

BACKGROUND

The City of Fayetteville has been looking into the possibility of using LED (Light Emitting Diode) type traffic signal lenses since 1990. Reducing maintenance cost was our initial motivation for considering LED signal lenses. Our semi-annual incandescent bulb change out was a major expense in our maintenance budget. However, the initial cost \$300-\$400 per traffic signal head was beyond the budgeted funds for a city of our size.

During the next ten years, energy shortages in California and other states with major population areas created “brown outs” and power failures. These problem areas became a wake-up call to save energy. The tremendous amount of energy wasted by hundreds of thousands of incandescent traffic signal bulbs nation wide accelerated LED lens research and development.

The state of California was one of the first to offer incentives to develop products which would conserve energy. Some of its energy programs offered to purchase up to 50% of the cost of a device which substantially reduced consumption of electricity. These cost share programs drastically increased the demand for LED traffic signal lenses and competition in the market to supply the product. By the year 2000, prices began to fall, and we began again to look at the possibility of using LED traffic signal lenses as a way of reducing maintenance and energy cost.

In late 2001, we heard about the ARKANSAS Energy Office LED traffic signal grant program when the Rebuild Arkansas Program Representative, Mr. Luke Elliot, visited Fayetteville Mayor Dan Coody. Mr. Elliot encouraged us to apply for the \$10,000 grant for testing LED traffic signals available from the Arkansas Department of Economic Development.

THE STUDY

The City of Fayetteville applied for and received a \$10,000 grant from the Arkansas Department of Economic Development, March 6, 2002. The funds were to be used for installing, testing, and evaluating the LED traffic signal lenses in at least one Fayetteville intersection for one year. Two intersections were chosen for the testing period. The Sixth St. (Hwy 180)/College Ave. (Hwy 71B) intersection and the Township St. (Hwy 180)/College Ave (Hwy 71B) intersections were chosen. Both traffic signals have the same configuration, eight 3-section heads (two per approach) and four 5-section heads (one for each left turn lane). For the purpose of evaluation, we used the Township St. (Hwy 180)/College Ave. (Hwy 71B) intersection. We should comment that local utility AEP SWEPCO was very helpful in collecting and providing historical data for the study. The following chart contains the 12 month historical data for the Township/College intersection:

DATE	KWH	BILLING
02/01/01	1,169	69.73
03/02/01	1,210	71.89
04/02/01	1,314	77.37
05/02/01	1,241	73.52
06/04/01	1,362	86.33
07/03/01	1,178	75.75
08/02/01	1,202	77.07
08/31/01	1,176	75.57
10/02/01	1,297	82.53
10/31/01	1,196	71.08
12/03/01	1,361	79.78
01/04/02	<u>1,347</u>	<u>79.05</u>
TOTAL	15,053	919.67
AVERAGE	1,254.41	76.64

In anticipation of receiving the grant, quotes were requested, evaluated, and the purchase of GE GELCORE traffic signal LED equipment was awarded to Temple, Inc. of Decatur, Alabama. For the quantities needed to perform the evaluation study at this intersection, the price quotes were:

TYPE	PRICE
12" Red Ball	92.00
12" Yellow Ball	103.00
12" Green Ball	189.00
12" Yellow Arrow	93.00
12" Green Arrow	126.00

The traffic signal equipment was received and installed during the month of January of 2002 by the City of Fayetteville Traffic Signal Maintenance Division. The retrofit was very simple to do and after a couple of change outs, the crews were able to perform the task in less than ten minutes for each LED signal lens.



THE STUDY RESULTS

The 12 month test began in February after the transitional installation month of January 2002. The following chart is a summary of the AEP SWEPCO usage and billing during that period:

DATE	KWH	BILLING
03/04/02	140	15.43
04/01/02	171	17.07
04/29/02	147	14.37
05/28/02	154	15.38
06/26/02	156	15.48
07/26/02	162	15.75
08/26/02	165	15.97
09/25/02	162	15.82
10/24/02	154	14.71
11/22/02	154	14.71
12/27/02	185	16.06
01/28/03	<u>168</u>	<u>15.32</u>
TOTAL	1,918	186.07
AVERAGE	159.83	15.50

EVALUATION OF DATA

After collecting data from 12 months of usage with the LED traffic signal lenses installed, a comparison with the previous historical data was done. The comparison of data sets indicated the following savings at the Township/College intersection:

	Monthly Average KWH	Monthly Average Billing
Before LED technology	1,254.41	76.64
After LED technology	159.83	15.50
	Annual KWH Usage	Annual Billing Total
Before LED technology	15,043	919.67
After LED technology	1,918	186.07
	<u>Savings</u>	<u>87.25%</u>
		<u>79.77%</u>

The data for 12 months clearly shows a tremendous amount of energy can be saved (87.25%) and a significant reduction in utility cost (79.77%) when LED traffic signal technology is implemented.

IMPLEMENTATION

After collecting data for several months, the Traffic Division realized the savings this equipment provided would be of great benefit to our operating budget and the citizens of Fayetteville. Since the economy was lagging and revenues were down, all City of Fayetteville operational divisions were faced with cut backs and the Traffic Division was looking at the possibility of losing a technician during the budget process. In early June 2002, after completing six months of the test, we submitted the following memo to our Finance Director, Steve Davis, to illustrate how we could install LED traffic signal lenses and save enough utility cost to continue funding our Traffic Signal Technician:

Steve,

As you know, I have ordered LED traffic signal lenses (10 year life) for two traffic signal locations to conduct a field test. I want to see if the 85% energy savings claimed by manufacturers hold true for the usage and rates we pay for power in our area. Here is a proposal which would reduce my general fund budget to the 2000 budget level and not involve laying off Traffic Division personnel:

LED TRAFFIC SIGNAL LENSE REPLACEMENT COST

Color	# of Lenses	Expected bid price	Total
Red	522	\$70	\$36,540
Yellow	522	\$70	\$36,540
Green	490	\$140	\$68,600
Yellow Arrow	74	\$70	\$5,180
Green Arrow	119	\$140	<u>\$16,660</u>
Total Replacement Cost			\$163,520

UTILITY COST SAVINGS

2002 Estimated Traffic Signal Utility Costs	\$50,000
Actual LED Signal Utility Cost (85% Reduction)	(\$7,500)
Annual Utility Cost Savings	<u>\$42,500</u>

CIP INVESTMENT PAYBACK

$$\text{\$163,520} / \text{\$42,500} = \text{3.8 Years}$$

The Mayor, City Council, and Finance Department agreed with findings of the study and approved a \$163,537 CIP (Capital Improvement Project) to fund a 100% replacement of all incandescent lamps in our traffic signals, including all pedestrian signals with LED technology. Quotes were received for the quantities needed to complete the entire retrofit project. By ordering such a large quantity of LEDs, we were able to get much better pricing. LED prices quoted for the project were:

TYPE	PRICE	QUANTITY
12" Red Ball	57.17	600
12" Yellow Ball	66.03	600
12" Green Ball	119.57	550
12" Yellow Arrow	66.03	130
12" Green Arrow	83.70	100
16" Ped (full hand outline)	138.00	50

All of the equipment was received in early fall of 2002, and the installation was completed by late spring of 2003. The City thought about contracting the retrofit project, but the installation was found to be easy and fairly quick, so we did the project in house.

Since we included pedestrian signals in our project, our payback remains the same at approximately 3.8 years.

CONCLUSIONS

- LED signals have proven they save energy and are cost justifiable.
- Most LED signals manufactured today are Federal Government “Energy Star” compliant.
- Retrofitting LED signals was quick and easy to accomplish.
- LED signal colors are vibrant and much more visible to the elderly.
- LED signals do not “wash out” in the morning and afternoon when the sun is shining directly into them.
- LED signals have proven to be very reliable. We have experienced only seven failures out of hundreds in the field since we started the project two years ago.
- LED signals require a very small amount of energy to operate. Because little energy is required, they can operate with emergency backup systems. This equipment enables the Traffic Division to keep major intersections operational during power failures. At a cost of approximately \$3,000 each, we already have installed emergency backup systems at four intersections in Fayetteville.
- LED signals do not have filaments and are expected to have a ten year life. In the past, when burn outs became frequent, the Traffic Division had a two year cycle on a complete change out of several thousand incandescent traffic signal bulbs. We have completely eliminated after hour technician call outs for burn outs.
- Since there is no filament to heat up for light, LED signals indications come on in milliseconds.
- LED traffic signals are great PR!! ALL POSITIVE!! NO NEGATIVES!!