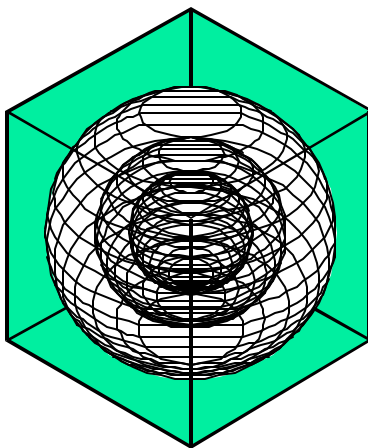


**TEXAS LOANSTAR PROGRAM  
SAVINGS CALCULATION WORKBOOK**

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## SUMMARY

This is the report and manual for the Texas LoanSTAR Program Savings Calculation Workbook. The purpose of this report is to document the Texas LoanSTAR Program Savings Calculation Workbook to be used by the State Energy Conservation Office (SECO). The workbook may be used to track the historical energy and dollar savings as of August 2002, and to project the future LoanSTAR program savings including: measured retrofit savings, Continuous Commissioning<sup>SM</sup> (CC<sup>SM</sup>) savings, estimated retrofit savings, emission reductions, and state agencies savings. In addition, an example of how to use this worksheet also is presented.

The workbook includes twelve worksheets that have been developed to preserve the program savings data from 1990 to August 2002, and to forecast the LoanSTAR program savings beginning on September 2002. The workbook comprises: a) three output worksheets, b) four information worksheets, and c) five supporting worksheets. Three graphs are provided in the workbook: cumulative savings, measured retrofit savings and yearly savings graphs. All the spreadsheets and graphs are updated automatically through built-in programs. This workbook was developed by the Energy Systems Laboratory of Texas A&M University Systems in MS Excel<sup>®</sup>.

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## 1 INTRODUCTION

This is the report and manual for the Texas LoanSTAR Program Savings Calculation Workbook.

### 1.1 Purpose of this report

The purpose of this report is to document the Texas LoanSTAR Program Savings Calculation Workbook to be used by the State Energy Conservation Office (SECO); to track the historical savings data as of August 2002 and to project the future LoanSTAR program savings including measured retrofit savings, Continuous Commissioning<sup>SM</sup> (CC<sup>SM</sup>) savings, estimated retrofit savings, emission reductions, and state agency savings.

### 1.2 Contents of this report

This report presents the description of the Texas LoanSTAR Program Savings Calculation Workbook. In addition, examples of how to use it are also presented. In Section 2, an overview of the LoanSTAR Savings Calculation Workbook is presented. Next, a description of each worksheet is presented. Section 3 discusses the procedures for using the worksheets to update savings and adding new loan sites savings. An example of how to use the spreadsheet is given and some sample reports are provided in the attachment.

## 2 DESCRIPTION OF THE WORKSHEET

### 2.1 Overview

The Texas LoanSTAR Program Savings Calculation Workbook was developed using the Microsoft Excel<sup>®</sup> and contains twelve worksheets and three charts. These worksheets and charts are linked together as shown in Figure 2.1. All the worksheets are updated automatically with the input year and month, which are the only inputs for these worksheets. Then the LoanSTAR program savings as of the designated date would be calculated and shown in the tables and graphs.

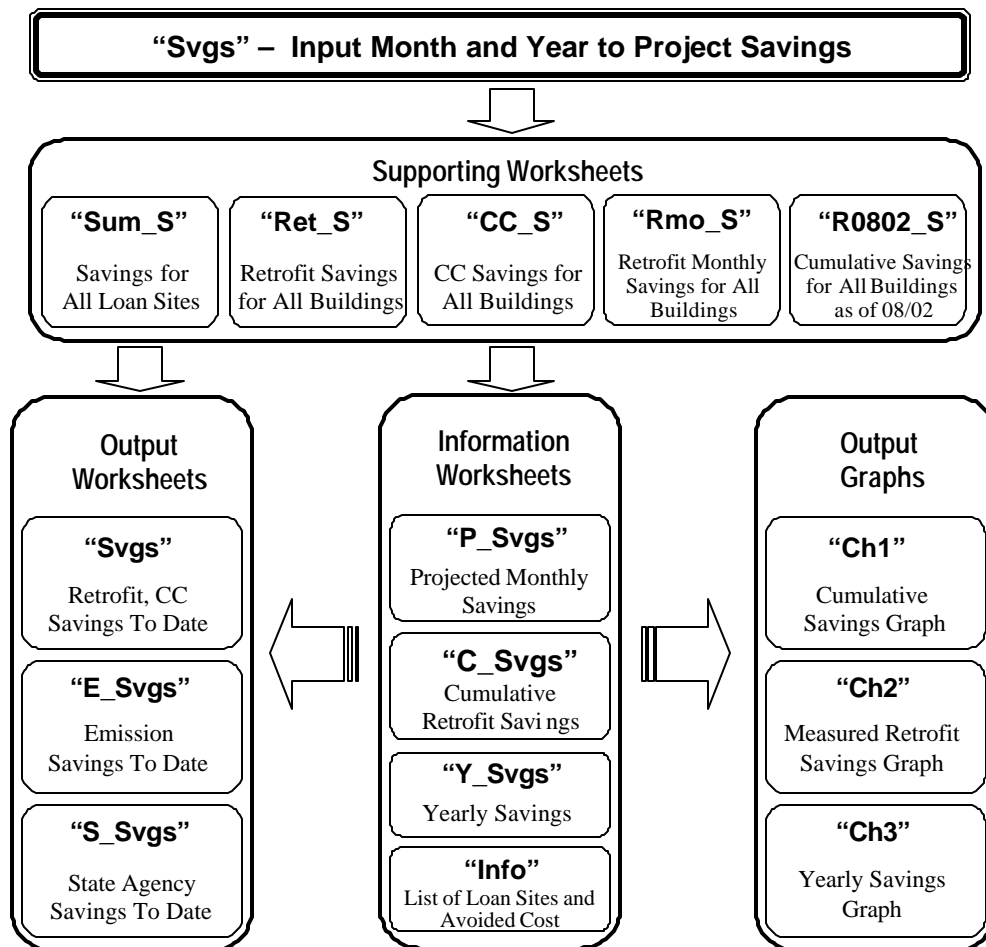


Figure 2.1: The Structure of the LoanSTAR Savings Spreadsheets

### 2.2 Worksheet description

In this section, an overview of the worksheets and charts is presented. The twelve worksheets are basically divided into three parts as shown in Figure 2.1: a) output worksheets to show savings as of entered date including retrofit savings, CC savings, emission savings, and state agency savings as of the entered date, b) information worksheets to include historical data

and support the calculation of savings and plotting the graphs, and c) supporting worksheets to preserve retrofit and CC savings for all buildings. The three graphs provide such information as the cumulative LoanSTAR savings, the retrofit savings in three categories including heating energy, cooling energy, and electricity, and the yearly LoanSTAR savings since 1990.

### 2.2.1 Input section

The first section of worksheet “Svgs” is the input section. Figure 2.2 presents a view of this section that is used to input the year and month for projecting LoanSTAR savings. After entering the year and month to get savings, all worksheets but “C\_Svgs”, “Y\_Svgs”, “P\_Svgs”, “R0802\_S”, “Rmo\_S”, and “Info” will be updated automatically regarding to these inputs. If the user wants to update the three graphs and their related worksheets “C\_Svgs”, and “Y\_Svgs”, the user needs to press the button “Update Graphs” to complete the task.

There are several criteria for updating the savings and graphs. Firstly, savings must be updated month by month. This avoids any troubles if new loan sites are added into the system. For example, in Figure 2.2, the blue text near the button “Update Graphs” shows the year and month when the savings were last updated, that is, August 2002. Any attempt for updating savings in dates beyond one month of the last updated date or later, i.e. in this case for October 2002, may cause problems and it is not allowed. The user must be very careful about it because the system can only give a wrong message when updating graphs by pressing the button while the savings in most of spreadsheets may have already been incorrectly updated. Secondly, as a prevention measure, years before than 2002 are not allowed to enter and only numbers between 1 and 12 is allowed to enter into cell of “month”. The workbook is designed to provide only savings estimation after August 2002. Historical savings data until August 2002 are stored in worksheets “C\_Svgs” and “Y\_Svgs”. Finally, if new loan sites will be added into the system the user must update these new sites savings in worksheets “Rmo\_S” and “CC\_S” first before updating graphs and printing reports.

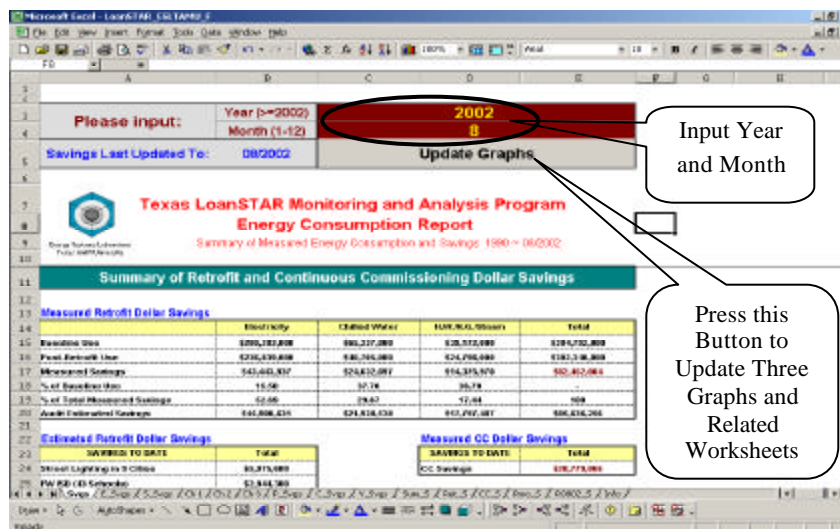


Figure 2.2: Year and Month Input Section

## 2.2.2 Output worksheets

### Worksheet “Svgs”

Figure 2.3 shows that the five tables in the second section of worksheet “Svgs” present the summary of LoanSTAR retrofit and CC dollar savings from 1990 to the entered date. This section contains measured retrofit savings, estimated retrofit savings, CC savings, overlap retrofit and CC savings, and total program savings. The table named *Measured Retrofit Dollar Savings* summarizes the total baseline energy cost, post-retrofit energy cost, measured savings, percentage of the savings vs. the baseline use, the percentage of the savings vs. total savings, and the audit estimated savings for electricity, chilled water, and hot water/gas/steam. Table named *Estimated Retrofit Dollar Savings* includes the summary of savings from street lighting retrofits in 9 cities, lighting retrofits at 43 Fort Worth ISD buildings, 11 Zero level sites, Austin ISD, Northside ISD, and Groom ISD. The two tables on the right hand side of the *Estimated Retrofit Dollar Savings* table calculate CC savings and savings overlap between retrofit savings and CC savings respectively. Table named *Total Program Dollar Savings* shows the total savings obtained by adding measured retrofit savings, estimated retrofit savings, and CC savings together and subtracting retrofit and CC overlap savings.

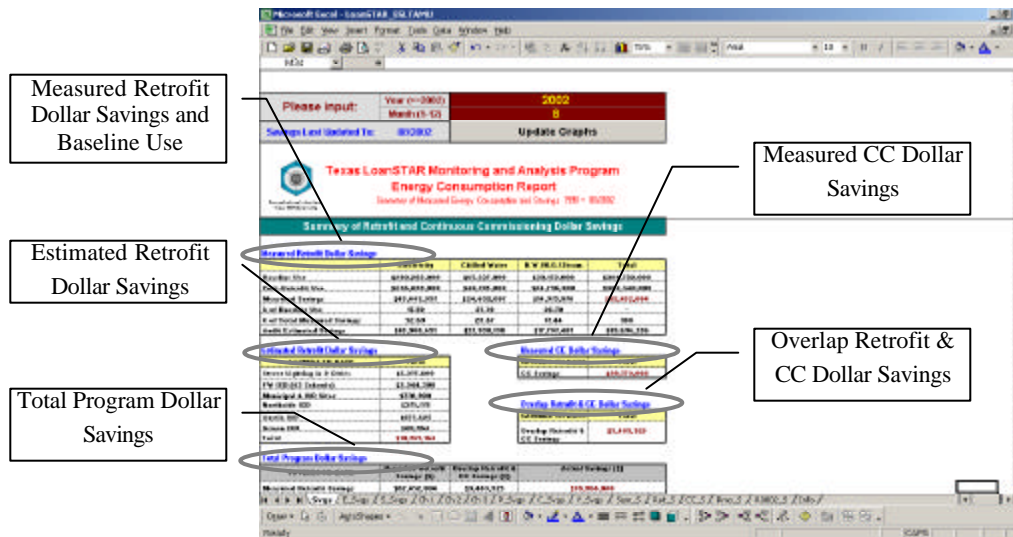


Figure 2.3: Summary of Retrofit and Continuous Commissioning Savings

The final section that appears in this worksheet gives the summary of the LoanSTAR energy savings. As shown in Figure 2.4 total electricity savings in kWh, electrical demand savings in kW, hot water/steam/gas savings in MMBtu, and chilled water savings in MMBtu are listed in the first table, and energy savings in MMBtus are shown in the next table.



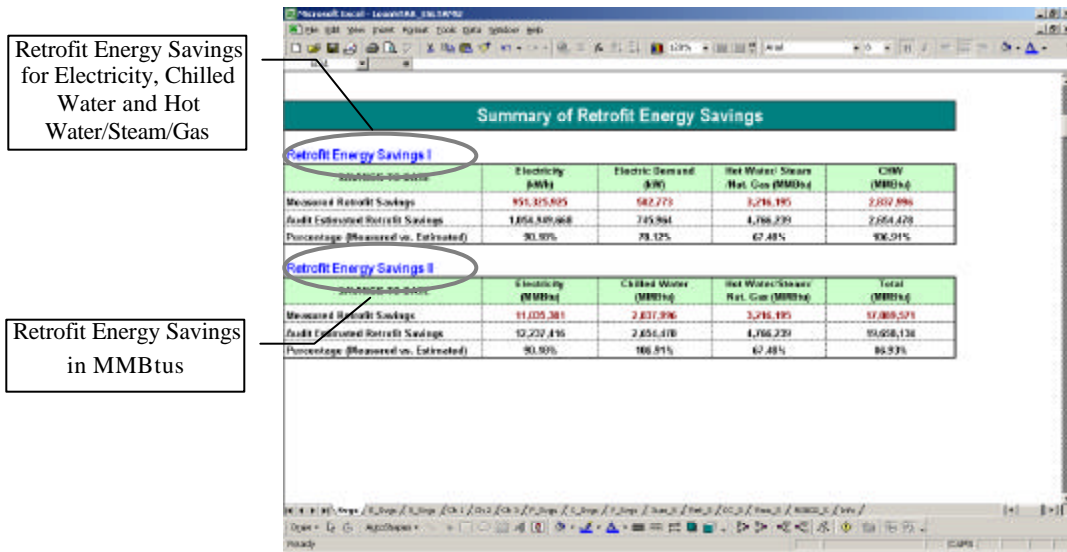


Figure 2.4: Summary of Retrofit Energy Savings

### 2.2.2.1 Worksheet “E\_Svgs”

Worksheet “E\_Svgs” involves the summary of the potential emissions savings from the energy conservation in LoanSTAR program. Figure 2.5 shows the first section of this worksheet that presents the potential emissions savings summary as of the designated date using Texas and national average emission factors from the Environmental Protection Agency’s report of 1992. Potential emissions reductions in NOx, CO2 and SO2 are broken-down into heating, cooling electric, and other electric savings. The total potential emission savings are shown in the yellow cells.

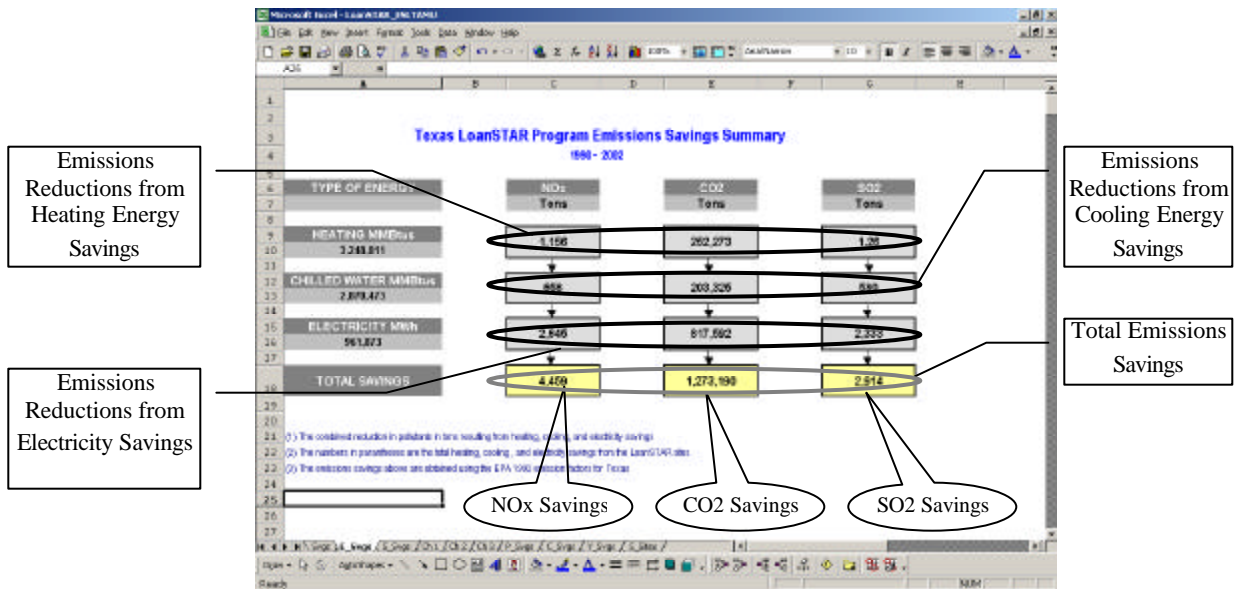


Figure 2.5: Emissions Savings Summary

The next section of the worksheet presents the emissions calculation table. The sources of the emission factors used in the calculation are listed in the first column of the four tables calculating the emissions reductions from the heating energy savings, cooling energy savings, and other electricity savings, shown in Figure 2.6.

The next section of the worksheet allows the user to compare the emission factors used in the LoanSTAR program to the most recent emission factors published in EGRID 2000 by EPA (Figure 2.7). In the 1990s the power plant emissions factors began to change dramatically as utilities and industries were mandated by the Texas Legislature to lower their NOx emissions. As these emission levels continue to drop, it is important to associate each year’s energy savings with the appropriate emissions factors for the utility that supplied the electricity. The last table in this section presents some factors used in the emissions calculation.

The screenshot shows an Excel spreadsheet with the following content:

**LoanSTAR Emissions Savings Calculation**

Using emission factors (EPA 1992) in LoanSTAR report beginning 1990

**Heating Emission Savings**

Source of Emission Factors	Heating Savings (MMBtu)	Actual Heating Savings (MMBtu)	LoanSTAR Emission Savings		
			NOx (Tons)	SO2 (Tons)	CO2 (Tons)
EPA 1992 Report (National Average)	3,240,195	4,200,260	1,144.87	1.24	269,832

**CHW Emission Savings**

Source of Emission Factors	CHW Savings (MMBtu)	CHW Savings (MMWh)	LoanSTAR Emission Savings		
			NOx (Tons)	SO2 (Tons)	CO2 (Tons)
EPA Report - Green Light Implementation Codes Report (Texas Average)	2,837,896	236,900	690.37	673.51	201,025

**Electricity Emission Savings**

Source of Emission Factors	Electricity Savings (MWh)	Actual Electricity Savings (MWh)	LoanSTAR Emission Savings		
			NOx (Tons)	SO2 (Tons)	CO2 (Tons)
EPA Report - Green Light Implementation Codes Report (Texas Average)	851,326	851,326	2,636.15	2,306.97	800,027

Figure 2.6: Emissions Calculation Tables

### 2.2.2.2 Worksheet “S\_Svgs”

Worksheet “S\_Svgs” reports the cumulative savings from 21 state agency loan sites. Audit estimated retrofit savings, measured retrofit savings, commissioning savings, total savings, loan amount, pre-retrofit utility costs, and number of months of savings will be refreshed automatically regarding the input year and month, as shown in Figure 2.8.

The next section presents the information that is used to calculate the pre-retrofit utility cost for each building of these 21 state agency loan sites (Figure 2.9).

**Emissions Factors**

**Electricity**

Source	NO <sub>x</sub> output emission rate (\$/MWh)	SO <sub>2</sub> output emission rate (\$/MWh)	CO <sub>2</sub> output emission rate (\$/MWh)
EPA/NERC 1998/EGRI Implemented in Codes Report (Texas)	5.50	4.05	1,700
EGRI 2000/TX	2.68	3.89	1,696

**Heating (Natural Gas)**

Source	NO <sub>x</sub> (\$/MMBtu)	SO <sub>2</sub> (\$/MMBtu)	CO <sub>2</sub> (\$/MMBtu)
EPA 1992 Report USA	0.53	0.00058	117

**Factors Used in Emissions Calculation**

**Other Factors**

Other Factor	Other Efficiency	CFR Multiplier	Loss Factor
LoanSTAR Emissions Calculation	0.75	1.00	0.00

Figure 2.7: Emissions Factors and Other Factors

**CUMULATIVE SAVINGS FOR STATE AGENCIES 1990-2002**

No.	State Agency	Audit-estimated Retrofit Savings (\$)	Measured Retrofit Savings (\$)	Commissioning Savings (\$)	Total Savings (\$)	Pre-retrofit Utility Cost (\$)	Loan Amount (\$)	No. of Months of Savings
1	Texas A&M University	\$5,117,054	\$4,768,024	\$851,282	\$10,736,360	\$4,500,572	\$0,000,000	142
2	UT Austin	\$76,700,000	\$26,358,700	\$2,830,881	\$105,889,581	\$13,352,000	\$7,504,000	142
3	UT Arlington	\$4,807,000	\$1,102,000	\$0	\$6,709,000	\$6,007,000	\$37,281,672	72
4	UTSA, San Marcos	\$4,522,258	\$1,717,000	\$0	\$6,239,258	\$2,850,800	\$5,000,000	72
5	UTSA, San Marcos	\$3,920,295	\$2,121,000	\$0	\$6,041,295	\$2,900,744	\$5,111,300	72
6	UTSA, San Marcos	\$3,807,667	\$4,988,138	\$0	\$8,795,805	\$1,378,488	\$1,800,000	127
7	UTSA, San Marcos	\$3,607,267	\$244,000	\$0	\$3,851,267	\$2,256,862	\$0,000,000	127
8	UTSA, San Marcos	\$6,000,734	\$1,300,700	\$0	\$7,301,434	\$5,000,000	\$1,480,000	117
9	Wade Capital Complex	\$6,158,000	\$5,288,452	\$839,927	\$12,286,379	\$10,345,461	\$48,000,000	72
10	Central Texas	\$1,100,000	\$730,000	\$200,000	\$2,030,000	\$1,100,000	\$0,000,000	72
11	Capital Education	\$4,200,000	\$450,402	\$802,292	\$5,452,694	\$1,533,277	\$5,241,217	72
12	AMHS, Austin	\$0,000,000	\$48,000	\$0	\$48,000	\$0	\$12,200,000	118
13	UTSA, San Marcos	\$0,000,000	\$298,116	\$270,382	\$568,498	\$200,000	\$20,000,000	72
14	UTSA	\$420,042	\$447,000	\$0	\$867,042	\$300,281	\$0,000,000	58
15	College of Management	\$1,448,722	\$1,004,000	\$0	\$2,452,722	\$2,000,000	\$0,000,000	72
16	Public Health Unit	\$1,100,000	\$420,000	\$0	\$1,520,000	\$1,100,000	\$0,000,000	72
17	UTSA, San Marcos	\$400,000	\$0,000	\$0	\$400,000	\$0,000,000	\$0,000,000	72
18	UTSA, San Marcos	\$1,358,734	\$24,000	\$0	\$1,382,734	\$625,895	\$0,000,000	72
19	Texas Dept. of Health	\$6,148,000	\$1,118,254	\$0	\$7,266,254	\$1,545,800	\$27,217,000	72
20	Texas Tech University	\$2,800,000	\$20,444	\$200,000	\$3,020,444	\$0,000,000	\$0,000,000	72
21	TAMU, Maricopa	\$0,000,000	\$0,000,000	\$0	\$0,000,000	\$0,000,000	\$0,000,000	72
	<b>Total</b>	<b>\$124,200,000</b>	<b>\$40,000,000</b>	<b>\$1,000,000</b>	<b>\$165,200,000</b>	<b>\$100,000,000</b>	<b>\$100,000,000</b>	<b>1,000</b>

Figure 2.8: Cumulative Savings for State Agencies

Agency	Annual Utility Cost	No. of Months to Date	Total Utility Costs of Each Building To Date	Total Energy Costs To Date	No. of Months to Date
<b>Texas A&amp;M University</b>					
Center Engineering Center	\$483,042	128	\$61,820,256	\$1,361,736	128
<b>U.T. Austin</b>					
McCombs Building	\$224,173	128	\$28,694,144	\$636,426	128
University Teaching Center	\$268,043	128	\$34,310,104	\$737,260	128
Henry Customer Library	\$1,472,643	128	\$187,898,304	\$4,127,467	128
Engineering Hall	\$122,449	128	\$15,673,472	\$339,467	128
Industry Hall	\$1,228,956	128	\$157,806,336	\$3,439,035	128
Blackburn Hall	\$162,029	128	\$20,739,712	\$452,884	128
Housing Building	\$128,029	128	\$16,387,712	\$357,775	128
University Hall	\$268,763	128	\$34,387,664	\$747,126	128
Center Hall	\$224,173	128	\$28,694,144	\$636,426	128
U.S. Hall	\$122,449	128	\$15,673,472	\$339,467	128
Engineering Hall	\$122,449	128	\$15,673,472	\$339,467	128
University Hall	\$268,763	128	\$34,387,664	\$747,126	128
Center Hall	\$224,173	128	\$28,694,144	\$636,426	128
College of Business Building	\$483,042	128	\$61,820,256	\$1,361,736	128
University School of Business	\$483,042	128	\$61,820,256	\$1,361,736	128
Marble Hill	\$1,228,956	57	\$70,020,552	\$1,528,127	57
<b>U.T. Arlington</b>					
University Hall	\$268,763	128	\$34,387,664	\$747,126	128
Business Building	\$268,763	128	\$34,387,664	\$747,126	128
University Building	\$268,763	128	\$34,387,664	\$747,126	128
Engineering II	\$118,027	57	\$7,037,559	\$153,262	57
Center Hall	\$118,027	57	\$7,037,559	\$153,262	57
Engineering Hall	\$118,027	57	\$7,037,559	\$153,262	57
U.S. Science Building	\$128,029	57	\$16,387,712	\$357,775	57
Library	\$128,029	57	\$16,387,712	\$357,775	57
Engineering Hall	\$128,029	57	\$16,387,712	\$357,775	57

Figure 2.9: Pre-retrofit Utility Costs for State Agencies

## 2.2.3 Output graphs

### 2.2.3.1 Cumulative savings graph

The graph in worksheet “Ch1” shows cumulative LoanSTAR savings, which will be updated automatically according to the designated year and month. For example, as of August 2002, the completed retrofits show \$79.0 million in measured savings. When combined with \$28.8 million in CC savings, \$10.8 million in estimated savings from 98 sites, a total program savings of \$118.5 million is shown in Figure 2.10.

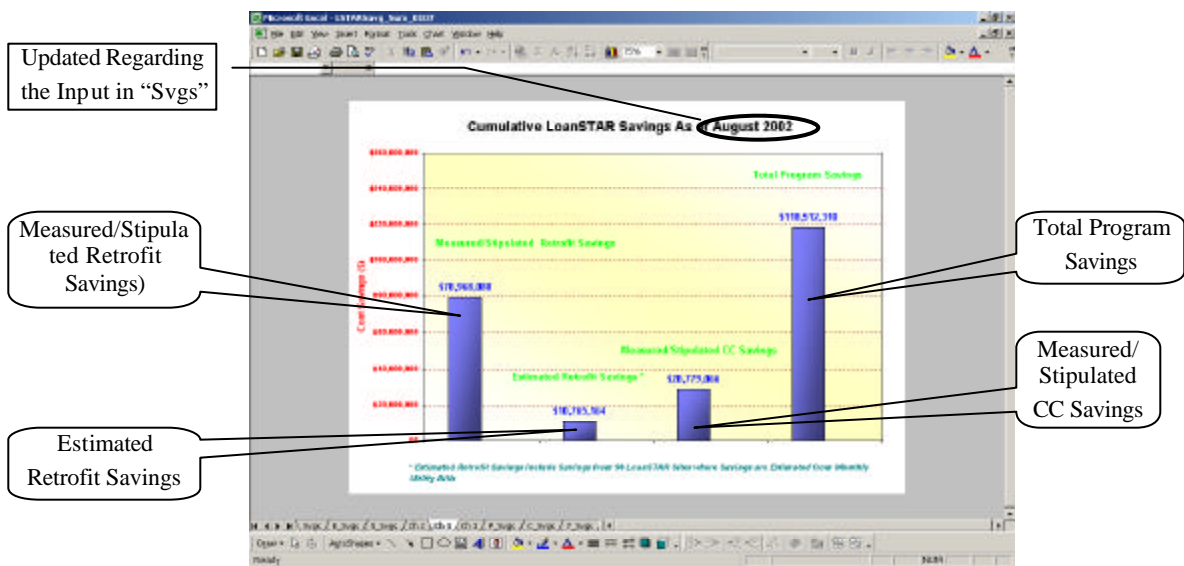


Figure 2.10: Cumulative LoanSTAR Savings

### 2.2.3.2 Measured retrofit savings graph

Worksheet “Ch2” shows the graph of measured LoanSTAR retrofit savings from 1990 to the designated date. As shown in Figure 2.11, it is broken down into three components, electricity savings, cooling savings, and heating savings. The overlap between retrofit and CC savings is shown under the title of the graph.

### 2.2.3.3 Yearly savings graph

Yearly savings from LoanSTAR program from 1990 to the designated date is shown in the chart of worksheet “Ch3” (Figure 2.12). The bars showing yearly savings are divided into two parts: retrofit savings and CC savings. The chart is associated with the year and month entered in the worksheet “Svgs” and will be updated automatically.

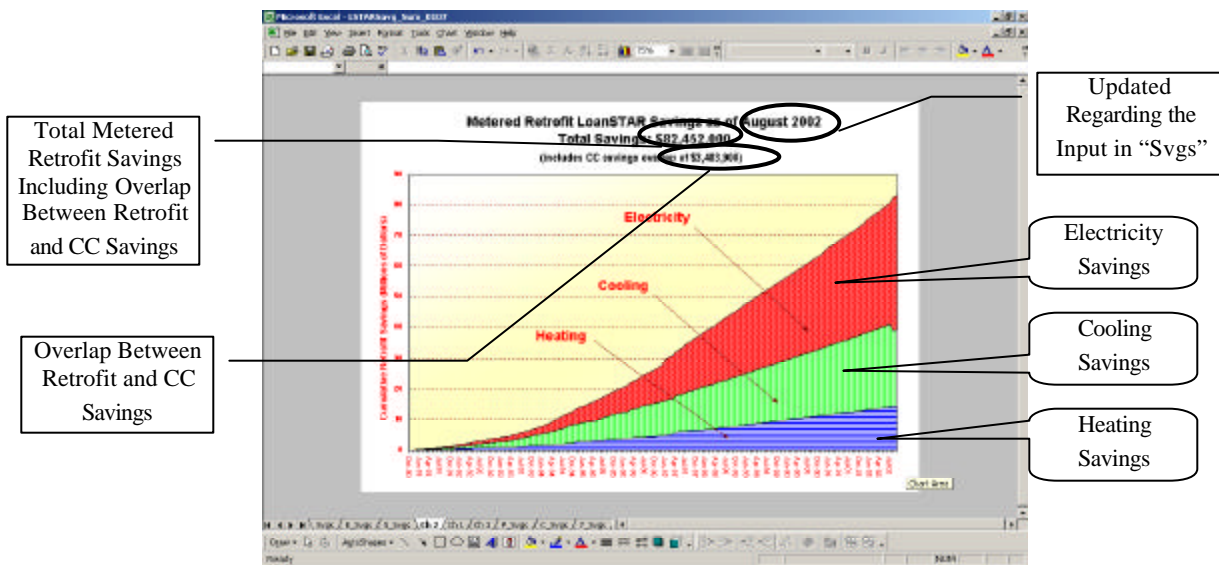


Figure 2.11: Measured Retrofit LoanSTAR Savings



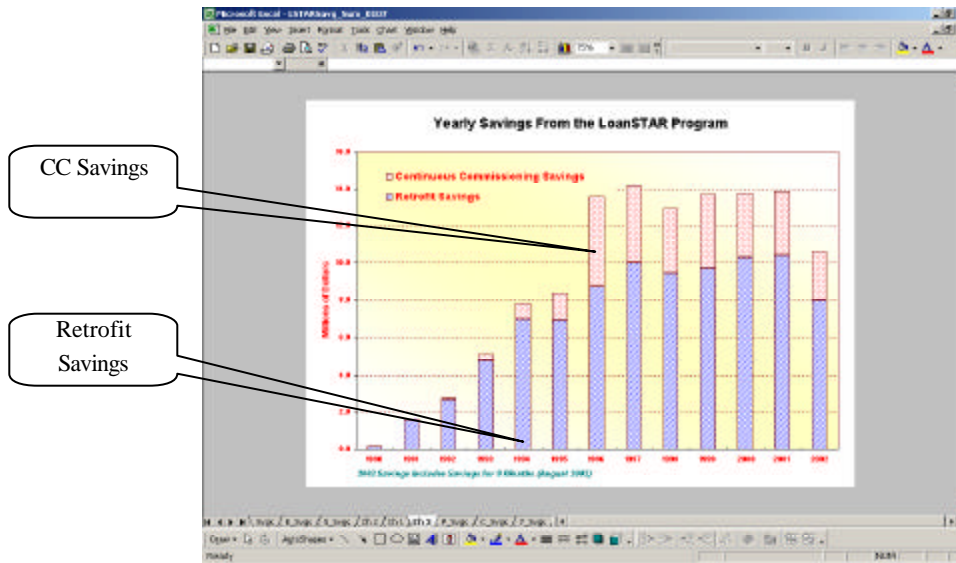


Figure 2.12: Yearly LoanSTAR Savings

## 2.2.4 Information worksheets

### 2.2.4.1 Worksheet “P\_Svgs”

The summary of LoanSTAR dollar and energy savings as of August 2002, and monthly projected dollar and energy savings are presented in worksheet “P\_Svgs”. This worksheet also includes the retrofit dollar and energy savings and CC dollar savings for the new loan sites which will be added by the user. This worksheet is not related to the input year and month and is used for calculation and reference. The worksheet includes four sections which will be discussed below.

Figure 2.13 shows the five tables in the first section of worksheet “P\_Svgs” which summarize the LoanSTAR retrofit and CC dollar savings from 1990 to August 2002. Table named *Measured Retrofit Dollar Savings* summarizes measured savings and audit estimated savings as of August 2002 for electricity, chilled water, and hot water/gas/steam and shows the total measured retrofit savings. Table named *Estimated Retrofit Dollar Savings* includes the summary of savings as of August 2002 from street lighting retrofits in 9 cities, lighting retrofits at 43 Fort Worth ISD buildings, 11 Zero level sites, Austin ISD, Northside ISD, and Groom ISD. The two tables on the right hand side of the *Estimated Retrofit Dollar Savings* table present CC savings and the savings overlap between retrofit and CC as of August 2002 respectively. Table named *Total Program Dollar Savings* shows the total savings as of August 2002 by adding measured retrofit savings, estimated retrofit savings, and CC savings together and subtracting retrofit and CC overlap savings.

The next section appears in this worksheet provides the projected monthly dollar savings for all loan sites, which is used to project the total program savings beginning September 2002 (Figure 2.14).

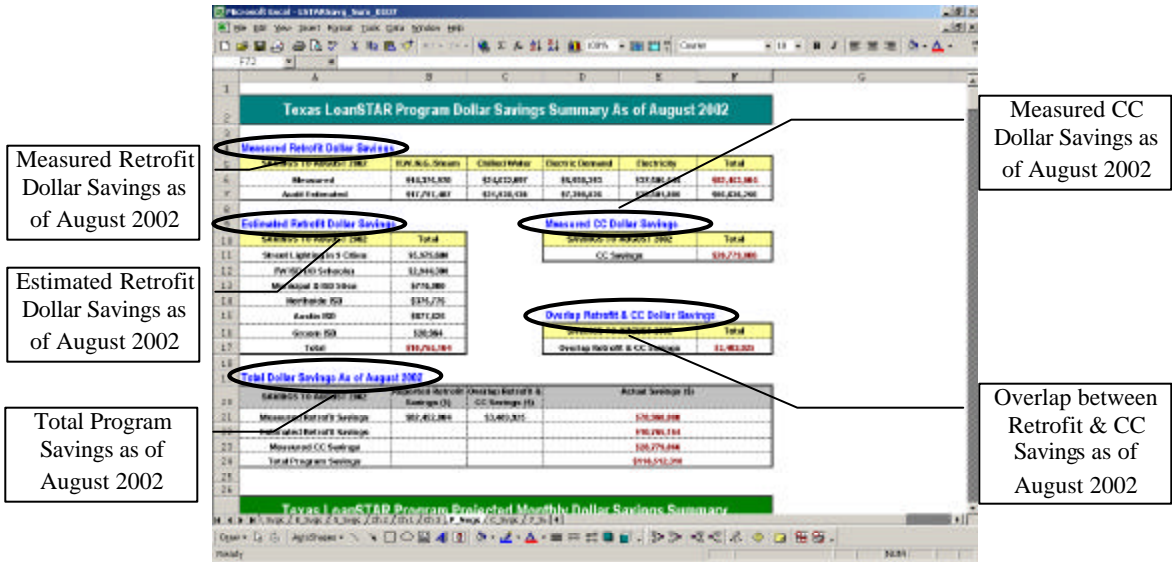


Figure 2.13: Total Program Dollar Savings as of August 2002

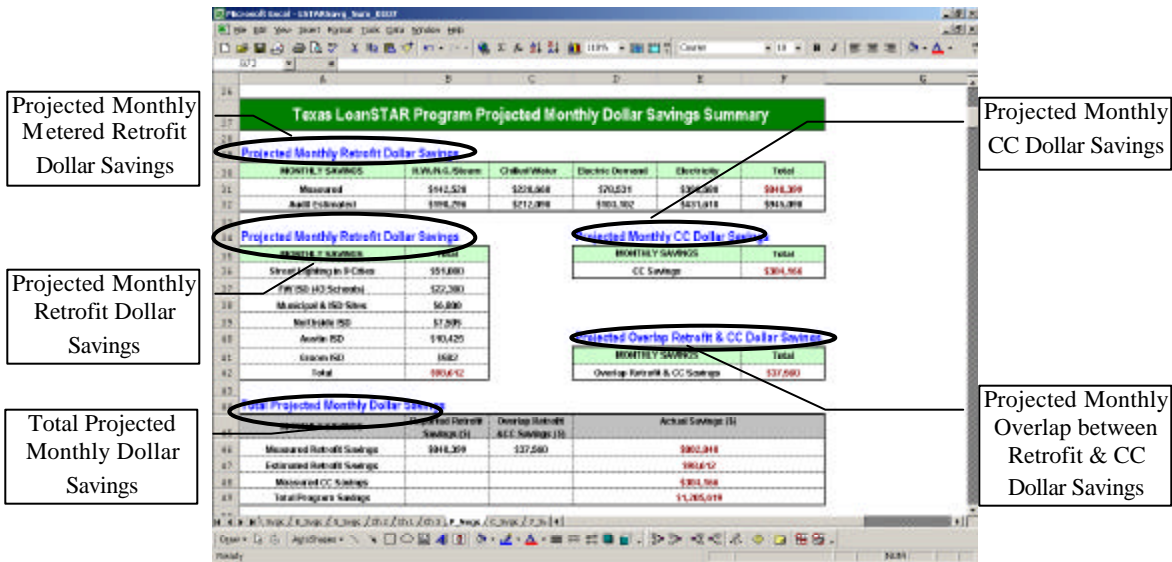


Figure 2.14: Projected Monthly Dollar Savings

The next section in this worksheet reports the total retrofit energy savings as of August 2002 and monthly projected energy savings. As shown in Figure 2.15 total retrofit energy savings as of August 2002 including electricity in kWh, electrical demand in kW, hot water/steam/gas savings in MMBtu, and chilled water savings in MMBtu are listed in the first table. Monthly projected energy savings from retrofits are shown in the next table.

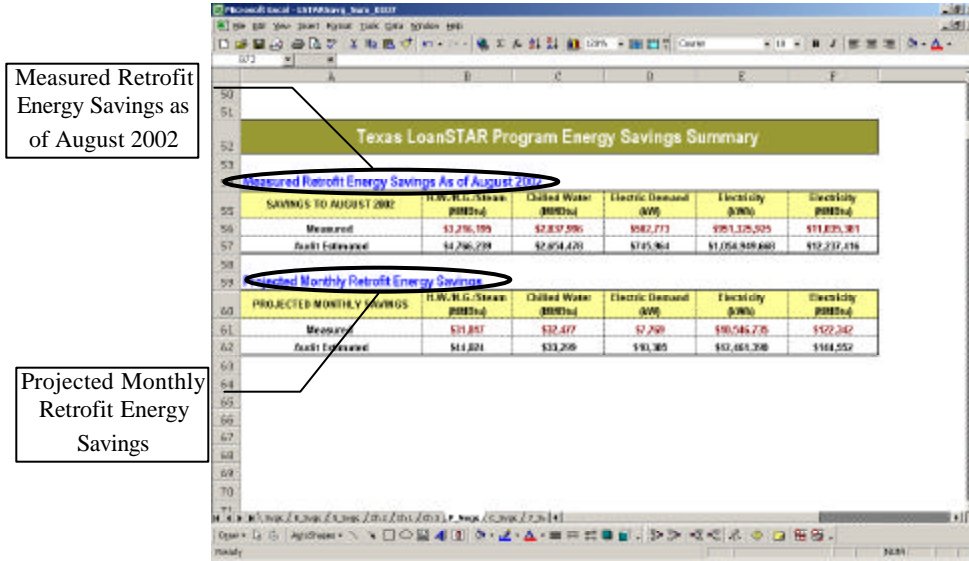


Figure 2.15: Total Retrofit Energy Savings as of August 2002 and Monthly Projected Retrofit Energy Savings

The final section in this worksheet (Figure 2.16) presents the retrofit and CC dollar and energy savings for the new loan sites which will be added into the system by the user. This section is linked with the worksheet “Ret\_S”, which shows the detailed new sites savings as of the entered date.

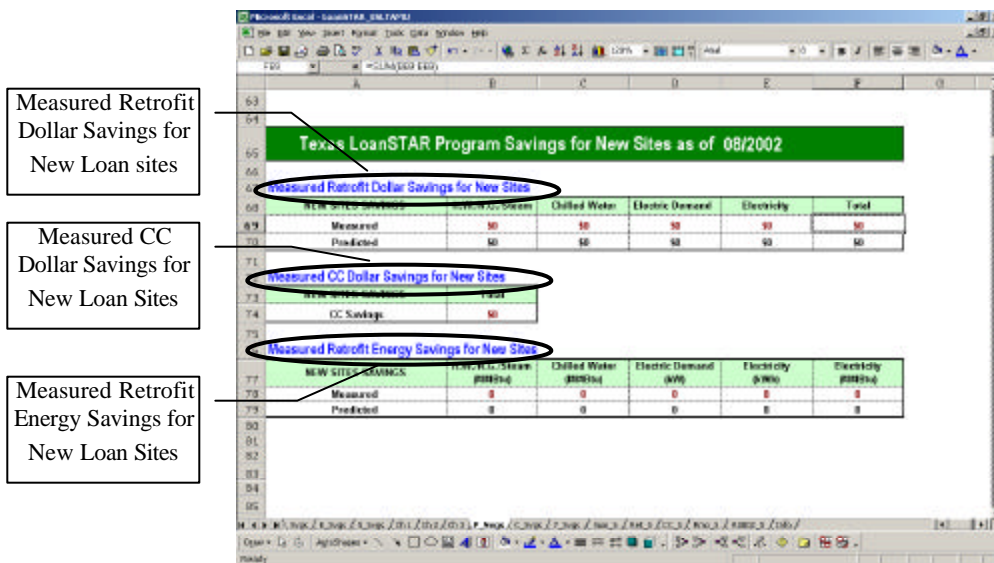


Figure 2.16: New Sites Savings



### 2.2.4.2 Worksheet “C\_Svgs”

Cumulative retrofit monthly savings of chilled water, hot water, electricity, electric demand, and total savings from the beginning of LoanSTAR program, October 1990, to the input date are stored in worksheet “C\_Svgs”. This worksheet provides information to update the graph in worksheet “Ch1” and is self-maintained through a built –in program. Figure 2.17 is the overview of this worksheet.

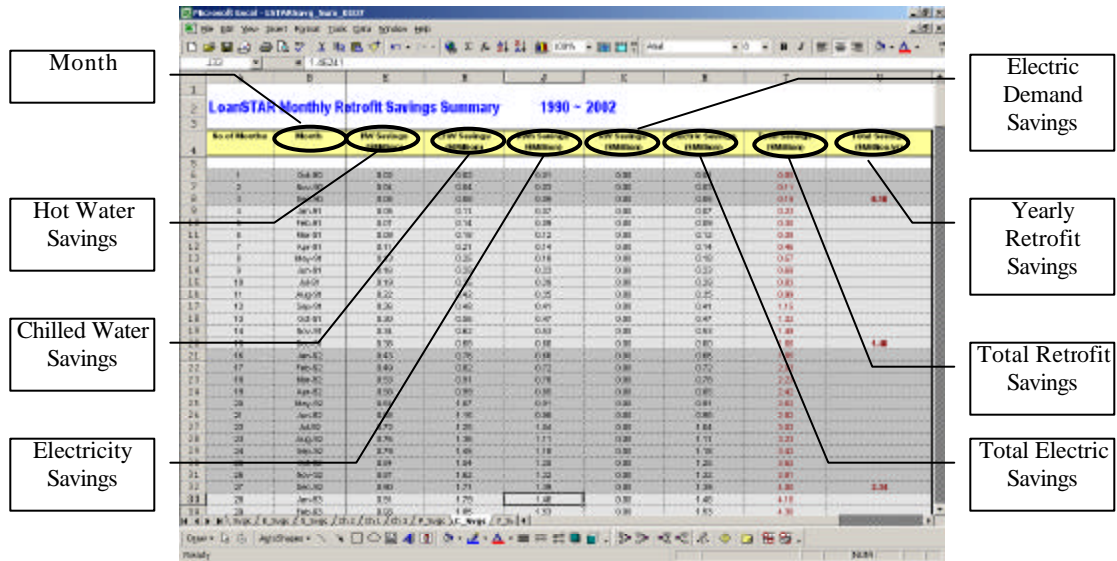


Figure 2.17: Monthly Retrofit Savings (1990 ~ date)

### 2.2.4.3 Worksheet “Y\_Svgs”

Worksheet “Y\_Svgs” maintains the yearly total program savings beginning 1990 as well as cumulated total program savings since July 1997. It can also create quarterly report as needed.

Figure 2.18 shows that yearly total program savings are included in Table 1. It is self-maintained through a built-in program by adding a new row to include the corresponding savings for a new year, for example, 2003. Yearly measured retrofit savings, overlap between CC and retrofit, estimated retrofit savings, total retrofit savings, CC savings, and total program savings are listed starting from 1990. The graph in worksheet “Ch3” is associated with the information in this table.

Cumulated measured retrofit savings, overlap between CC and retrofit, estimated retrofit savings, total retrofit savings, CC savings, and total program savings beginning July 1997 are maintained in Table 2 as shown in Figure 2.19. It is updated automatically by adding new rows to include cumulated savings for new months.

Quarterly report provided in Table 3 of worksheet “Y\_Svgs” looks three months far into the past from the entered date. The same as the above two tables, it is automatically controlled by internal program and reports measured retrofit savings, overlap between CC and retrofit,

estimated retrofit savings, total retrofit savings, CC savings, and total program savings for each month, as shown in Figure 2.20.

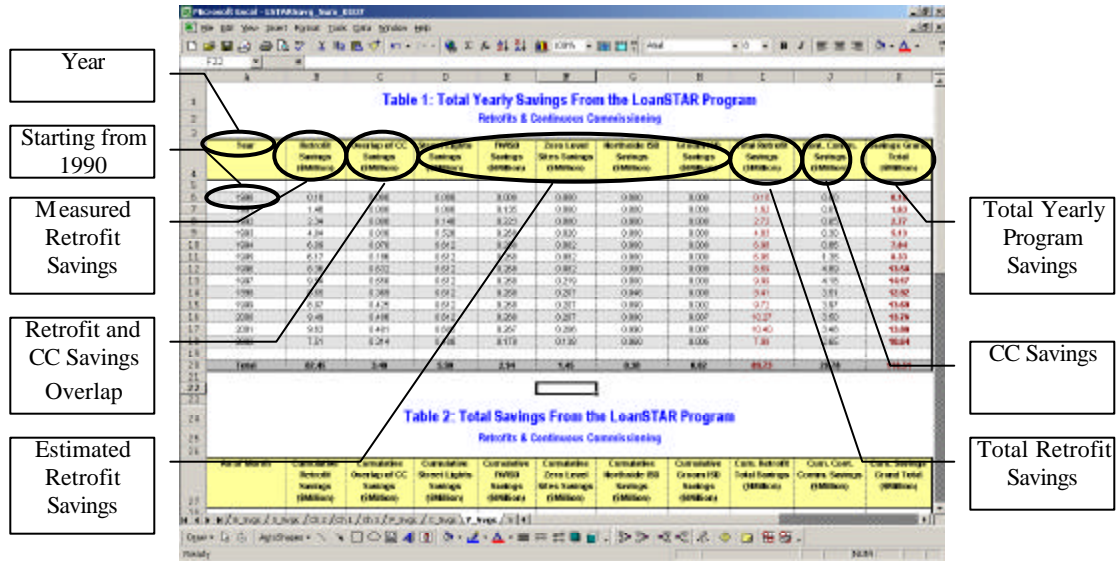


Figure 2.18: Total LoanSTAR Yearly Savings (1990~date)

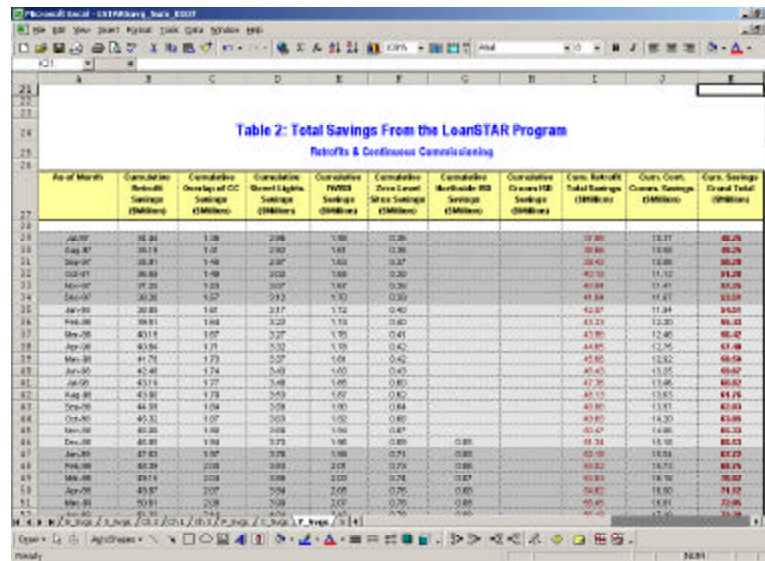


Figure 2.19: Cumulated Total LoanSTAR Savings (July 1997~date)

Month	Avoided Savings (\$MM/yr)	Savings of CC (\$MM/yr)	Smart Lights Savings (\$MM/yr)	HVAC Savings (\$MM/yr)	Data Center Savings (\$MM/yr)	Airside ES Savings (\$MM/yr)	Controls ES Savings (\$MM/yr)	Total Retrofit Savings (\$MM/yr)	Cap. Costs (\$MM/yr)	Total LoanSTAR Savings (\$MM/yr)
Jan-03	1.071	3.026	0.001	0.000	0.017	0.000	0.000	3.095	0.217	2.878
Jan-02	0.078	0.008	0.001	0.000	0.017	0.000	0.000	0.095	0.063	0.032
Jan-01	0.078	0.008	0.001	0.000	0.017	0.000	0.000	0.095	0.063	0.032
Total	1.127	3.042	0.002	0.000	0.034	0.000	0.000	3.190	0.343	2.847

Figure 2.20: Quarterly LoanSTAR Savings Report

2.2.4.4 Worksheet “Info”

Worksheet “Info” contains such information as the avoided cost of energy for all loan sites and the category of all loan sites. The avoided costs of electricity, electric demand, natural gas, hot water/steam, and chilled water, which are used in the spreadsheets to calculate savings are presented in the first table as shown in Figure 2.21.

	Electricity (\$MM/yr)	Natural Gas (\$MM/yr)	Natural Gas (\$MM/yr)	HVAC (\$MM/yr)	CHW (\$MM/yr)	MEMO
Texas A&M University Buildings	0.02188				0.7988	0.82068
A.I. Austin Buildings	0.04550				0.2999	1.4254
A.I.A. Arlington Buildings	0.02976				0.4480	0.4778
A.I.A. Arlington Buildings (2nd Issue)	0.02976	18.72			0.4480	Cost: State Op. (17)
South Worth ES	0.01440					Cost: State Op. (17)
Metropolitan (Metropolitan High School)	0.00444	13.42	3.8588			
Metropolitan (Metropolitan High School)	0.00444	13.42	3.8588			
STCPC (P&I) Buildings	0.00000	5.40		0.2100	4.1900	
STCPC (P&I)	0.00000	6.17				
Texas Dept. of Health, Austin	0.00915	8.75	3.5500	0.4400		
Wind Mountain Hospital	0.00920	18.72				
UTMB Galveston	0.00618	2.42		0.8100	1.7800	
McCombs School	0.00000	6.80	4.0000			
McCombs County Courthouse	0.00000	18.72	3.8588			
McCombs County Courthouse	0.00000	3.16	0.2000			
McCombs County Courthouse	0.00000	6.80				
UTMB Galveston	0.00915	8.75	3.5500	0.4400		
UTMB Galveston	0.00920	18.72				
UTMB Galveston	0.00618	2.42		0.8100	1.7800	
UTMB Galveston	0.00000	6.80	4.0000			
UTMB Galveston	0.00000	18.72	3.8588			
UTMB Galveston	0.00000	3.16	0.2000			
UTMB Galveston	0.00000	6.80				
UTMB Galveston	0.00915	8.75	3.5500	0.4400		
UTMB Galveston	0.00920	18.72				
UTMB Galveston	0.00618	2.42		0.8100	1.7800	
UTMB Galveston	0.00000	6.80	4.0000			
UTMB Galveston	0.00000	18.72	3.8588			
UTMB Galveston	0.00000	3.16	0.2000			
UTMB Galveston	0.00000	6.80				
UTMB Galveston	0.00915	8.75	3.5500	0.4400		
UTMB Galveston	0.00920	18.72				
UTMB Galveston	0.00618	2.42		0.8100	1.7800	
UTMB Galveston	0.00000	6.80	4.0000			
UTMB Galveston	0.00000	18.72	3.8588			
UTMB Galveston	0.00000	3.16	0.2000			
UTMB Galveston	0.00000	6.80				

Figure 2.21: Avoided Cost of Energy

In Figure 2.22, the second table shows all loan sites whose savings are included in the spreadsheets. Among the 31 loan sites listed in the table, six of them are school districts; four are counties; all others are state agencies. Some of the loan sites have more than one loan, for

example, University of Texas Austin, University of Texas Arlington, Texas A&M University, and Del Mar College each has two loans; Texas Department of MHMR has four loans, etc.

No.	Loan Sites	Category
1	Texas A&M University	
2	U.T. Austin	
3	U.T. Arlington	
4	Fort Worth ISD	School District
5	Victoria ISD	School District
6	UTHSC, Houston	
7	TDH, Austin	
8	Ward Mem. Hospital	
9	UTMB Galveston Bldgs.	
10	Nacogdoches ISD	School District
11	Midland County CH	County
12	UNTMC (TECOM)	
13	Galveston ISD	School District
14	UTMDA Cancer Ctr.	
15	Delmar College	School District

Figure 2.22: List of Loan Sites

### 2.2.5 Supporting worksheets

Five supporting worksheets are developed to store historical savings data and to calculate and present savings as of the entered date for each loan site and each building. The output worksheets gather information from these worksheets and present the total program savings in different output tables and graphs as required by the user. These worksheets are self-maintained unless new loan sites are first added into it. The user needs to modify some of the worksheets to include new site savings. The detailed instruction will be given in Section 3 of this report.

#### 2.2.5.1 Worksheet “Ret\_S”

Worksheet “Ret\_S” is designed to calculate measured and audit-estimated (predicted) retrofit savings as of the entered date for all LoanSTAR buildings based on the input year and month, and information in worksheet “Rmo\_S” and “R0802\_S”. As shown in Figure 2.23, the table presents the building code, site number, energy savings from hot water/gas/steam, chilled water, electric demand, and electricity, dollar savings from hot water/gas/steam, chilled water, electric demand, and electricity, total months, total estimated savings, and total measured savings. The measured retrofit savings are shown in red or dark red text, and the predicted retrofit savings are shown in blue or dark blue text.



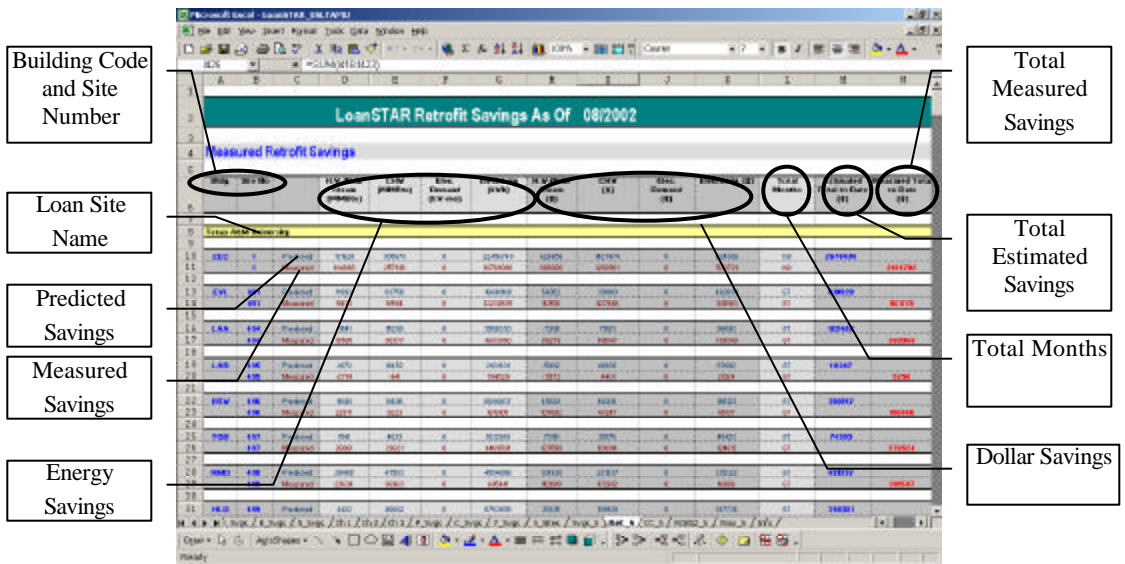


Figure 2.23: Retrofit Savings for All Buildings

The next part of worksheet “Ret\_S” (Figure 2.24) is reserved for new loan sites which will be completed by the user in the future. In section 3 of this report, instruction will be given on how to add new site retrofit savings in this section.

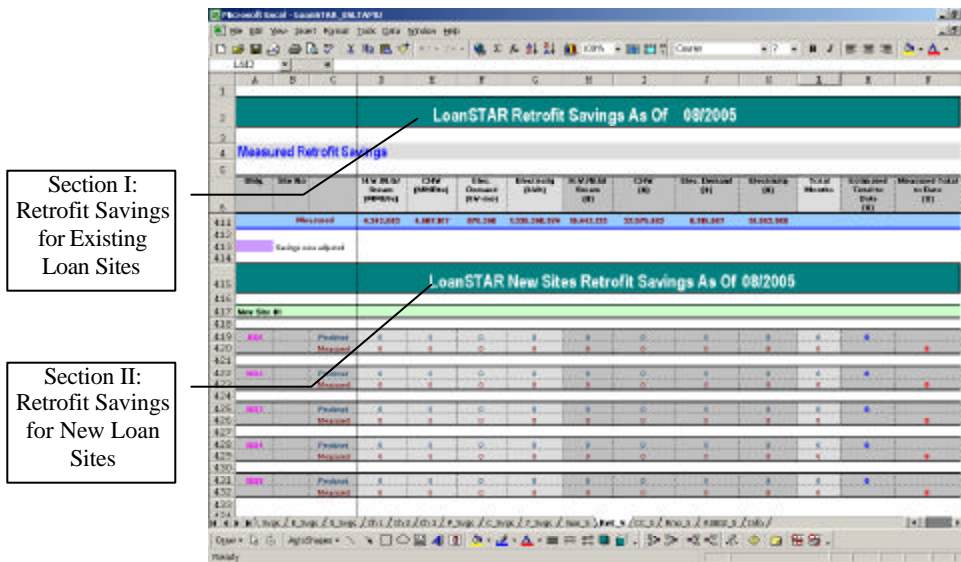


Figure 2.24: New Sites Savings Section

The final section of this worksheet is used to estimate retrofit savings as of the entered date for street lighting retrofits in 9 cities, lighting retrofits at 43 Fort Worth ISD buildings, 11

Zero level sites, Austin ISD, Northside ISD, and Groom ISD. Figure 2.25 shows this section, where estimated retrofit savings as of August 2002, estimated monthly retrofit savings, and estimated retrofit savings as of the entered date for the above sites are displayed.

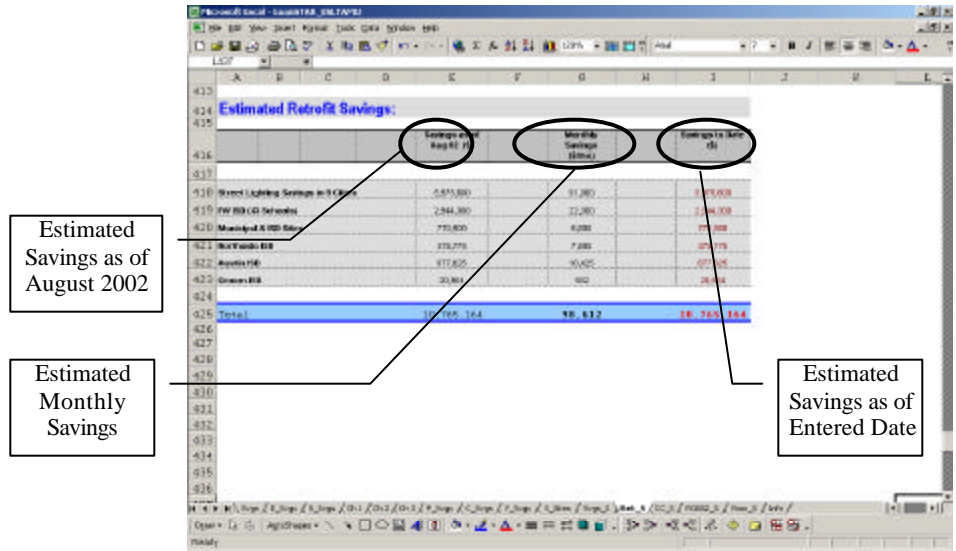


Figure 2.25: Estimated Retrofit Savings for All Buildings

2.2.5.2 Worksheet “Rmo\_S”

Worksheet “Rmo\_S” maintains the projected and audit-estimated monthly retrofit savings for all LoanSTAR buildings. Figure 2.26 shows that the sites and savings information are listed in the same fashion as in worksheet “Ret\_S”.

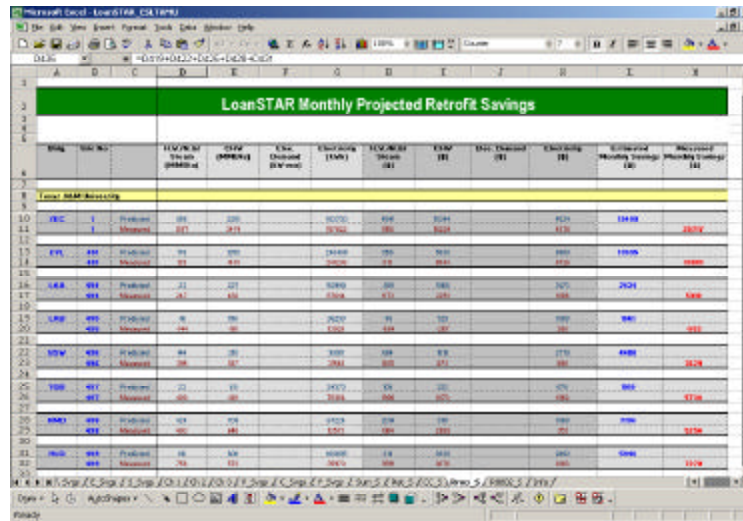


Figure 2.26: Monthly Projected Retrofit Savings for All Buildings

Figure 2.27 shows that monthly retrofit savings for new loan sites can be added to the system in the second part of worksheet “Rmo\_S”. Section 3 of this report will deal with the procedure on adding monthly retrofit savings for new loan sites.

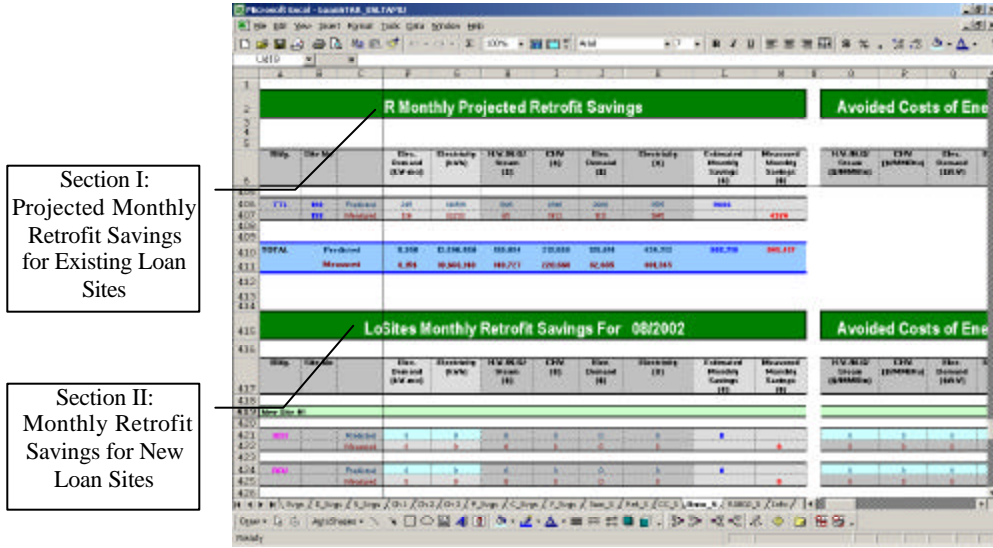


Figure 2.27: Monthly Retrofit Savings for New Sites

### 2.2.5.3 Worksheet “R0802\_S”

Worksheet “R0802\_S” is designed in a similar fashion to worksheet “Ret\_S”, shown in Figure 2.28. It preserves the measured and audit-estimated retrofit savings for all existing LoanSTAR buildings as of August 2002.

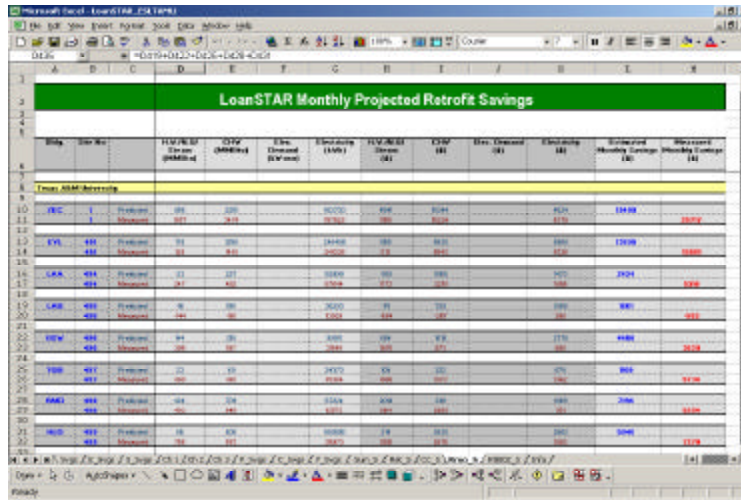


Figure 2.28: Retrofit Savings as of August 2002 for All Buildings

### 2.2.5.4 Worksheet “CC\_S”

Worksheet “CC\_S” is used for calculating CC savings as of the entered date. Detailed information on the site name, building code, site number, building name, area of the building, implemented CC measures, implemented date, and identified company, as well as savings information including yearly CC savings, number of months of savings, measured savings to the input date, number of months of savings as of August 2002, and measured CC savings as of August 2002 are listed in a big table shown in Figure 2.29. The blue text in the table shows the part of CC savings that have been included in the retrofit savings number, that is, the overlap between CC and retrofit savings.

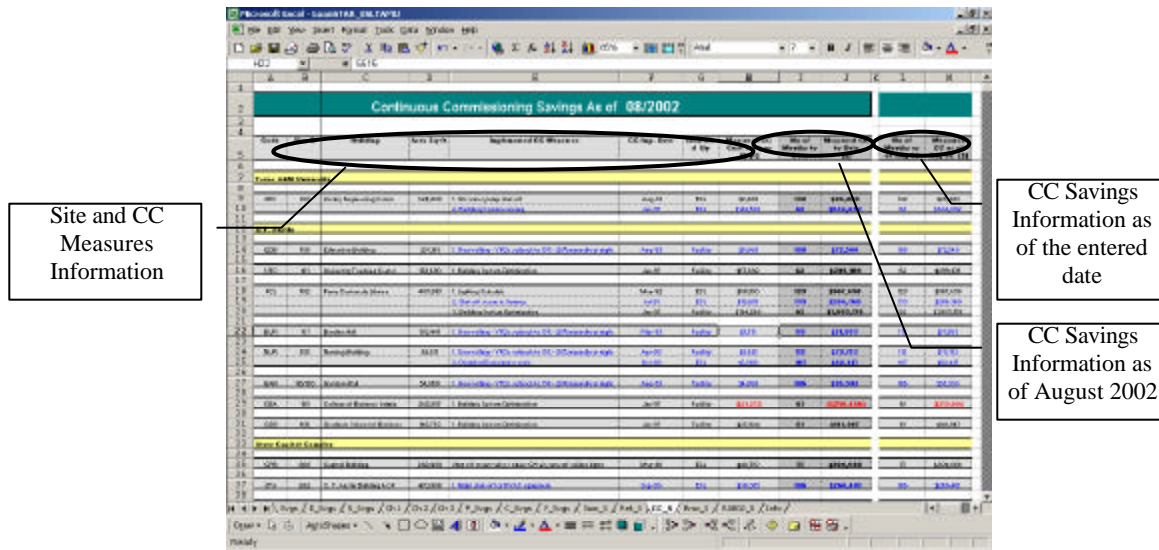


Figure 2.29: CC Savings For All Buildings

The CC savings in the worksheet “C\_Svgs” will be updated automatically according to the input year and month except for the new loan sites. The CC savings for new loan sites can be added in the second section of this worksheet (Figure 2.30). A detailed instruction on how to add new sites CC savings will be given in Section 3 of this report.

### 2.2.5.5 Worksheet “Sum\_S”

Worksheet “Sum\_S” includes three tables and presents the summary of savings as of the entered date for all loan sites. The first table shows the predicted and measured total retrofit and CC dollar savings for all loan sites (Figure 2.31). The second table, which is on the right hand side of the first table, shows the retrofit energy savings from hot water/steam/gas, chilled water, electric demand, and electricity for all loan sites (Figure 2.32). The third table, paralleled to the first two tables, shows the retrofit dollar savings from hot water/steam/gas, chilled water, electric demand, and electricity for all loan sites (Figure 2.33). The audit-estimated (predicted) savings are shown in dark blue text while the projected measured savings are shown in dark red text in these tables.



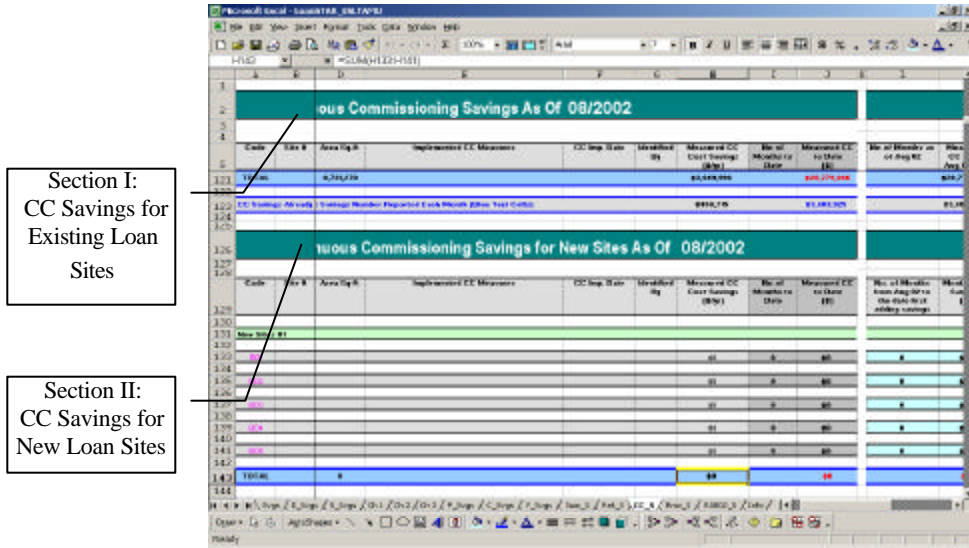


Figure 2.30: CC Savings for New Sites

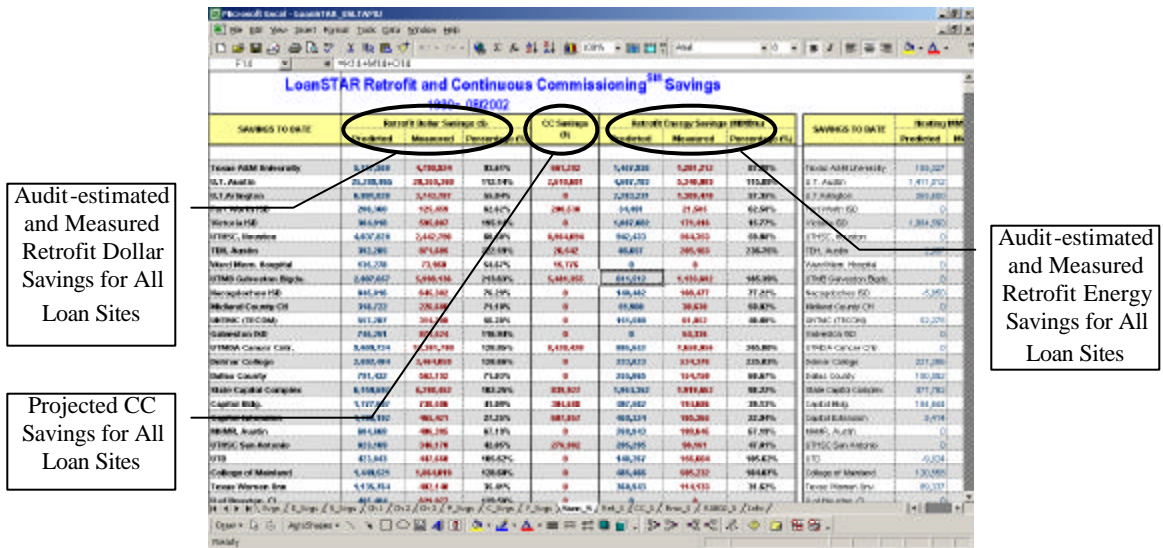


Figure 2.31: Savings Summary for All Loan Sites

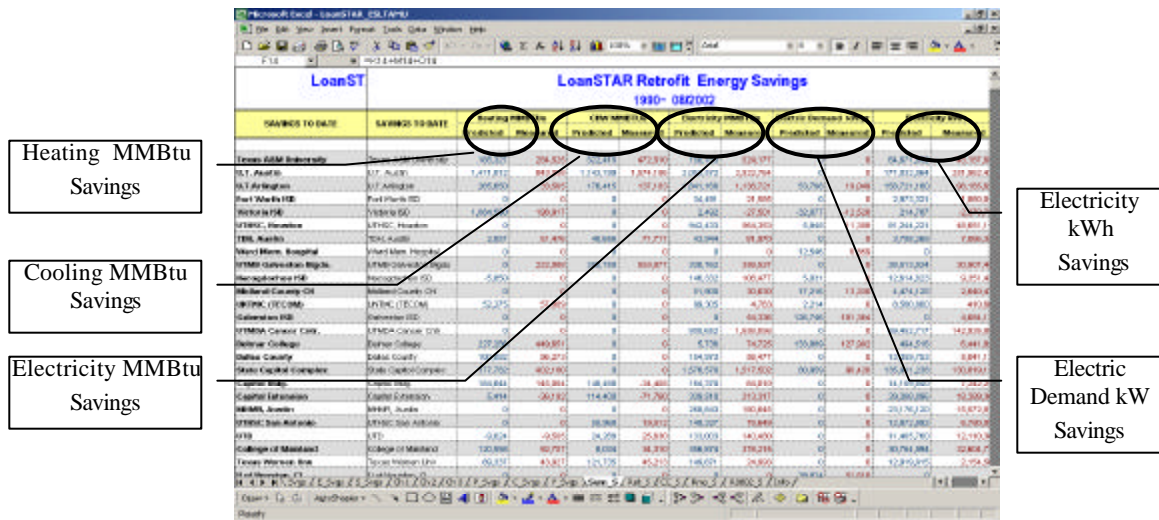


Figure 2.32: Retrofit Energy Savings for All Loan Sites

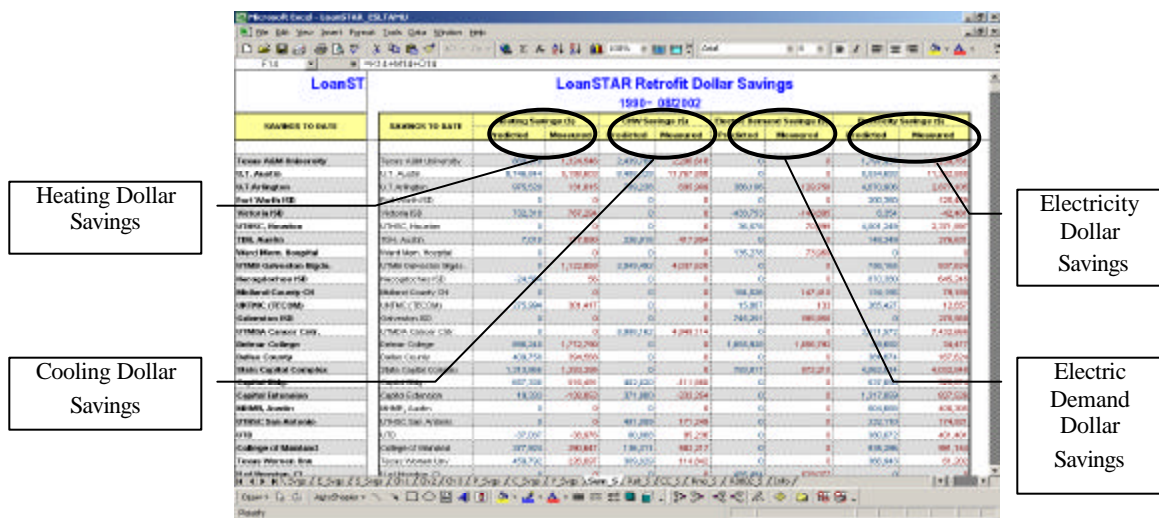


Figure 2.33: Retrofit Dollar Savings for All Loan Sites

### 2.3 Description of the files on the distribution disk

There are two files included with the distribution disk for the LoanSTAR Savings Calculation Workbook. The first file "LoanSTAR\_ESLTAMU\_Manual.doc" is the file that contains this document. The second file "LoanSTAR\_ESLTAMU.xls" is the workbook for projecting LoanSTAR savings beginning September 2002.

### 3 EXAMPLE USE OF THE SPREADSHEETS

#### 3.1 General Instruction

To begin the use of the LoanSTAR Savings Calculation Workbook, it is recommended to create a new folder and storage the generated files. After created the new folder, then copy the files from the distribution CD-ROM to the new folder.

The general process for using the workbook to project LoanSTAR savings for existing loan sites is as follows:

- Step 1: If this is the first time the update savings is done, which means projecting savings for September 2002, open the file named “LoanSTAR\_ESLTAMU.xls”, then save it with other filename indicating the month and year the savings will be updated. For example, if it is thought to evaluate the LoanSTAR program savings for September 2002, it is recommended that the file be given a name “LoanSTAR\_ESLTAMU\_0902”. When the savings will be updated for October 2002, rather than opening the original file, open file “LoanSTAR\_ESLTAMU\_0902” and save it as “LoanSTAR\_ESLTAMU\_1002” and then go to the next step. Be sure to press button <Enable Macros> when the system dialog is shown to ask about Macros when opening the file.
- Step 2: The next step is the input process in worksheet “Svgs”. Before inputting the year and month in the two dark red cells on top part of this worksheet for projecting the LoanSTAR savings, be sure to check the blue text near the button <Update Graphs> first, which shows the year and month when the savings were last updated. The savings can be updated one month after that date, which means, if it is required to project October 2002 savings, the September 2002 saving have to be updated first. The system will not give any wrong message until the user update graphs by pressing the button <Update Graphs>. It is necessary re-enter the right year and month before printing out any reports and updating graphs.
- Step 3: After entering the year and month, worksheets “Svgs”, “E\_Svgs”, and “S\_Svgs” will be updated automatically to present the total program savings summary, emissions savings, and state agencies savings from 1990 to the entered date. Worksheets “Sum\_S”, “CC\_S”, and “Ret\_S” will also be updated instantly to show the savings summary for all loan sites, CC savings for all buildings, and retrofit savings for all buildings, respectively. Detailed savings information for all sites and buildings can be found in these worksheets.
- Step 4: To update the three savings graphs (retrofit savings, cumulative savings and yearly savings graphs) and worksheets “Y\_Svgs” and “C\_Svgs”, which are the base worksheets for plotting these graphs, press button <Update Graphs>. All the savings graphs and related worksheets are then updated.
- Step 5: Go to worksheet “Svgs” and print out the summary report. Go to worksheet “E\_Svgs” and print out the emissions savings report. Go to worksheet “S\_Svgs” and print out state agencies savings report.

Step 6: Go to worksheets “Ch1”, “Ch2”, “Ch3” and print out the graphs for cumulated LoanSTAR savings, metered retrofit savings, and yearly savings, respectively.

Step 7: To obtain the quarterly report, go to worksheet “Y\_Svgs” and print page 7.

Step 8: Save the file when exit the workbook so that all the updates can be saved.

### 3.2 Adding new loan sites savings and updating savings

New loan sites savings can be added into the worksheets by following the below instructions:

Step 1: Follow steps 1 to 3 described in section 3.1.

Step 2: Go to worksheets “Rmo\_S” and “CC\_S”. In the *Tools* menu, point to the *Protection*, and then choose *Unprotect Sheet* and input password “ESL”. These two worksheets are then unprotected and can be modified. It will be necessary to edit worksheet “Rmo\_S” and “Ret\_S” to add retrofit savings for a new site. To add CC savings, edit worksheet “CC\_S”.

Step 3: Go to worksheet “Rmo\_S” and find the LoanSTAR new sites monthly retrofit savings section starting from row 415. There is reserved rows for adding twenty new sites. It is assumed that the audit-estimated savings equals the measured savings for new loan sites in this section. It will be only necessary to edit the light turquoise cells in the following steps unless there exist real measured savings and need to change the default formulas in these cells.

Step 4: Input the site name in cell A419 first, then input the building code in A 421, and the site number in both B421 and B422. Next, enter the predicted hot water/steam/gas monthly savings in MMBtu in cell D421, predicted chilled water savings in MMBtu in cell E421, predicted electric demand savings in kW in cell F421, and predicted electricity savings in kWh in cell G421. Similarly, input the avoided costs for hot/water/steam/gas savings, chilled water, electric demand, and electricity in cells O421 to R421.

Step 5: Input the number of months in light turquoise cell T421. The default formula in this cell gives the number of months between August 2002 and the date that was just input in worksheet “Svgs” in step 1 (not including August 2002 and the entered date). For example, if it has been updating savings for December 2002, it shows 3 in cell T421. If December 2002 is the first month the site starts achieving savings from completed retrofits, the default value has to be kept by deleting the formula and entering 3 as a fixed number in cell T421. However, if the new site has already achieved three months savings starting from October 2002, it is necessary to calculate the number of months between August 2002 and October 2002 (not including August 2002 and October 2002), that is one month, and then input “1” in cell T421. By doing this, actually it will be added three months savings at one time in December 2002. But beginning January 2003, the savings for this new site will be update automatically month by month.

- Step 6: Repeat steps 4 to 5 to add other new sites. If less than twenty sites are being added, skip steps 7 to 9 and go to step 10 directly.
- Step 7: To add more than twenty sites, select row 481, then go to *Insert* menu, point to *Rows*. A new row is then added into the worksheets. After inserting three rows, select cells A478:T479, then go to *Edit* menu, point to *Copy*. Then select cell A481, go to *Edit* menu again, point to *Paste*. See that cells A481:T482 now have the same format and built-in formulas as that of cells A478:T479. Repeat steps 4 to 5 to input the right information in these two rows of cells.
- Step 8: Repeat step 7 to finish adding all other new sites. Then go to the two light blue rows on the bottom of the new site monthly retrofit savings section. Change the formulas in the cells to include the savings for all the new sites.
- Step 9: Go to worksheet “Ret\_S” and unprotect it first. Then find the section starting from row 415 for showing cumulated retrofit savings for new sites. In this worksheet, it is not a need to input savings numbers into cells because it is linked to worksheet “Rmo\_S” and will be self-maintained. However, since rows are being inserted to add more than 20 new sites in the worksheet “Rmo\_S”, a same number of rows to calculate cumulated savings for these new sites has to be inserted. To insert rows in this sheet, select row 481, then go to *Insert* menu, point to *Rows*. A new row is then added into the worksheets. After inserting three rows, select cells A478:N479, then go to *Edit* menu, point to *Copy*. Then select cell A481, go to *Edit* menu again, point to *Paste*. See that cells A481:N482 now have the same format and formulas as that of cells A478:N479. Repeat this step until it has been added the same number of rows as added in worksheet “Rmo\_S”.
- Step 10: To add CC savings for a new site, go to worksheet “CC\_S” and find the section starting from row 126 for adding cumulated CC savings for new sites. After inputting the site and building information and CC measures information in the columns A to G, input monthly CC savings for new sites in the light turquoise cells in column M. To input the number of months in column L, follow the method described in step 5. To add more than five new sites, insert two rows after row 141 to add one site, then apply the method described in step 7 to get the same format as the above rows. Finally, update the formulas in the cells of the light blue row, which is on the bottom of this section to show the savings for all added new sites.
- Step 11: Compare the total retrofit savings for the new sites in worksheet “Ret\_S” and total CC savings for the new sites in worksheet “CC\_S” with the corresponding numbers in the third section of worksheet “P\_Svgs”. If they are the same, it means that right cumulated savings are added into the workbook; otherwise, go through the steps 1 to 11 again to correct mistakes.
- Step 12: Follow steps 4 to 7 in section 3.1 to update graphs and related worksheets, and to print the reports.
- Step 13: Update worksheet “Sum\_S” and “S\_Svgs” to include the new sites savings in the savings summary for all LoanSTAR sites and state agencies savings if necessary.

Step 14: Protect worksheets “Ret\_S”, “Rmo\_S”, and “CC\_S” again with the same password (“ESL”) to avoid mistakes when updating savings for next month.

Step 15: Save the file when exit the workbook so that all the updates can be hold.

### 3.3 Example session

The following example shows how to add new loan sites savings and update savings to September 2002.

#### 3.3.1 Save the Original File

First open the original file. Then as shown in Figure 3.1, in the folder created for storing savings files, in this example, called *LoanSTAR Savings*, save the original file as “LoanSTAR\_ESLTAMU\_0902.xls”.

#### 3.3.2 Input Year and Month

Second, go to worksheet “Svgs” and input year “2002” and month “9” in the dark red cells (Figure 3.2). On the left side of the button <Update Graphs>, the blue text shows that the savings have been updated to August 2002. Therefore, the savings can be updated to September 2002 this time. After entering the year and month, the savings numbers in worksheets “Svgs” will be updated instantly. So do the other worksheets like “E\_Svgs”, “S\_Svgs”, “Ret\_S”, “CC\_S”, “Rmo\_S”, “Sum\_S”, etc. Do not press the button <Update Graphs> at this time because the new site savings have not been added in the worksheets yet.

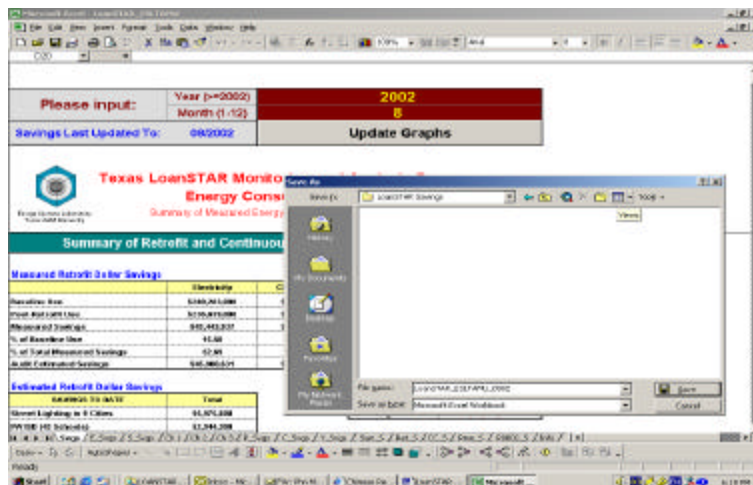


Figure 3.1: Example: Save the Original File as Another File



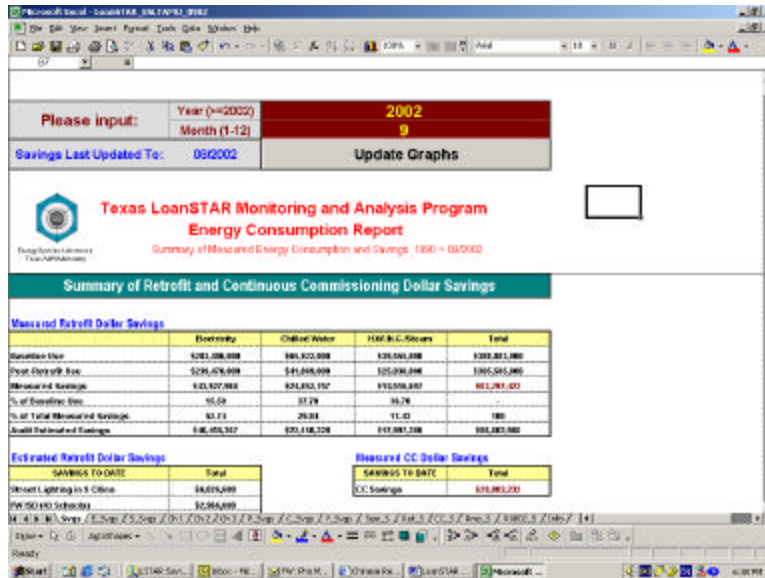


Figure 3.2: Example: Input Year and Month

### 3.3.3 Add Monthly Retrofit Savings for A New Loan Site

Next, go to worksheet “Rmo\_S” and unprotect it first. Assuming that the new loan site have two buildings, input the site name “TAMU1” in cell A419, the first building code “TB1” in A421 and site number 990 in both B421 and B422, and the second building code “TB2” in A424 and site number 991 in both B424 and B425, next enter the monthly audit-estimated energy savings. Figure 3.3 shows the audit-estimated savings from hot water, chilled water, electric demand, and electricity for site 990 and 991 that were entered into light turquoise cells D421 to G425. The measured savings numbers will then be updated automatically and equal to the audit-estimated savings in this case. Then input the avoided costs for these two buildings in light turquoise cells O421 to R425. Finally, follow step 5 in section 3.2 to get the number of months. It is assumed that the retrofits were completed in August 2002. Therefore, September 2002 is the first month for these two buildings to achieve savings. Input zero into T421 and T424. Figure 3.4 shows the area where the avoided costs and number of months are entered. After completing this step, check the cells L421, L424, M421, M424, and also the cells in the light blue row on the bottom of this section to see if the total savings numbers are correct or not.

### 3.3.4 Check Cumulated Retrofit Savings for A New Loan Site

The next step is to check the cumulated retrofit savings as of September 2002 for these two buildings in worksheet “Ret\_S”. It is shown in column T, that the number of month is “1”, which means only one month of retrofit savings will be included as of September for these two buildings. Then, compare the cumulative total savings (cells M421 and M424 in worksheet “Ret\_S”) for each building to the monthly savings (cells M421 and M424 in worksheet “Rmo\_S”) multiplied by the total months (cells L421 and L424 in worksheet “Ret\_S”). If they are not the same, check the formulas in all related cells. Figure 3.5 shows the cumulated savings for these two buildings as of September 2002. Also check the total retrofit savings in the third section of worksheet “P\_Svgs” to see if it matches the number in cell M482.

As seen from the above steps, if a new site has been added into the workbook, it is not needed to update anything from the next month for this site. However, it is suggested to perform the necessary check procedure to the worksheet “Ret\_S” to avoid unexpected mistakes before updating graphs and printing reports every month.

LoanSTAR New Sites Monthly Retrofit Savings For 09/2002												
Bldg.	Site No		H.V./N.G/ Steam (MMBtu)	CHW (MMBtu)	Elec. Demand (kW-mo)	Electricity (kWh)	H.V./N.G/ Steam (\$)	CHW (\$)	Elec. Demand (\$)	Electricity (\$)	Estimated Monthly Savings (\$)	Measured Monthly Savings (\$)
<b>TAMUI</b>												
TB1	990	Predicted	100	300	60	20000	350	1050	516	450	2366	
	990	Measured	100	300	60	20000	350	1050	516	450		2366
TB2	991	Predicted	50	230	45	15000	175	805	387	338	1705	
	991	Measured	50	230	45	15000	175	805	387	338		1705
BD3		Predicted	0	0	0	0	0	0	0	0	0	0
		Measured	0	0	0	0	0	0	0	0		0
BD4		Predicted	0	0	0	0	0	0	0	0	0	0
		Measured	0	0	0	0	0	0	0	0		0
BD5		Predicted	0	0	0	0	0	0	0	0	0	0
		Measured	0	0	0	0	0	0	0	0		0

Figure 3.3: Example: Input Monthly Savings for New Sites

Avoided Costs of Energy				No. of Mon.
H.V./N.G/ Steam (\$/MMBtu)	CHW (\$/MMBtu)	Elec. Demand (\$/kW)	Electricity (\$/kWh)	No. of Months from Aug 02 to the Date Retrofits Completed
3.50	3.50	8.60	0.022500	0
3.50	3.50	8.60	0.022500	0
3.50	3.50	8.60	0.022500	0
3.50	3.50	8.60	0.022500	0
0.00	0.00	0.00	0.000000	0
0.00	0.00	0.00	0.000000	0
0.00	0.00	0.00	0.000000	0
0.00	0.00	0.00	0.000000	0

Figure 3.4: Example: Input Avoided Costs for New Sites



LoanSTAR New Sites Retrofit Savings As Of 09/2002											
New Site #1											
600	Predicted	100	300	11	20000	350	180	51	41	1	2344
	Measured	100	300	11	20000	350	180	51	41	1	2344
602	Predicted	50	230	45	8000	175	300	397	228	1	1705
	Measured	50	230	45	8000	175	300	397	228	1	1705
603	Predicted	0	0	0	0	0	0	0	0	1	0
	Measured	0	0	0	0	0	0	0	0	1	0
604	Predicted	0	0	0	0	0	0	0	0	1	0
	Measured	0	0	0	0	0	0	0	0	1	0
605	Predicted	0	0	0	0	0	0	0	0	1	0
	Measured	0	0	0	0	0	0	0	0	1	0

Figure 3.5: Example: Input Cumulated Savings for New Sites

### 3.3.5 Update Graphs and Print Reports

To update the graphs go back to worksheet “Svgs” and press the button <Update Graphs>. To print the reports go to worksheet “Svgs” for the total savings summary report, to the worksheet “E\_Svgs” for the emissions savings report, and to the worksheet “S\_Svgs” for state agencies savings report. To print the graphs, find worksheets “Ch1”, “Ch2”, “Ch3” and print out the graphs for cumulated LoanSTAR savings, metered retrofit savings, and yearly savings, respectively. All the printed reports in this example are enclosed in the appendix.

**APPENDIX OUTPUT REPORTS AND GRAPHS**



**Texas LoanSTAR Monitoring and Analysis Program  
Energy Consumption Report**

Summary of Measured Energy Consumption and Savings 1990 ~ 09/2002

**Summary of Retrofit and Continuous Commissioning Dollar Savings**

**Measured Retrofit Dollar Savings**

	Electricity	Chilled Water	H.W./M.G./Steam	Total
Baseline Use	\$283,406,000	\$65,922,000	\$39,555,000	\$388,883,000
Post-Retrofit Use	\$239,478,000	\$41,069,000	\$25,038,000	\$305,585,000
Measured Savings	\$43,927,968	\$24,852,757	\$14,516,697	\$83,297,422
% of Baseline Use	15.50	37.70	36.70	-
% of Total Measured Savings	52.74	29.84	17.43	100
Audit Estimated Savings	\$46,455,357	\$22,150,228	\$17,997,380	\$86,602,966

**Estimated Retrofit Dollar Savings**

SAVINGS TO DATE	Total
Street Lighting in 9 Cities	\$6,026,600
FW ISD (43 Schools)	\$2,966,600
Municipal & ISD Sites	\$777,700
Northside ISD	\$383,280
Austin ISD	\$688,050
Groom ISD	\$21,546
<b>Total</b>	<b>\$10,863,776</b>

**Measured CC Dollar Savings**

SAVINGS TO DATE	Total
CC Savings	\$29,083,232

**Overlap Retrofit & CC Dollar Savings**

SAVINGS TO DATE	Total
Overlap Retrofit & CC Savings	\$3,521,484

**Total Program Dollar Savings**

SAVINGS TO DATE	Reported Retrofit Savings (\$)	Overlap Retrofit & CC Savings (\$)	Actual Savings (\$)
Measured Retrofit Savings	\$83,297,422	\$3,521,484	\$79,775,938
Estimated Retrofit Savings			\$10,863,776
Measured CC Savings			\$29,083,232
<b>Total Program Savings</b>			<b>\$119,722,946</b>

**Summary of Retrofit Energy Savings**

**Retrofit Energy Savings I**

SAVINGS TO DATE	Electricity (kWh)	Electric Demand (kW)	Hot Water/ Steam /Nat. Gas (MMBtu)	CHW (MMBtu)
Measured Retrofit Savings	961,992,066	590,927	3,247,484	2,870,473
Audit Estimated Retrofit Savings	1,067,550,528	757,914	4,810,709	2,687,777
Percentage (Measured vs. Estimated)	90.11%	77.97%	67.51%	106.80%

**Retrofit Energy Savings II**

SAVINGS TO DATE	Electricity (MMBtu)	Chilled Water (MMBtu)	Hot Water/Steam/ Nat. Gas (MMBtu)	Total (MMBtu)
Measured Retrofit Savings	11,159,108	2,870,473	3,247,484	17,277,065
Audit Estimated Retrofit Savings	12,383,586	2,687,777	4,810,709	19,882,073
Percentage (Measured vs. Estimated)	90.11%	106.80%	67.51%	86.90%

*Table 1. LoanSTAR Savings Summary Report*



Energy Systems Laboratory  
Texas A&M University

### Texas LoanSTAR Program Emissions Savings Summary 1990~ 09/2002

TYPE OF ENERGY	NOx Tons	CO2 Tons	SO2 Tons
HEATING MMBtus 3,247,484	1,156	252,232	1.26
CHILLED WATER MMBtus 2,870,473	658	203,325	580
ELECTRICITY MWh 961,992	2,645	817,693	2,333
<b>TOTAL SAVINGS</b>	<b>4,459</b>	<b>1,273,250</b>	<b>2,914</b>

- (1) The combined reduction in pollutants in tons resulting from heating, cooling, and electricity savings
- (2) The numbers in parantheses are the total heating, cooling , and electricity savings from the LoanSTAR sites
- (3) The emissions savings above are obtained using the EPA 1992 emission factors for Texas

Table 2. Emissions Savings Report



Energy Systems Laboratory  
Texas A&M University

### CUMULATIVE SAVINGS FOR STATE AGENCIES 1990~ 09/2002

No.	State Agencies	Audit Estimated Retrofit Savings (\$)	Measured Retrofit Savings (\$)	Commissioning Savings (\$)	Total Savings (\$)	Loan Amount (\$)	Pre- Retrofit Utility Costs (\$)	No. of Months of Savings
1	Texas A&M University	\$9,173,777	\$4,057,167	\$673,370	\$5,530,637	\$4,590,273	\$6,415,452	143
2	U.T. Austin	\$25,539,165	\$28,807,254	\$2,841,809	\$31,249,563	\$19,359,298	\$74,242,758	144
3	U.T.Arlington	\$6,887,282	\$3,781,311	\$0	\$3,781,311	\$5,087,968	\$37,825,727	136
4	UTHS-C, Houston	\$4,095,212	\$2,473,004	\$9,056,805	\$11,535,892	\$5,005,985	\$26,327,005	137
5	TDM, Austin	\$395,527	\$878,985	\$28,833	\$905,690	\$289,174	\$6,183,857	122
6	UTMB Galveston Bldgs.	\$2,630,268	\$6,056,922	\$5,624,277	\$11,980,299	\$1,802,805	\$26,616,273	128
7	UNTHC (TECOM)	\$201,818	\$316,777	\$0	\$316,777	\$224,052	\$9,038,228	124
8	UTMDA Cancer Cntr.	\$9,692,810	\$12,489,456	\$8,508,691	\$20,998,147	\$3,248,767	\$115,263,737	118
9	State Capitol Complex	\$6,227,374	\$6,262,909	\$849,042	\$7,212,651	\$4,842,461	\$48,827,130	136
10	Capitol Bldg.	\$1,785,828	\$736,447	\$308,790	\$1,047,197	\$1,247,420	\$2,844,218	93
11	Capitol Extension	\$1,724,617	\$489,696	\$665,655	\$1,165,751	\$1,380,518	\$3,575,468	105
12	MHR, Austin	\$610,165	\$409,989	\$0	\$409,899	\$692,102	\$12,303,333	111
13	UTHS-C San Antonio	\$592,524	\$350,513	\$278,371	\$629,884	\$236,484	\$38,267,718	90
14	UTD	\$428,258	\$452,324	\$0	\$452,324	\$756,201	\$6,387,183	97
15	College of Marland	\$1,485,107	\$1,093,242	\$0	\$1,093,242	\$902,004	\$5,821,870	97
16	Texas Woman Univ	\$1,147,472	\$406,286	\$0	\$406,286	\$1,657,881	\$4,083,333	98
17	U of Houston, CL	\$481,871	\$637,012	\$0	\$637,012	\$382,500	\$5,734,845	89
18	TAMU, Galveston	\$1,361,528	\$326,750	\$0	\$326,750	\$623,685	\$5,775,000	129
19	Texas Dept. of MHR	\$6,284,301	\$3,790,700	\$0	\$3,790,700	\$15,066,838	\$27,888,427	77
20	Texas Tech University	\$219,193	\$106,419	\$290,024	\$396,443	\$1,247,950	\$2,621,954	29
21	TAMU, Kingsville	\$453,855	\$121,639	\$0	\$121,639	\$2,072,144	\$2,055,205	21
	<b>Total</b>	<b>\$78,778,415</b>	<b>\$72,882,541</b>	<b>\$28,864,826</b>	<b>\$108,667,378</b>	<b>\$62,833,138</b>	<b>\$689,564,579</b>	

Table 3. State Agencies Savings Report

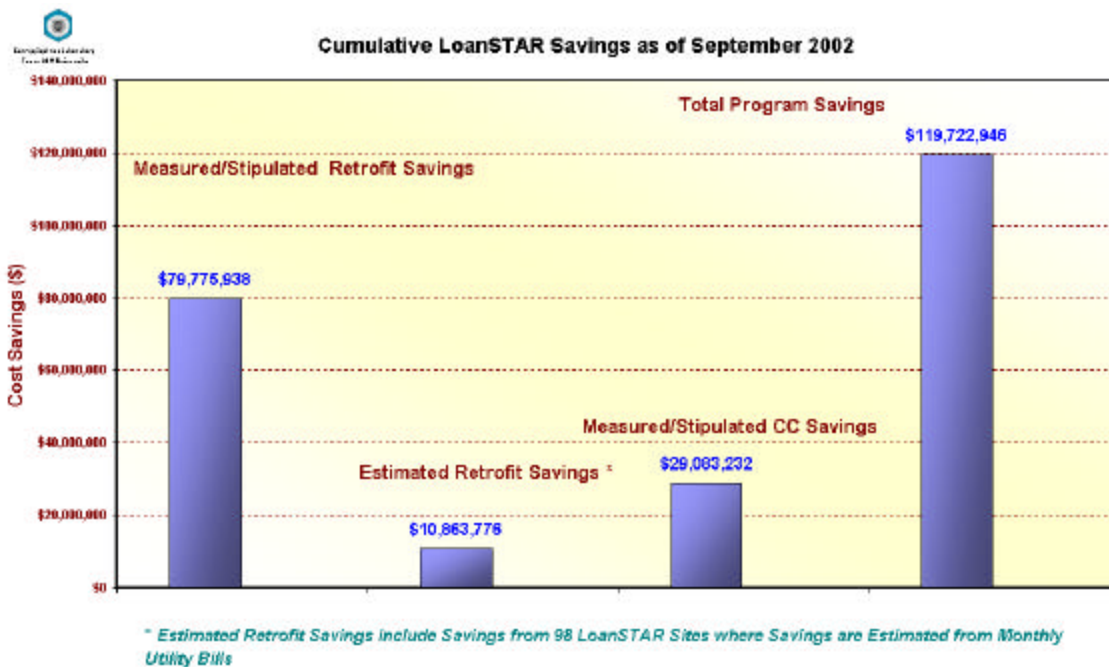


Figure 1. Cumulative LoanSTAR Savings as of September 2002

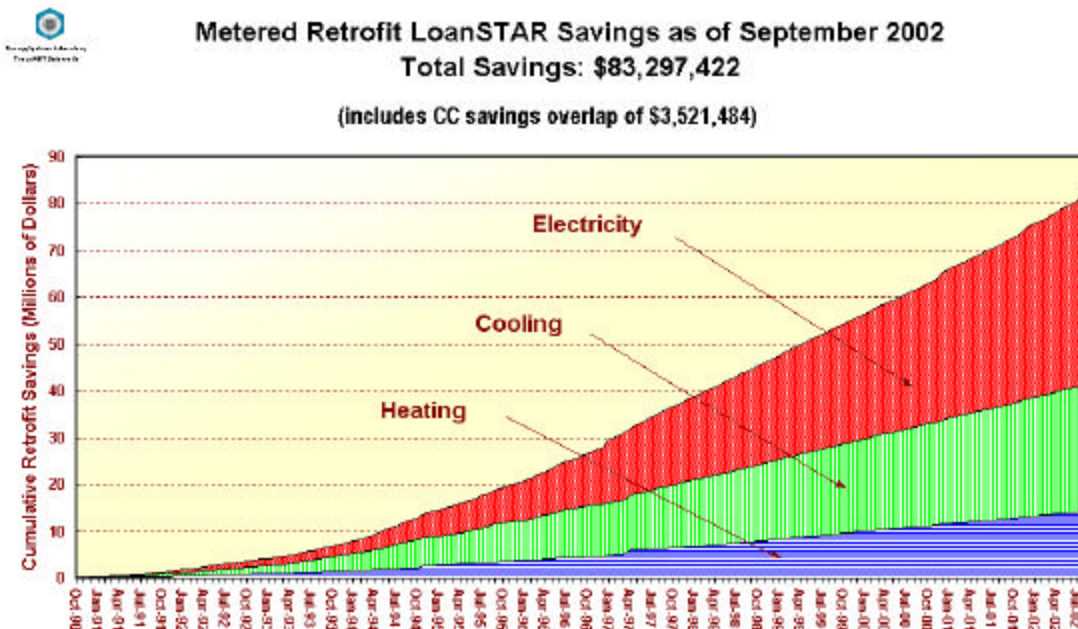


Figure 2. Metered Retrofit LoanSTAR Savings as of September 2002

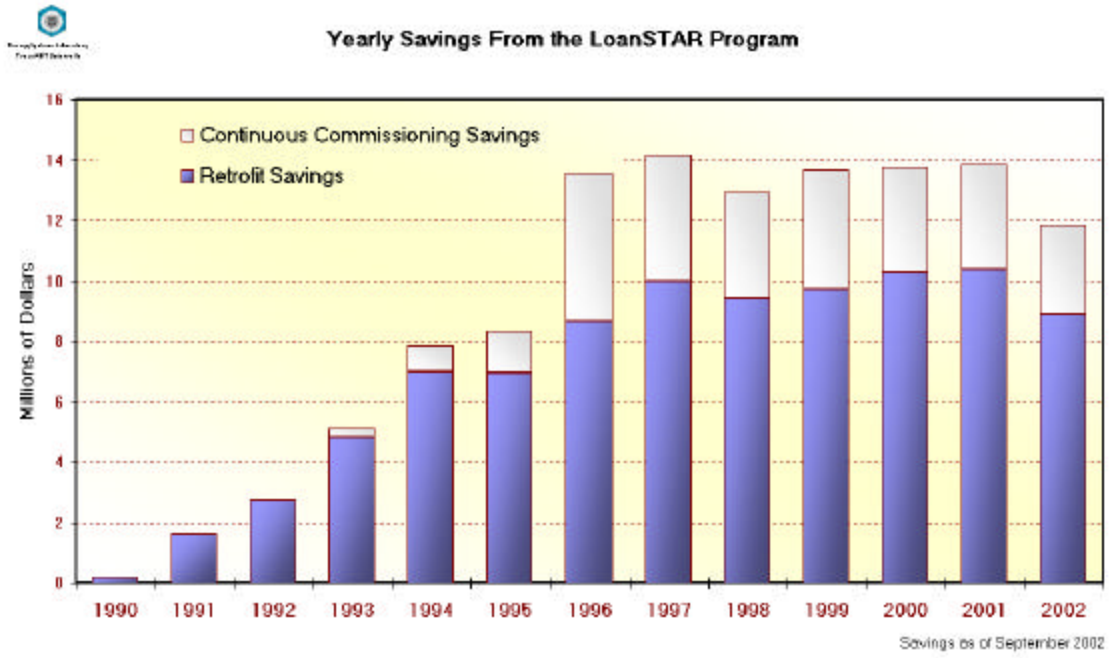


Figure 3. Yearly LoanSTAR Savings