COOL STORAGE APPLICATIONS IN THE TEXAS LOANSTAR PROGRAM:

OVERVIEW AND PRELIMINARY RESULTS

Mustafa Abbas
Jeff S. Haberl
W. Dan Turner

Energy Systems Laboratory
Texas Engineering Experiment Station,
Texas A & M University

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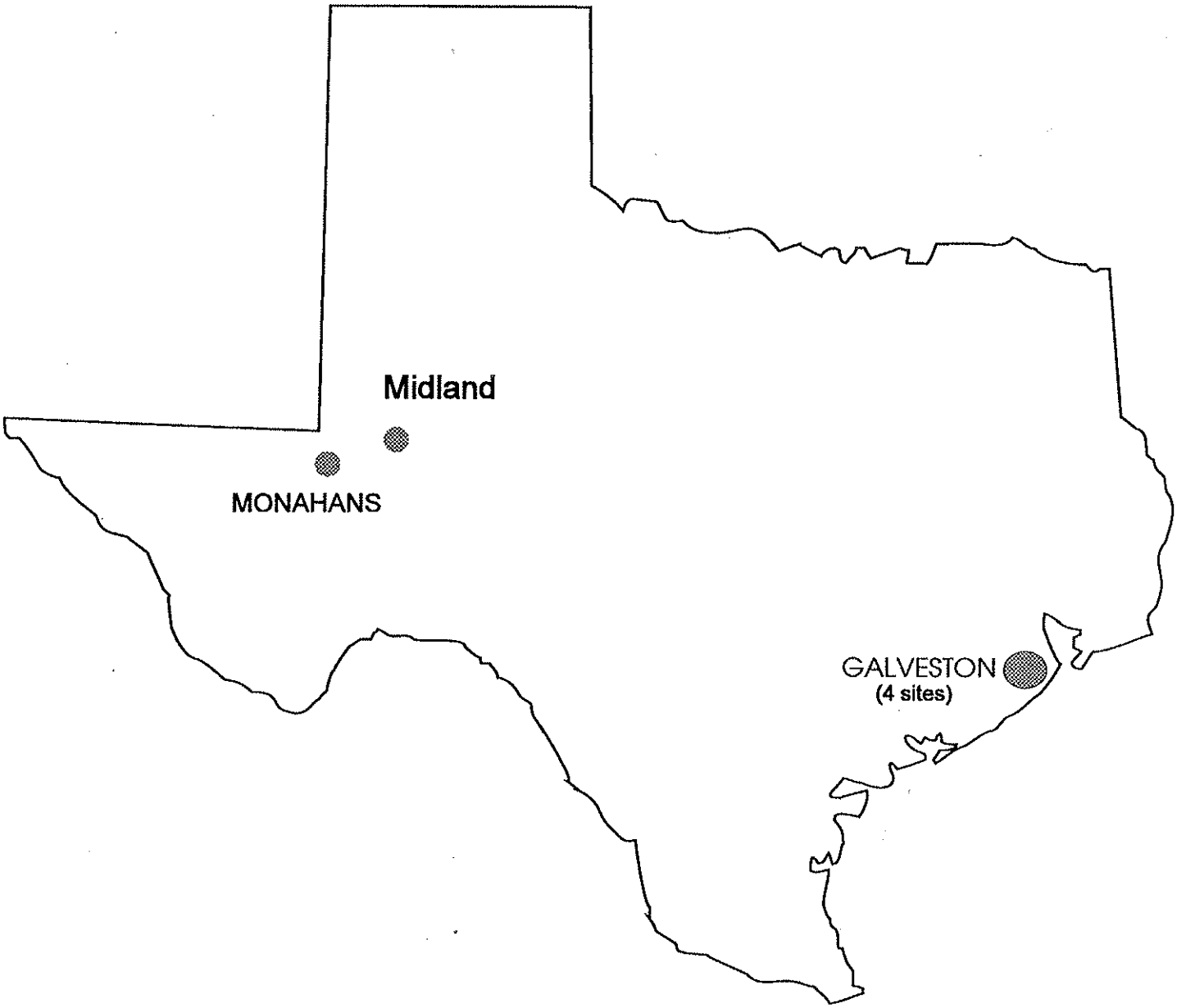
Cool Storage Sites in the Texas LoanSTAR Program



Cool Storage Systems (CSS) in the Texas LoanSTAR Program

LoanSTAR Site Name	Conditioned Area		Cool Storage Type
	m^2	ft^2	
Midland County Courthouse	8,374	90,100	Ice
Ward Memorial Hospital	3,439	37,000	Chilled Water
Oppe Elementary School	7,472	80,400	Ice
Weis Middle School	7,506	80,769	Ice
Parker Elementary School	7,597	81,742	Ice
Morgan Elementary School	7,137	76,798	Ice

Chiller and tank storage capacities

LoanSTAR Site Name	# of Pre-Retrofit Chiller	# of Post-Retrofit Chiller	Total Storage Capacity
	GJ/h (tons)	GJ/h (tons)	GJ (ton-hr)
Midland County Courthouse	2x1 = 2 (2x83 = 166)	1x2.5 = 2.5 (1x210 = 210)	13.9 (1160)
Ward Memorial Hospital	1x1.2 = 1.2 (1x100 = 100)	1x1.2 = 1.2 (1x100 = 100)	7.8 (653)
Oppe Elementary School	1x2.2 = 2.2 (1x188 = 188)	1x2.2 + 1x0.5 = 2.7 (1x188 + 1x45 = 233)	7.9 (665)
Weis Middle School	2x1.4 = 2.8 (2x120 = 240)	2x1.4 + 1x0.7 = 3.5 (2x120 + 1x60 = 300)	10.8 (902)
Parker Elementary School	3x1.2 = 3.6 (3x100 = 300)	3x1.2 + 1x0.7 = 4.3 (3x100 + 1x60 = 360)	10.3 (862)
Morgan Elementary School	3x1.2 = 3.6 (3x100 = 300)	3x1.2 + 1x0.8 = 4.4 (3x100 + 1x70 = 370)	12.5 (1038)

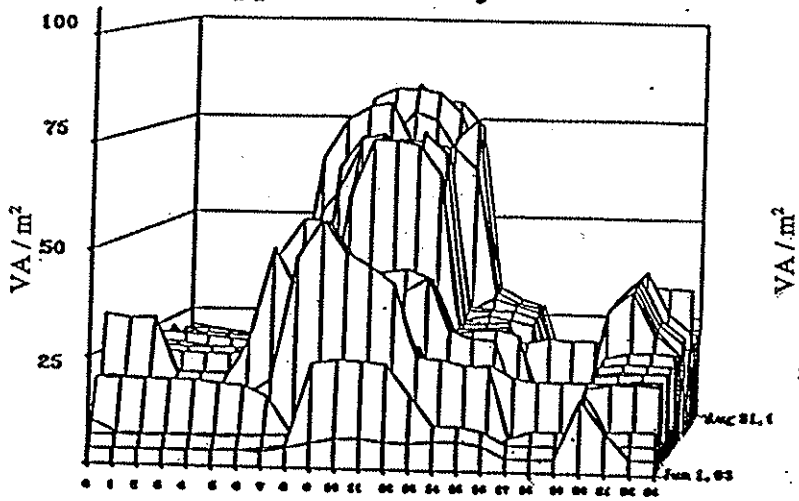
Annual electricity use and measured savings

LoanSTAR Site Name	Annual Elec. Use kWh/ft2-yr		Ann. Retrofit	Measured Annual Savings	
	Pre-	Post-	Savings ($)	$/m2	$/ft2
Midland County Courthouse	19.9	16.6	$14,555	1.74	0.16
Ward Memorial Hospital	37.7	38.5	$13,195	3.84*	0.36*
Oppe Elementary School	9.7	10.4	$18,555	2.48	0.23
Weis Middle School	11.4	10.8	$17,092	2.28	0.21
Parker Elementary School	9.2	10.5	$17,291	2.28	0.21
Morgan Elementary School	12.1	12.9	$16,671	2.34	0.22

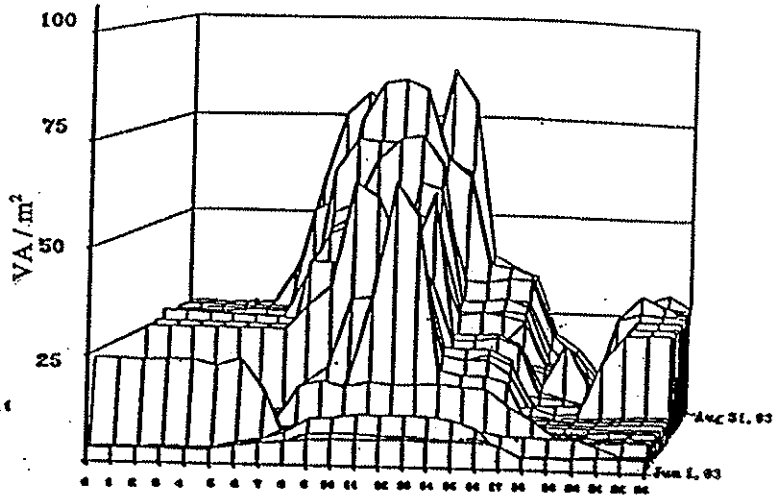
* Ignores current problems due to under capacity.

Post-retrofit electricity consumption for LoanSTAR sites with thermal storage system

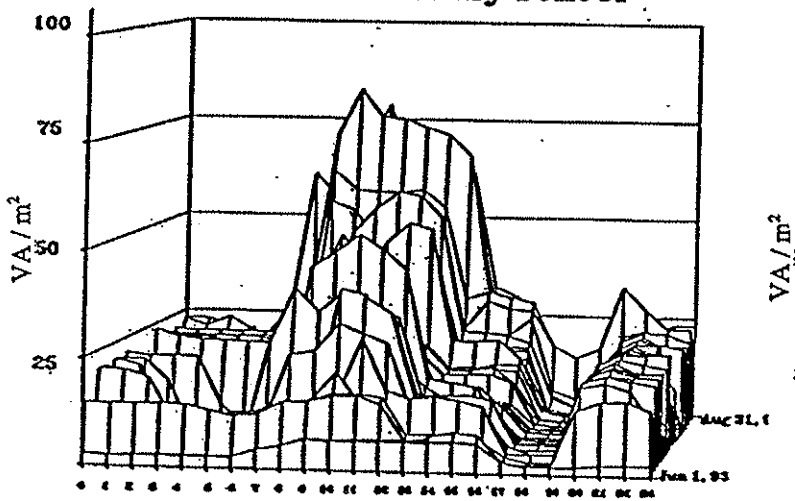
Oppe Elementary School



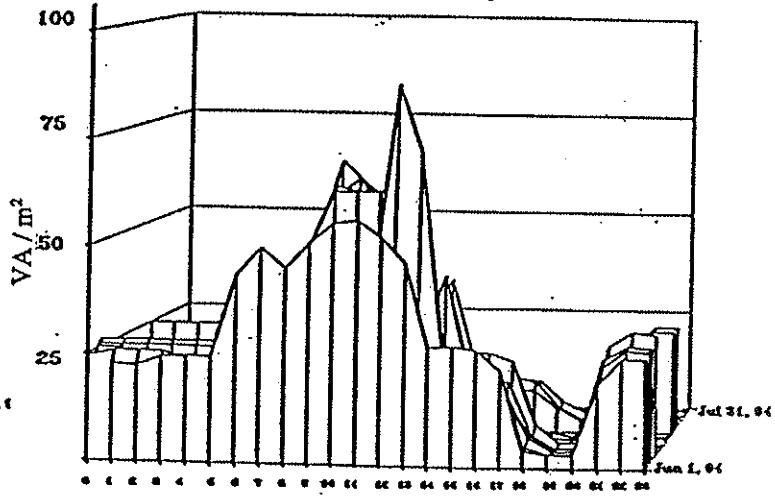
Weis Middle School



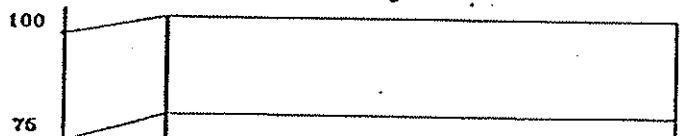
Parker Elementary School



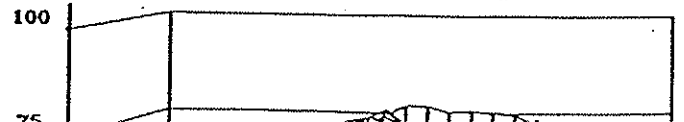
Morgan Elementary School



Midland County Courthouse



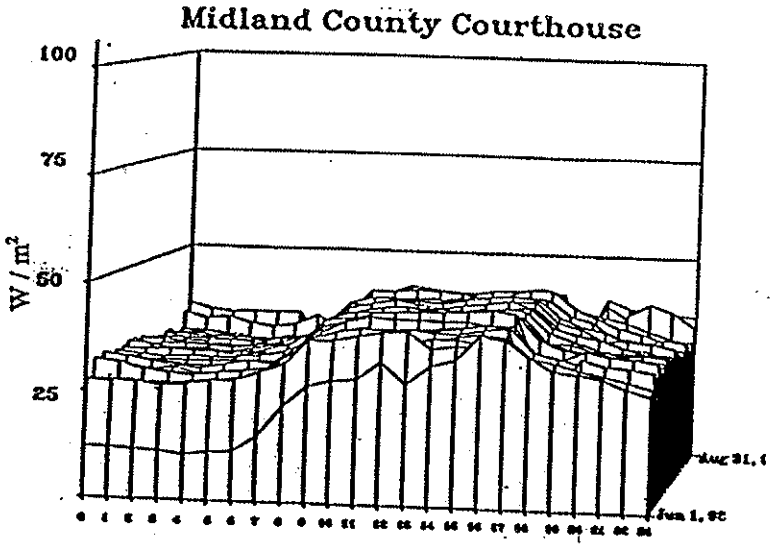
Ward Memorial Hospital

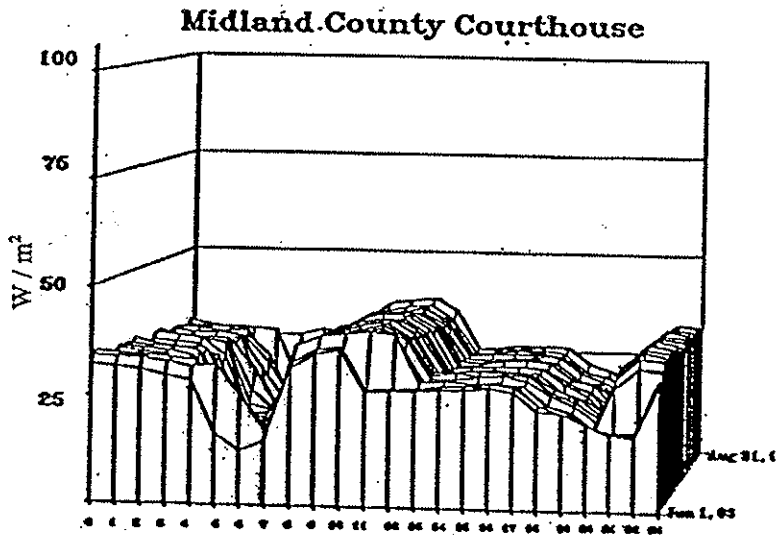


Midland County Courthouse

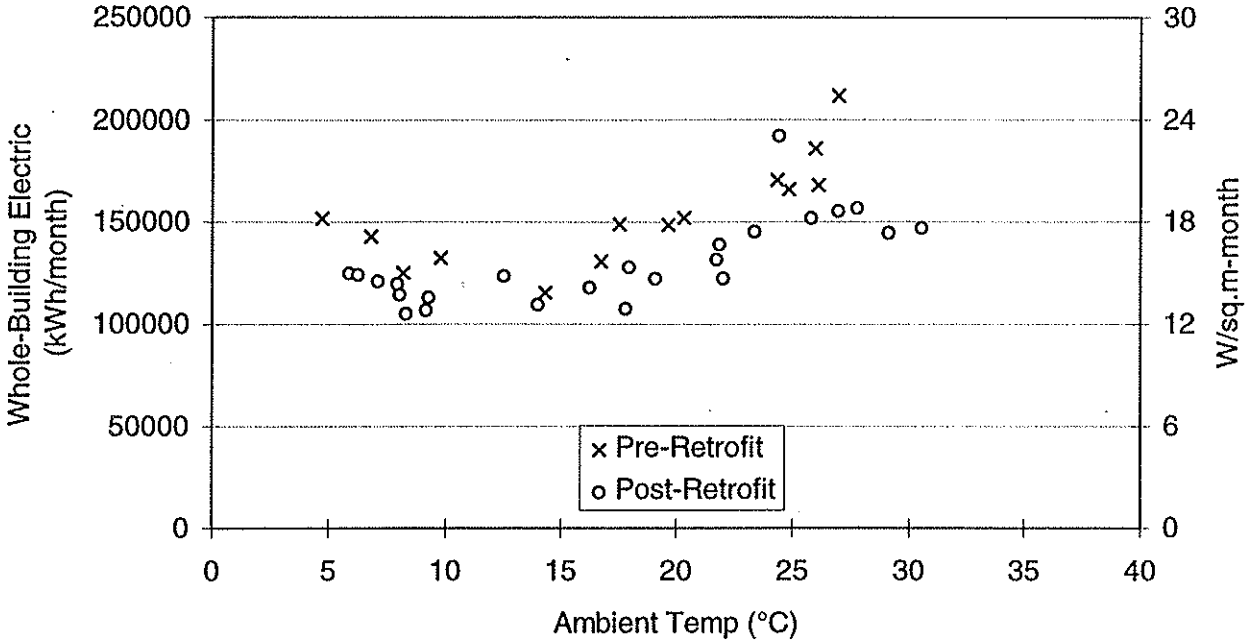
Ice Storage Tanks

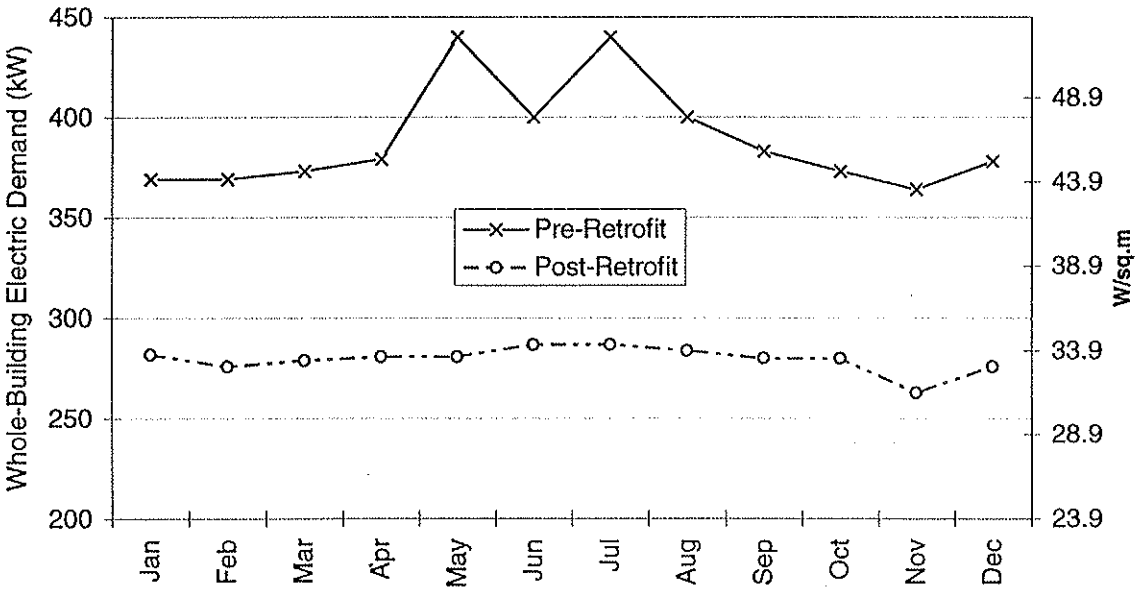
Pre- and post-retrofit electricity consumption for the Midland County Courthouse





Midland County Courthouse

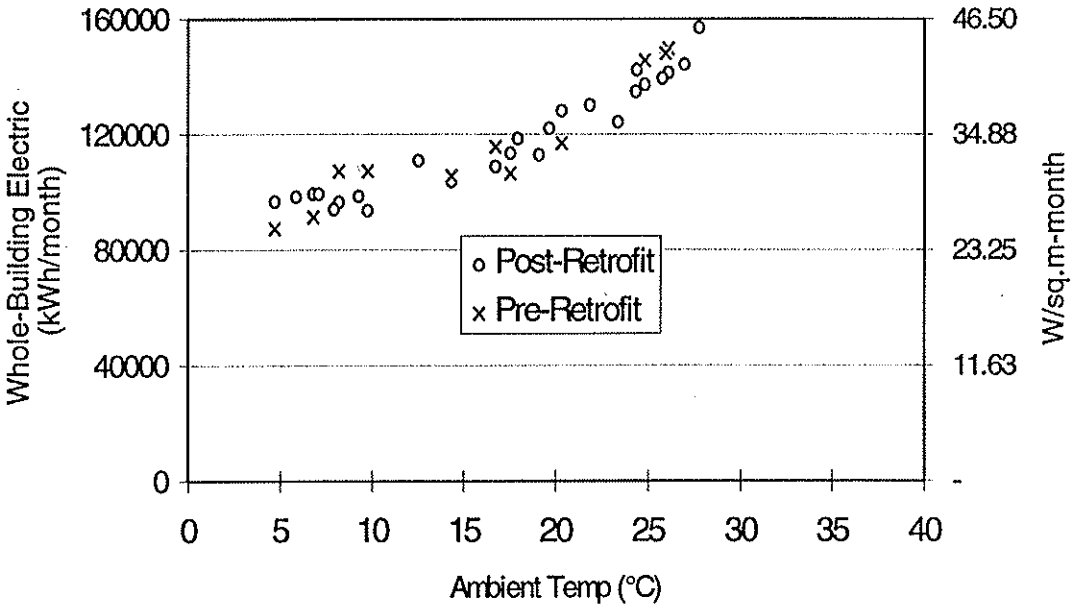


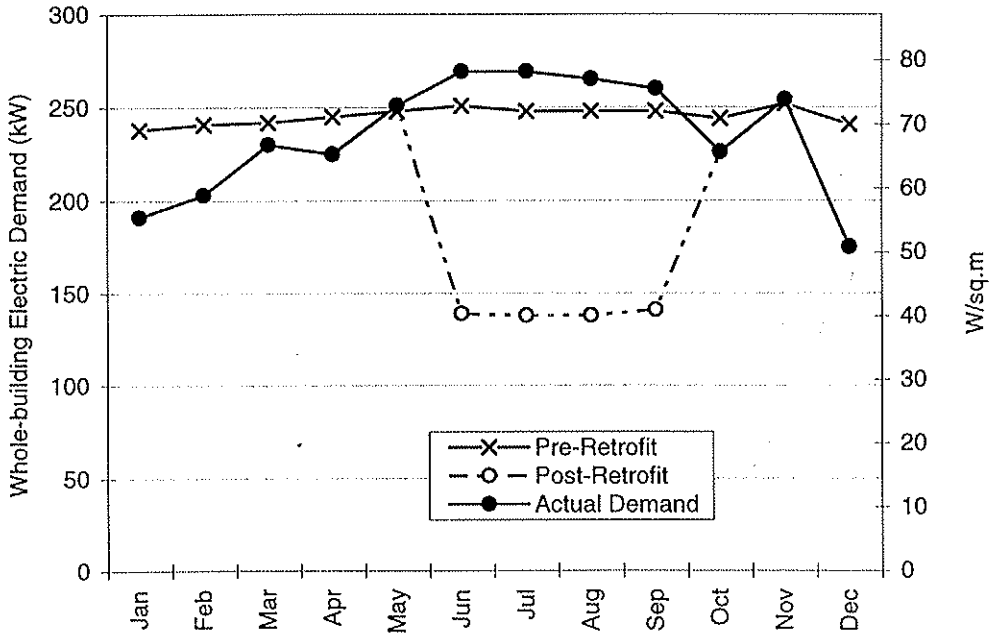


Ward Memorial Hospital

Chilled Water Storage Tanks

Ward Memorial Hospital





Chiller and storage capacity indices

LoanSTAR Site Name	Chiller Capacity Index[1]		Storage Capacity Index[2]
	kWh/m^2-yr-GJ/h (Wh/ft^2-yr-ton)		kWh/m^2-yr-GJ (Wh/ft^2-yr-ton-hr)
	Pre	Post	
Midland County Courthouse	107.6 (120)	71.7 (80)	12.5 (14)
Ward Memorial Hospital	333.2 (370)	340.9 (380)	52.9 (59)
Oppe Elementary School	44.8 (50)	35.9 (40)	13.5 (15)
Weis Middle School	44.8 (50)	35.9 (40)	10.7 (12)
Parker Elementary School	26.9 (30)	26.9 (30)	10.7 (12)
Morgan Elementary School	35.9 (40)	35.9 (40)	10.7 (12)

1. Chiller Capacity Index = $\frac{\text{building kWh/yr}}{\text{(chiller capacity) x (building area)}}$

2. Storage Capacity Index = $\frac{\text{building kWh/yr}}{\text{(storage capacity) x (building area)}}$

CONCLUSIONS:

- Cool storage systems reduce electric demand
- Energy penalties for using cool storage systems can be minimized by careful construction and efficient system operation
- Simplified indices such as chiller capacity index (kWh /m^2-yr-GJ/h) and storage capacity index (kWh/m^2-yr-GJ) may provide useful indicators for utilities and building operators/owners to screen projects for improper design and installation

ANALYSIS OF RESIDENTIAL RETROFITS FOR THE TEXAS DEPARTMENT OF HOUSING

PURPOSE:

- Analyze the effectiveness of energy conservation retrofits to 500+ residences using Advanced PRISM 1.0

OBJECTIVE:

- Analyze the electricity savings using PRISM CO or HC
- Analyze the natural gas savings using PRISM HO
- Determine those houses where savings can be statistically determined from other influencing factors.

ANALYSIS OF RESIDENTIAL RETROFITS FOR THE TEXAS DEPARTMENT OF HOUSING

PROS AND CONS OF USING A STANDARD TOOL LIKE ADVANCED PRISM

PROS

- PRISM is one of the industry standard methods of evaluating savings in residences.

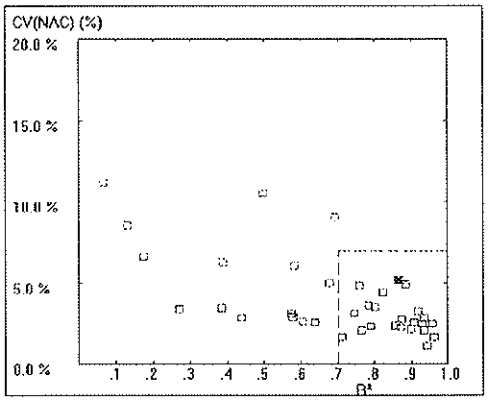
- Analysis done with PRISM can be compared to similar residences in other regions of the U.S. of within a utility's service area.

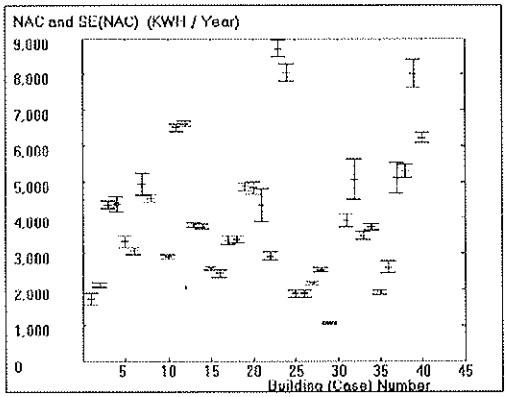
CONS

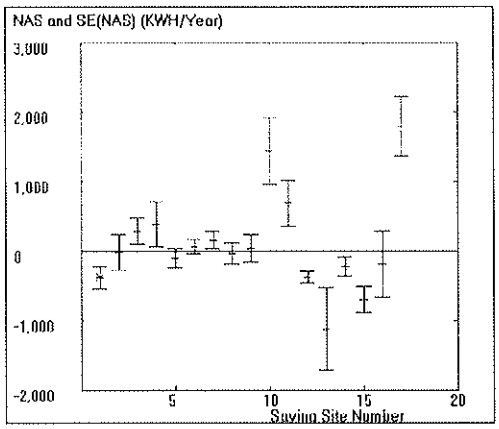
- Preparation of input files for use by PRISM can be tedious, time consuming and error prone.

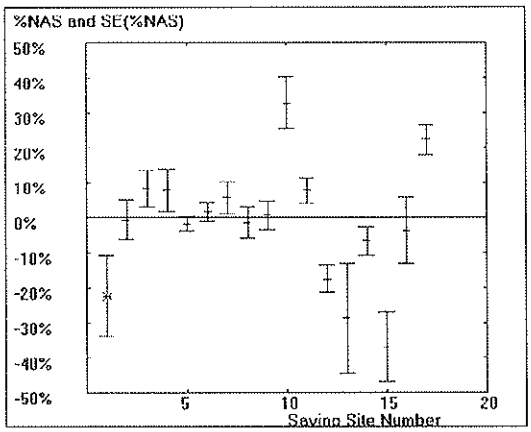
- Intrepretation of output from PRISM requires very specialized technical skills.

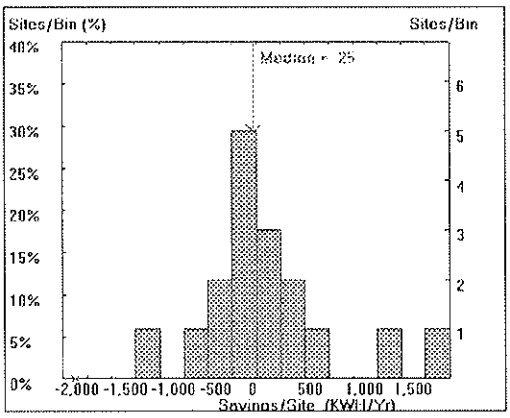
The Plots for ELPASO City

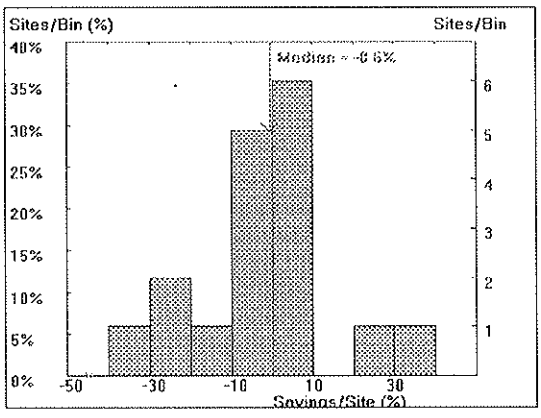




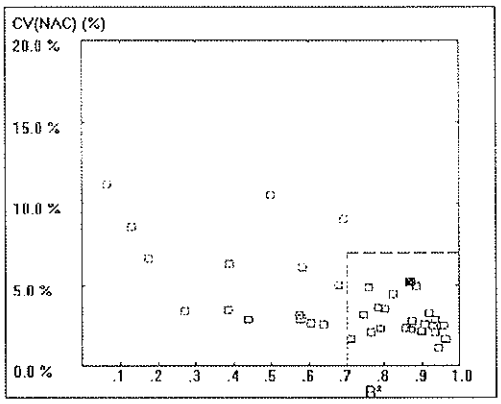


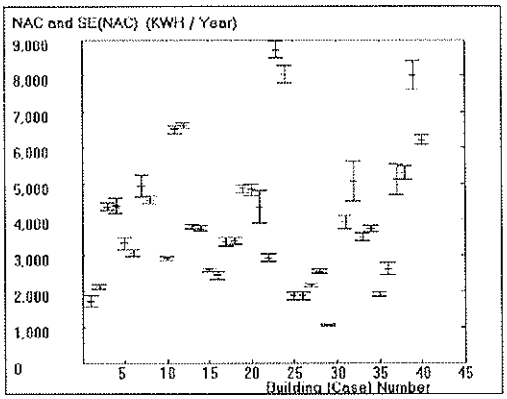


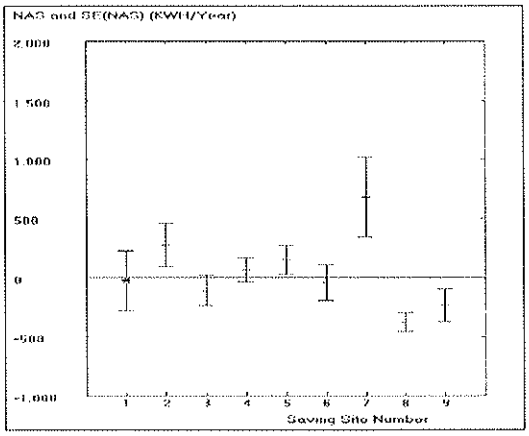


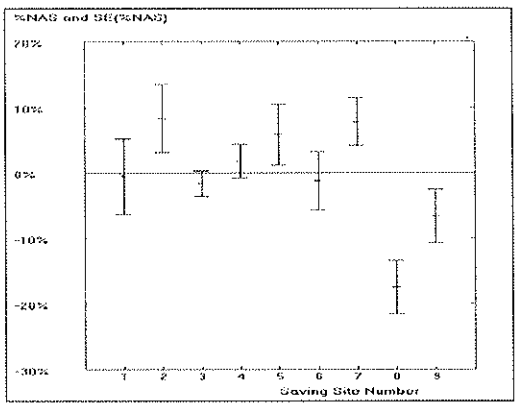


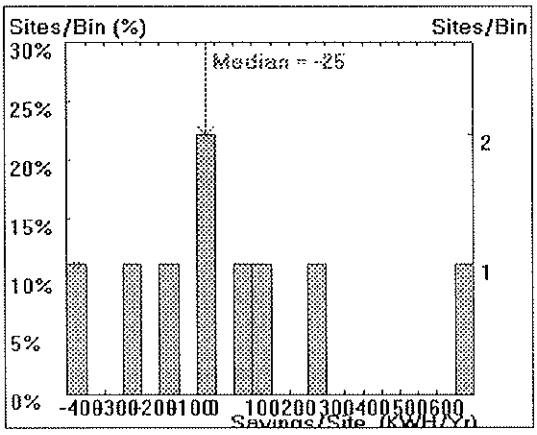
For the houses that satisfy the criteria:

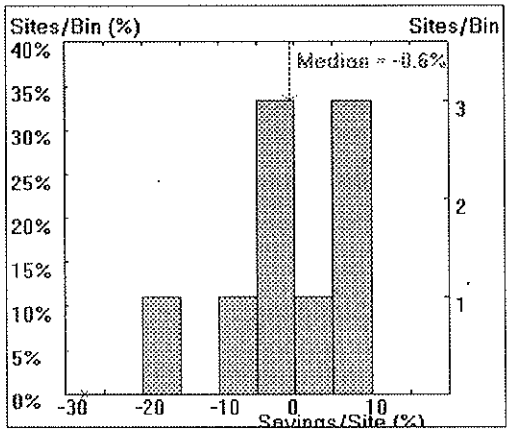












ANALYSIS OF RESIDENTIAL RETROFITS FOR THE TEXAS DEPARTMENT OF HOUSING

VALUE OF THE WORK:

Not all retrofits to residences produce positive savings when the following are considered:

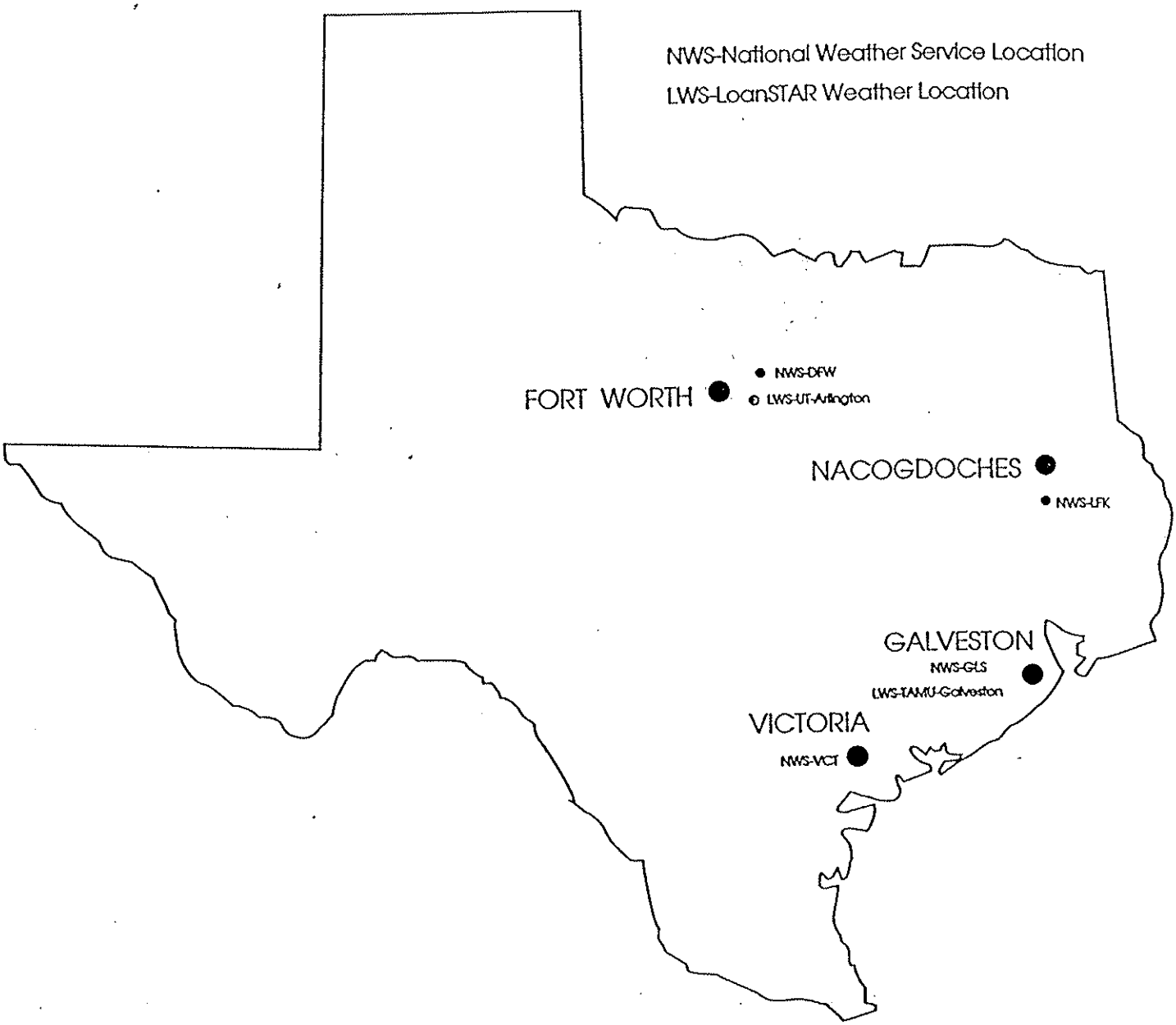
- Year-to-year weather variations
- Changes in occupancy
- Changes in function

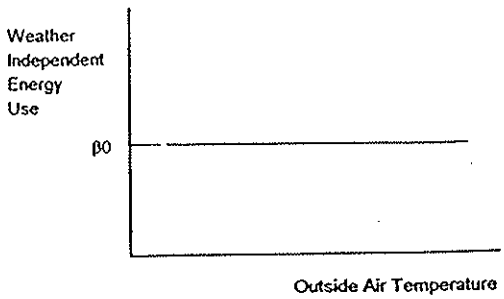
PRESCREENING PROCEDURES FOR SCHOOL BUILDINGS

Work Sponsored by the U.S.D.O.E. through Oak Ridge National Lab in Support of the "Rebuild America" program.

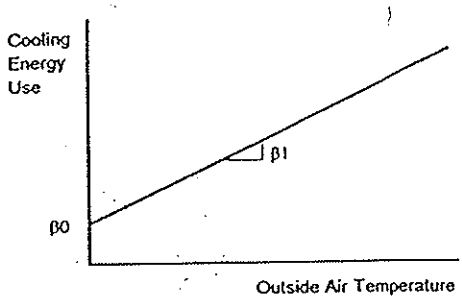
PURPOSE:

- Develop and test prescreening procedures for determining likely candidates for energy conservation retrofits based on limited information.

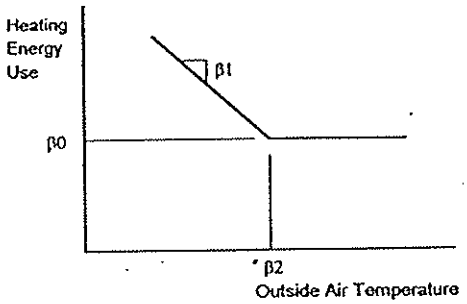

NWS-National Weather Service Location
LWS-LoanSTAR Weather Location
FORT WORTH
NWS-DFW
LWS-UT-Arlington
NACOGDOCHES
NWS-LFK
GALVESTON
NWS-GLS
LWS-TAMU-Galveston
VICTORIA
NWS-VCT


Weather
Independent
Energy
Use
β0
Outside Air Temperature

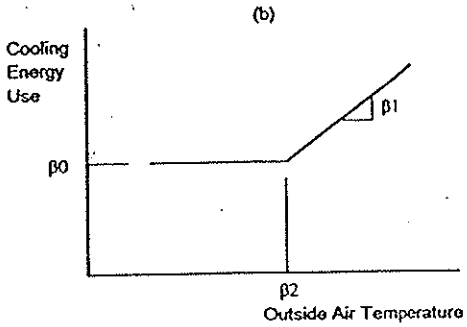
(a)


Cooling
Energy
Use
β1
β0
Outside Air Temperature

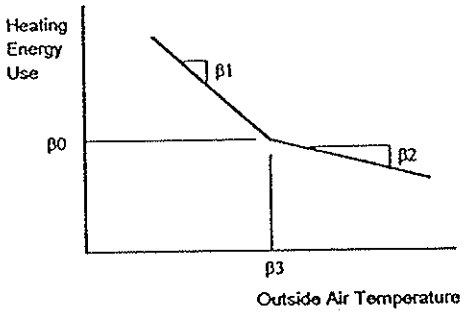
(b)


Heating
Energy
Use
β1
β0
β2
Outside Air Temperature

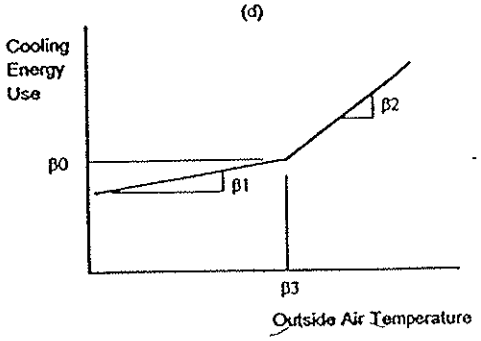
(c)


Cooling
Energy
Use
β1
β0
β2
Outside Air Temperature

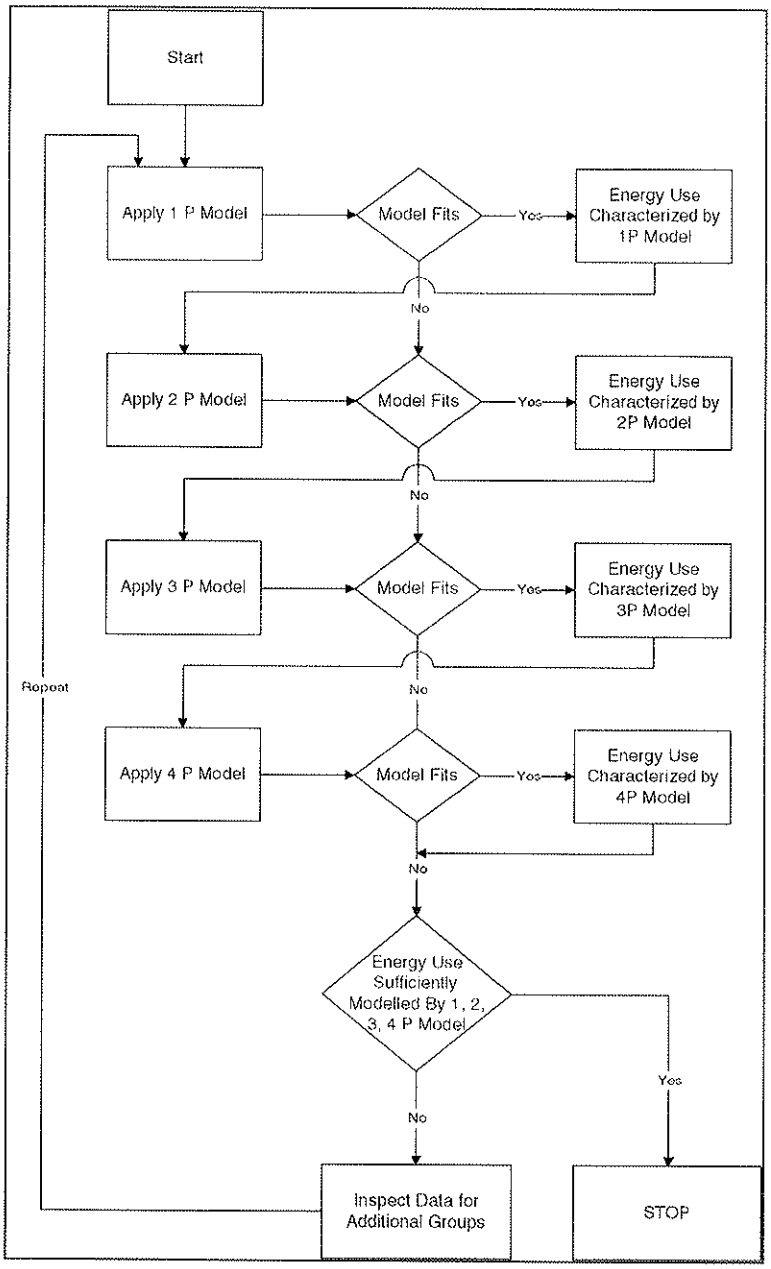
(d)


Heating
Energy
Use
β1
β0
β2
β3
Outside Air Temperature

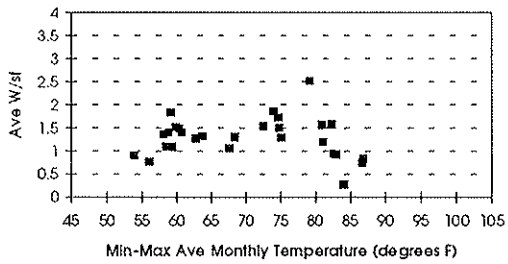
(e)


Cooling
Energy
Use
β2
β0
β1
β3
Outside Air Temperature

(f)


Start
Apply 1 P Model
Model Fits
Yes
Energy Use Characterized by 1P Model
No
Apply 2 P Model
Model Fits
Yes
Energy Use Characterized by 2P Model
No
Apply 3 P Model
Model Fits
Yes
Energy Use Characterized by 3P Model
No
Repeat
Apply 4 P Model
Model Fits
Yes
Energy Use Characterized by 4P Model
No
Energy Use Sufficiently Modelled By 1, 2, 3, 4 P Model
Yes
No
Inspect Data for Additional Groups
STOP

OES



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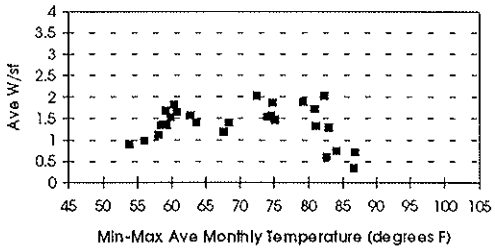

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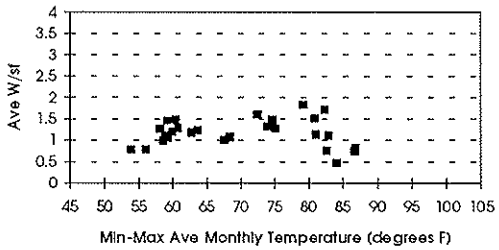
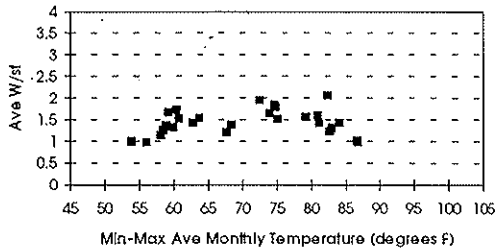
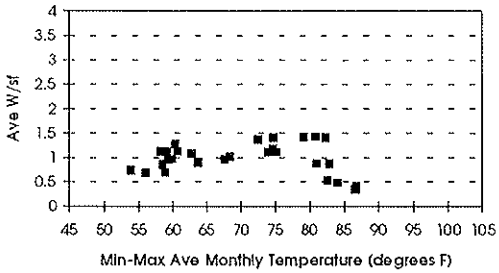
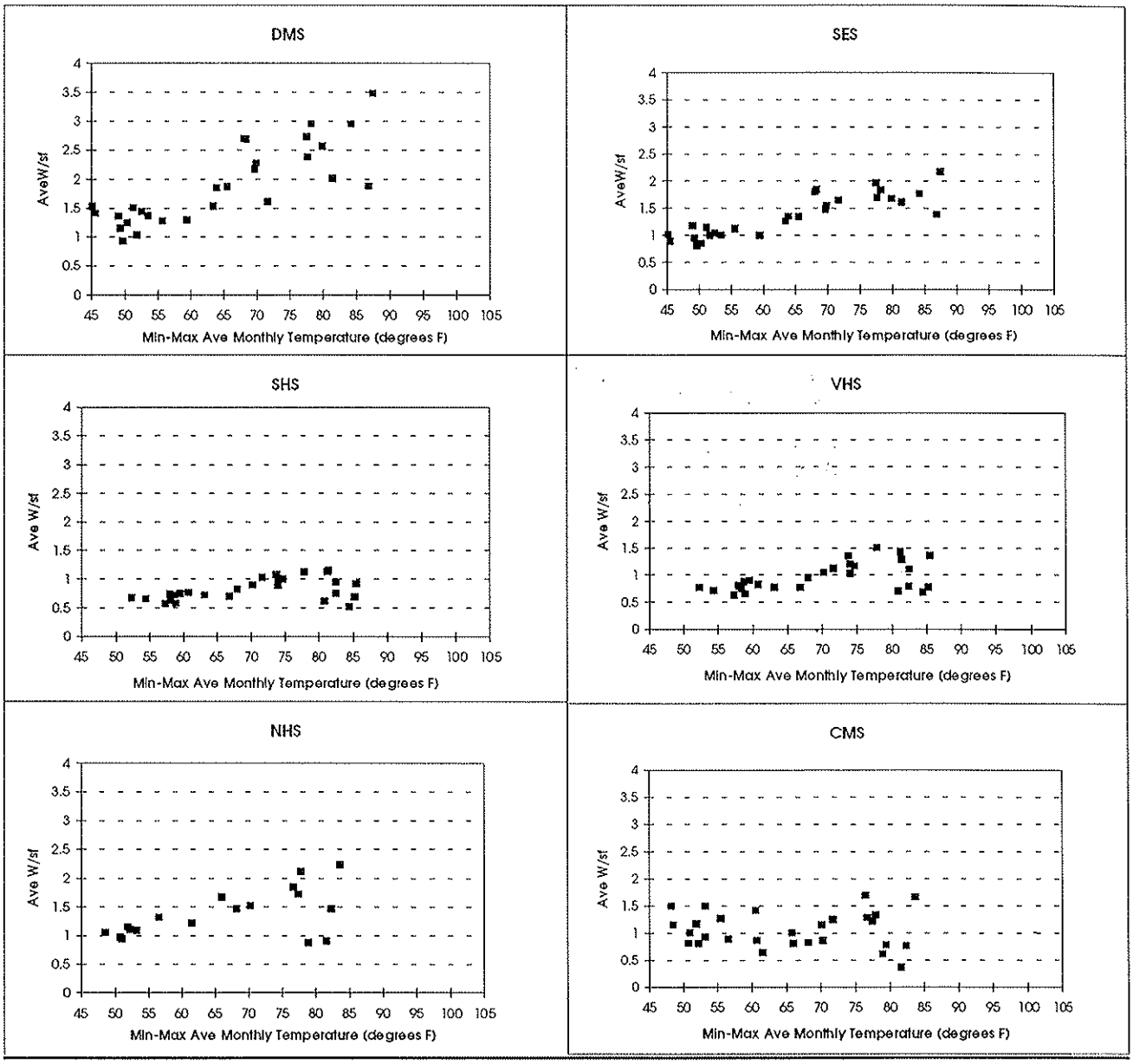


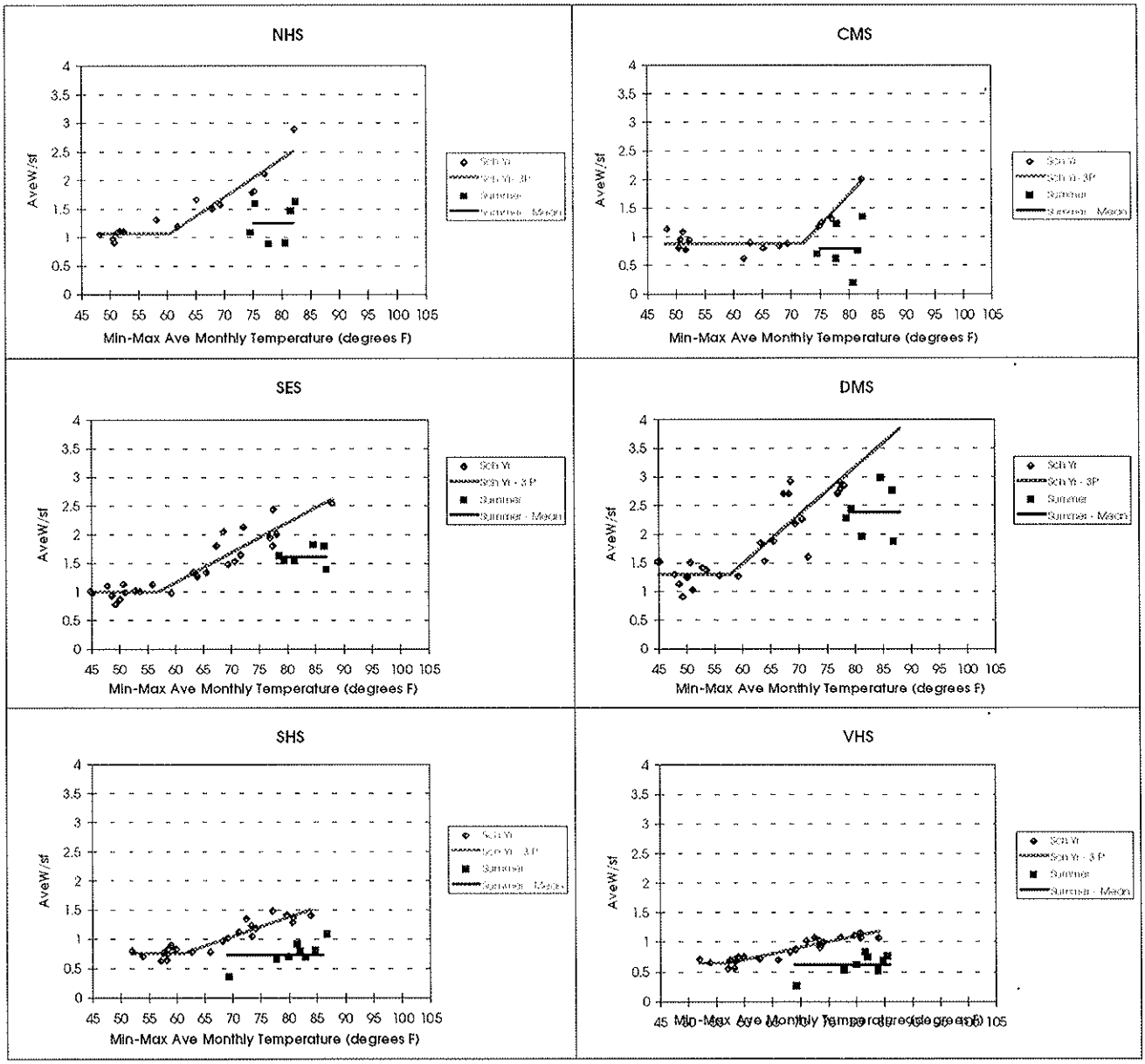
MES

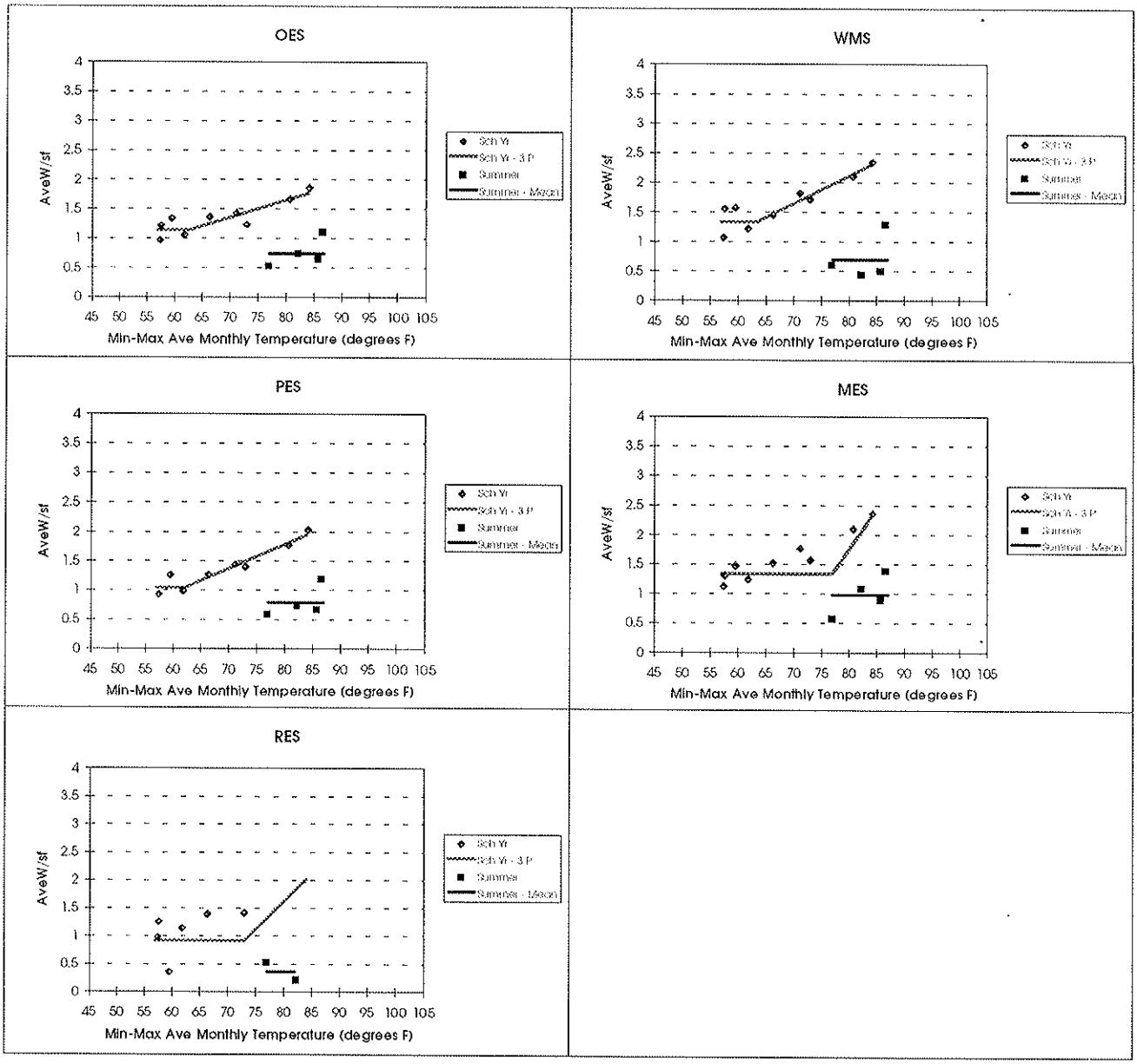


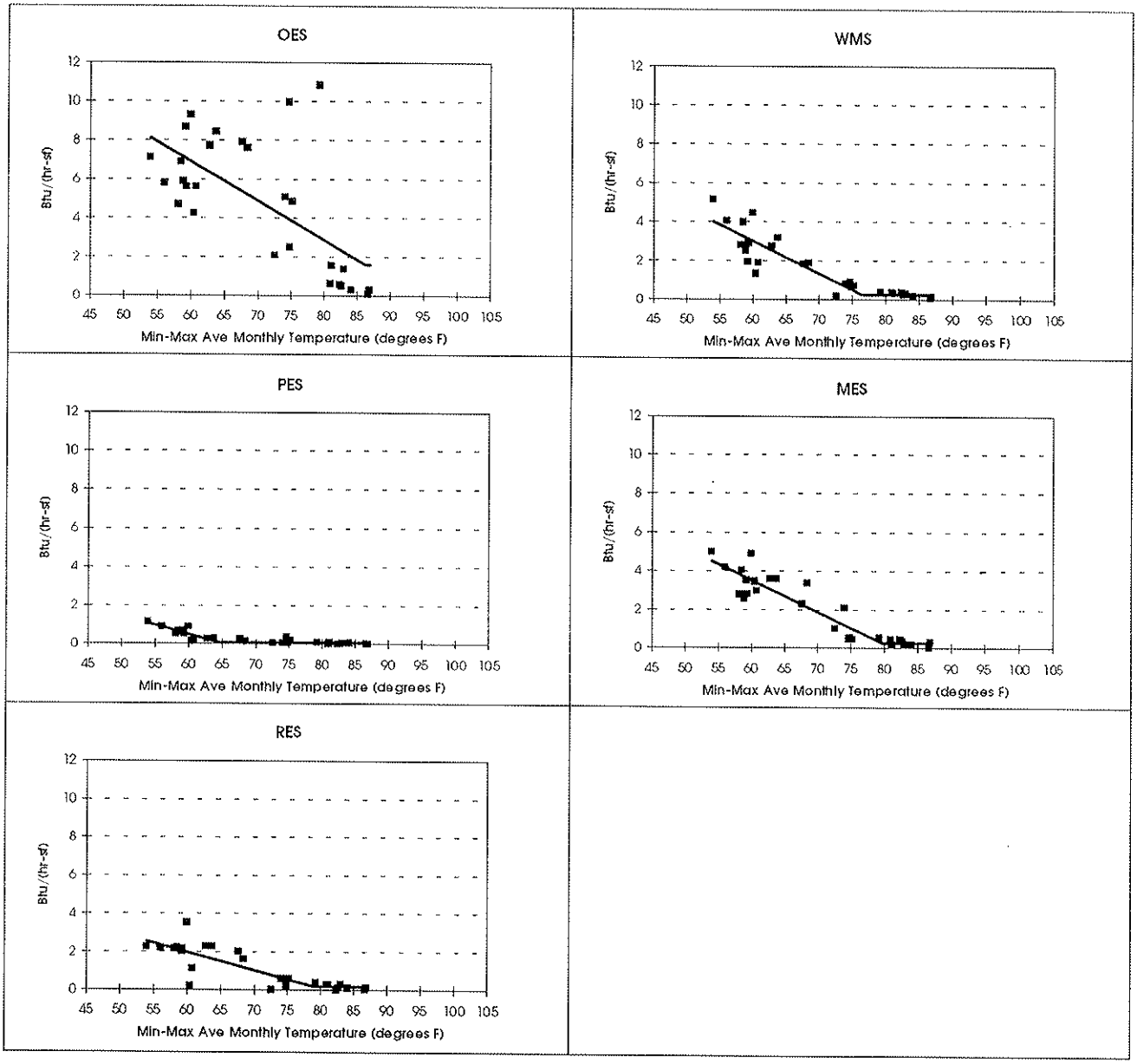
RES

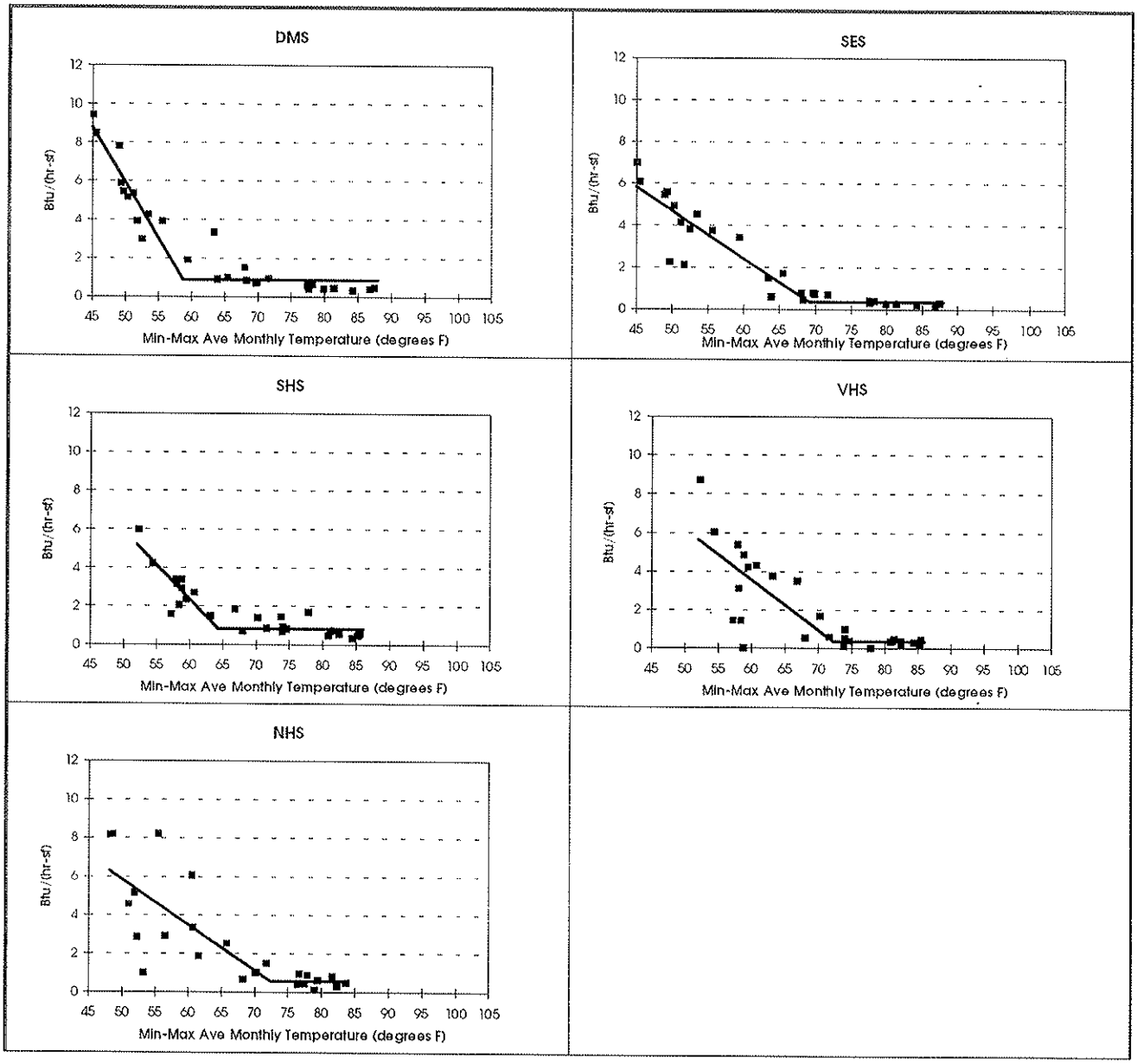


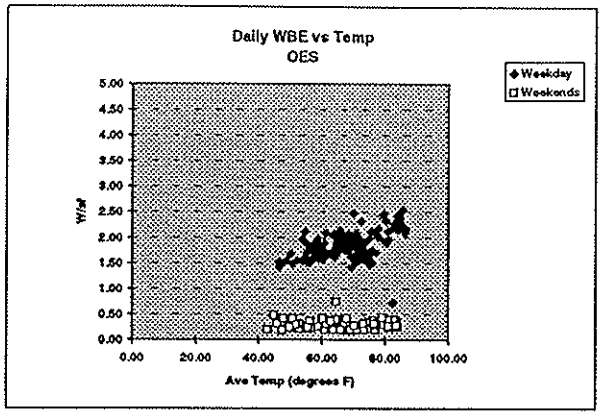

DMS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
SES
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
SHS
Ave W/sf
Min-Max Ave Monthly Temperature (degrees F)
VHS
Ave W/sf
Min-Max Ave Monthly Temperature (degrees F)
NHS
Ave W/sf
Min-Max Ave Monthly Temperature (degrees F)
CMS
Ave W/sf
Min-Max Ave Monthly Temperature (degrees F)

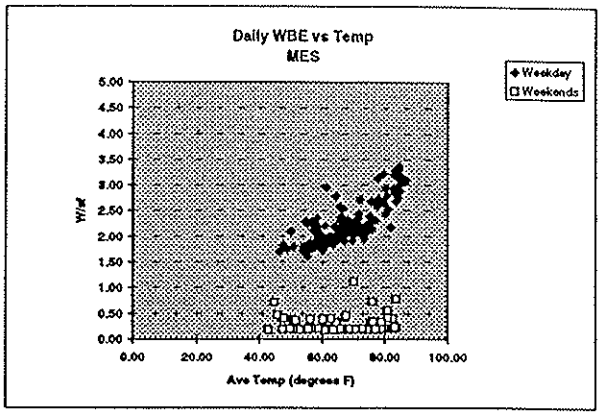

NHS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
CMS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
SES
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
DMS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
SHS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
VHS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)

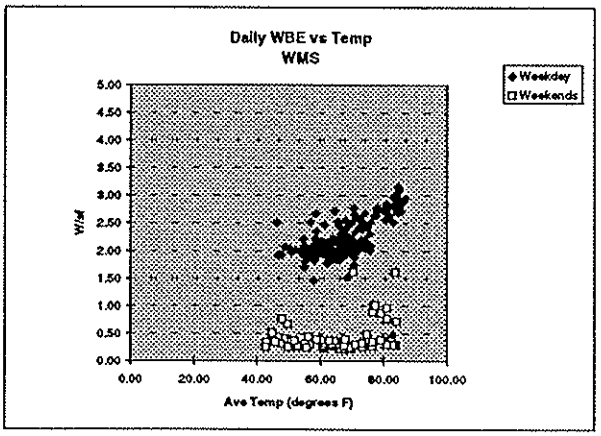

OES
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
Sch Yr
Sch Yr - 3 P
Summer
Summer - Mean
WMS
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
PES
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
MES
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)
RES
AveW/sf
Min-Max Ave Monthly Temperature (degrees F)

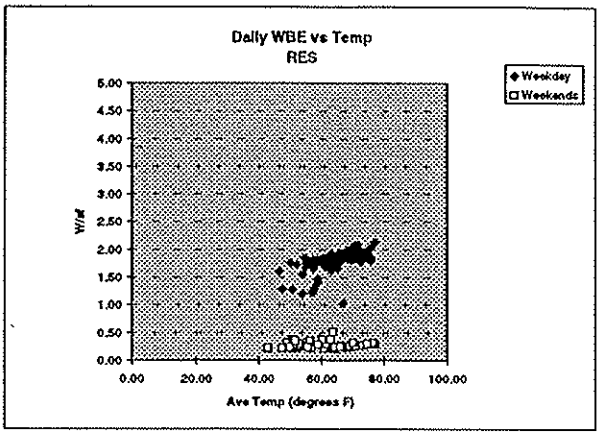

OES
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
WMS
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
PES
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
MES
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
RES
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)

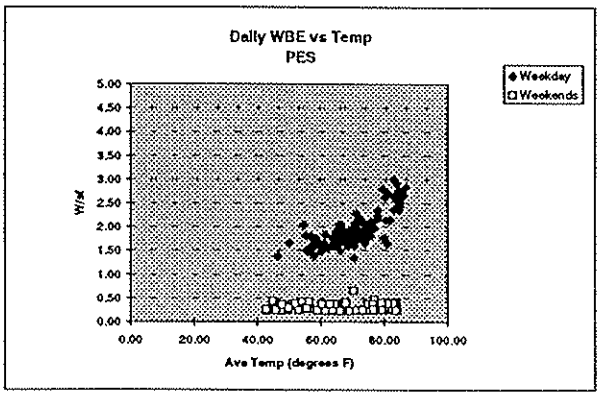

DMS
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
SES
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
SHS
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
VHS
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)
NHS
Btu/(hr-sf)
Min-Max Ave Monthly Temperature (degrees F)

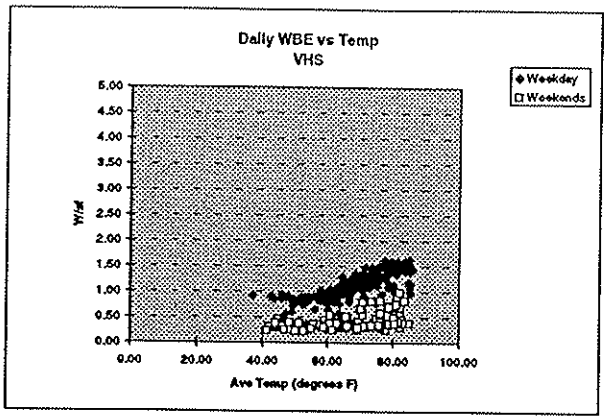

Daily WBE vs Temp
OES
Weekday
Weekends
W/sf
Ave Temp (degrees F)

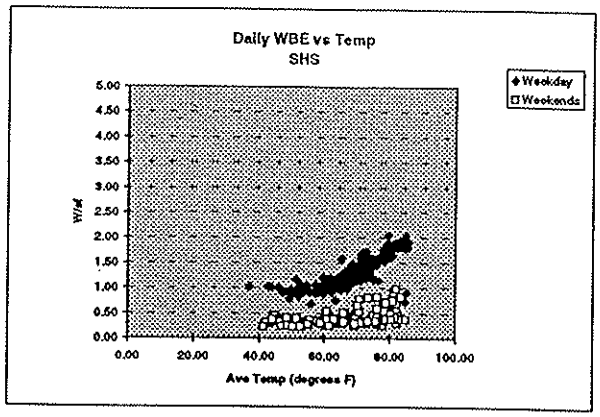

Daily WBE vs Temp
MES
Weekday
Weekends
W/sf
Ave Temp (degrees F)

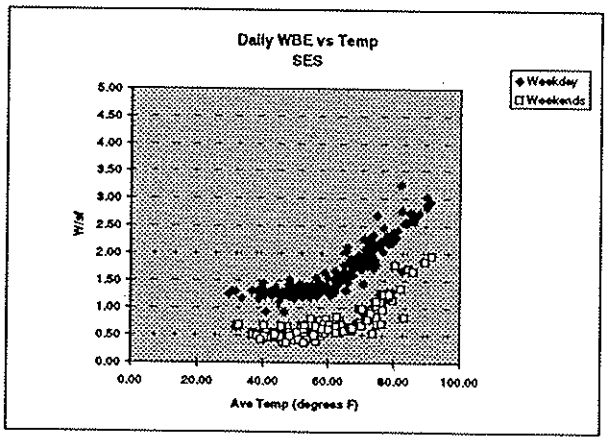

Daily WBE vs Temp
WMS
Weekday
Weekends
W/sf
Ave Temp (degrees F)

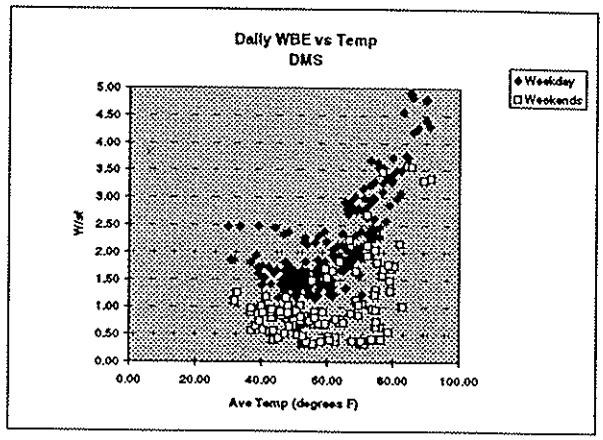

Daily WBE vs Temp
RES
Weekday
Weekends
W/sf
Ave Temp (degrees F)

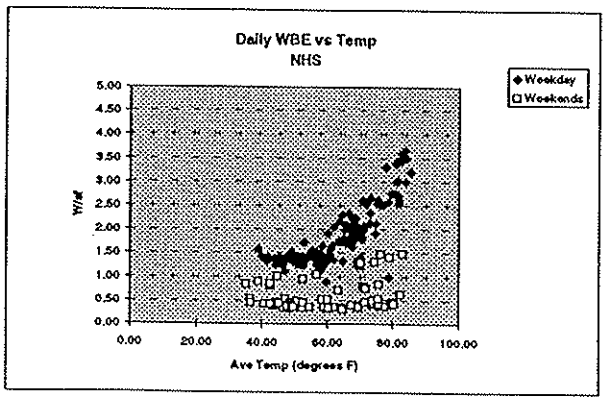

Daily WBE vs Temp
PES
Weekday
Weekends
W/sf
Ave Temp (degrees F)

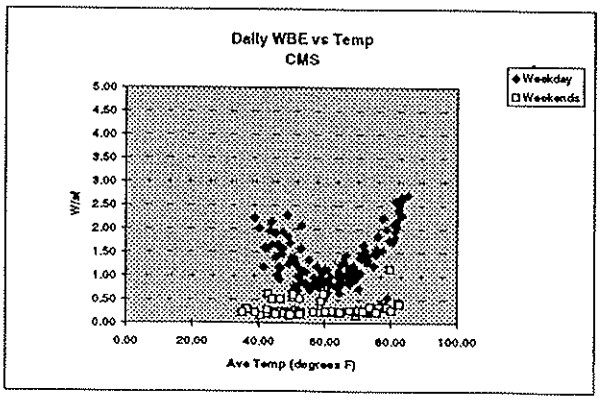

Daily WBE vs Temp
VHS
Weekday
Weekends
W/sf
Ave Temp (degrees F)


Daily WBE vs Temp
SHS
Weekday
Weekends
W/sf
Ave Temp (degrees F)


Daily WBE vs Temp
SES
Weekday
Weekends
W/sf
Ave Temp (degrees F)


Daily WBE vs Temp
DMS
Weekday
Weekends
W/sf
Ave Temp (degrees F)


Daily WBE vs Temp
NHS
Weekday
Weekends
W/sf
Ave Temp (degrees F)


Daily WBE vs Temp
CMS
Weekday
Weekends
W/sf
Ave Temp (degrees F)

Annual

	1	2	3	4
School	Area	Peak WBE	Ave WBE	Natural Gas
	sf	W/sf (VA/sf*)	W/sf	(Btu/hr-sf)
Chamberlain	66,778	4.00	0.98	XXXXX
Dunbar	92,884	4.52	1.67	2.34
Morgan *	76,798	6.38	1.30	2.15
Nacogdoches	202,515	2.16	1.39	2.86
Oppe *	80,400	6.20	1.13	4.45
Parker *	81,742	5.89	1.07	0.27
Rosenberg *	63,044	4.27	0.90	1.19
Sims	62,400	3.28	1.36	2.35
Stroman	210,474	2.73	0.80	1.68
Victoria	257,014	3.12	0.92	2.37
Weis *	80,769	5.54	1.26	1.78
Average	115,902	4.37	1.18	2.14

Monthly

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	School -yr		*School -yr*		*Jun-Jul*		*Summer*		*School -yr*	*School -yr*	*School -yr*	*School -yr*	*School -yr*	*School -yr*	*Summer*	*Summer*
School	Peak WBE	std-dev	Ave WBE	std-dev	Peak WBE	std-dev	Ave WBE	std-dev	Base Level WBE	Base Level WBE	Cooling Slope	Cooling Slope	Change Pt Temp	Whole Model	Base Level WBE	Whole Model
	W/sf (VA/sf*)		W/sf		W/sf (VA/sf*)		W/sf		W/sf	CV		CV	degrees F	CV	W/sf	CV
Chamberlain	5.68	0.80	1.02	0.28	4.36	1.43	0.82	0.47	0.88	0.04	0.11	0.01	71.43	0.12	0.80	0.34
Dunbar	6.90	1.08	1.84	0.60	5.25	1.19	2.35	0.60	1.30	0.09	0.08	0.01	56.92	0.13	2.38	0.28
Morgan *	9.06	1.47	1.60	0.29	6.68	0.57	1.07	0.19	1.34	0.06	0.05	0.01	63.51	0.30	0.98	0.44
Nacogdoches	4.83	0.68	1.48	0.36	3.66	0.73	1.27	0.57	1.07	0.06	-0.07	0.01	74.78	0.13	1.25	0.53
Oppe *	8.11	1.48	1.35	0.37	7.29	1.74	0.79	0.31	1.15	0.06	0.29	0.01	62.81	0.12	0.75	0.56
Parker *	7.43	1.47	1.42	0.27	7.45	1.86	0.82	0.25	1.05	0.06	0.05	0.01	62.28	0.11	0.79	0.35
Rosenberg *	5.34	0.74	1.28	0.23	4.90	1.29	0.40	0.23	0.92	0.16	0.04	0.03	59.63	0.80	0.36	0.35
Sims	5.38	0.75	1.37	0.36	3.78	0.99	1.61	0.26	1.00	0.05	0.05	0.00	56.92	0.14	1.00	0.10
Stroman	3.37	0.30	1.02	0.19	2.38	0.54	0.76	0.17	0.77	0.03	0.03	0.00	61.61	0.10	0.74	0.29
Victoria	4.37	0.62	0.87	0.26	2.45	1.04	0.67	0.27	0.65	0.02	0.02	0.00	57.14	0.08	0.62	0.07
Weis *	9.71	1.31	1.65	0.31	7.29	2.14	0.66	0.39	1.34	0.07	0.05	0.01	63.51	0.21	0.70	0.16
Average	6.38	0.97	1.36	0.32	5.04	1.23	1.02	0.34	1.04	0.065	0.08	0.008	62.78	0.203	0.94	0.316

Monthly

	21	22	23	24	25	26	27	28	29
	All -yr		*All -yr*		*All -yr*	*All -yr*			
School	Base Level Natural Gas	Base Level Natural Gas	Hesting Slope	Hesting Slope	Change Pt Temp.	Whole Model	ELF	OLF	PLF
	(Btu/hr-sf)	CV		CV	degrees F	CV			
Chamberlain							0.27	0.40	0.19
Dunbar	0.89	0.19	-0.57	0.03	58.73	0.29	0.24	0.33	0.19
Morgan	0.27	0.18	-0.16	0.01	79.64	0.31	0.30	0.37	0.24
Nacogdoches	0.57	0.44	-0.23	0.04	72.38	0.62	0.24	0.35	0.18
Oppe	1.63	0.90	-0.20	0.05	86.23	0.54	0.24	0.37	0.20
Parker	0.09	0.03	-0.09	0.01	64.49	0.49	0.35	0.40	0.23
Rosenberg	0.17	0.16	-0.10	0.01	78.98	0.51	0.30	0.32	0.24
Sims	0.38	0.21	-0.23	0.02	68.89	0.36	0.26	0.27	0.24
Stroman	0.84	0.13	-0.35	0.03	64.29	0.34	0.25	0.37	0.17
Victoria	0.37	0.35	-0.26	0.04	72.26	0.73	0.39	0.44	0.17
Weis	0.28	0.18	-0.17	0.02	76.35	0.40	0.40	0.44	0.20
Average	0.55	0.277	-0.24	0.025	72.23	0.460	0.29	0.37	0.20

Daily

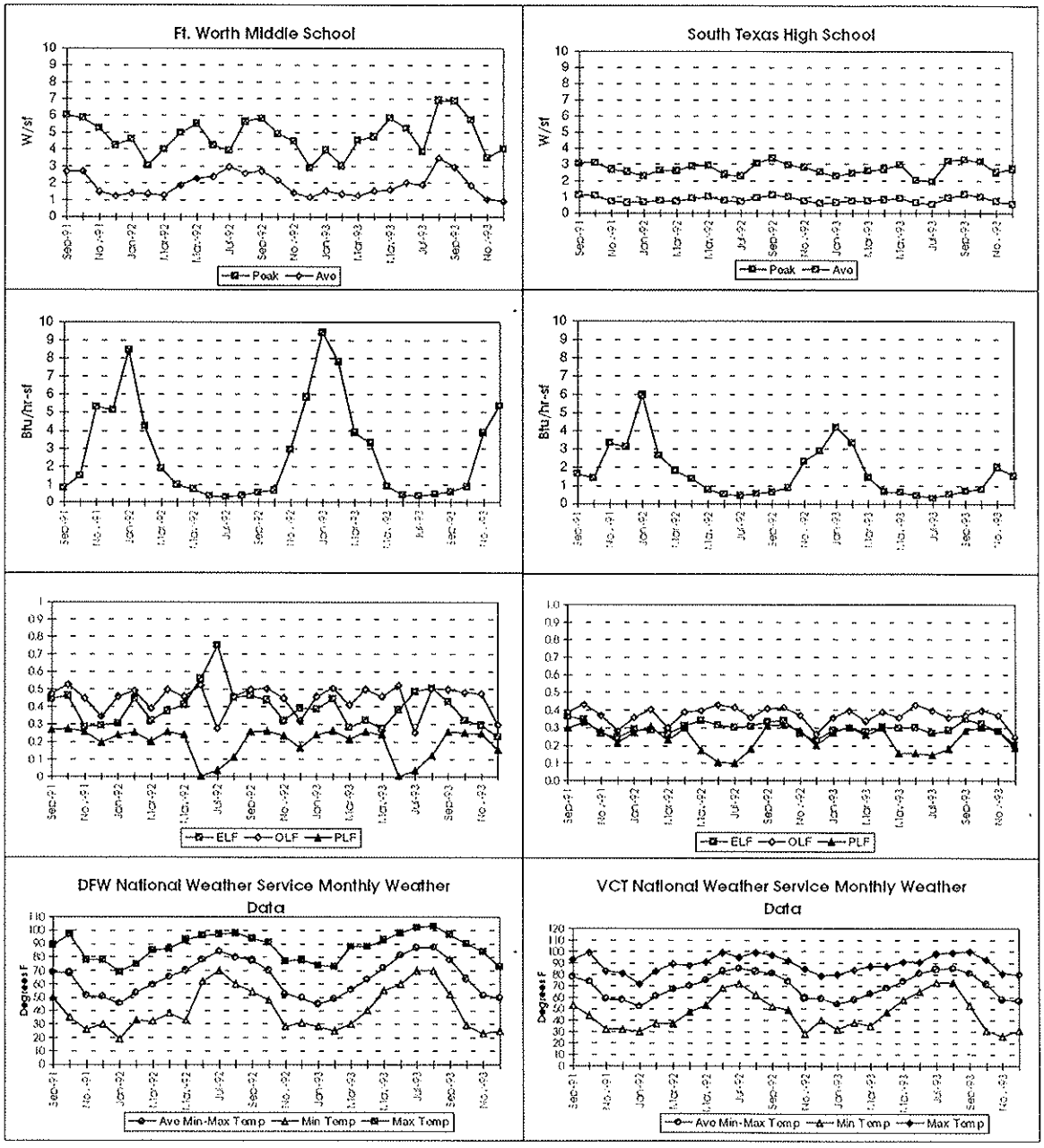
	30	31	32	33	34	35	36	37	38	39	40	41
	School -yr	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***	***School -yr***
	Weekday	*Weekday*	*Weekend*	*Weekend*	*Weekday*	*Weekday*	*Weekday*	*Weekday*	*Weekday*	*Weekday*	*Weekend*	*Weekend*
School	Ave WBE Weekday	std-dev	Ave WBE Weekend	std-dev	Base Level WBE	Base Level	Cooling Slope	Cooling Slope	Change Pt Temp.	Whole Model	Base Level WBE	Whole Model
	W/sf		W/sf		W/sf	CV		CV	degrees F	CV	W/sf	CV
Chamberlain	1.32	0.51	0.31	0.18	0.99	0.04	0.25	0.03	77.59	0.46	0.71	0.80
Dunbar	2.19	0.84	1.04	0.63	1.30	0.05	0.09	0.01	60.27	0.36	1.45	0.67
Morgan	2.18	0.46	0.27	0.17	0.75	0.15	0.42	0.01	43.32	0.48	1.03	0.89
Nacogdoches	1.87	0.62	0.57	0.31	1.07	0.07	0.07	0.01	60.52	0.42	1.15	0.64
Oppe	1.82	0.29	0.28	0.13	0.79	0.12	0.03	0.00	43.32	0.46	0.91	0.82
Parker	1.92	0.39	0.29	0.09	0.51	0.15	0.04	0.01	43.32	0.45	0.90	0.83
Rosenberg	1.76	0.21	0.27	0.06	0.58	0.16	0.04	0.01	43.13	0.46	0.87	0.86
Sims	1.66	0.49	0.72	0.33	0.98	0.04	0.05	0.00	56.53	0.35	1.13	0.55
Stroman	1.28	0.35	0.43	0.18	0.73	0.04	0.03	0.00	60.29	0.47	0.82	0.61
Victoria	1.09	0.27	0.39	0.14	0.36	0.07	0.02	0.00	37.73	0.45	0.72	0.53
Weis	2.20	0.37	0.40	0.28	0.92	0.16	0.04	0.01	43.32	0.48	1.21	0.75
Average	1.75	0.44	0.45	0.23	0.82	0.096	0.10	0.007	51.76	0.440	0.99	0.72

Daily

	42	43	44	45	46	47	48	49
	Summer	***Summer***	***Summer***	***Summer***	***Summer***	***Summer***	***Summer***	***Summer***
	Weekday	*Weekday*	*Weekend*	*Weekend*	*Weekday*	*Weekday*	*Weekend*	*Weekend*
School	Ave WBE Weekday	std-dev	Ave WBE Weekend	std-dev	Base Level WBE	Whole Model	Base Level WBE	Whole Model
	W/sf		W/sf		W/sf	CV	W/sf	CV
Chamberlain	0.91	0.52	0.60	0.52	0.97	0.49	0.63	0.95
Dunbar	2.53	0.46	1.91	0.76	2.38	0.19	1.82	0.42
Morgan	1.38	0.51	0.30	0.37	1.36	0.39	0.32	1.13
Nacogdoches	1.53	0.65	0.65	0.28	1.46	0.45	0.70	0.61
Oppe	0.93	0.48	0.46	0.51	0.92	0.52	0.45	1.09
Parker	1.02	0.42	0.32	0.11	1.02	0.43	0.33	0.36
Rosenberg	0.48	0.15	0.21	0.07	0.53	0.51	0.21	0.34
Sims	1.69	0.31	1.43	0.33	1.63	0.23	1.36	0.29
Stroman	0.92	0.24	0.47	0.12	0.87	0.22	0.46	0.22
Victoria	0.82	0.19	0.33	0.07	0.77	0.24	0.32	0.22
Weis	0.80	0.62	0.32	0.34	0.80	0.78	0.40	1.20
Average	1.18	0.41	0.63	0.32	1.16	0.405	0.64	0.620

Example evaluation of two schools using the graphs

Figure 1: *Monthly Power Level indices for two schools.* The left graphs (a) are for the Fort Worth Middle School. The left graphs (a) are for the South Texas High School. Graph 1a and 1b are Electricity Power Levels. Graph 2a and 2b are Natural Gas Power Levels. Graph 3a and 3b are ELF, OLF, and PLF. Graphs 4a and 4b are min, max, and min-max ave dry bulb temp. from the NWS



PRESCREENING PROCEDURES FOR SCHOOL BUILDINGS

VALUE OF THE WORK:

- Prescreening indices can provide a utility with a useful tool for scanning the customer data base for likely candidates for energy conservation retrofits.

- Prescreening indices can help provide a minimum analysis level for all customer screening.

- Advanced prescreening indices can actually begin to recommend specific advice for likely retrofits.

THE U.S.D.O.E. FORRESTAL BUILDING LIGHTING RETROFIT:

PRELIMINARY ANALYSIS OF ELECTRICITY SAVINGS

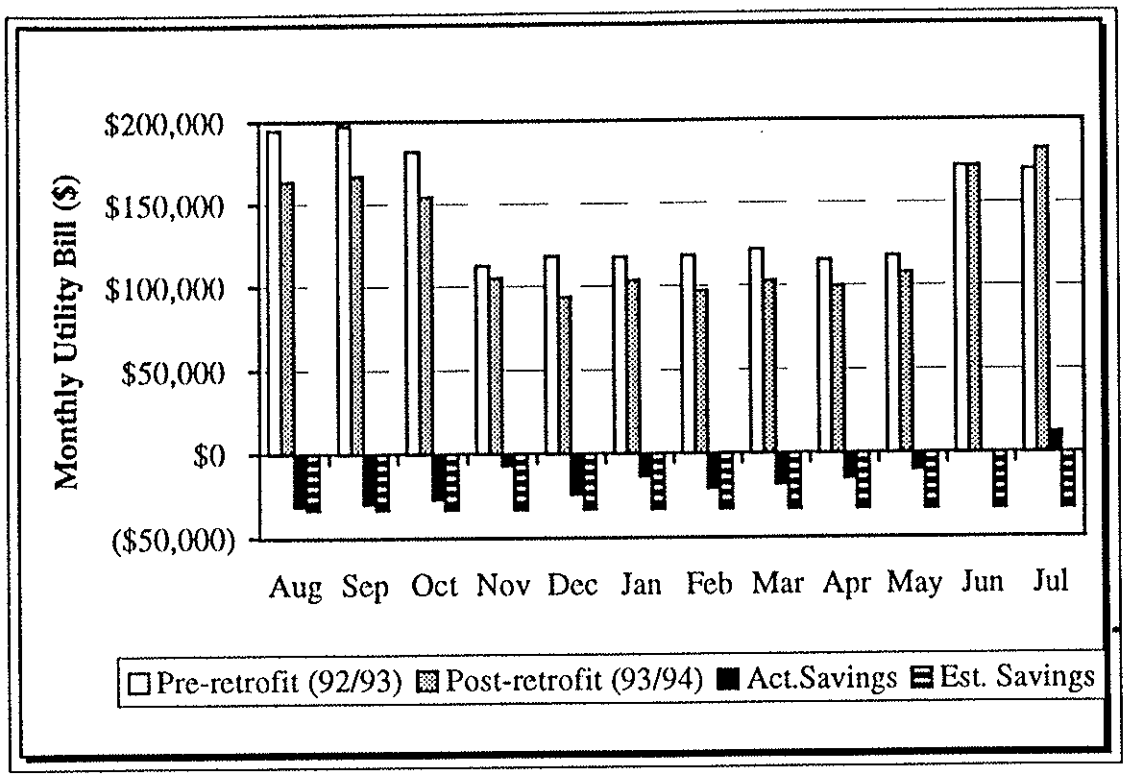
Jeff Haberl, Tarek Bou Saada

Energy Systems Laboratory
Texas A&M University
College Station, TX 77843-3123

E. James Vajda, Mike Shincovich,
Louis A. D'Angelo III,
Louis Harris

Federal Energy Management Program,
United States Department of Energy,
Washington, D.C., 20585

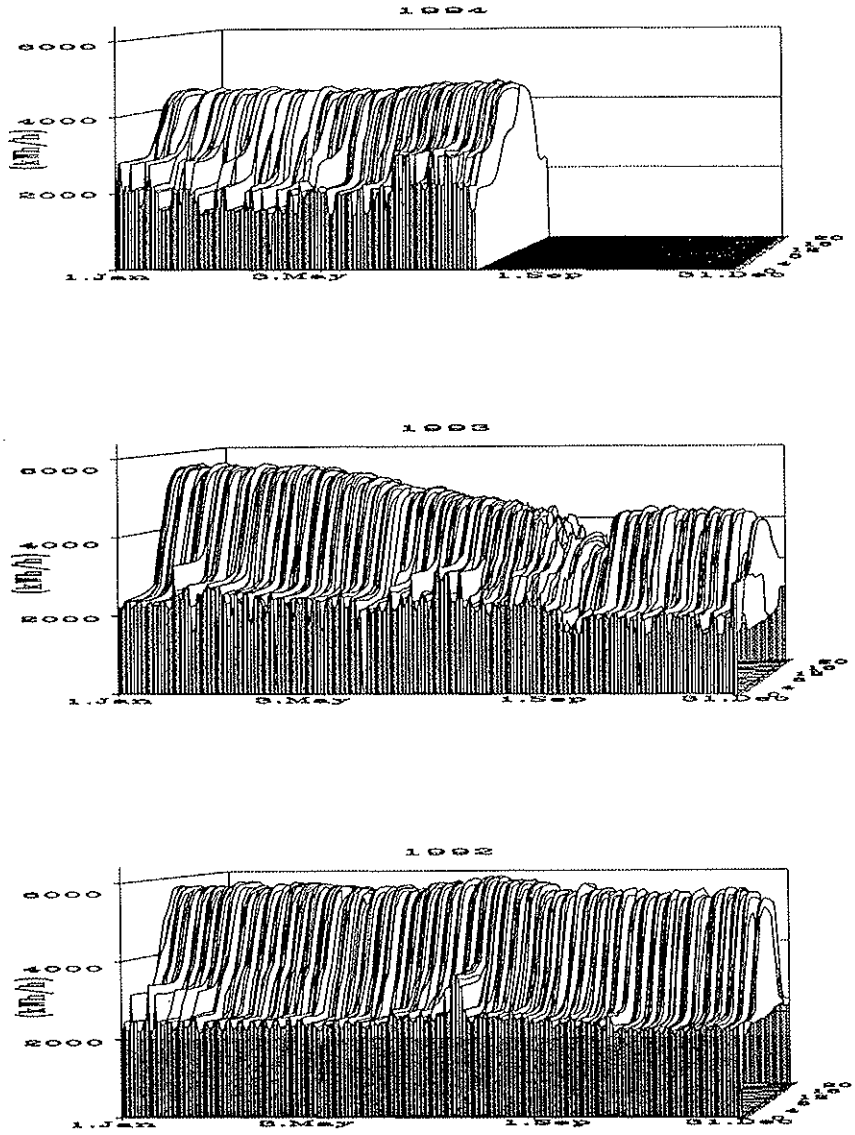
SIGNIFICANCE OF MEASURING THE SAVINGS



- Cost savings do not always result from unadjusted comparisons of utility bills.
- Unadjusted utility costs for the Forrestal complex shown above from August 1992 - July 1993, and August 1993 - July 1994.
- None of the months showed savings that equaled or exceeded the estimated $33,256 monthly savings.

RESULTS

WHOLE-BUILDING ELECTRICITY USE FOR THE DOE FORRESTAL COMPLEX.



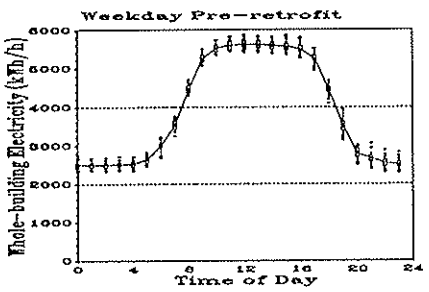
- Prior to the retrofit in 1993 the whole-building electricity profiles were very uniform.
- Exceptions are few days during the year when air-handling units were run longer than normal during severe winter and summer conditions.

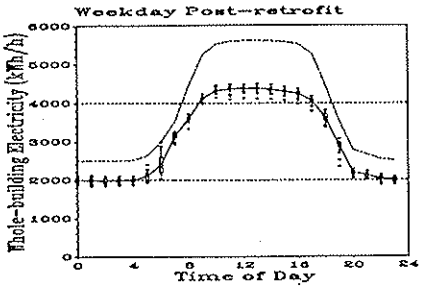
METHODOLOGY (Cont.)

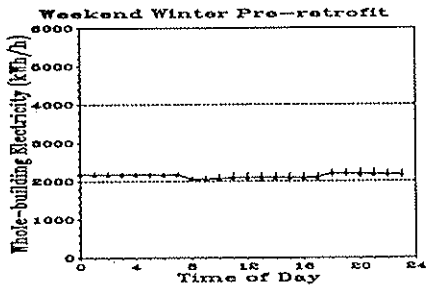
- Non-weather-dependent procedure calculates a baseline statistical model of the 1992 non-weather dependent energy use using 24-hour, weekday-weekend hourly profiles.

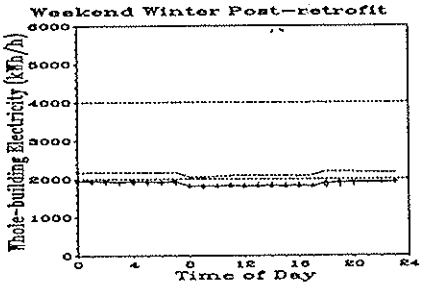
- The hourly electricity savings were then calculated by forecasting the baseline electricity use into the post-retrofit period and summing the hourly differences between the pre-retrofit and post-retrofit models.

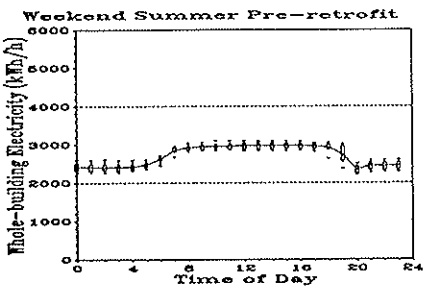
RESULTS

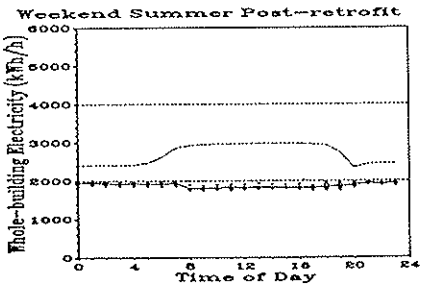






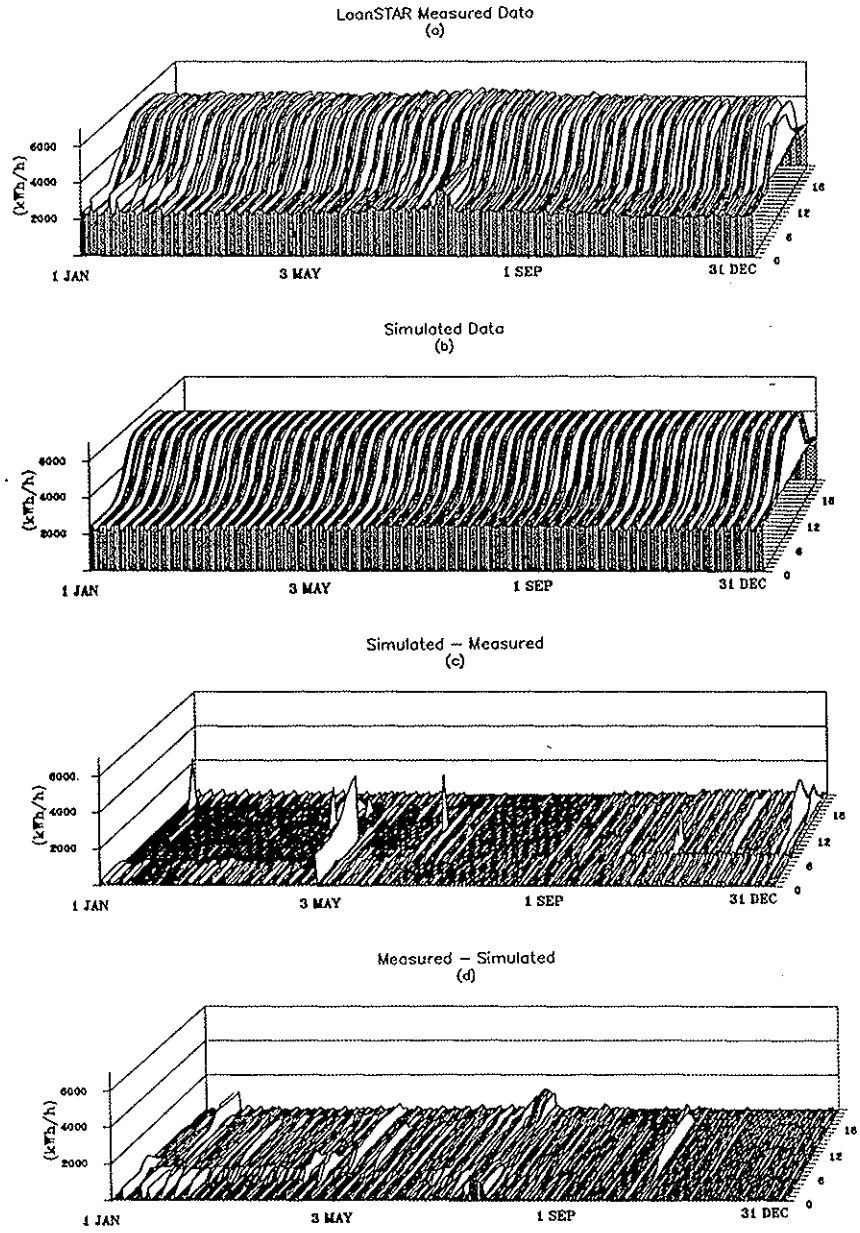






- Modeling the whole-building electricity use required three non-weather dependent 24-hour daytype profiles:
  1. a weekday profile (i.e., the upper plot),
  2. a winter weekend profile (middle plot), and
  3. a summer weekend profile (lower plot).

RESULTS (Cont.)



- Small inter-quartile range for bins and CV(RMSE) of 6.22% indicated a good model.

- RMSE of 208.75 kWh/h 31 indicated that the model was capable of measuring the estimated 1,300 kW demand savings.

RESULTS (Cont.)

Savings Comparison:

- The estimated savings are 6.149 million kWh per year.
- The estimated demand reduction is 1,300 kW.
- The savings calculated by simply comparing the utility bills for the 12 month period was 5,532 million kWh (NOTE: these reflect the utility's corrected readings).
- The savings calculated using the pre-post daytypes for the 12 month period from August 1993 to July 1994 are 5.566 million kWh. (90% of the estimated savings).
- The measured 15-minute demand savings varied from a low of 959.0 kW to a high of 1,186.6 kW (68 to 91% of estimated demand reductions)
- The comparison of pre-post model's hourly CV(RMSE) of 6% to 8% against the annual electricity reduction of 20% indicates that the level of savings is above the statistical noise of the measurement method.

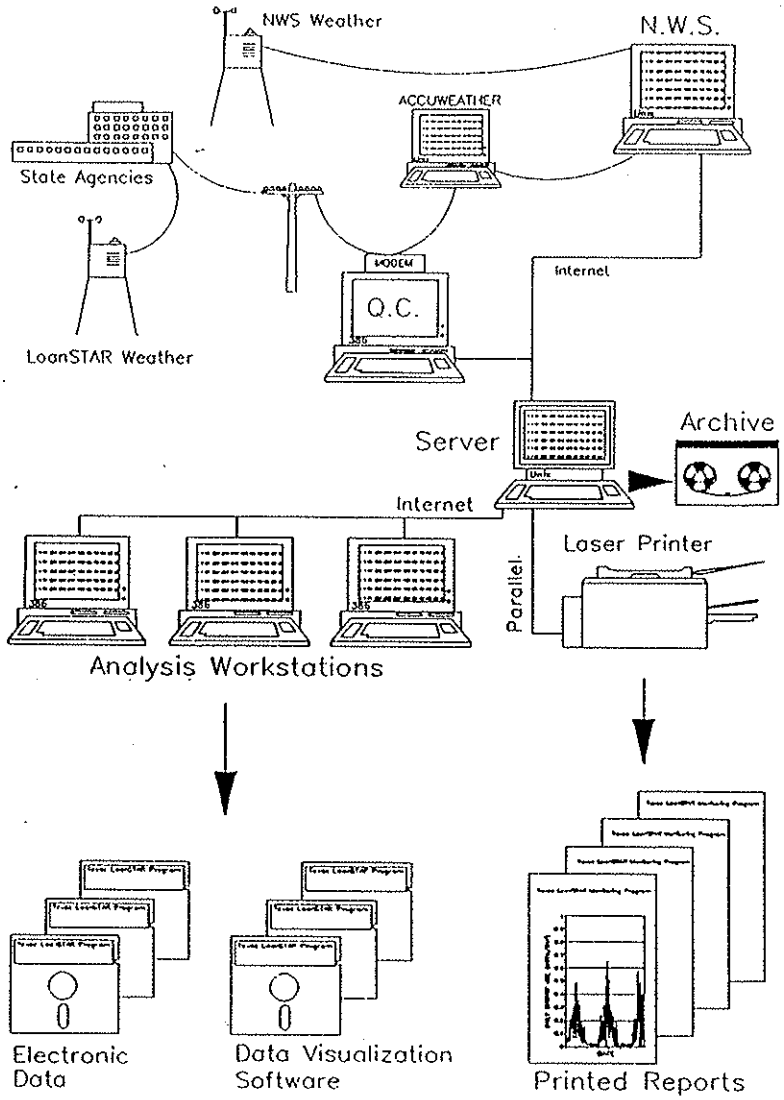
DISCUSSION

- In the case of the Forrestal building differences in the utility's month to month unit cost factors and billing adjustments obscured the monetary retrofit savings.

- Comparisons of unadjusted utility billing costs may not be sufficient to measure savings from lighting retrofits.

- Utility revenue meters can fail. Therefore it is recommended that redundant meters be used.

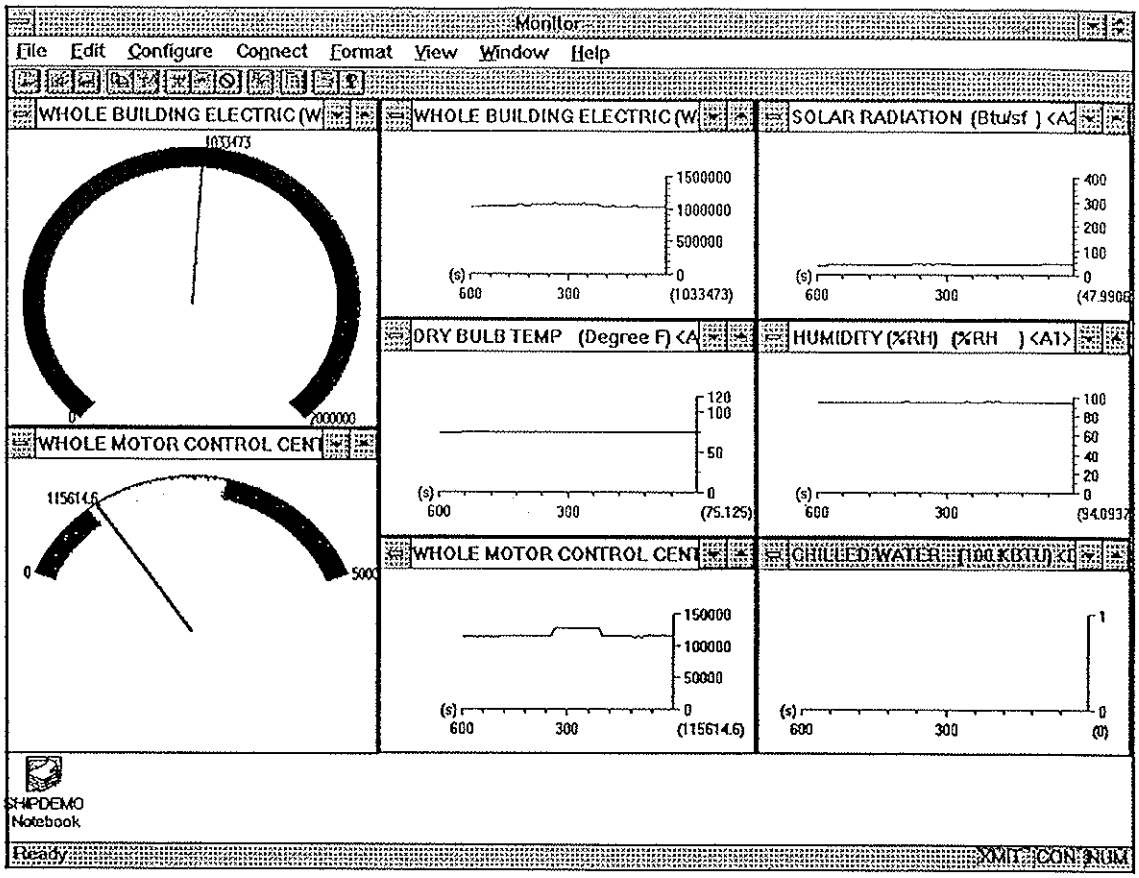
- Weekly inspection of the metered data proved invaluable in finding and fixing the broken meters quickly.



THE LOANSTAR DATA PROCESSING NETWORK

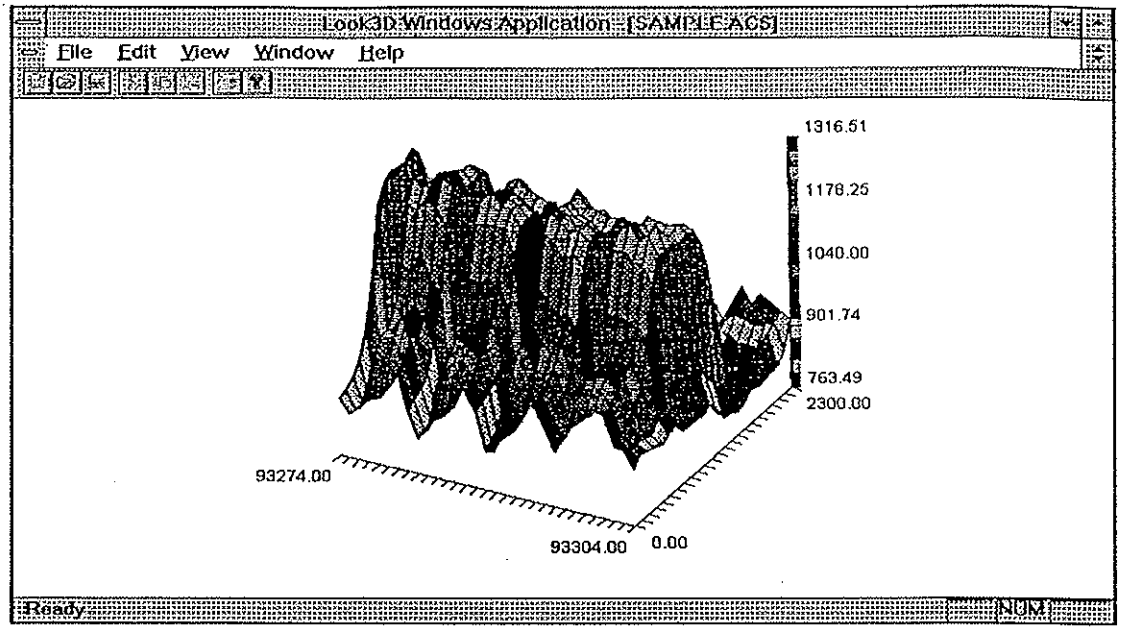
The LoanSTAR data processing network collects data each week from 71 loggers located around the state of Texas. Data are checked and archived on a Unix server with 2.5 gigabytes of disk storage and made available to PC-based and Unix-based analysis work stations located around Texas A&M University.

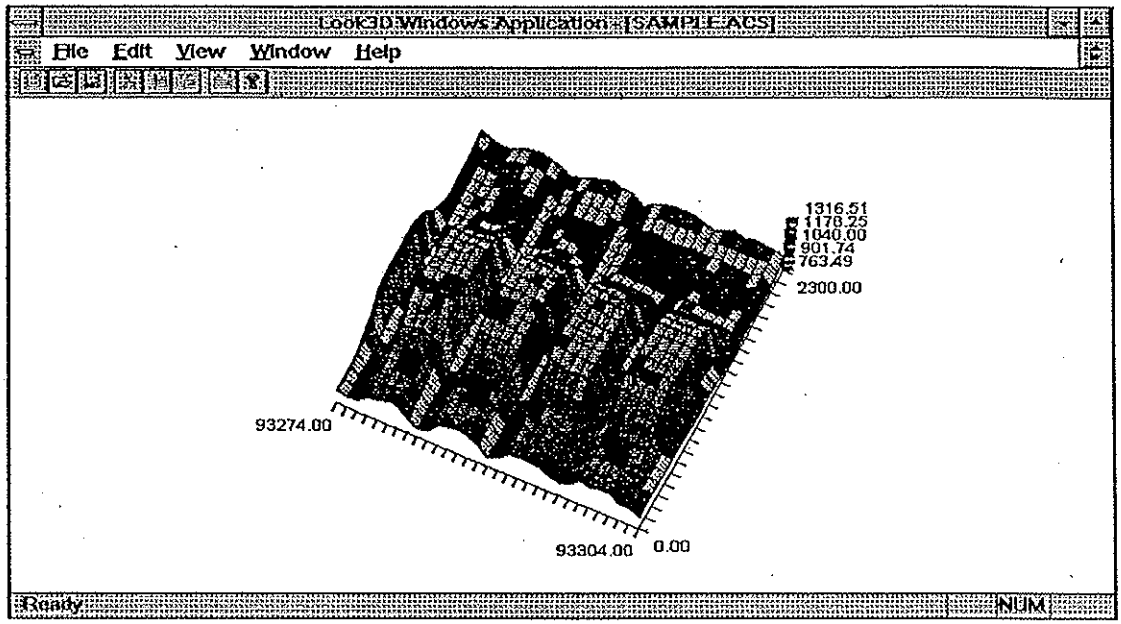
A major effort of the LoanSTAR program has been the reporting of savings and results in the form of printed monthly reports, and data in electronic form for browsing. The LoanSTAR program also maintains a home page on the World Wide Web where visitors can graphically browse through the data in the data base.



ESL'S C180 MONITOR v 0.05a

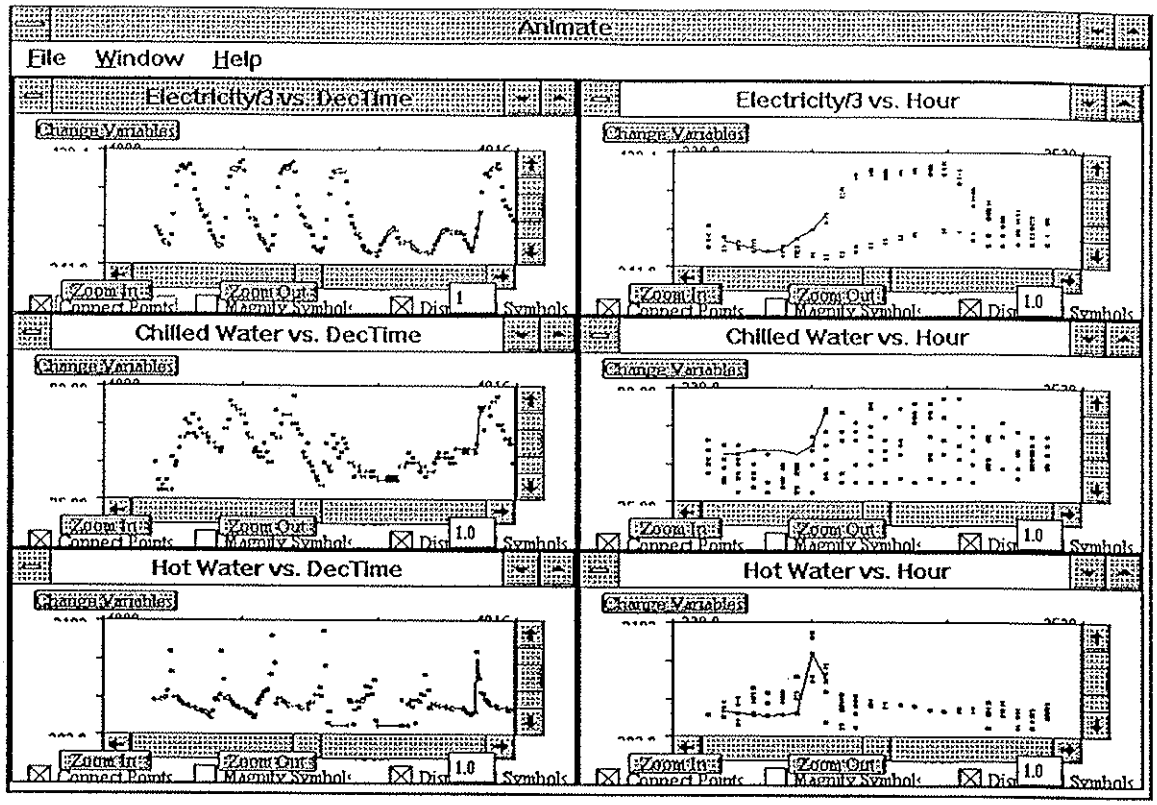
The C180 MONITOR is the ESL's new MS Windows-based software that allows for remote graphical browsing of real time data from a Synergistics C180 located in the field. With the C180 MONITOR the analyst can easily view all end-use channels at a site without leaving his desk or having to wait while data is downloaded and transferred to another software package for viewing. The C180 MONITOR also comes with a notebook feature that allows the graphical setup for a site to be developed once and then saved for later use. No extra files are needed for the C180 since it reads the Synergistics C180 parameter sets.



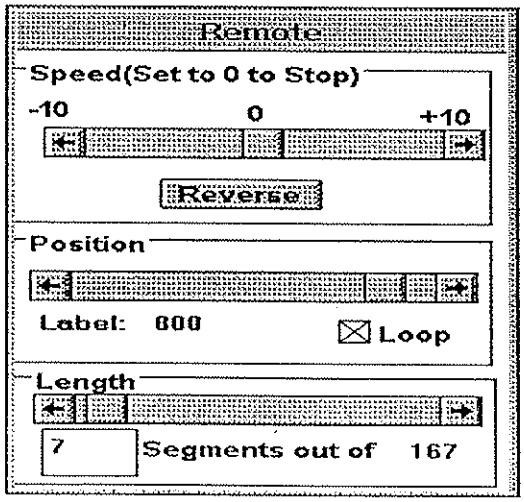


ADVANCED DATA VIEWING: ESL'S LOOK3D

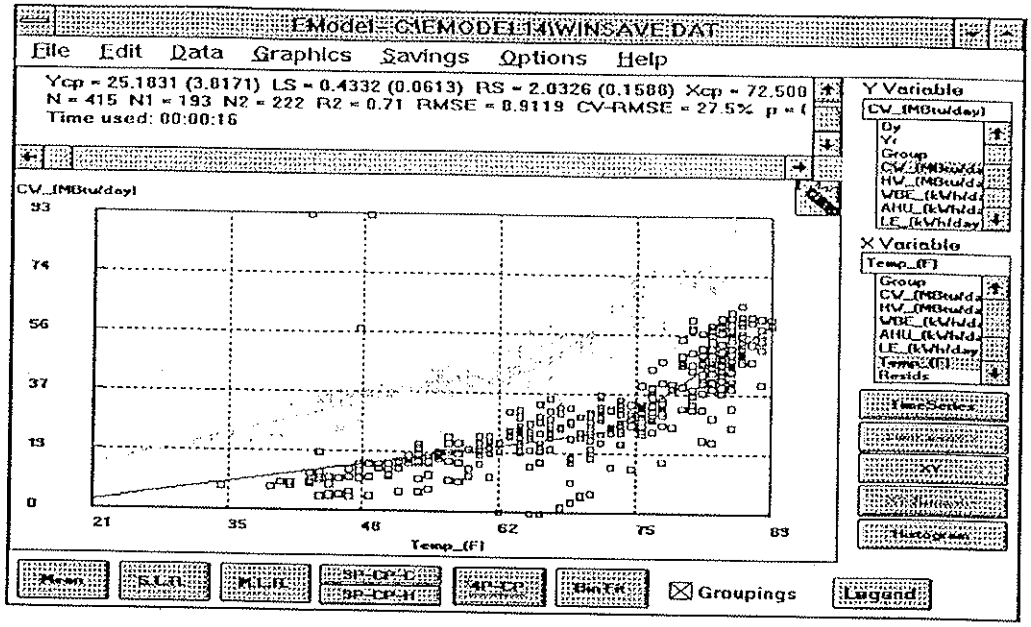
The ESL's LOOK3D is an MS Windows based data exploration software for viewing and analyzing two and three dimensional color views of end-use data. LOOK3D operates on columnar ASCII data and generates 3-D plots in any rotation or viewing angle. Using LOOK3D an analyst can easily browse through data from a larger data base in a 3-D format.

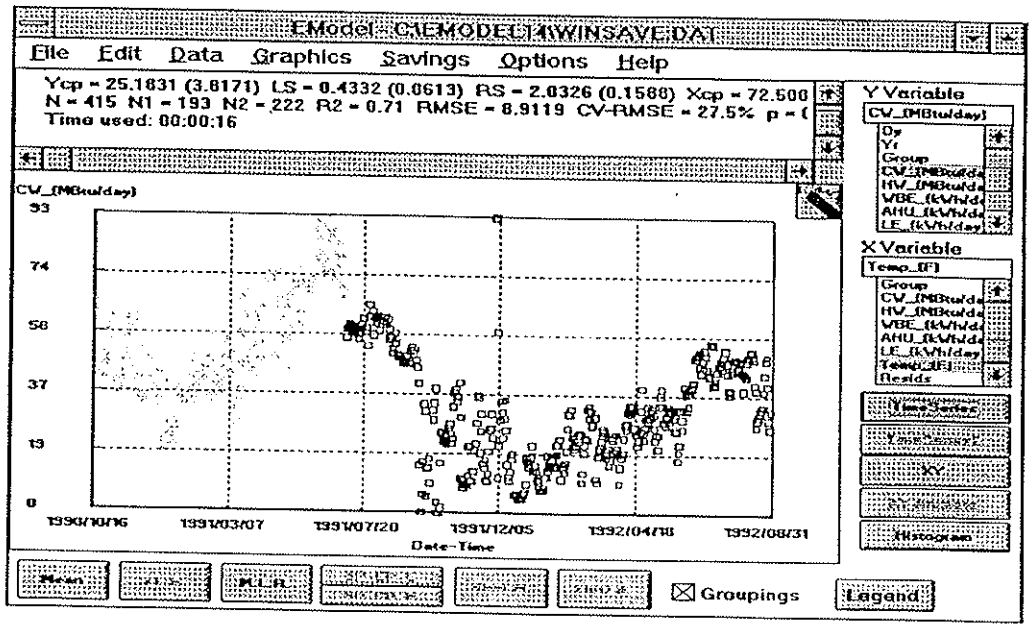


ADVANCED DATA VIEWING AND END-USE DATA ANALYSIS: ANIMATE



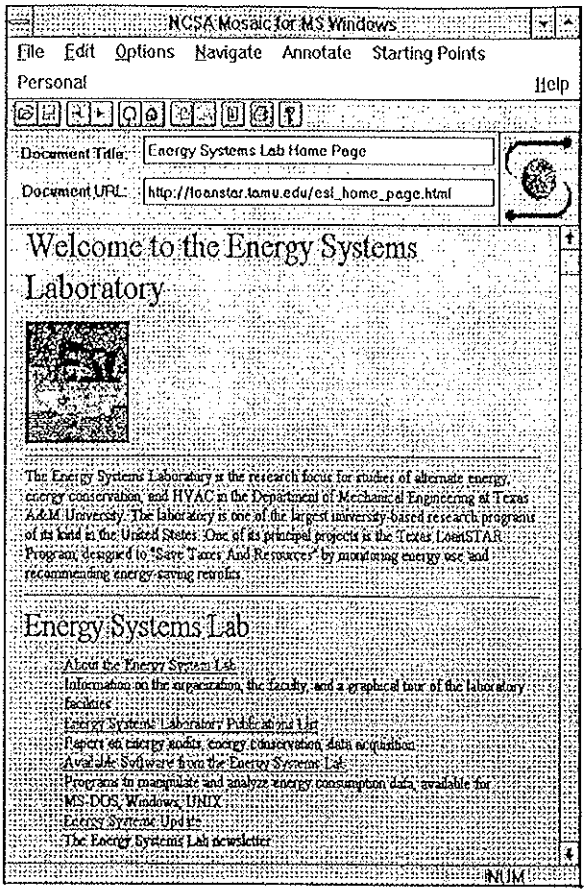
ANIMATE is the ESL's MS Windows-based data exploration software for the time-synchronized viewing and analysis of multiple channels of end-use data. ANIMATE operates on columnar ASCII data and a heading file and comes with a notebook feature so that previous setups can be saved for rapid reloading.

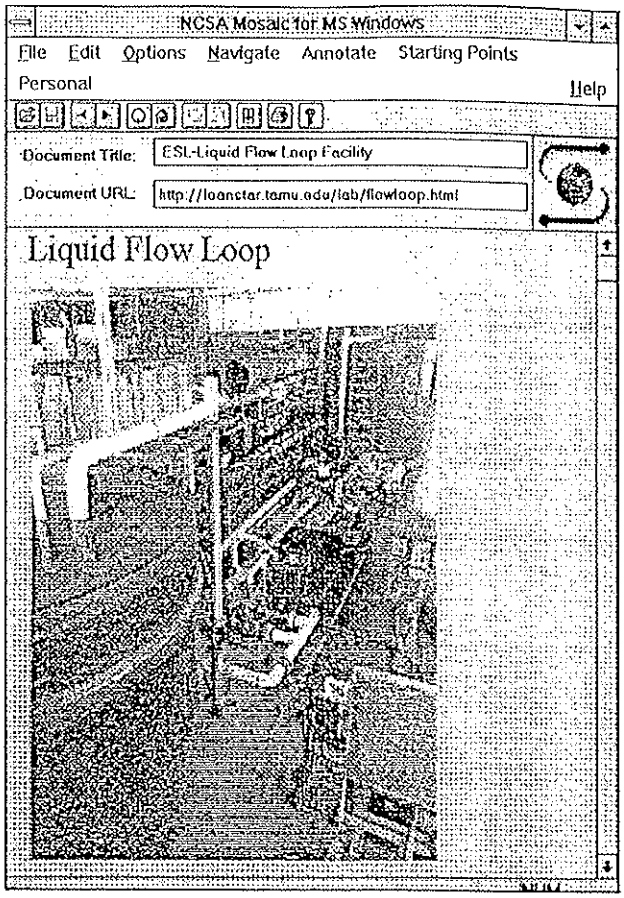




RETROFIT SAVINGS MEASURMENT: EMODEL

EMODEL is the ESL's MS Windows based retrofit savings analysis toolkit that is capable of performing linear, change-point linear (3 and 4 parameter), multiple regression and bin analysis on columnar ASCII data. EMODEL also records every keystroke and reports goodness of fit parameters in a log file to allow for traceablility of an analysis. EMODEL can be linked to the ESL's Animate to provide animated viewing displays.





LOANSTAR HOME PAGE ON THE WORLD WIDE WEB

The Texas LoanSTAR program has also developed and maintains a home page on the World Wide Web (WWW). The WWW is the Internet-accessible information network available which originated from CERN in Switzerland. The WWW allows for worldwide access to hypertext and multimedia information.The ESL uses the Mosaic software package--just one of the tools available to access the WWW. The LoanSTAR home page has been designed to allow users to interactively learn about the program and browse through the database.

VALUE OF TEXAS LOANSTAR PROGRAM TO HL&P

- Advanced graphical reports can provide value-added customer feedback.
- Utility coordinated O&M program can help retain loyal HL&P customers.
- Thermal storage screening indices can help HL&P assure customers of effective thermal storage projects.
- Standardized analysis of residential and commercial customer energy conservation retrofits can assure proper allocation of customer programs.
- Prescreening indices can help determine likely candidates for energy conservation retrofits and suggest retrofits.

SUMMARY:

- Overview of the Texas LoanSTAR Program
- LoanSTAR Analysis Procedures, O&M Procedures, Software & Publications
- Evaluation of Thermal Storage Systems
- Analysis of Residential Retrofits for the TDOH
- Prescreening Procedures for School Buildings
- Lighting Retrofit Analysis Measurement Procedures & Calibrated DOE-2 Modeling