049	1,588,049	1,588,049	1,588,049
25	Net annual savings based on 15 full years of operating cost for 26,546 lights)	1,282,901	1,371,385	1,462,524	1,556,398
26	Accumulative Net Savings starting the first year of full deployme	7,261,316	8,632,702	10,095,226	11,651,624
27	Addition Cost Factors that were not included in the original ROI s				
28	EPB Pole Charges (3% incr.)	260,077	282,132	304,849	328,247
29	GGL maintenance /warranty/ increased to 15years	318,000	318,000	318,000	318,000
30	Additional Install. Cost (\$20/light x 26,546)	35,387	35,387	35,387	35,387
31	Stranded plant charges. Five years.	186,672	186,672	186,672	186,672
		800,135	822,191	844,908	868,306

Appendix 3: Global Current ROI based on a full deployment of 26,500 Street lights in the City of Chattanooga

See Note

1	Energy savings Multiplier				
		Year 11	Year 12	Year 13	Year 14
2	Current City Lighting System				
3	EPB Energy cost (3% annual increase)	1,644,459	1,693,793	1,744,607	1,796,945
4	TVA Fuel cost adjustment (3% incr)	1,004,750	1,034,893	1,065,939	1,097,918
5	Facility charges (3% incr)	1,438,738	1,481,900	1,526,357	1,572,148
6	Total operating cost	4,087,947	4,210,585	4,336,903	4,467,010
7	New City Lighting System with Added GGL Lights				
8	EPB Energy cost (3% annual increase)	476,893	491,200	505,936	521,114
9	TVA Fuel cost adjustment (3% incr)	291,378	300,119	309,122	318,396
10	Facility / EPB Pole Charges (3% incr.)	-	-	-	-
11	GGL maintenance /warranty/ 8 years	-	-	-	-
12	Annual Access Fee	78,540	78,540	78,540	78,540
13	Total projected operating cost	846,811	869,859	893,598	918,050
14	Total projected annual operating cost savings	3,241,136	3,340,727	3,443,305	3,548,960
15	Cumulative project annual operating cost savings	30,773,249	34,113,976	37,557,280	41,106,240
16	The ROI of the total cost of deployment paid for by the operatin				
17	Projected Deployment Cost:				
18	Total capital cost	1,200,017	1,200,017	1,200,017	1,200,017
19	Installation cost (\$70 per light x 26,500)	123,667	123,667	123,667	123,667
20	Additional install. Cost (\$20/light x 26,500)	-	-	-	-
21	Stranded Plant Charges. Amortized over Fifteen years.	-	-	-	-
22	Total capital equipment cost	1,323,684	1,323,684	1,323,684	1,323,684
23	Interest charges for a 15 yrs. 3% bond	264,365	264,365	264,365	264,365
24	Total projected deployment cost	1,588,049	1,588,049	1,588,049	1,588,049
25	Net annual savings based on 15 full years of operating cost for 26,546 lights)	1,653,087	1,752,678	1,855,256	1,960,911
26	Accumulative Net Savings starting the first year of full deployme	13,304,711	15,057,389	16,912,645	18,873,556
27	Addition Cost Factors that were not included in the original ROI s				
28	EPB Pole Charges (3% incr.)	352,348	377,171	402,739	429,074
29	GGL maintenance /warranty/ increased to 15years	318,000	318,000	318,000	318,000
30	Additional Install. Cost (\$20/light x 26,546)	35,387	35,387	35,387	35,387
31	Stranded plant charges. Five years.	186,672	186,672	186,672	186,672
		892,406	917,230	942,798	969,133

Appendix 3: Global Current ROI based on a full deployment of 26,500 Street lights in the City of Chattanooga

See Note

1	Energy savings Multiplier				
		Year 15	15 Year Totals	Annual Avg	Average Monthly Charge
2	Current City Lighting System				
3	EPB Energy cost (3% annual increase)	1,850,853	22,758,228	1,517,215	126,435
4	TVA Fuel cost adjustment (3% incr)	1,130,855	13,905,077	927,005	77,250
5	Facility charges (3% incr)	1,619,312	19,911,179	1,327,412	110,618
6	Total operating cost	4,601,020	56,574,484	3,771,632	314,303
7	New City Lighting System with Added GGL Lights				
8	EPB Energy cost (3% annual increase)	536,747	6,599,886	439,992	36,666
9	TVA Fuel cost adjustment (3% incr)	327,948	4,032,472	268,831	22,403
10	Facility / EPB Pole Charges (3% incr.)	-	-	-	-
11	GGL maintenance /warranty/ 8 years	-	-	-	-
12	Annual Access Fee	78,540	1,178,100	78,540	6,545
13	Total projected operating cost	943,235	11,810,458	787,364	65,614
14	Total projected annual operating cost savings	3,657,785	44,764,025	2,984,268	248,689
15	Cumulative project annual operating cost savings	44,764,025			
16	The ROI of the total cost of deployment paid for by the operatin				
17	Projected Deployment Cost:				
18	Total capital cost	1,200,017	18,000,261	1,200,017	100,001
19	Installation cost (\$70 per light x 26,500)	123,667	1,855,000	123,667	10,306
20	Additional install. Cost (\$20/light x 26,500)	-	-	-	-
21	Stranded Plant Charges. Amortized over Fifteen years.	-	-	-	-
22	Total capital equipment cost	1,323,684	19,855,261	1,323,684	110,307
23	Interest charges for a 15 yrs. 3% bond	264,365	3,965,472	264,365	22,030
24	Total projected deployment cost	1,588,049	23,820,733	1,588,049	132,337
25	Net annual savings based on 15 full years of operating cost for 26,546 lights)	2,069,736	20,943,292	1,396,219	116,352
26	Accumulative Net Savings starting the first year of full deployme	20,943,292			
27	Addition Cost Factors that were not included in the original ROI s				
28	EPB Pole Charges (3% incr.)	456,199	456,199	456,199	456,199
29	GGL maintenance /warranty/ increased to 15years	318,000	4,770,000	318,000	26,500
30	Additional Install. Cost (\$20/light x 26,546)	35,387	530,800	35,387	2,949
31	Stranded plant charges. Five years.	186,672	2,800,080	560,016	46,668
		996,258	12,425,711	828,381	55,225

Appendix 3: Global Current ROI based on a full deployment of 26,500 Street lights in the City of Chattanooga

Appendix 3 Notes:

- 1 Energy Savings Multiplier 29%. Projected energy savings to be 71%
- 2 Using the September 2011 projected over 15 years. The projected operating cost if the city does nothing to the lighting system.
- 3 The base line EPB Energy cost is cost is based on September 2011. The projected annual increase is 3%.
- 4 The Base line TVA fuel Projected cost is based on September 2011. The projected annual increase is 3%
- 5 The base line Facility cost is based on September 2011. The annual increase is 3%.
- 6 Total projected operating cost for the current lighting Infrastructure based on the city making no changes.
- 7 Projected Operating cost based on the new city owned GGL lights.
- 8 Projected EPB energy Cost based on the measured performance from phase one and projected over the fully deployment count of 26,500 This includes a 3% annual increase.
- 9 Projected TVA fuel adjustment Cost based on the measured performance from phase one and projected over the fully deployment count of 26,500 This includes a 3% annual increase.
- 10 The final facility cost has not been determined, until the asset basis can be finalized and confirmed to be accurate. It is GGL's opinion that there should not be any further facility charges applied to the old lights. GGL also feels that there should be no service charges for bringing power to the metered street light. GGL does agree there should be a charge for the city owned metered light to be hosted on the EPB pole. An estimated \$0.50 per light on each EPB pole would be considered resonable, considering the pole service other functions. GGL also feels the pole charges should include the easement right of way for the city to atttach to the city owned light or mounting arm other devices such as Wifi, Cameras and Sensors. So long as those devices are metered seperately from the Street light.
- 11 GGL offers a 8 year warranty at no cost to the city. GGL has offered to extend the warranty to 15 years for \$1.00 per light per month, (\$26,500 per month) and will manage the repair of all non warranty lights and charge the city for the non warranty repairs.
- 12 GGL will own the network infrastructure and operating system. GGL will be responsible for the maintenance and care of the hardware and the software upgrades. GGL will lease the city access to the infrastructure based on a cost of \$0.25 per light per month.
- 13 Total projected operating cost: The new total operating cost of the new city owned Street lights
- 14 Total projected annual operating cost savings: Based on the cost comparisons of the September 2011 bench mark, and the measured energy savings from phase one, and projected over a full deployment.
- 15 Cumulative project annual operating cost savings: Each years savings added to the previous year.
- 16 The ROI of the total cost of deployment paid for by the operating cost savings is 8 to 10 years Max.
- 17 Projected Deployment Cost: (these are one time charges that would be applied to the initial installation of the new lighting system.
- 18 Total Capital Cost: The capital equipment cost has been estimated to be \$18,261,000. This number will vary based on the actual termination of how many lights are in the city. The EPB inventory is very inaccurate.
- 19 Installation cost (\$70 per light x 26,500): GGL has determined the average installation cost to be \$70 per light. The EPB should be willing to match or allow the city to higher the GGL and its subcontractor to finish the deployment of the lights, or bid it out.
- 20 Additional install. Cost (\$20/light x 26,546): The City should not be paying any additional installation charges. The EPB is charging the City by the hour to install the lights. The hourly deployment rate is too low and has increased the average deployment costs.
- 21 Stranded Plant Charges. Amortized Over Fifteen Years.: The added cost of the stranded investment was not included in the original ROI calculations. If the City feels it should be paid, we recommend it be considered part of the upfront capital cost and included in the bond amount we also recommend that a more detailed investigation be conducted on the methods of the maintaining of the asset schedules, and the over charges that have come for the poor documentation of the EPB.
- 22 Total capital equipment cost: This is the total amount be bonded and paid back over a 15 year period. This is the only bond that will pay for its self before its matured.
- 23 Interest charges for a 15 yrs. 3% bond: Estimated added interest rate charges for the bond.
- 24 Total projected deployment cost
- 25 Net annual savings based on 15 full years of operating cost for 26,500.
- 26 Accumulative Net Savings Starting the first year of full deployment

Appendix 4: City Analysis Based on 60% Savings

GGL's Detailed ROI Projections (their numbers with formulas added)

Assumed annual increases **1.5%**

40.0000%

	Actual reported monthly cost	Year 1	Year 2	Year 3
Current City Lighting System				
EPB Energy cost (1.5% annual increase)	101,904	1,222,846	1,241,188	1,259,806
TVA Fuel cost adjustment (1.5% incr)	51,081	612,968	622,162	631,495
Facility charges (1.5% incr)	94,238	1,129,500	1,146,443	1,163,639
Total operating cost	247,222	2,965,313	3,009,793	3,054,940

New City Lighting System with Added GGL Lights				
EPB Energy cost (1.5% annual increase)	40,762	489,138	496,475	503,922
TVA Fuel cost adjustment (1.5% incr)	20,432	245,187	248,865	252,598
EPB Pole Charges (1.5% incr.)	16,667	200,000	203,000	206,045
GGL maintenance /warranty	27,000	324,000	324,000	324,000
Annual Access Fee	6,545	78,540	78,540	78,540
Total projected operating cost	111,405	1,336,865	1,350,880	1,365,105

Total projected annual operating cost savings	135,817	1,628,448	1,658,913	1,689,835
Cumulative project annual operating cost savings		1,628,448	3,287,361	4,977,195

Projected Deployment Cost				
Total capital cost	100,000	1,200,000	1,200,000	1,200,000
Installation cost (\$70 per light x 26,546)	10,323	123,876	123,876	123,876
addtl install. Cost (\$20/light x 26,546)	2,949	35,387	35,387	35,387
Stranded plant charges	46,667	560,000	560,000	560,000
Total capital equipment cost	159,939	1,919,263	1,919,263	1,919,263
Interest charges for a 15 yr 3% bond		546,863	510,405	473,948
Total projected deployment cost	159,939	2,466,126	2,429,668	2,393,211

Net savings(loss) based on 15 full years of operating cost for 26,546 lights)	(24,122)	(837,678)	(770,755)	(703,376)
		(837,678)	(1,608,433)	(2,311,810)

Appendix 4: City Analysis Based on 60% Savings

GGL's Detailed ROI Projections (their numbers with formula)

Assumed annual increases **1.5%**

40.0000%

	Actual reported monthly cost	Year 4	Year 5	Year 6
Current City Lighting System				
EPB Energy cost (1.5% annual increase)	101,904	1,278,703	1,297,884	1,317,352
TVA Fuel cost adjustment (1.5% incr)	51,081	640,967	650,582	660,340
Facility charges (1.5% incr)	94,238	1,181,094	1,198,810	1,216,792
Total operating cost	247,222	3,100,764	3,147,275	3,194,484

New City Lighting System with Added GGL Lights				
EPB Energy cost (1.5% annual increase)	40,762	511,481	519,153	526,941
TVA Fuel cost adjustment (1.5% incr)	20,432	256,387	260,233	264,136
EPB Pole Charges (1.5% incr.)	16,667	209,136	212,273	215,457
GGL maintenance /warranty	27,000	324,000	324,000	324,000
Annual Access Fee	6,545	78,540	78,540	78,540
Total projected operating cost	111,405	1,379,544	1,394,199	1,409,074

Total projected annual operating cost savings	135,817	1,721,220	1,753,077	1,785,411
Cumulative project annual operating cost savings		6,698,415	8,451,492	10,236,903

Projected Deployment Cost				
Total capital cost	100,000	1,200,000	1,200,000	1,200,000
Installation cost (\$70 per light x 26,546)	10,323	123,876	123,876	123,876
addtl install. Cost (\$20/light x 26,546)	2,949	35,387	35,387	35,387
Stranded plant charges	46,667	560,000	560,000	
Total capital equipment cost	159,939	1,919,263	1,919,263	1,359,263
Interest charges for a 15 yr 3% bond		437,490	401,033	364,575
Total projected deployment cost	159,939	2,356,753	2,320,296	1,723,838

Net savings(loss) based on 15 full years of operating cost for 26,546 lights)	(24,122)	(635,533)	(567,219)	61,573
		(2,947,343)	(3,514,562)	(3,452,989)

Appendix 4: City Analysis Based on 60% Savings

GGL's Detailed ROI Projections (their numbers with formula)

Assumed annual increases **1.5%**

40.0000%

	Actual reported monthly cost	Year 7	Year 8	Year 9
Current City Lighting System				
EPB Energy cost (1.5% annual increase)	101,904	1,337,112	1,357,169	1,377,526
TVA Fuel cost adjustment (1.5% incr)	51,081	670,245	680,299	690,504
Facility charges (1.5% incr)	94,238	1,235,044	1,253,570	1,272,373
Total operating cost	247,222	3,242,402	3,291,038	3,340,403

New City Lighting System with Added GGL Lights				
EPB Energy cost (1.5% annual increase)	40,762	534,845	542,868	551,011
TVA Fuel cost adjustment (1.5% incr)	20,432	268,098	272,120	276,201
EPB Pole Charges (1.5% incr.)	16,667	218,689	221,969	225,299
GGL maintenance /warranty	27,000	324,000	324,000	324,000
Annual Access Fee	6,545	78,540	78,540	78,540
Total projected operating cost	111,405	1,424,172	1,439,496	1,455,051

Total projected annual operating cost savings	135,817	1,818,230	1,851,542	1,885,353
Cumulative project annual operating cost savings		12,055,133	13,906,674	15,792,027

Projected Deployment Cost				
Total capital cost	100,000	1,200,000	1,200,000	1,200,000
Installation cost (\$70 per light x 26,546)	10,323	123,876	123,876	123,876
addtl install. Cost (\$20/light x 26,546)	2,949	35,387	35,387	35,387
Stranded plant charges	46,667			
Total capital equipment cost	159,939	1,359,263	1,359,263	1,359,263
Interest charges for a 15 yr 3% bond		328,118	291,660	255,203
Total projected deployment cost	159,939	1,687,381	1,650,923	1,614,466

Net savings(loss) based on 15 full years of operating cost for 26,546 lights)	(24,122)	130,849	200,619	270,887
		(3,322,140)	(3,121,522)	(2,850,635)

Appendix 4: City Analysis Based on 60% Savings

GGL's Detailed ROI Projections (their numbers with formula)

Assumed annual increases **1.5%**

40.0000%

	Actual reported monthly cost	Year 10	Year 11	Year 12
Current City Lighting System				
EPB Energy cost (1.5% annual increase)	101,904	1,398,189	1,419,162	1,440,450
TVA Fuel cost adjustment (1.5% incr)	51,081	700,861	711,374	722,045
Facility charges (1.5% incr)	94,238	1,291,459	1,310,831	1,330,493
Total operating cost	247,222	3,390,509	3,441,367	3,492,988

New City Lighting System with Added GGL Lights				
EPB Energy cost (1.5% annual increase)	40,762	559,276	567,665	576,180
TVA Fuel cost adjustment (1.5% incr)	20,432	280,344	284,550	288,818
EPB Pole Charges (1.5% incr.)	16,667	228,678	232,108	235,590
GGL maintenance /warranty	27,000	324,000	324,000	324,000
Annual Access Fee	6,545	78,540	78,540	78,540
Total projected operating cost	111,405	1,470,838	1,486,863	1,503,127

Total projected annual operating cost savings	135,817	1,919,671	1,954,504	1,989,860
Cumulative project annual operating cost savings		17,711,698	19,666,203	21,656,063

Projected Deployment Cost				
Total capital cost	100,000	1,200,000	1,200,000	1,200,000
Installation cost (\$70 per light x 26,546)	10,323	123,876	123,876	123,876
addtl install. Cost (\$20/light x 26,546)	2,949	35,387	35,387	35,387
Stranded plant charges	46,667			
Total capital equipment cost	159,939	1,359,263	1,359,263	1,359,263
Interest charges for a 15 yr 3% bond		218,745	182,288	145,830
Total projected deployment cost	159,939	1,578,008	1,541,551	1,505,093

Net savings(loss) based on 15 full years of operating cost for 26,546 lights)	(24,122)	341,663	412,953	484,767
		(2,508,972)	(2,096,018)	(1,611,251)

Appendix 4: City Analysis Based on 60% Savings

GGL's Detailed ROI Projections (their numbers with formula)

Assumed annual increases **1.5%**

40.0000%

	Actual reported monthly cost	Year 13	Year 14	Year 15
Current City Lighting System				
EPB Energy cost (1.5% annual increase)	101,904	1,462,056	1,483,987	1,506,247
TVA Fuel cost adjustment (1.5% incr)	51,081	732,875	743,868	755,026
Facility charges (1.5% incr)	94,238	1,350,451	1,370,707	1,391,268
Total operating cost	247,222	3,545,382	3,598,563	3,652,542

New City Lighting System with Added GGL Lights				
EPB Energy cost (1.5% annual increase)	40,762	584,823	593,595	602,499
TVA Fuel cost adjustment (1.5% incr)	20,432	293,150	297,547	302,011
EPB Pole Charges (1.5% incr.)	16,667	239,124	242,710	246,351
GGL maintenance /warranty	27,000	324,000	324,000	324,000
Annual Access Fee	6,545	78,540	78,540	78,540
Total projected operating cost	111,405	1,519,636	1,536,393	1,553,401

Total projected annual operating cost savings	135,817	2,025,746	2,062,170	2,099,141
Cumulative project annual operating cost savings		23,681,809	25,743,979	27,843,120

Projected Deployment Cost				
Total capital cost	100,000	1,200,000	1,200,000	1,200,000
Installation cost (\$70 per light x 26,546)	10,323	123,876	123,876	123,876
addtl install. Cost (\$20/light x 26,546)	2,949	35,387	35,387	35,387
Stranded plant charges	46,667			
Total capital equipment cost	159,939	1,359,263	1,359,263	1,359,263
Interest charges for a 15 yr 3% bond		109,373	72,915	36,458
Total projected deployment cost	159,939	1,468,636	1,432,178	1,395,721

Net savings(loss) based on 15 full years of operating cost for 26,546 lights)	(24,122)	557,110	629,992	703,420
		(1,054,141)	(424,149)	279,271

Appendix 4: City Analysis Based on 60% Savings

GGL's Detailed ROI Projections (their numbers with formula)

Assumed annual increases **1.5%**

49,188,492

40.0000%

	Actual reported monthly cost	15 Year Totals	Annual Avg	Average Monthly Charge
Current City Lighting System				
EPB Energy cost (1.5% annual increase)	101,904	20,399,678	1,359,979	113,332
TVA Fuel cost adjustment (1.5% incr)	51,081	10,225,611	681,707	56,809
Facility charges (1.5% incr)	94,238	18,842,475	1,256,165	104,680
Total operating cost	247,222	49,467,764	3,297,851	274,821

New City Lighting System with Added GGL Lights				
EPB Energy cost (1.5% annual increase)	40,762	8,159,871	543,991	45,333
TVA Fuel cost adjustment (1.5% incr)	20,432	4,090,244	272,683	22,724
EPB Pole Charges (1.5% incr.)	16,667	3,336,428	222,429	18,536
GGL maintenance /warranty	27,000	4,860,000	324,000	27,000
Annual Access Fee	6,545	1,178,100	78,540	6,545
Total projected operating cost	111,405	21,624,643	1,441,643	120,137

Total projected annual operating cost savings	135,817	27,843,120	1,856,208	154,684
Cumulative project annual operating cost savings				

Projected Deployment Cost				
Total capital cost	100,000	18,000,000	1,200,000	100,000
Installation cost (\$70 per light x 26,546)	10,323	1,858,140	123,876	10,323
addtl install. Cost (\$20/light x 26,546)	2,949	530,805	35,387	2,949
Stranded plant charges	46,667	2,800,000	560,000	46,667
Total capital equipment cost	159,939	23,188,945	1,919,263	159,939
Interest charges for a 15 yr 3% bond		4,374,904	291,660	24,305
Total projected deployment cost	159,939	27,563,849	2,210,923	184,244

Net savings(loss) based on 15 full years of operating cost for 26,546 lights)	(24,122)	279,271	(354,715)	(29,560)
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Appendix 5: Office of Internal Audit (OIA) Projection and Assumptions

Current	Assumption		Year 1	Year 2	Year 3
EPB Energy	4.00%		\$ 1,224,000	\$ 1,273,000	\$ 1,324,000
EPB/TVA Fuel Cost	4.00%		748,000	778,000	809,000
EPB Billing Discrepancy	12.40%		(245,000)	(254,000)	(264,000)
Adjusted EPB/TVA Energy/Fuel Cost			1,727,000	1,797,000	1,869,000
EPB Facilities Charge (12.3%)	0.00%		1,071,000	1,071,000	1,071,000
Total EPB			\$ 2,798,000	\$ 2,868,000	\$ 2,940,000

New	Assumption		Year 1	Year 2	Year 3
EPB/TVA Energy/Fuel Cost	68.80%		\$ 539,000	\$ 561,000	\$ 583,000
EPB Facilities Charge (12.3%)			483,000	483,000	483,000
EPB Facilities Charge (Discarded Assets)			560,000	560,000	560,000
GGL Access Fee	\$2.9580		78,000	78,000	78,000
GGL Monitoring Fee	Waived		-	-	-
Total Lighting Project EPB/GGL			\$ 1,660,000	\$ 1,682,000	\$ 1,704,000

Total Savings			\$ 1,138,000	\$ 1,186,000	\$ 1,236,000
Cumulative Savings			\$ 1,138,000	\$ 2,324,000	\$ 3,560,000

Cost of New Lights					
Installation (22,188 lights) - \$70 per light					
Installation - Phase 1 (4,312 lights) - Actual					
Interest Charges					
Total Cost of New Lights					
Payback Period (Years)					

Assumptions -

Number of New Lights		26,500
Cost of New Lights	\$	18,000,000
Installation	\$	70 per light, post Phase 1
Annual Inflation - Energy		4.00%
Annual Inflation - TVA Fuel Cost/Facilities		4.00%
EPB Billing Discrepancy		12.40%
Annual Inflation - Facility Charge		0.00%
Energy Savings		68.80%
Access Fee		\$2.9580 per light, per year
Monitoring Fee		Waived
Interest Rate		2.75%
Amount Borrowed	\$	18,000,000
Term		15 years

Note: -

The "Current" section depicts projected costs of street lights if the lighting project was not initiated. The "New" section depicts projected costs of street lights if the lighting project is completed in total using the assumptions listed above.

Current	Assumption		Year 4	Year 5	Year 6
EPB Energy	4.00%		\$ 1,377,000	\$ 1,432,000	\$ 1,489,000
EPB/TVA Fuel Cost	4.00%		841,000	875,000	910,000
EPB Billing Discrepancy	12.40%		(275,000)	(286,000)	(297,000)
Adjusted EPB/TVA Energy/Fuel Cost			1,943,000	2,021,000	2,102,000
EPB Facilities Charge (12.3%)	0.00%		1,071,000	1,071,000	1,071,000
Total EPB			\$ 3,014,000	\$ 3,092,000	\$ 3,173,000

New	Assumption		Year 4	Year 5	Year 6
EPB/TVA Energy/Fuel Cost	68.80%		\$ 606,000	\$ 631,000	\$ 656,000
EPB Facilities Charge (12.3%)			483,000	483,000	483,000
EPB Facilities Charge (Discarded Assets)			560,000	560,000	-
GGL Access Fee	\$2.9580		78,000	78,000	78,000
GGL Monitoring Fee	Waived		-	-	-
Total Lighting Project EPB/GGL			\$ 1,727,000	\$ 1,752,000	\$ 1,217,000

Total Savings			\$ 1,287,000	\$ 1,340,000	\$ 1,956,000
Cumulative Savings			\$ 4,847,000	\$ 6,187,000	\$ 8,143,000

Cost of New Lights					
Installation (22,188 lights) - \$70 per light					
Installation - Phase 1 (4,312 lights) - Actual					
Interest Charges					
Total Cost of New Lights					
Payback Period (Years)					

Assumptions -

Number of New Lights		26,500
Cost of New Lights	\$	18,000,000
Installation	\$	70 per light, post Phas
Annual Inflation - Energy		4.00%
Annual Inflation - TVA Fuel Cost/Facilities		4.00%
EPB Billing Discrepancy		12.40%
Annual Inflation - Facility Charge		0.00%
Energy Savings		68.80%
Access Fee		\$2.9580 per light, per year
Monitoring Fee		Waived
Interest Rate		2.75%
Amount Borrowed	\$	18,000,000
Term		15 years

Note: -

The "Current" section depicts projected costs of street lights if the lighting project was not i
 projected costs of street lights if the lighting project is completed in total using the assumpt

Appendix 5: Office of Internal Audit (OIA) Projection and Assumptions

Current	Assumption		Year 7	Year 8	Year 9
EPB Energy	4.00%		\$ 1,549,000	\$ 1,611,000	\$ 1,675,000
EPB/TVA Fuel Cost	4.00%		946,000	984,000	1,023,000
EPB Billing Discrepancy	12.40%		(309,000)	(322,000)	(335,000)
Adjusted EPB/TVA Energy/Fuel Cost			2,186,000	2,273,000	2,363,000
EPB Facilities Charge (12.3%)	0.00%		1,071,000	1,071,000	1,071,000
Total EPB			\$ 3,257,000	\$ 3,344,000	\$ 3,434,000

New	Assumption		Year 7	Year 8	Year 9
EPB/TVA Energy/Fuel Cost	68.80%		\$ 682,000	\$ 709,000	\$ 737,000
EPB Facilities Charge (12.3%)			483,000	483,000	483,000
EPB Facilities Charge (Discarded Assets)			-	-	-
GGL Access Fee	\$2.9580		78,000	78,000	78,000
GGL Monitoring Fee	Waived		-	-	-
Total Lighting Project EPB/GGL			\$ 1,243,000	\$ 1,270,000	\$ 1,298,000

Total Savings			\$ 2,014,000	\$ 2,074,000	\$ 2,136,000
Cumulative Savings			\$ 10,157,000	\$ 12,231,000	\$ 14,367,000

Cost of New Lights					
Installation (22,188 lights) - \$70 per light					
Installation - Phase 1 (4,312 lights) - Actual					
Interest Charges					
Total Cost of New Lights					
Payback Period (Years)					

Assumptions -

Number of New Lights		26,500
Cost of New Lights	\$	18,000,000
Installation	\$	70 per light, post Phas
Annual Inflation - Energy		4.00%
Annual Inflation - TVA Fuel Cost/Facilities		4.00%
EPB Billing Discrepancy		12.40%
Annual Inflation - Facility Charge		0.00%
Energy Savings		68.80%
Access Fee		\$2.9580 per light, per year
Monitoring Fee		Waived
Interest Rate		2.75%
Amount Borrowed	\$	18,000,000
Term		15 years

Note: -

The "Current" section depicts projected costs of street lights if the lighting project was not ii
 projected costs of street lights if the lighting project is completed in total using the assumpt

Current	Assumption		Year 10	Year 11	Year 12
EPB Energy	4.00%		\$ 1,742,000	\$ 1,812,000	\$ 1,884,000
EPB/TVA Fuel Cost	4.00%		1,064,000	1,107,000	1,151,000
EPB Billing Discrepancy	12.40%		(348,000)	(362,000)	(376,000)
Adjusted EPB/TVA Energy/Fuel Cost			2,458,000	2,557,000	2,659,000
EPB Facilities Charge (12.3%)	0.00%		1,071,000	1,071,000	1,071,000
Total EPB			\$ 3,529,000	\$ 3,628,000	\$ 3,730,000

New	Assumption		Year 10	Year 11	Year 12
EPB/TVA Energy/Fuel Cost	68.80%		\$ 767,000	\$ 798,000	\$ 830,000
EPB Facilities Charge (12.3%)			483,000	483,000	483,000
EPB Facilities Charge (Discarded Assets)			-	-	-
GGL Access Fee	\$2.9580		78,000	78,000	78,000
GGL Monitoring Fee	Waived		-	-	-
Total Lighting Project EPB/GGL			\$ 1,328,000	\$ 1,359,000	\$ 1,391,000

Total Savings			\$ 2,201,000	\$ 2,269,000	\$ 2,339,000
Cumulative Savings			\$ 16,568,000	\$ 18,837,000	\$ 21,176,000

Cost of New Lights					
Installation (22,188 lights) - \$70 per light					
Installation - Phase 1 (4,312 lights) - Actual					
Interest Charges					
Total Cost of New Lights					
Payback Period (Years)					

Assumptions -

Number of New Lights		26,500
Cost of New Lights	\$	18,000,000
Installation	\$	70 per light, post Phas
Annual Inflation - Energy		4.00%
Annual Inflation - TVA Fuel Cost/Facilities		4.00%
EPB Billing Discrepancy		12.40%
Annual Inflation - Facility Charge		0.00%
Energy Savings		68.80%
Access Fee		\$2.9580 per light, per year
Monitoring Fee		Waived
Interest Rate		2.75%
Amount Borrowed	\$	18,000,000
Term		15 years

Note: -

The "Current" section depicts projected costs of street lights if the lighting project was not i
 projected costs of street lights if the lighting project is completed in total using the assumpt

Current	Assumption		Year 13	Year 14	Year 15
EPB Energy	4.00%		\$ 1,959,000	\$ 2,037,000	\$ 2,118,000
EPB/TVA Fuel Cost	4.00%		1,197,000	1,245,000	1,295,000
EPB Billing Discrepancy	12.40%		(391,000)	(407,000)	(423,000)
Adjusted EPB/TVA Energy/Fuel Cost			2,765,000	2,875,000	2,990,000
EPB Facilities Charge (12.3%)	0.00%		1,071,000	1,071,000	1,071,000
Total EPB			\$ 3,836,000	\$ 3,946,000	\$ 4,061,000

New	Assumption		Year 13	Year 14	Year 15
EPB/TVA Energy/Fuel Cost	68.80%		\$ 863,000	\$ 897,000	\$ 933,000
EPB Facilities Charge (12.3%)			483,000	483,000	483,000
EPB Facilities Charge (Discarded Assets)			-	-	-
GGL Access Fee	\$2.9580		78,000	78,000	78,000
GGL Monitoring Fee	Waived		-	-	-
Total Lighting Project EPB/GGL			\$ 1,424,000	\$ 1,458,000	\$ 1,494,000

Total Savings			\$ 2,412,000	\$ 2,488,000	\$ 2,567,000
Cumulative Savings			\$ 23,588,000	\$ 26,076,000	\$ 28,643,000

Cost of New Lights				\$ 18,000,000	
Installation (22,188 lights) - \$70 per light				1,553,000	
Installation - Phase 1 (4,312 lights) - Actual				462,000	
Interest Charges				3,965,000	
Total Cost of New Lights				\$ 23,980,000	
Payback Period (Years)				13.16	

Assumptions -

Number of New Lights		26,500
Cost of New Lights	\$	18,000,000
Installation	\$	70 per light, post Phas
Annual Inflation - Energy		4.00%
Annual Inflation - TVA Fuel Cost/Facilities		4.00%
EPB Billing Discrepancy		12.40%
Annual Inflation - Facility Charge		0.00%
Energy Savings		68.80%
Access Fee		\$2.9580 per light, per year
Monitoring Fee		Waived
Interest Rate		2.75%
Amount Borrowed	\$	18,000,000
Term		15 years

Note: -

The "Current" section depicts projected costs of street lights if the lighting project was not i
 projected costs of street lights if the lighting project is completed in total using the assumpt

Appendix 5: Office of Internal Audit (OIA) Projection and Assumptions

Current	Assumption	Total
EPB Energy	4.00%	\$ 24,506,000
EPB/TVA Fuel Cost	4.00%	14,973,000
EPB Billing Discrepancy	12.40%	(4,894,000)
Adjusted EPB/TVA Energy/Fuel Cost		34,585,000
EPB Facilities Charge (12.3%)	0.00%	16,065,000
Total EPB		\$ 50,650,000

New	Assumption	Total
EPB/TVA Energy/Fuel Cost	68.80%	\$ 10,792,000
EPB Facilities Charge (12.3%)		7,245,000
EPB Facilities Charge (Discarded Assets)		2,800,000
GGL Access Fee	\$2.9580	1,170,000
GGL Monitoring Fee	Waived	-
Total Lighting Project EPB/GGL		\$ 22,007,000

Total Savings		\$ 28,643,000
Cumulative Savings		

Cost of New Lights			
Installation (22,188 lights) - \$70 per light			
Installation - Phase 1 (4,312 lights) - Actual			
Interest Charges			
Total Cost of New Lights			
Payback Period (Years)			

Assumptions -

Number of New Lights	26,500
Cost of New Lights	\$ 18,000,000
Installation	\$ 70 per light, post Phas
Annual Inflation - Energy	4.00%
Annual Inflation - TVA Fuel Cost/Facilities	4.00%
EPB Billing Discrepancy	12.40%
Annual Inflation - Facility Charge	0.00%
Energy Savings	68.80%
Access Fee	\$2.9580 per light, per year
Monitoring Fee	Waived
Interest Rate	2.75%
Amount Borrowed	\$ 18,000,000
Term	15 years

Note: -

The "Current" section depicts projected costs of street lights if the lighting project was not i
 projected costs of street lights if the lighting project is completed in total using the assumpt