

5. Entertainment Benefits

FTTH-enabled broadband would give the family access to the Internet and allow anyone in the house to use the phone at the same time; watch movies and video online; save money on phone bills by using instant messaging or making calls over the internet; listen to radio stations from around the world; work from home with access over broadband and a virtual private network to one's office system; help children with school projects and homework; play interactive computer games online with likeminded people around the world; use online banking to manage finances; learn new skills and hobbies online with e-learning; be online 24/7 for one fixed cost per month.

CASE STUDY: The Shults Family

Tim Shults, his wife Berry, and their two children are wired to the Internet in some capacity at least seven hours a day.

"My wife and I use the connection for work, but we also use broadband heavily in our day to day lives. We can have two movies streaming from Netflix while listening to streaming music from Pandora with both my wife and I working online with no problems whatsoever. You can't find that anywhere else," says Tim of his fiber optic service.

After launching his business, LoKewl, at the 2009 48 Hour Launch, Tim continues to utilize the broadband service from his home.

"It's allowed my business to flourish," says Tim. "With the reliable bandwidth, I have been able to take on freelance development work and have the freedom to work odd hours. The consistency and speed of this network has contributed to my ability to follow my passion professionally while giving me the opportunity to spend more time with my family. There are other providers here, but you can't even compare the service."

Berry Shults took advantage of the 1 gigabit connection EPB supplied to the 2011 48 Hour Launch and the volunteer technical expertise to spark her business' web presence. Her concept, Relove to Reduce, an online consignment shop promoting waste reduction, launched a significant online presence in just a couple of days. Berry's business partner, Kacee Nazor, commented "We have gotten more done in five hours than we have in the past five months!"

Berry, a part time teacher at the local environmental charter school, uses the fiber connection to download lesson plans and grade student papers remotely. The Shults children also use the connection to enhance their educations, downloading online quizzes,

learning games, and materials to assist with homework – all while their parents run bandwidth heavy applications.

“The \$90 per month package is perfect for us,” says Tim. “We are saving \$20 per month with EPB’s package over the same package from our previous provider, but you can’t really compare the 30/30 mbps product with the other providers’ products – there just isn’t a comparison.”

E-Shopping Cost Savings

Busy families like the Shults would also value the time saved in e-shopping. The American Time Use Survey (2009) indicates that the average adult spends about 30 minutes per day for non-grocery shopping and 15 minutes traveling for such shopping.⁴¹ The time a person spends shopping is an important economic cost. According to a recent global survey conducted by The Nielsen Company, over 85 percent of the world’s online population has used the Internet to make a purchase, up 40 percent from two years ago, and more than half of Internet users are regular online shoppers, making online purchases at least once a month.⁴²

Assuming that the average person values his leisure at one-half the median wage, the time spent in non-grocery shopping/traveling is worth \$0.6713 per person per day in Hamilton County.⁴³ Annually, this amounts to \$245 per person. For the labor force in Hamilton County, this yields an estimate of the total cost associated with retail non-grocery shopping of \$42,433,122. Assuming that 10 percent of this cost is considered wasteful and is avoidable with advanced broadband technology, our estimates suggest a cost saving of **\$4.2 million** per year for the county.⁴⁴

⁴¹ Source: See The BLS’s *American Time Use Survey 2009* <http://www.bls.gov/tus/#tables>

⁴² <http://id.nielsen.com/news/documents/GlobalOnlineShoppingReportFeb08.pdf>

⁴³ Half the median wage rate x 45/480 minutes per day = $\$14.32/2 \times 0.09375 = \0.6713 per person per day.

⁴⁴ We ignore other savings such as reduced pollution and gasoline bills from not driving to the store.

6. Utility and Generator Benefits

As pointed out in Lobo *et al* (2008, 2009) Smart Grid-enabled DSM programs play an important role in mitigating electrical system emergencies, avoiding blackouts and increasing system reliability, reducing dependency on expensive imports, reducing high energy prices, providing relief to the power grid and generation plants, avoiding high investments in generation, transmission and distribution networks and leading to environmental protection. Some of these benefits (quantified in the 2009 study) are updated and reproduced below.

A. TVA Net Savings

By implementing a DSM program, Hamilton County could help reduce TVA's costs by reducing costly purchases from the power market at peak times and through avoided costs of building new capacity.

We assume the following:

- DSM program to be implemented: 90 event hours during the year at an average of 150 MW = 13,500,000 kWh shifted from peak to off-peak usage
- DSM incentive-costs to TVA: average of \$225 per MWh or \$3.0375 million.

1. Avoided Costs of Building New Capacity

DSM in Hamilton County could reduce the cost of building new capacity by **\$1,200,825** (i.e. Cost per kWh x 13,500,000 kWh). This estimate is based on cost-to-build estimates from the EIA (2006) and presented in our DSM (2008) study.

2. Avoided Costs of Purchasing (Peak) Power in the Open Market

An EPB analysis of market prices in 2010 suggests that TVA will likely pay on average \$201/MWh for the top 100 hours when the DSM program would be in effect. A DSM program in Hamilton County could reduce TVA's cost of purchasing power by \$201 x 150 MW x 90 hours = **\$2,713,500**.

3. Avoiding blackouts

During the California energy crisis of 2000-2001, rolling black-outs periodically shut down everything from assembly lines to computer servers. According to one study, just two days of blackouts alone cost California \$1.7 billion in lost productivity.⁴⁵

While blackout scenarios are less likely in Hamilton County, it is nonetheless instructive to estimate some impact from such a possibility. For analytical purposes, we *assume a blackout during any one peak hour*. Our calculations of the attendant output costs show that a one hour blackout could cost the county in excess of **\$1.5 million** in lost output in addition to about 121 lost jobs.

Hamilton County calculations:

- Per capita 2010 GDP for Tennessee⁴⁶ = \$39,730
- Estimate of Hamilton County GDP (2010) = per capita state GDP x county population = \$39,730 x 337,175 = \$13.4 billion
- Hourly GDP for Hamilton County = \$1,529,219
- Total Chattanooga MSA non-farm employment (May 2011)⁴⁷ = 231,500
- Total employment per hour = 121⁴⁸

4. Program/Incentive costs to TVA

We assume that the DSM incentive-costs to TVA will average \$225 per MWh or \$3.0375 million in total. We subtract this cost from the benefits listed above.

The net benefits to TVA from the DSM program are estimated to be **\$2,406,044**.

B. EPB Benefits

After updating the results from Lobo (2009), the estimated total benefit to EPB of a smart grid deployment is found to be **\$13,981,791**. The calculations are shown below in Table 7 and are based on a previous EPRI-sponsored (2007) study.⁴⁹

⁴⁵ http://marketplace.publicradio.org/display/web/2006/07/25/cost_of_rolling_blackouts/. See also <http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2531&context=lbnl>

⁴⁶ <http://www.bea.gov/regional/gdpmetro/>

⁴⁷ <http://www.tn.gov/labor-wfd/lmr/pdf/2011/LMRMay2011.pdf>

⁴⁸ 231,500 / (240 days x 8 h/day)

⁴⁹ "An Independent Review and Evaluation of Chattanooga Electric Power Board's Optical Fiber to the Home Project," prepared by EnerNex Corporation in February 20, 2007. The report was sponsored by the Electric Power Research Institute.

Table 7. Distributor Benefits of Smart Grid		
EPB Benefit	Assumption	Annual Value
Theft Detection	Meters can be secured faster - potential losses may be less. This assumes a 90% reduction in a 2% theft rate. (\$484 million revenue in 2008)	\$8,712,000
Automatic Meter Reading	100% elimination of meter-reading routes (\$0.60 for contract + \$0.36 overhead; 171,163 customers)	\$1,971,798
Successor-read work orders	100% elimination of successor-read trips (\$7.50/trip; Average: 2,370 trips/month)	\$213,333
Soft disconnects/reconnects	50% elimination of trips for disconnects & reconnects (\$7.50/trip; Average: 1,074 trips/month)	\$96,660
High-Low read resolutions	100% elimination of trips (\$7.50/trip; Average: 790 trips/month)	\$71,100
Starting watts and watts loss improvements	130,000 electromechanical meters with calculated watts-loss/meter of \$.015 and starting watts-loss/meter of \$.011	\$34,000
Improved outage response	\$0.40/meter/month (Source: Cambridge Energy Research Association)	\$784,224
Improved asset maintenance & utilization	10% of station equipment & transformer value over 30 years (= 4% overall value [10 years] plus \$250,000 utilization; plant value = \$134,174,000)	\$750,000
Meter & Itron salvage	Resale: 171,163 meters @ estimated \$7.50 each; Resale: 32 units @ \$2,500 ea, 1 server, 2 workstations; maintenance reduction	\$1,348,676 (one time value)
TOTAL		\$13,981,791

C. Other Societal Benefits

The implementation of a Smart Grid provides direct benefits to the end consumers of electricity. For instance, a consumer will be able to decide whether to run her dishwasher in the afternoon, when rates are higher, or at night, when rates are lower. The smart grid will also improve the adoption of renewable energy sources. However, many of these benefits accrue to society in general and are not limited to the end consumers. For

instance, if the consumer installs solar panels on her roof, she might be able to sell excess energy back to the utility, which could then be delivered to the national electrical grid.

A modernized Smart Grid electricity network allows for environmental and health benefits (discussed earlier), but also enables connection of distributed generation (with photovoltaic arrays, small wind turbines, micro hydro, or even combined heat power generators in buildings); incorporating grid energy storage for distributed generation load balancing; and eliminating or containing failures such as widespread power grid cascading failures.⁵⁰ The digital devices within the grid can decide how to best allocate power, depending on the demand, and they may be able to control devices attached to the grid.⁵¹

CASE STUDY: Spring storms in Chattanooga

Recently, the EPB service territory was hit by the costliest storm in the utility's history. Spring brought tornados that ripped through neighborhoods and business districts alike, at one point bringing down more than three quarters of the utility's customers. Despite the severity of the damage these tornados caused, things may have been worse for some area customers had the utility not had the advantage of its state-of-the-art Smart Grid.

S&C IntelliRupter switches have been installed throughout the service territory; two of these switches made a difference for one of EPB's largest customers and for hundreds of ratepayers during this spring storm season.

After a storm in early April, sensing that a tree had fallen on the line, two IntelliRupters were able to communicate, with the affected IntelliRupter staying open just long enough to drop the fault and tell the neighboring IntelliRupter to stay closed. The result of this intelligent communication was that US Xpress, the third largest private truckload carrier in the United States, along with 1,200 additional customers, retained access to electricity.

Because the Intellirupters can communicate remotely and solve the problems without physical human interference, EPB avoided spending four hours to manually correct the issue. In total, the Smart Grid allowed EPB to avoid 179,202 Customer Minutes Interrupted. During this massive outage, those critical hours and resources were utilized bringing customers back online in other areas.

⁵⁰ http://en.wikipedia.org/wiki/Smart_grid

⁵¹ In a simple example, a smart grid would recognize that a lot of people in one area were running air conditioners because it was hot, and opt to shuttle more power to that part of the grid. Furthermore, the smart grid might have the ability to shut down unused escalators and elevators in commercial buildings to free up power, or to adjust thermostats used for climate control to make energy usage more efficient.

The value of a consistent and reliable power supply cannot be overemphasized. ARS' IT officer Brown describes reliability as being one of the most critical components of their operation. "EPB is about 99.9999% reliable. We haven't had an outage in at least two years," says Brown. Just in case of an emergency, the company purchases back-up business class Internet service from Comcast, but Brown isn't impressed with the reliability. He described the connection as being available for only two or three hours a day and unable to handle the data transfers on which his company's business depends.

While attempting to capture all these benefits presents enormous empirical challenges, we can conservatively estimate the benefit to customer outage notification to be **\$2,053,956**.⁵²

7. CUSTOMER SAVINGS

a. Fiber optic services reduce electric rates for customers

EPB announced a rate hike of 5 percent effective July 1, 2011. A customer with a \$100 monthly power bill will see a \$4.58 rate hike. According to CEO Harold DePriest, EPB would have had to implement the increase in 2010 had it not been for increased revenues from the new fiber optic services.⁵³ In fact, the fiber optics division is expected to generate positive cash flow in the next two to three years and is expected to subsidize the electric utility going forward.⁵⁴

The value to the community of a deferred rate hike referred to by EPB above can be calculated as follows:

One-time annual savings to residential customers = 4.58% x average bill x 12 months x # residential customers

The 2009 average residential power bill for Tennessee as reported by the EIA was \$116.35/mo.⁵⁵ With 148,954 residential customers (as of June 2011), the one-time annual savings to Hamilton county would amount to **\$9.5 million**.

⁵² \$1 per customer per month for 171,163 customers.

⁵³ <http://www.timesfreepress.com/news/2011/may/20/chattanooga-area-power-bills-set-rise-five-percent/>

⁵⁴ These cash flows are not considered in the current analysis.

⁵⁵ http://www.eia.gov/energyexplained/index.cfm?page=electricity_home#tab2

b. Smart grid reduces outages

Moreover, going forward EPB estimates that the Smart Grid should cut the number and length of power outages for EPB by up to 40 percent. Based on DOE algorithms, EPB officials estimate the increased reliability from the Smart Grid is worth at least \$35 million a year to Chattanooga area businesses and homeowners.⁵⁶

c. Fiber optic build out completed sooner than projected

The original (2006) study assumed a 10-year time frame for the FTTH infrastructure build out. In effect, the project is likely to be completed in 5 years, i.e. by 2012. The benefit to the community will manifest in economic development (new firms moving to town) and the social/indirect benefits described earlier. Some of these implications are explored in the conclusion section of this study.

d. Triple Play benefits

In the 2006 study, we estimated cost savings averaging about \$15/month per household from bundling and competitive pricing of telephone/internet/TV offerings in the county. Those benefits continue to be relevant today. The latest census puts the number of households in Hamilton County at 134,507. We estimate a benefit to the community based on a 20% take rate of **\$4.9 million**.

e. Bill savings from Smart Grid-enabled DSM programs

The Smart Grid will allow utilities to move electricity around the system as efficiently and economically as possible. It will also allow the homeowner and business to use electricity as economically as possible. Based on the assumption that *an average of 150 MW over 90 event-hours per year would be shifted from peak to off-peak usage using time-of-day and critical-peak-pricing*, Lobo *et al* (2009) estimated that customers in the EPB footprint would collectively save **\$72.2 million** annually.

⁵⁶ <http://www.timesfreepress.com/news/2011/may/05/epb-touts-smart-grid-utilities/>; EPB's estimate is based off a DOE algorithm.

In total, customer savings could amount to as much as \$121.8 million annually from the aforementioned sources. For the purposes of this analysis, we exclude the \$35 million cited by EPB pending further analysis, yielding a total annual savings of **\$86.8 million**.

4. CONCLUSION

This study can be viewed as a follow-up to the Lobo *et al* (2006 and 2009) studies that estimated the economic and social impact of EPB's investments in FTTH broadband and the Smart Grid. While each of those previous studies examined the impact on Hamilton County of FTTH and the Smart Grid independently, this study attempts to capture the overall value to the community of these initiatives taken together.

This study has estimated that the economic value to Hamilton County of the integrated capital expenditures on fiber optic infrastructure to support FTTH broadband and a Smart Grid is roughly equal to \$589.8 million in added income and taxes or about \$1,750 per county resident. Additionally, we estimate that *at least* 3,716 new jobs can be associated with this investment.

The social and indirect benefits of this project are estimated to be \$ 209.3 million annually. As in Lobo *et al* (2006), we assume that these benefits will accrue to the community over the next 5 years in line with the following assumption: 10% in the first year, 20% in the second, 30% in the third, 40% in the fourth, 50% in the fifth year and 60% thereafter indefinitely. The present value of this stream of benefits at a 10% discount rate is just over a billion dollars or about \$2,973 per county resident.

Moreover, the social and indirect benefits outweigh the estimated economic effects by a margin of 1.7-to-1. In total, we estimate that the capital expenditure of \$396.1 million will generate incremental economic and social benefits of about \$1.2 billion and at least 3,700 new jobs for Hamilton County in the future.

It bears noting that estimates, such as those presented in this study, are sensitive to the assumptions made and to changing economic realities. Today, we view broadband as essential infrastructure (like good roads and schools). In fact, broadband is an enabler, and as such the effects of broadband technology are felt in conjunction with other information and communication technologies, as well as with associated organizational and social changes (Lobo, Ghosh and Novobilski, 2008). The relative lack of economic and demographic data on the relationship between broadband and regional economic outcomes, and employment in particular, continues to hamper detailed econometric analysis.

As previously pointed out the Chamber of Commerce estimated that some 38 new businesses have moved to Chattanooga since 2007 and some 53 firms have expanded operations in the region. How much of the economic activity in Hamilton County is due the availability of broadband and the Smart Grid? Data limitations prevent us from directly answering this important question. However, the IMPLAN estimates give us some idea of what the typical employment impact would be for a capital investment of the sort EPB has made. These estimates can be fine-tuned analytically.

Kolko (2010), for instance, correctly points out that broadband may offer benefits not fully captured in measures of output, employment, or growth. For instance, people may use broadband to share pictures with friends or to download music - activities that might not fulfill a public policy goal, even though people value these activities. Other benefits such as access to news, remote medical services, or distance learning might be public policy goals but might not be reflected in standard economic indicators such as employment, output, or income.

Kolko's analysis indicates a positive relationship between broadband expansion and economic and employment growth. Moreover, the relationship is stronger in industries

that rely more on information technology and in areas with lower population densities.⁵⁷ In particular, the relationship between broadband and employment tends to be stronger in industries where information technology (IT) services (Internet publishing, telecommunications services, data processing, and related services) represent a larger share of an industry's inputs. These industries include: information; professional, scientific, and technical services; management; administrative services; and educational services. Of these, all but educational services are among the industries whose employment growth shows the strongest relationship with broadband expansion.

In addition, industries with a larger share of employees in computer specialist occupations tend to show a stronger relationship between broadband expansion and employment growth. Utilities; information; finance and insurance; professional, scientific, and technical services; and management had a higher share of employees in these occupations, and all five of these industries are among those showing the strongest relationship between broadband expansion and employment growth.

To generate first pass analytical estimates of the likely impact of new firms entering the region, we use the Bureau of Economic Analysis' Regional Input-Output Modeling System multipliers (RIMS II) for the Chattanooga MSA.⁵⁸ We identify the sectors most likely to benefit from the availability of high speed broadband based on Kolko's findings. The RIMS II multipliers for firms in such sectors are listed in Table 8.

⁵⁷ Although the evidence leans in the direction of a causal relationship, the data and methods do not definitively indicate that broadband causes this economic growth.

⁵⁸ These are basic type II multipliers which include direct, indirect and induced effects of an investment on final demand. Unlike IMPLAN, this method does not allow for detailed modeling of the expenditure function. The BEA multipliers were last updated in August 2010.

Table 8.
Types of new firms likely to move to the Chattanooga MSA

Sector	NAICS CODE	NAICS DESCRIPTION	RIMS II Output Multiplier *	RIMS II Employment Multiplier**
Financial Services	523000	Securities, commodity contracts, investments, and related activities	1.8508	13.3405
Software development	541511	Custom Computer Programming Services	1.9263	16.0133
Information	541512	Information management computer systems integration design services	1.9614	14.7204
Utilities	5416A0	Environmental and other technical consulting services	1.7973	18.2226
Management	541610	Management, scientific, and technical consulting services	1.8584	16.8219
Scientific Research Labs	541700	Scientific research and development services	1.9095	14.0553
Healthcare / Medicine	621B00	Medical and diagnostic labs and outpatient and other ambulatory care services	1.9793	18.2930

Notes:
* total dollar change in output that occurs in all industries for each additional dollar of output delivered to final demand by the industry
** total change in number of jobs that occurs in all industries for each additional \$1 million of output delivered to final demand by the industry

We then estimate the likely regional economic impact on output and employment of firms in these sectors entering the Chattanooga MSA. We judge the size of the average firm in the sector/industry based on 1) average total receipts and 2) average total assets, as reported in the Almanac of Business and Industrial Financial Ratios. The projected impacts are contained in Table 9.

Table 9.					
Estimated economic impact of new firms moving to the Chattanooga MSA					
Sector	NAICS CODE*	Average Total Receipts (\$ '000)**	Average Total Assets (\$ '000)**	Average Output Impact (\$ million)†	Average Employment Impact†
Financial Services	523120	13,068	100,240	104.8	756
Software development	541515	2,164	1,910	3.9	33
Information	541515	2,164	1,910	3.9	30
Utilities	541600	1,120	706	1.6	17
Management	541600	1,120	706	1.7	15
Scientific Research Labs	541700	5,511	7,508	12.4	91
Healthcare / Medicine	621415 621515	4,829	6,196	10.9	101
TOTAL		29,975	119,175	139.5	1,043
* These were closest to the NAICS codes for which the RIMS II multipliers are provided.					
** Used as a proxy for average firm size; <u>Source</u> : the Almanac of Business and Industrial Financial Ratios (2011 Ed.)					
† Based on the average of impacts generated from using average total receipts and average total assets					

Thus, if a new firm in the “software development” sector, for instance, were to set up in the Chattanooga MSA, it would generate over \$3.9 million in total output (direct, indirect and induced) and create about 33 new jobs in the regional economy.

If just one representative firm from each sector listed in Table 9 were to relocate to the Chattanooga MSA, they would collectively generate almost \$140 million in total economic impact in addition to creating over 1,000 new jobs in the regional economy.

Projections of this nature are sensitive to the assumptions. Consequently, this study should be viewed as part of an ongoing process to assess the economic and social value of these investments to the local economy. As more information about customer experiences becomes available, the estimates will get refined. Moreover, estimates will

be further clarified as input-output models such as IMPLAN reorganizing economic sectors and keeping up with changes in the inter-relationships between sectors.

Another difficult empirical question relates to the impact of high-speed broadband availability and the Smart Grid on the in-migration of skilled labor into Chattanooga. RelocateAmerica found that the city is attracting skilled labor at a rate about 30 percent faster than the national average. These people are baby boomers and members of the millennial generation and those who are characterized as the young, creative class - the driving force behind new, innovative businesses. Quantifying the reasons for such relocations is an important additional issue that further research must address.

Future studies will focus on newer developments in the field of telemedicine, telework, education, e-business, and entertainment, especially as they pertain to Hamilton County. Moreover, such studies can also examine the demographic characteristics of and reasons for the in-migration of skilled labor into the region. A study of the integrated value of the investment in broadband and the Smart Grid will follow.

5. REFERENCES

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CHATTANOOGA CITY CHARTER

Title 10

MUNICIPAL ELECTRICAL SYSTEM¹

- Ch. I. In General, §§ 10.1 – 10.21
Ch. II. Electric Power Board of Chattanooga,
§§ 10.22 – 10.35

CHAPTER I. IN GENERAL

Sec. 10.1. Authorization for city to purchase, construct, acquire, etc., electric light, power and distribution stations, etc., within and without city.

The City of Chattanooga in its corporate capacity is hereby authorized and empowered to purchase, construct, lease or otherwise acquire, and to maintain, operate and regulate, either within or without the corporation limits of said city, and [an] electric light and power plant and distribution system and substations, together with all necessary or appropriate equipment, appliances and appurtenances for the proper operation thereof, for the purpose of lighting public buildings, streets, parks and other municipal property, and for any and all other purposes; and for the sale of electric current for light, heat, power, or any other purpose whatever, within the corporate limits of said city and the territory adjacent thereto. (Priv. Acts 1935, Ch. 455, § 2)

Sec. 10.2. Authorization for city to purchase, construct, acquire, etc., electric light, power and distribution system, etc., within and without city and in State of Georgia; city may sell, advertise, etc., electrical current and portions of electric distribution system.

The City of Chattanooga in its corporate capacity, is hereby authorized and empowered to purchase, construct, lease, or otherwise acquire, and to maintain, operate, and regulate an electric light and power plant and distribution system and substations, together with all necessary and appropriate equipment, appliances, and appurtenances, for the proper operation thereof, within the corporate limits of said city, and within the territory of Hamilton County, Tennessee, and adjoining counties, and within the territory of Catoosa County and Walker County, in the State of Georgia, for the purpose of sale of electric current for light, heat, power, or any other purposes; and that the said City of Chattanooga is hereby authorized and empowered, in its corporate capacity, to expend such moneys as may be deemed necessary to further the sale of electric energy, including educational work, advertising, sales promotion and such other means

¹ Cross references--Public utilities generally, Title 14; board of electrical examiners, § 9.1.

MUNICIPAL ELECTRICAL SYSTEM

as may be deemed necessary for the efficient operation of said electric distribution system and the furthering of sales of electric current; and the said City of Chattanooga is hereby authorized and empowered, in its corporate capacity, to lease, sell, and convey, any part or portion of said electric power plant and distribution system, lying outside of the corporate limits of the City of Chattanooga, that may be deemed necessary and expedient for the efficient and successful operation of said electric distribution system. (Priv. Acts 1939, Ch. 538, § 1)

Sec. 10.3. Bonds-Authority to issue.

The said City of Chattanooga be and it is hereby authorized, in its corporate capacity, to issue and sell its bonds to be signed by the mayor and countersigned by the finance officer of said city in an amount not exceeding fourteen million dollars (\$14,000,000.00) for the purpose of acquiring an existing electric power plant and distributing system, or of constructing, equipping, maintaining and operating an electric power plant and distribution system. (Priv. Acts 1935, Ch. 455, § 3; Priv. Acts 1939, Ch. 348, § 1; Ord. No. 10742, § 1(1), 8-18-98)

Sec. 10.4. Same-Denominations; to be issued as serial bonds; interest; how payable; signatures; tax levy when bonds issued as general obligations of city; sale to federal agencies; private sales.

The bonds herein authorized shall be payable in lawful money of the United States of America and shall be executed in denominations of one hundred dollars (\$100.00) or multiples thereof, no single bond to exceed one thousand dollars (\$1,000.00), said bonds shall be issued as serial bonds, maturing in such amounts and at such times not less than three (3) nor more than thirty (30) years from the date of the issuance thereof as the city council may determine, and shall bear interest at the rate of not more than six per cent (6%) per annum, payable semiannually, said interest installments to be evidenced by coupons attached to the bonds, which coupons shall bear the printed or lithographed facsimile of the signatures of the mayor and finance officer of said city; and said bonds and coupons shall be payable to bearer and the bonds shall be sold at the best price obtainable and shall in no case be sold for less than par and accrued interest. Said bonds shall be issued from time to time in such amounts, and shall bear dates, as the electric power board hereinafter created shall direct; and it shall be the duty of the mayor and city council of the city to provide by resolution or ordinance for the issuance of said bonds as directed by said electric power board. Said bonds shall be known as electric power bonds of the City of Chattanooga and they may be issued either as direct and general obligations of the city, payable out of its general income and revenue, or at the election and subject to the determination of said power board they may be made payable only out of the revenue from said power plant and distribution system. In case the bonds are issued as general obligations of the city, it shall be the duty of the governing board of said city to levy a tax each year over and above the taxes levied for general municipal purposes, to pay the interest and principal of said bonds as they mature, provided, however, that in case the revenue derived from the operation of the electric plant and distribution system herein provided for is sufficient to pay the interest and principal of

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said bonds, as they severally mature, then, in that event it will not be necessary to make a special levy for the payment of said interest and principal, but the city shall each year levy a sufficient amount which, when added to the amount of revenue derived from the operation of the electric power plant and distribution system, will be sufficient to pay the interest on said bonds and the installments of principal maturing during the year.

The mayor of said city, with the approval of the city council, shall have power and authority to sell the bonds issued under the provisions of this Act to the Reconstruction Finance Corporation, Public Works Administration, Tennessee Valley Authority or any federal agency at private sale, without any public advertisement. Unless the bonds are sold to a federal agency, said bonds shall be sold at public sale in accordance with the provisions of section 3707, Tennessee Code of 1932 [T.C.A. § 6-57-209], and the mayor and city council shall have power and authority to hypothecate any or all of the bonds issued under the provisions of this Act and to borrow thereon funds from the Reconstruction Finance Corporation, the Public Works Administration, or any other similar government agency or board, or from any bank. Said bonds shall contain a recital that they are issued pursuant to and in accordance with this Act, and such recital shall be conclusive of their legality. (Priv. Acts 1935, Ch. 455, § 4; Ord. No. 10742, § 1(1), 8-18-98; Ord. No. 11272, § 1, 05-02-02)

Sec. 10.5. Same-Statutory mortgage lien created on power plant and distribution system purchased with bonds.

In event the power board shall elect to have bonds issued payable only out of the revenue from the operation of said power plant and distribution system they shall notify the city council of such determination. If revenue bonds are issued for the construction or acquiring of an existing power plant and distribution system there is hereby created a statutory mortgage lien upon the power plant and distribution system constructed or acquired to and in favor of the holders of said revenue bonds. Any holder of any of said bonds may either at law or in equity by suit, action, mandamus or other proceedings protect and enforce the statutory mortgage lien hereby conferred, and may by suit, action, mandamus, or other proceedings enforce and compel performance of all the duties required by this Act. (Priv. Acts 1935, Ch. 455, § 4; Priv. Acts 1937, Ch. 899, § 1; Ord. No. 11272, § 1, 05-02-02)

Sec. 10.6. Same-City Council authorized to do certain acts to secure payment of revenue bonds.

In order to secure the payment of revenue bonds issued pursuant to this Act and the interest thereon, the city council shall have the power as to such bonds, to the extent not inconsistent with the mandatory provisions of this Act:

(a) After the payment of operating expenses from the gross revenue to pledge all or any part of the remaining revenue derived from the operation of the electric power plant and distribution system to secure the payment of the bonds and interest thereon.

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(b) The covenant as to the rates and charges to be imposed and the amounts to be raised in each year by such rates and charges and the use and disposition thereof, and the electric power board shall carry out the provisions of this covenant.

(c) To set aside a reserve or sinking fund and the relation and disposition thereof and to provide for the redemption of revenue bonds and to provide the terms and conditions thereof.

(d) To covenant and prescribe as to what happenings or occurrences shall constitute "default" and the terms and conditions upon which any or all of such bonds shall become or may be declared due before maturity and as to the terms and conditions upon which such declaration and its consequences may be waived.

(e) To covenant as to the right, liabilities, and powers and duties arising upon the breach by it of any covenant, condition or obligation.

(f) To vest in a trustee or trustees the right to receive all or any part of the income assigned to, or for the benefit of, the holder or holders of bonds issued hereunder, and to hold, apply and dispose of the same and the right to enforce any covenant made to secure or pay or in relation to the bonds; to execute and deliver a trust agreement or trust agreements which may set forth the powers and duties and the remedies available to such trustee or trustees and limiting the liabilities thereof, and describing what occurrences shall constitute default, and prescribing the terms and conditions upon which such trustee or trustees or the holder or holders of bonds of any specified amount or percentage of such bonds may exercise such rights and enforce any and all of such covenants and resort to such remedies as may be appropriate.

(g) To make covenants other than, and in addition to, the covenants herein authorized, of like or different character, necessary or advisable to effectuate the purpose of this Act.

(h) To execute all instruments necessary or convenient in the exercise of the powers herein granted or in the performance of its covenants or duties.

(i) To provide for the replacement of lost, destroyed or mutilated bonds.

(j) The electric power board shall carry out the agreements and covenants made by the city council with the holder or holders of revenue bonds as herein provided. (Priv. Acts 1937, Ch. 899, § 1; Ord. No. 11272, § 1, 05-02-02)

(Paragraph 4 of the Amended Plan appended to the Agreed Order, dated 1-18-90, in the case of Brown v. Board of Commissioners, U.S.D.C., No. CIV-1-87-388).

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Sec. 10.7. Same-Rights of holders of revenue bonds.

Any holder or holders of revenue bonds, including a trustee or trustees for holders of such bonds, shall have the right, in addition to all other rights:

(a) By mandamus or other suit, action or proceedings in any court of competent jurisdiction to enforce his or their rights against the City of Chattanooga, the city council thereof, and the electric power board of said city and any other proper officer, agent or employee of any of them, including, but without limitation, the right to require the electric power board and any proper officer, agent or employee thereof to fix and collect rates and charges adequate to carry out any agreement as to the electric power plant and distribution system revenues.

(b) By action or suit in equity to enjoin any acts or things which may be unlawful or a violation of the rights of such holders of bonds. (Priv. Acts 1937, Ch. 899, § 1; Ord. No. 11272, § 1, 05-02-02)

Sec. 10.8. Same-City Council authorized to confer certain rights upon bond holders.

The City of Chattanooga shall have power by resolution of its city council to confer upon any holder or holders of a specified amount or percentage of bonds the right in event of default as defined in such resolution or as may be defined in any agreement with the holder or holders of such bonds or the trustee or trustees therefor:

(a) By suit, action or proceedings in any court of competent jurisdiction to obtain the appointment of a receiver of the electric power plant and distribution system or any part or parts thereof. If such receiver be appointed he may enter and take possession of such electric power plant and distribution system or any part or parts thereof and operate and maintain the same, and collect the revenue thereafter arising therefrom in the same manner as the electric power board or City of Chattanooga might do and shall deposit such moneys in a separate account or accounts and apply the same in accordance with the obligations of the City of Chattanooga as the court shall direct.

(b) By suit, action or proceedings in any court of competent jurisdiction, to require the city council of the City of Chattanooga and the electric power board of said city to account as if they were the trustee on an express trust. (Priv. Acts 1937, Ch. 899, § 1; Ord. No. 11272, § 1, 05-02-02)

Sec. 10.9. Same-Use of proceeds from sale of bonds.

All moneys received from bonds issued under this Act shall be used solely for the purpose of defraying the cost of acquiring or constructing an electric power and distribution system, and extension thereof, and the equipment, appliances and appurtenances necessary or appropriate thereto; provided, however, that such moneys may be also used to pay interest

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maturing on said bonds during negotiations for the acquiring of an existing electric power and distribution system, or during the construction of such power plant and distribution system, and until the system has been put into operation. The board hereinafter created is authorized to incur expenses for the making of surveys and estimates of costs and of revenues, and to certify the expense thereof to the city council of said city, who shall pay the same from the general funds of the city; and such payments from the general funds shall be considered as temporary loans, and shall be repaid, upon sale and delivery of said bonds, out of said bond fund. (Priv. Acts 1935, Ch. 455, § 5; Ord. No. 11272, § 1, 05-02-02)

Sec. 10.10. What cost of electric power plant and distribution system to include.

The cost of the electric power plant and distribution system shall be deemed to include all necessary expenses of preliminary surveys, estimates of costs and of revenues, and all the cost of acquiring such power plant and distribution system or of the construction thereof also the cost of all necessary or suitable property; rights-of-way, casements [easements] and franchises; and also to include interest in bonds issued under this Act maturing prior to and during the construction or acquisition of the plant for six (6) months thereafter, together with engineering and legal expenses, expenses for plans, specifications and surveys, administrative expenses and all such other expenses as may be necessary or incidental to the financing of, acquiring or constructing and equipping an electric power and distribution system as herein authorized, and the placing of such power plant and distribution system is [in] operation. (Priv. Acts 1935, Ch. 455, § 6)

Sec. 10.11. Statutes fixing maximum indebtedness of city not to apply to bonds issued under act.

No statute, general or special, fixing the maximum indebtedness of the said City of Chattanooga, or prohibiting the issuance of bonds, notes or other indebtedness, shall apply to or limit the amount of bonds that may be issued or the amount of money that may be borrowed under this Act and all acts or provisions of the Charter of said city in conflict with the provisions of this Act are hereby repealed. (Priv. Acts 1935, Ch. 455, § 17)

Secs. 10.12 -- 10.21. Reserved.

CHAPTER II. ELECTRIC POWER BOARD OF CHATTANOOGA

Sec. 10.22. Created; membership; term of office of members.

There is hereby created a board to be known and designated as the "Electric Power Board of Chattanooga," consisting of five (5) members, all of whom shall be residents of Hamilton County, Tennessee. Two (2) members of said board shall be appointed for a period of four (4) years; two (2) for a period of six (6) years, and one for a period of eight (8) years, and each of the

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members of the board shall serve until his successor is appointed and qualified. The first board shall consist of the following named persons, to wit: Stanton Smith and L.J. Wilhoite, who are appointed for a period of four (4) years; J.C. Twinam and George H. Patton, who are appointed for a term of six (6) years; and Harold C. Fiske, who is appointed for a period of eight (8) years, and who shall act as chairman of said board.

When the term of the first appointee, hereinabove named, expires, his successor shall be appointed to serve for a period of two (2) years or until his successor is elected and qualified, and thereafter, his successor shall be appointed for a period of five (5) years or until his successor is elected and qualified. Upon the expiration of the term of the second appointee, his successor shall serve for a period of four (4) years or until his successor is elected and qualified, and, thereafter, his successor shall be appointed for a period of five (5) years or until his successor is elected and qualified. Upon the expiration of the term of the third appointee, his successor shall be appointed for a term of three (3) years or until his successor is elected and qualified, and, at the expiration of said term of three (3) years, his successor shall be appointed for a term of five (5) years or until his successor is elected and qualified. Upon the expiration of the term of the fourth appointee, his successor shall be appointed for a term of five (5) years or until his successor is elected and qualified, and, thereafter, his successor shall be appointed for a term of five (5) years or until his successor is elected and qualified. On or about April 15, 2007 and every year thereafter, the members of the Electric Power Board shall elect from among their number a chairperson and a vice chairperson to serve for a year's term. The current chairperson shall continue as a member of the Board until the normal expiration of his five (5) year term as a Board member and thereafter his successor shall be appointed in the same manner and for the same length of term as other Board members. (Priv. Acts 1935, Ch. 455, § 7; Priv. Acts 1941, Ch. 455, § 1; Ord. No. 11872, § 1, 8-22-06)

Sec. 10.23. Vacancies in office of board.

When the term of appointment of any member or members of said board shall have expired, or when any vacancy in the board occurs by reason of death, resignation, removal or other cause, the vacancy or vacancies shall be filled by appointments made by the mayor, subject to confirmation by the city council of the City of Chattanooga, and if any appointment made by the mayor shall not be confirmed by the city council within a period of ten (10) days after notice of the appointment has been given to the city council, such appointment shall be null and void, and thereupon it will be the duty of the mayor to make a new appointment or appointments, which shall likewise be subject to confirmation by the city council of the City of Chattanooga. (Priv. Acts 1935, Ch. 455, § 7; Ord. No. 11872, § 1, 8-22-06; Ord. No. 11272, § 1, 05-02-02)

Sec. 10.24. General counsel-Position created; appointment of assistants.

There is hereby created the position of general counsel of said electric power board for a period of eight (8) years. The first general counsel of said board shall be Will F. Chamblee, who shall serve for a period of eight (8) years from and after the passage of this Act, or until his