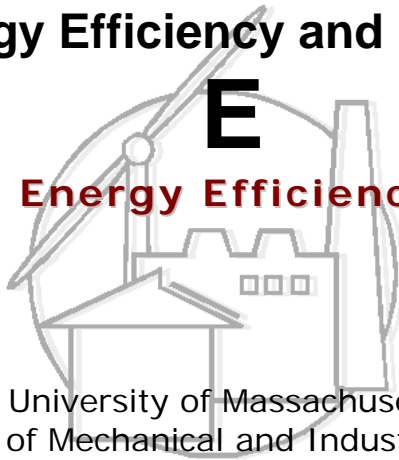


**Center for Energy Efficiency and Renewable Energy**

**C E E R E**

**Building Energy Efficiency Program**



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**Analysis of energy performance of selected fenestration  
systems in commercial buildings**

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June 26, 2003

## Introduction

This study is done in eQuest ver 3.24. The detailed input assumptions have been given in Appendix. The following variations have been considered in this study:

### Climates:

1. Miami
2. Anchorage
3. Atlanta

### Building Types

- |                              |                         |         |
|------------------------------|-------------------------|---------|
| 1. Office Building, highrise | 250,000 ft <sup>2</sup> | 8 story |
| 2. High-rise residential     | 72,000 ft <sup>2</sup>  | 8 story |
| 3. School, College/univ      | 250,000ft <sup>2</sup>  | 4 story |

### Windows

#### a. Glazing

S.No.	Glazing	Fill gas	U	SHGC	Initial cost (1997) \$/sf		
					Alum w/o bk	Alum w/ bk	Renf'd vinyl
1	Double clear	Air	0.48	0.76	3.93	5.88	9.13
2	Double Green	Air	0.48	0.57	4.43	6.38	9.63
3	Double lowE Pye (e2=0.1)	Arg	0.27	0.54	5.23	7.18	10.43
4	Double lowE Spe (e2=0.04)	Arg	0.25	0.39	5.88	7.83	11.08
5	Triple lowe (film)	Air	0.22	0.51			\$15.17

Note: 3mm glass panes with 12.7mm gap is used in all the glazing

#### b. Frames

1. Alum w/o brk mtl spacer
2. Alum w/ brk mtl spacer
3. Renf'd vinyl with mtl spacer

**Overall Window U factor and SHGC- NFRC size**

S. No.	Glazing Description	Fill gas	Glazing		Overall window																	
			U (Btu/hr-ft <sup>2</sup> F)	SHGC	Casement						Fixed						H Slider					
					Al w/o brk		Al w/ brk		Renf'd vinyl		Al w/o bk		Al w/ bk		Renf'd vinyl		Al w/o brk		Al w/ brk		Renf'd vinyl	
					U	SHGC	U	SHGC	U	SHGC	U	SHGC	U	SHGC	U	SHGC	U	SHGC	U	SHGC	U	SHGC
1	Double clear	Air	0.48	0.76	0.86	0.69	0.63	0.63	0.45	0.55	0.73	0.71	0.58	0.68	0.46	0.62	0.79	0.70	0.61	0.66	0.46	0.60
2	Double Green	Air	0.48	0.57	0.86	0.54	0.63	0.49	0.45	0.42	0.73	0.55	0.58	0.52	0.46	0.47	0.78	0.55	0.61	0.51	0.46	0.45
3	Double lowE (e2=0.1)	Arg	0.27	0.54	0.73	0.52	0.560	0.47	0.33	0.40	0.57	0.53	0.42	0.50	0.31	0.45	0.64	0.53	0.46	0.49	0.32	0.43
4	Double lowE (e2=0.04)	Arg	0.25	0.39	0.72	0.41	0.49	0.35	0.32	0.29	0.55	0.40	0.41	0.37	0.29	0.33	0.63	0.41	0.45	0.36	0.31	0.31
5	Triple lowe (film)	Air	0.22	0.51	0.70	0.50	0.47	0.44	0.30	0.38	0.53	0.50	0.38	0.46	0.27	0.42	0.60	0.50	0.43	0.46	0.29	0.40



# Table 1: Annual electric and gas consumption

Total Electric consumption (in 1000 kWh)									
	Miami			Anchorage			Atlanta		
Office	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clr	3,082.10	3,081.60	3,081.00	2,360.70	2,360.50	2,360.20	2,728.60	2,728.20	2,727.80
Double Green	3,062.20	3,061.50	3,060.90	2,361.80	2,361.70	2,361.70	2,718.50	2,718.00	2,717.60
Double lowE.1	3,064.20	3,063.70	3,063.00	2,362.30	2,362.20	2,362.20	2,718.10	2,717.60	2,717.30
Double lowE.04	3,040.70	3,040.10	3,039.40	2,363.70	2,363.90	2,363.90	2,708.60	2,708.00	2,707.60
Triple lowE (film)			3,060.90			2,362.20			2,715.90
University	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clr	3,157.10	3,156.70	3,156.70	1,645.30	1,645.30	1,645.30	2,118.80	2,118.80	2,119.00
Double Green	3,134.40	3,134.00	3,133.50	1,645.30	1,645.30	1,645.30	2,106.30	2,106.30	2,106.40
Double lowE.1	3,140.90	3,140.40	3,140.00	1,645.30	1,645.30	1,645.30	2,113.00	2,113.10	2,113.10
Double lowE.04	3,112.80	3,112.30	3,111.80	1,645.20	1,645.20	1,645.20	2,094.40	2,094.40	2,094.40
Triple lowE (film)			3,137.80			1,645.30			2,111.90
Residential	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clr	594.64	594.11	593.55	340.08	340.07	340.05	449.83	449.62	449.38
Double Green	580.14	579.61	579	339.31	339.29	339.28	441.81	441.72	441.31
Double lowE.1	580.97	580.41	579.79	339.44	339.42	339.4	442.86	442.89	442.34
Double lowE.04	564.17	563.60	563.12	338.46	338.43	338.41	432.69	432.38	432.20
Triple lowE (film)			578.24			339.35			441.81
Total Gas consumption (Btu x 10**6)									
	Miami			Anchorage			Atlanta		
Office	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clr	356.27	355.21	354.15	8710	8690	8650	1,967.80	1,946.80	1,929.20
Double Green	354.26	352.65	352.59	8820	8800	8770	2,091.90	2,073.10	2,054.40
Double lowE.1	345.5	345.41	344.73	8550	8530	8520	1,833.10	1,812.40	1,797.80
Double lowE.04	351.49	350.48	350.46	8920	8910	8890	2,224.20	2,206.20	2,187.60
Triple lowE (film)	344.73	344.73	344.72	8510	8510	8520	1,796.90	1,796.90	1,801.30
University	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clr	894.6	894.58	894.58	8950	8920	8890	1,842.10	1,836.90	1,830.60
Double Green	894.94	894.92	894.90	9030	9010	8980	1,884.00	1,878.50	1,872.10
Double lowE.1	894.53	894.52	894.51	8620	8590	8560	1,792.40	1,787.00	1,780.20
Double lowE.04	895.19	895.17	895.15	9070	9040	9010	1,916.00	1,910.70	1,904.30
Triple lowE (film)	894.50	894.50	894.51	8540	8540	8550	1,778.50	1,778.50	1,780.40
Residential	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
(Gas heating..)									
Double Clr	615.87	615.87	615.87	2,512.10	2,483.60	2,448.50	896.62	890.97	884.20
Double Green	615.87	615.87	615.87	2,567.60	2,538.30	2,502.70	919.67	908.58	906.25
Double lowE.1	615.87	615.87	615.87	2,292.90	2,264.30	2,229.20	864.93	853.09	853.52
Double lowE.04	615.87	615.87	615.87	2,611.30	2,581.60	2,545.20	944.39	935.58	930.14
Triple lowE (film)	615.87	615.87	615.87	2,221.50	2,221.50	2,186.90	853.45	853.45	853.45

**Table 2: Annual total energy consumption (in 1000 kWh)**

	Total energy (in 1000 kWh)								
	Miami			Anchorage			Atlanta		
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
<b>Office</b>									
Double Clr	3,186.49	3,185.68	3,184.77	4,912.73	4,906.67	4,894.65	3,305.17	3,298.61	3,293.06
Double Green	3,166.00	3,164.83	3,164.21	4,946.06	4,940.10	4,931.31	3,331.43	3,325.42	3,319.54
Double lowE.1	3,165.43	3,164.91	3,164.01	4,867.45	4,861.49	4,858.56	3,255.20	3,248.63	3,244.06
Double lowE.04	3,143.69	3,142.79	3,142.08	4,977.26	4,974.53	4,968.67	3,360.29	3,354.42	3,348.57
Triple lowE (film)			3,161.90			4,858.56			3,243.68
<b>University</b>									
Double Clr	3,419.22	3,418.81	3,418.81	4,267.65	4,258.86	4,250.07	2,658.54	2,657.01	2,655.37
Double Green	3,396.62	3,396.21	3,395.71	4,291.09	4,285.23	4,276.44	2,658.31	2,656.70	2,654.93
Double lowE.1	3,403.00	3,402.49	3,402.09	4,170.96	4,162.17	4,153.38	2,638.17	2,636.69	2,634.70
Double lowE.04	3,375.09	3,374.58	3,374.08	4,302.71	4,293.92	4,285.13	2,655.79	2,654.24	2,652.36
Triple lowE (film)			3,399.89			4,150.45			2,633.56
<b>Residential</b>									
(Gas heating..)									
Double Clr	775.09	774.56	774.00	1,076.13	1,067.76	1,057.46	712.54	710.67	708.45
Double Green	760.59	760.06	759.45	1,091.62	1,083.01	1,072.57	711.27	707.93	706.84
Double lowE.1	761.42	760.86	760.24	1,011.26	1,002.86	992.56	696.28	692.85	692.42
Double lowE.04	744.62	744.05	743.57	1,103.57	1,094.84	1,084.15	709.40	706.50	704.73
Triple lowE (film)			758.69			980.11			691.87

**Table 3: Cumulative electric and gas savings (wrt to double clear as a base case)**

Cumulative Electric energy SAVINGS (negative entries indicate increased energy consumption)							Base:Double Clear (in 1000 kWh)		
Miami			Anchorage			Atlanta			
Office	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	19.9	20.1	20.1	-1.1	-1.2	-1.5	10.1	10.2	10.2
Double LowE (e2=0.1)	17.9	17.9	18	-1.6	-1.7	-2	10.5	10.6	10.5
Double LowE (e2=0.04)	41.4	41.5	41.6	-3	-3.4	-3.7	20	20.2	20.2
Triple LowE (film)			20.1			-2			11.9
<b>University</b>									
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	22.7	22.7	23.2	0	0	0	12.5	12.5	12.6
Double LowE (e2=0.1)	16.2	16.3	16.7	0	0	0	5.8	5.7	5.9
Double LowE (e2=0.04)	44.3	44.4	44.9	0.1	0.1	0.1	24.4	24.4	24.6
Triple LowE (film)			18.9			0			7.1
<b>Residential</b>									
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	14.5	14.50	14.55	0.77	0.78	0.77	8.02	7.90	8.07
Double LowE (e2=0.1)	13.67	13.70	13.76	0.64	0.65	0.65	6.97	6.73	7.04
Double LowE (e2=0.04)	30.47	30.51	30.43	1.62	1.64	1.64	17.14	17.24	17.18
Triple LowE (film)			15.31			0.7			7.57

Cumulative Gas Energy SAVINGS (negative entries indicate increased energy consumption)							Base:Double Clear (in 1000 kWh )		
Miami			Anchorage			Atlanta			
Office	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	0.59	0.75	0.46	-32.23	-32.23	-35.16	-36.36	-37.01	-36.68
Double LowE (e2=0.1)	3.16	2.87	2.76	46.88	46.88	38.09	39.47	39.38	38.50
Double LowE (e2=0.04)	1.40	1.39	1.08	-61.53	-64.46	-70.32	-75.13	-76.00	-75.71
Triple LowE (film)	3.38	3.07	2.76	58.60	52.74	38.09	50.07	43.92	37.47
<b>University</b>									
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	-0.10	-0.10	-0.09	-23.44	-26.37	-26.37	-12.28	-12.19	-12.16
Double LowE (e2=0.1)	0.02	0.02	0.02	96.69	96.69	96.69	14.56	14.62	14.77
Double LowE (e2=0.04)	-0.17	-0.17	-0.17	-35.16	-35.16	-35.16	-21.65	-21.62	-21.59
Triple LowE (film)	0.03	0.02	0.02	120.13	111.34	99.62	18.63	17.11	14.71
<b>Residential (Gas heating)</b>									
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	0.00	0.00	0.00	-16.26	-16.03	-15.88	-6.75	-5.16	-6.46
Double LowE (e2=0.1)	0.00	0.00	0.00	64.23	64.25	64.25	9.29	11.10	8.99
Double LowE (e2=0.04)	0.00	0.00	0.00	-29.07	-28.71	-28.33	-14.00	-13.07	-13.46
Triple LowE (film)	0.00	0.00	0.00	85.15	76.80	76.65	12.65	10.99	9.01

Note: The gas Btus have been converted to kWh for the sake of consistency

**Table 4: First cost for the different options (1997 costs)**

	<b>Total cost (\$)</b>		
<b>Office</b>			
	<b>Mtl w/o brk</b>	<b>Mtl with brk</b>	<b>Reinf'd Vinyl</b>
Double Clr	\$39,931.32	\$59,744.56	\$92,766.64
Double Green	\$45,011.64	\$64,824.88	\$97,846.96
Double lowE.1	\$53,140.15	\$72,953.40	\$105,975.48
Double lowE.04	\$59,744.56	\$79,557.81	\$112,579.89
Triple lowE (film)			\$154,136.91
<b>University</b>			
	<b>Mtl w/o brk</b>	<b>Mtl with brk</b>	<b>Reinf'd Vinyl</b>
Double Clr	\$31,440.00	\$47,040.00	\$73,040.00
Double Green	\$35,440.00	\$51,040.00	\$77,040.00
Double lowE.1	\$41,840.00	\$57,440.00	\$83,440.00
Double lowE.04	\$47,040.00	\$62,640.00	\$88,640.00
Triple lowE (film)			\$121,360.00
<b>Residential</b>			
	<b>Mtl w/o brk</b>	<b>Mtl with brk</b>	<b>Reinf'd Vinyl</b>
Double Clr	\$21,787.92	\$32,598.72	\$50,616.72
Double Green	\$24,559.92	\$35,370.72	\$53,388.72
Double lowE.1	\$28,995.12	\$39,805.92	\$57,823.92
Double lowE.04	\$32,598.72	\$43,409.52	\$61,427.52
Triple lowE (film)			\$84,102.48

**Table 5: Life Cycle Cost (life=25 years)**

**Cumulative Life-Cycle SAVINGS (negative entries indicate increased costs)**

Base: Double Clear

Office	Miami			Anchorage			Atlanta		
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	\$32,493	\$32,644	\$32,642	-\$13,953	-\$14,269	-\$15,146	\$8,408	\$8,405	\$8,630
Double LowE (e2=0.1)	\$20,832	\$20,756	\$20,800	-\$444	-\$1,246	-\$4,523	\$18,636	\$18,998	\$19,593
Double LowE (e2=0.04)	\$56,937	\$57,191	\$57,430	-\$37,527	-\$38,917	-\$40,401	\$2,666	\$7,183	\$8,203
Triple LowE (film)			-\$25,027			-\$52,956			-\$25,910
<b>University</b>									
Double Clear									
Double Green	\$31,967	\$32,073	\$32,971	-\$9,337	-\$9,417	-\$19,967	\$58,208	\$16,609	\$17,067
Double LowE (e2=0.1)	\$17,306	\$17,381	\$18,264	\$12,029	\$12,000	\$0	\$46,646	\$5,046	\$5,535
Double LowE (e2=0.04)	\$55,407	\$55,542	\$56,500	-\$19,953	-\$19,935	-\$30,402	\$67,186	\$25,571	\$26,120
Triple LowE (film)			-\$16,138			-\$37,158			-\$30,095
<b>Residential</b>									
Double Clear									
Double Green	\$67,308	\$67,325	\$67,566	-\$4,369	-\$4,310	-\$4,280	\$26,878	\$26,807	\$27,125
Double LowE (e2=0.1)	\$55,331	\$55,445	\$55,718	\$12,031	\$12,165	\$12,329	\$21,949	\$21,407	\$22,217
Double LowE (e2=0.04)	\$135,638	\$135,783	\$135,156	-\$12,845	-\$12,694	-\$12,605	\$52,267	\$52,894	\$52,571
Triple LowE (film)			\$36,306			-\$10,353			-\$2,036

## Appendix

### 1. Office Building – Input data assumptions

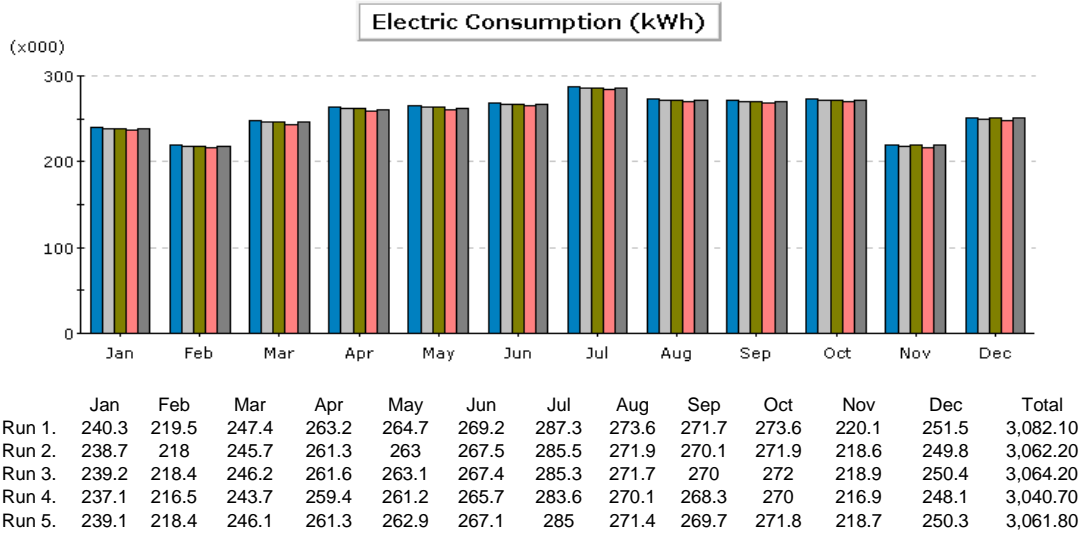
Model Parameter	Value
Shape	Square, 177 ft x 177 ft
Conditioned floor area	250, 000 ft <sup>2</sup>
No floors	8
Floor to ceiling	9 ft
Plenum height	3 ft
Perimeter zone depth	15 ft
Window/wall ratio	20
Exterior wall construction	Metal frame brick wall with R-18 insulation
Roof construction	Built up metal frame roof with R-19 Batt Insulation
Lighting power density	1.3 W/ft <sup>2</sup>
Equipment power density	1.5 W/ft <sup>2</sup>
Design occupancy	150 sf/person
Infiltration (shell tightness)	Perimeter :0.038 cfm/ft <sup>2</sup> (ext wall area) Core: 0.001 cfm/ft <sup>2</sup> (floor area)
HVAC system	Standard VAV with HW reheat
Thermostat setpoints	Heating: 70/64; Cooling: 76/82
Schedule	Typical US Office

**Results:** Results have been presented in terms of energy consumption. The cumulative life cycle cost saving in comparison to base case (double clear glazing) has also been presented. The frame input data for all triple glazed window are considered with the vinyl frame.

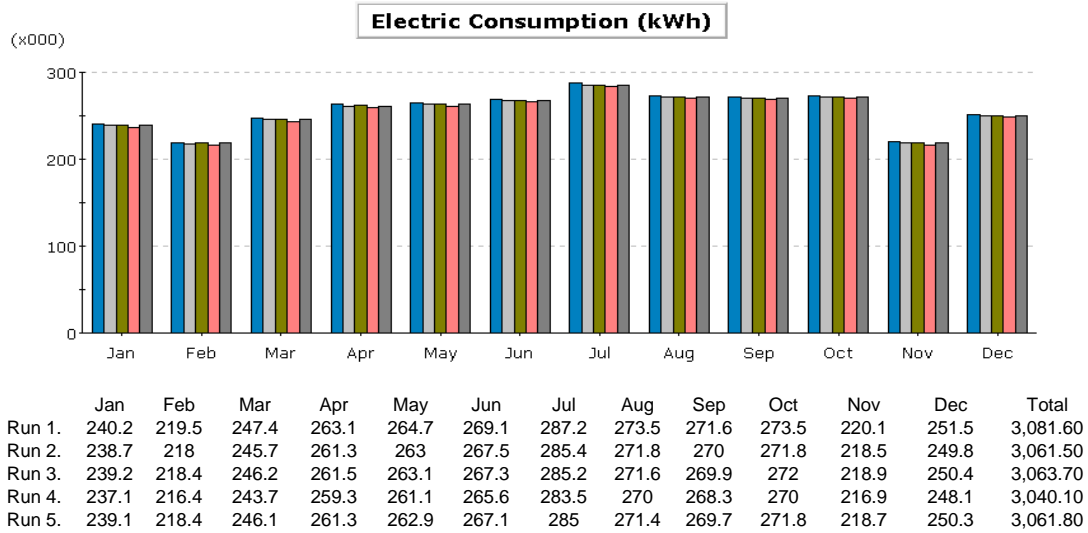
The Run1 to 5 in the results represent the glazing system as follows:

- Run 1: Double Clear
- Run 2: Double Green
- Run 3 : Double lowE Pye (e=0.1)
- Run 4 : Double lowE Spe (e=0.04)
- Run 5: Triple lowE (film)

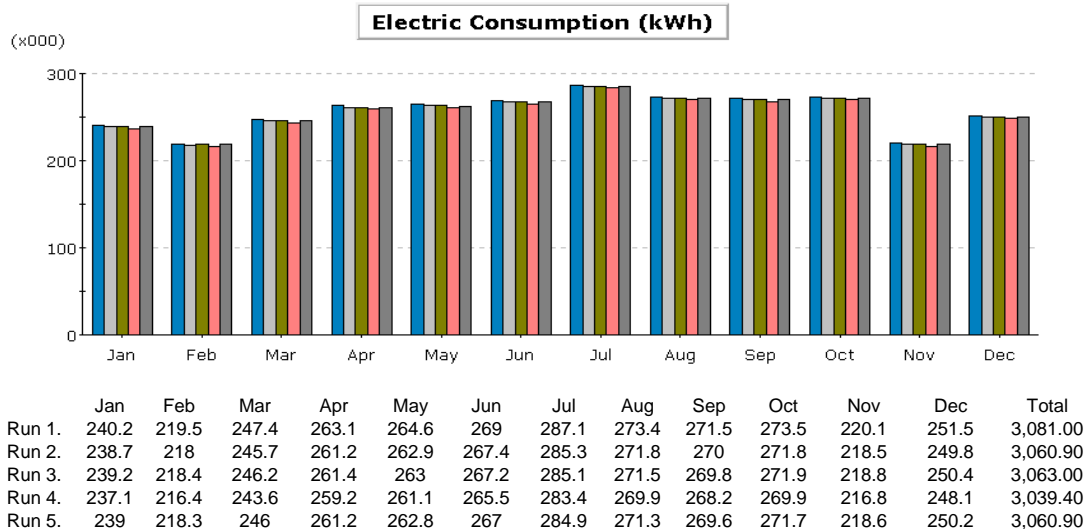
Frame: Metal without thermal break



Frame: Metal with thermal break



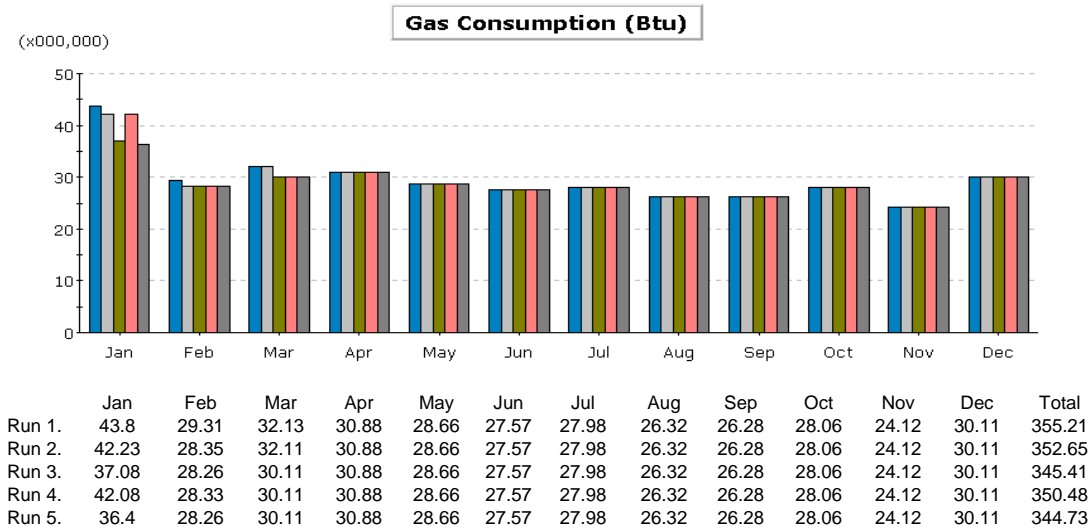
Frame: Reinforced Vinyl



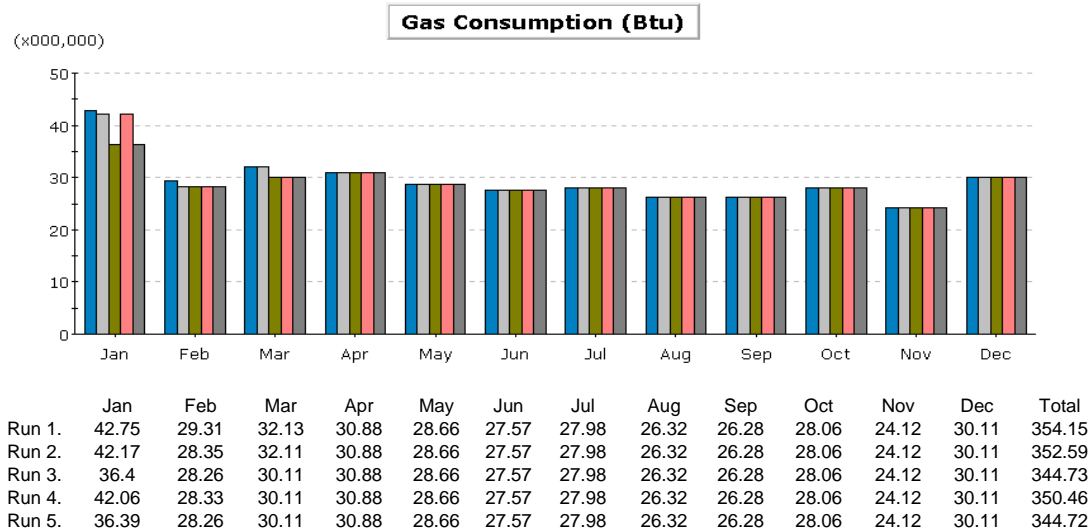
Frame: Metal without thermal break



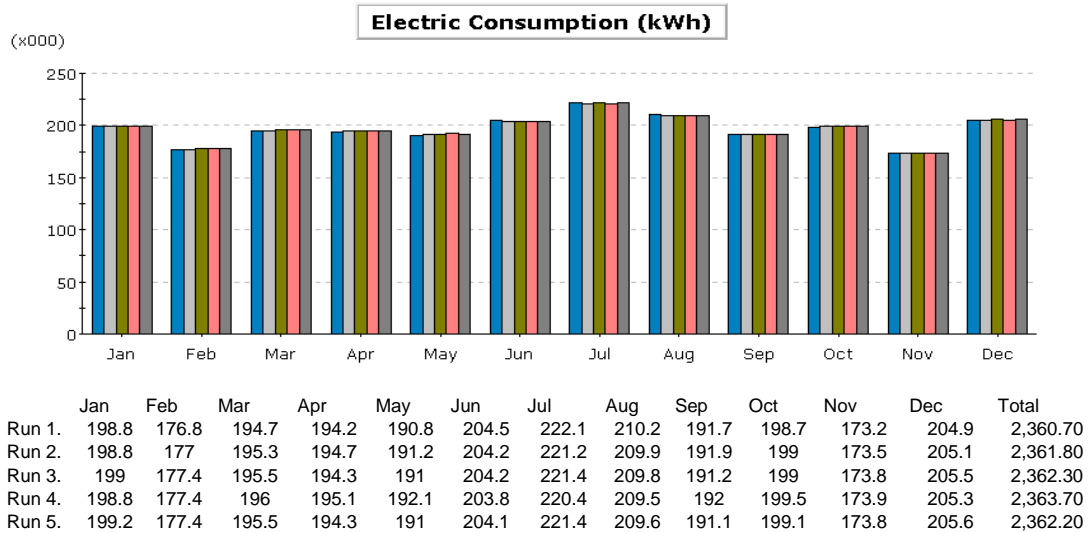
Frame: Metal with thermal break



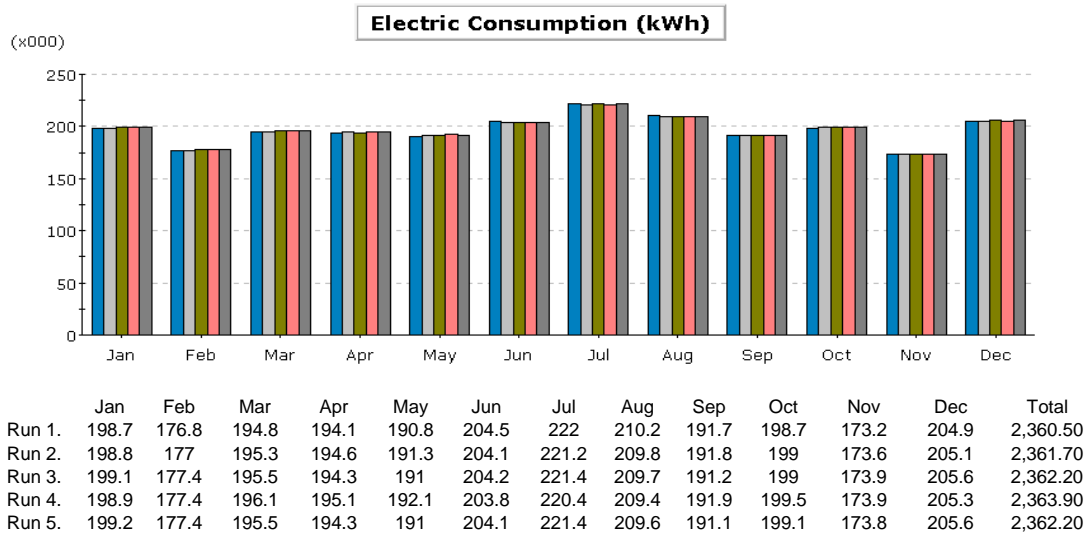
Frame: Reinforced Vinyl



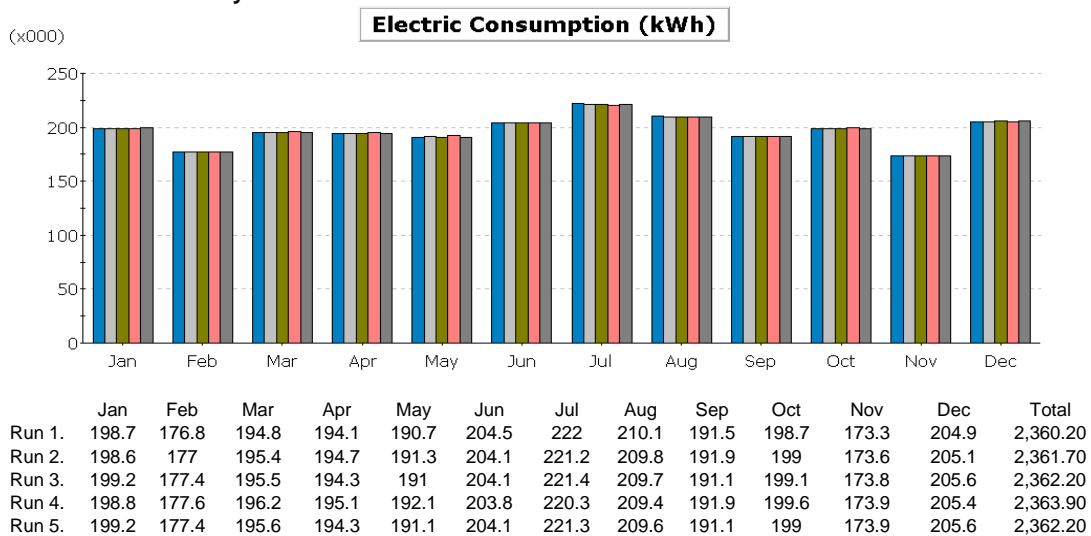
## Frame: Metal without thermal break



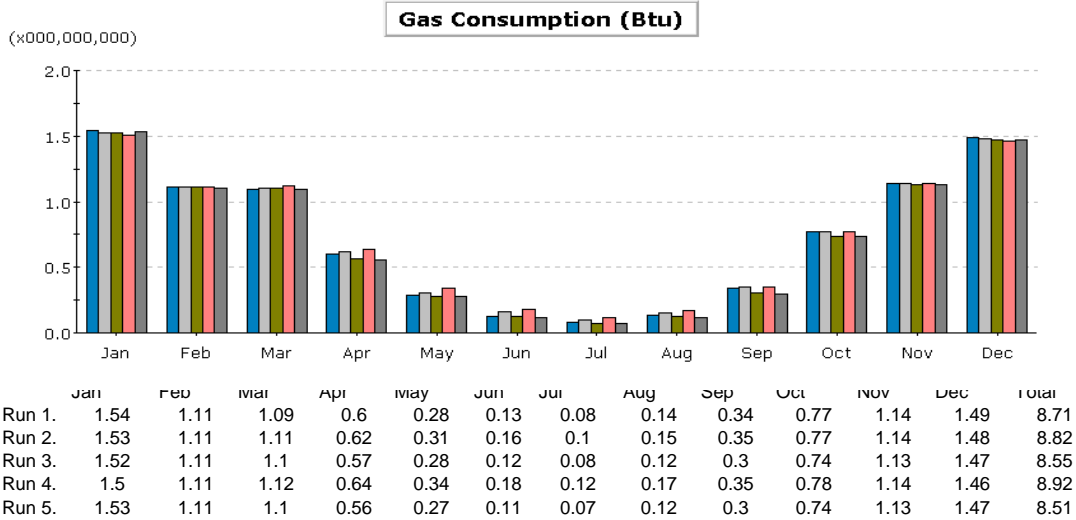
## Frame: Metal with thermal break



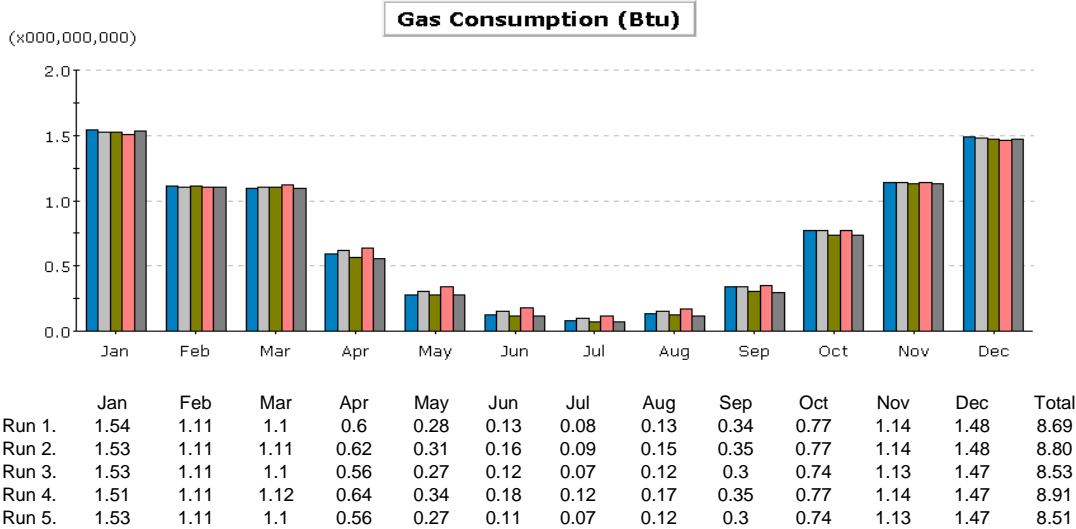
## Frame: Reinforced Vinyl



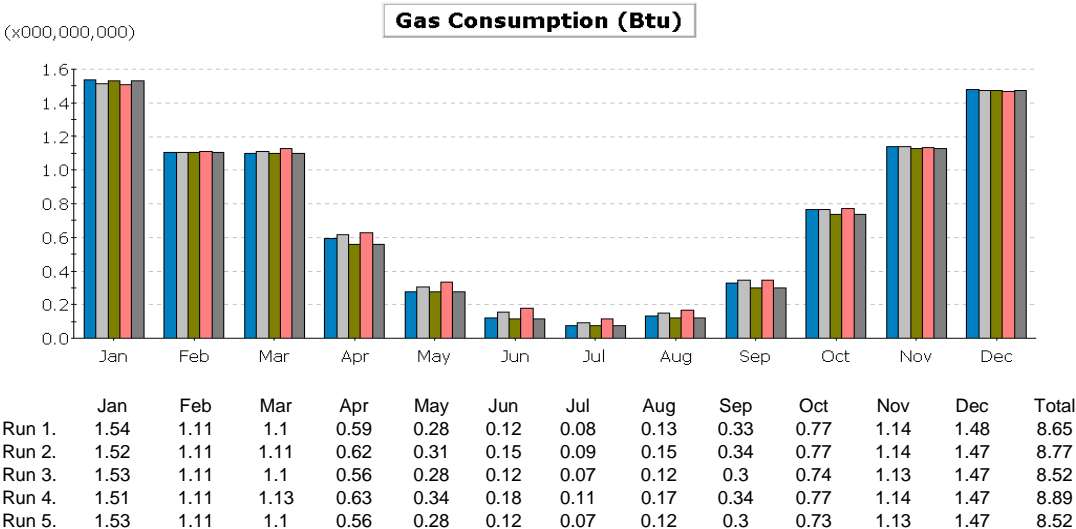
## Frame: Metal without thermal break



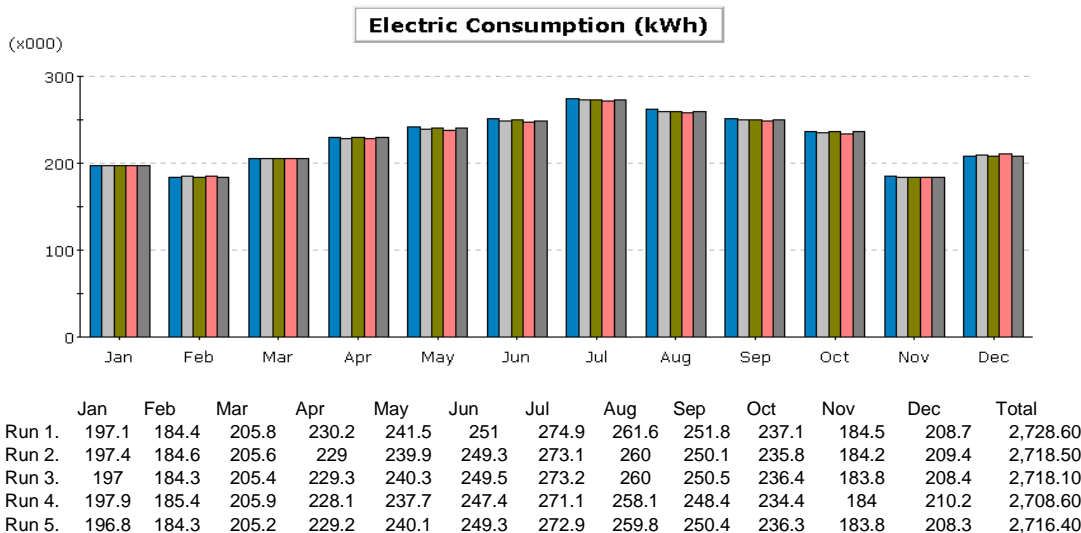
## Frame: Metal with thermal break



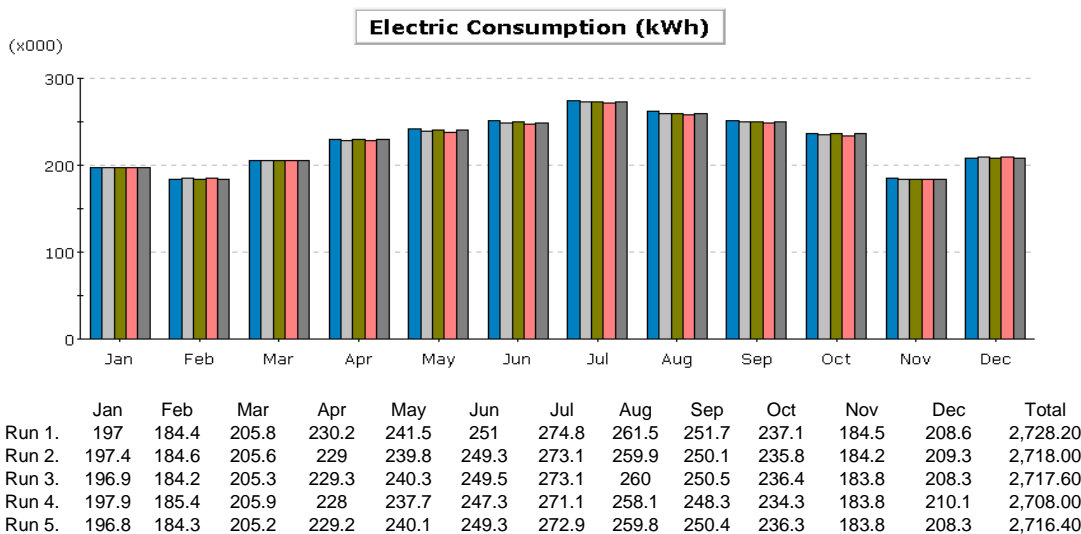
## Frame: Reinforced Vinyl



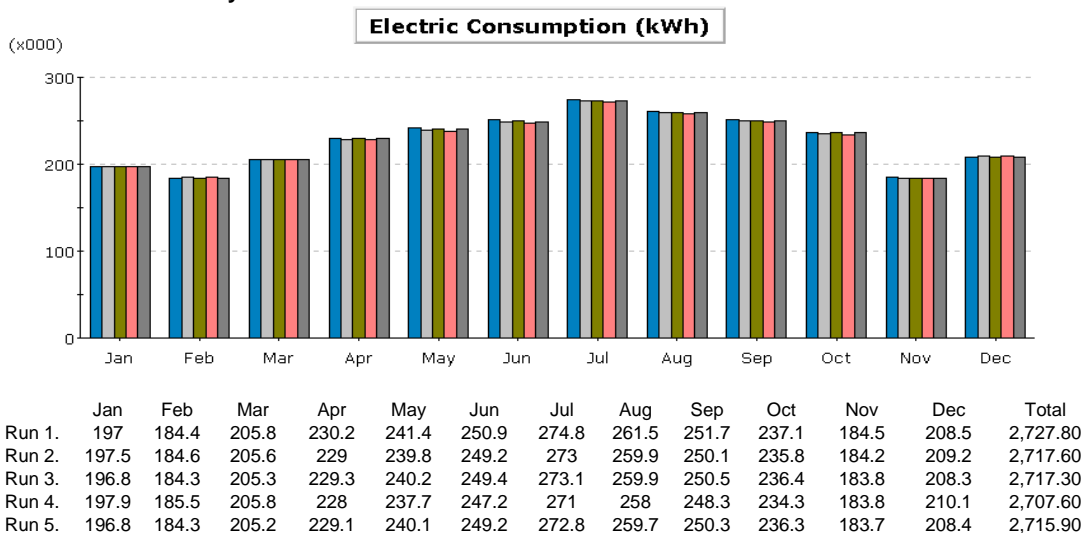
Frame: Metal without thermal break



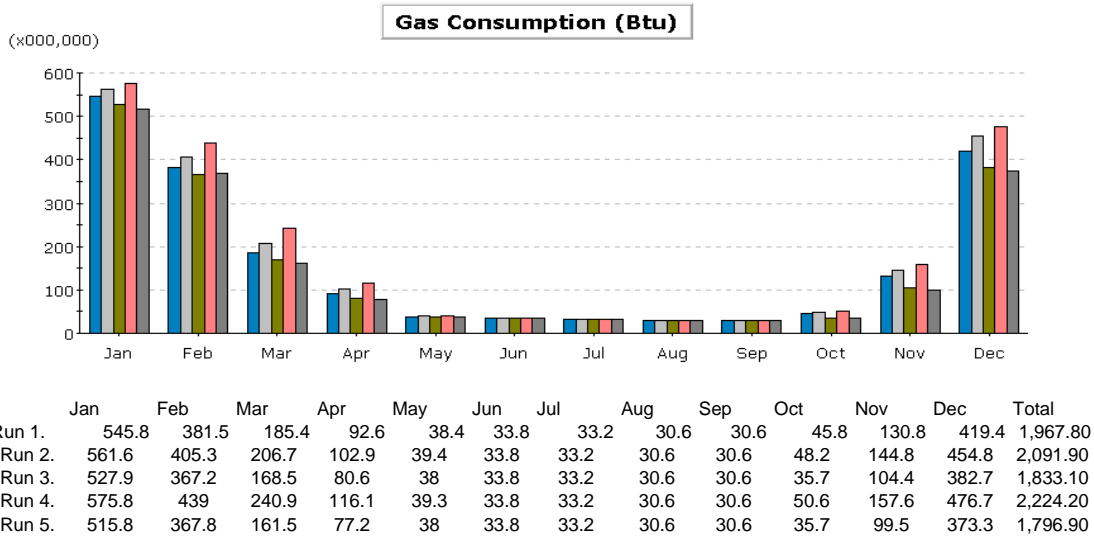
Frame: Metal with thermal break



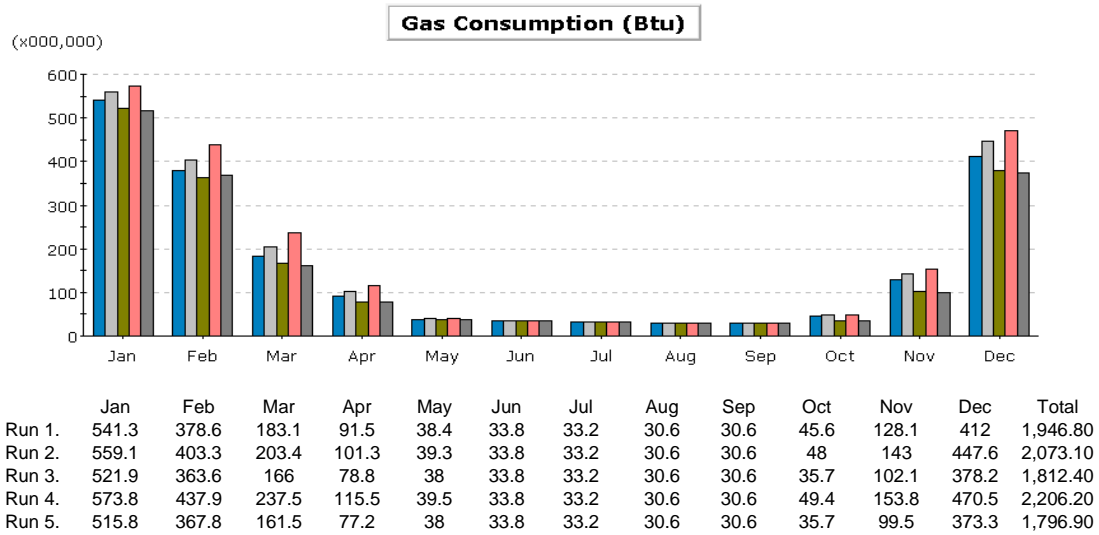
Frame: Reinforced Vinyl



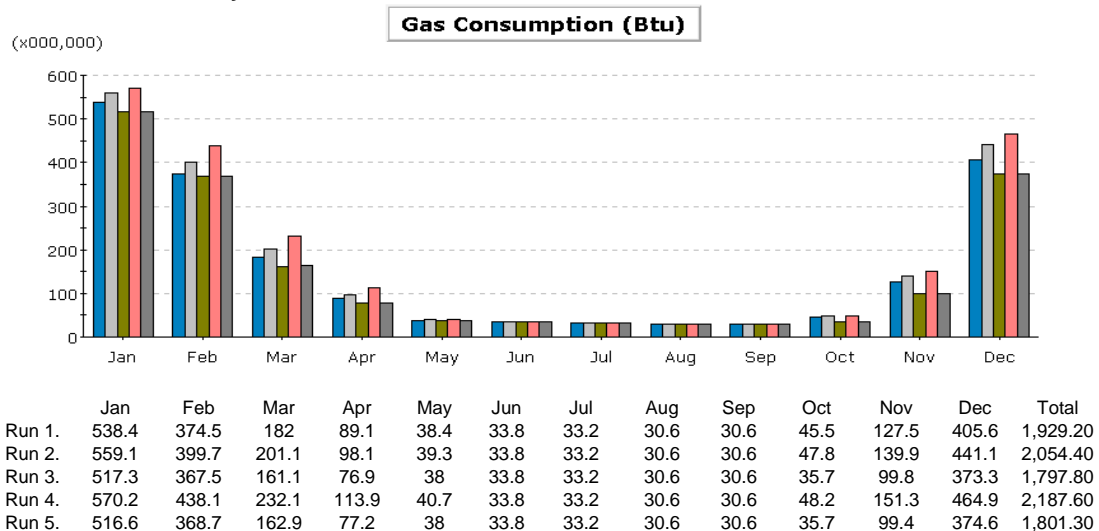
Frame: Metal without thermal break



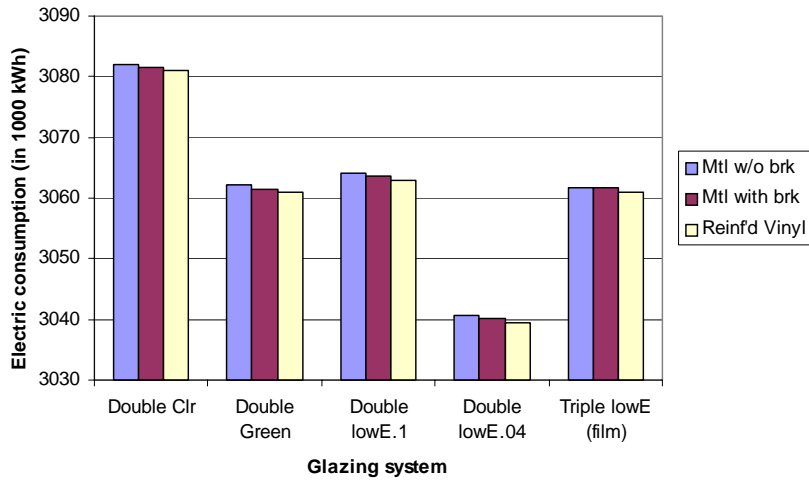
Frame: Metal with thermal break



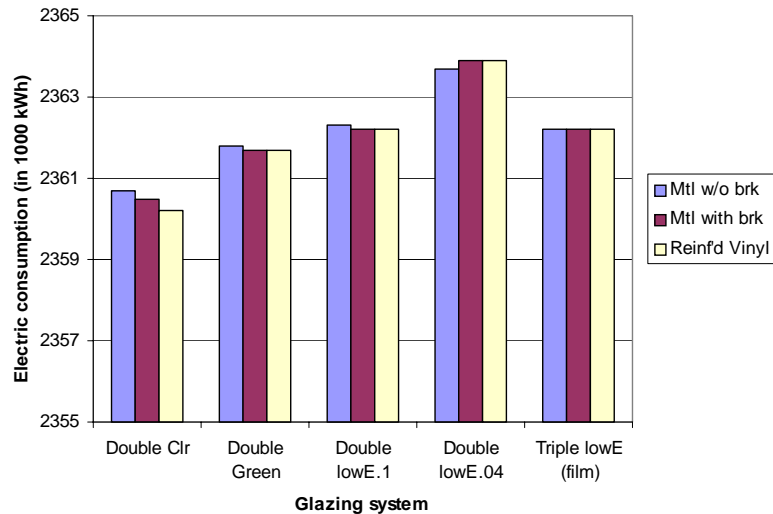
Frame: Reinforced Vinyl



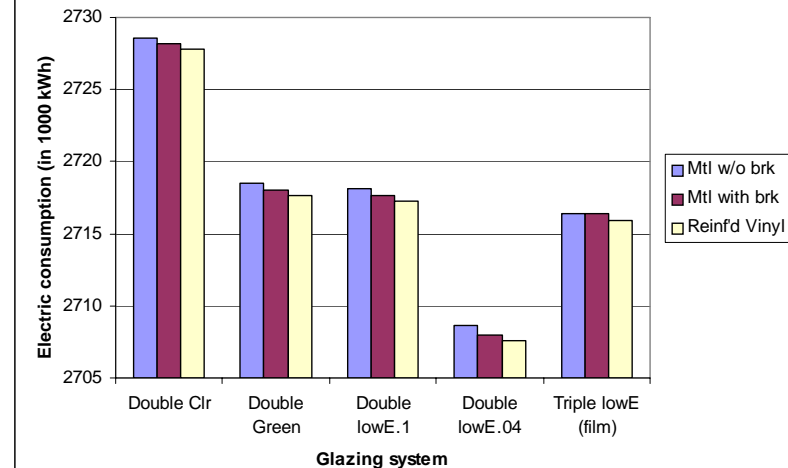
**Annual electric consumption in a typical office building - Miami**



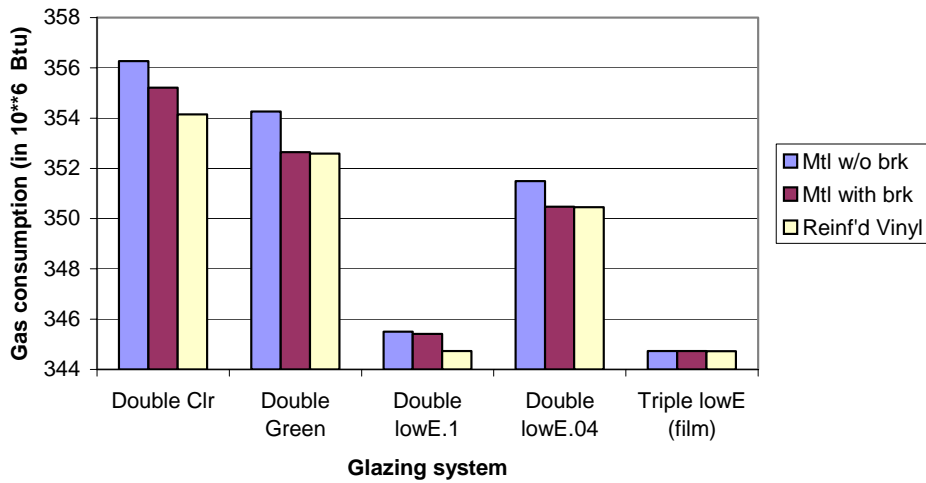
**Annual electric consumption in a typical office building - Anchorage**



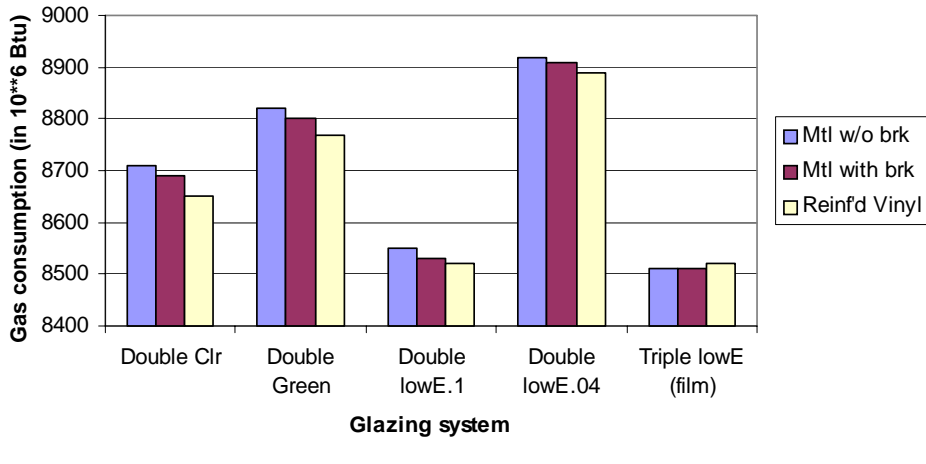
**Annual electric consumption in a typical office building - Atlanta**



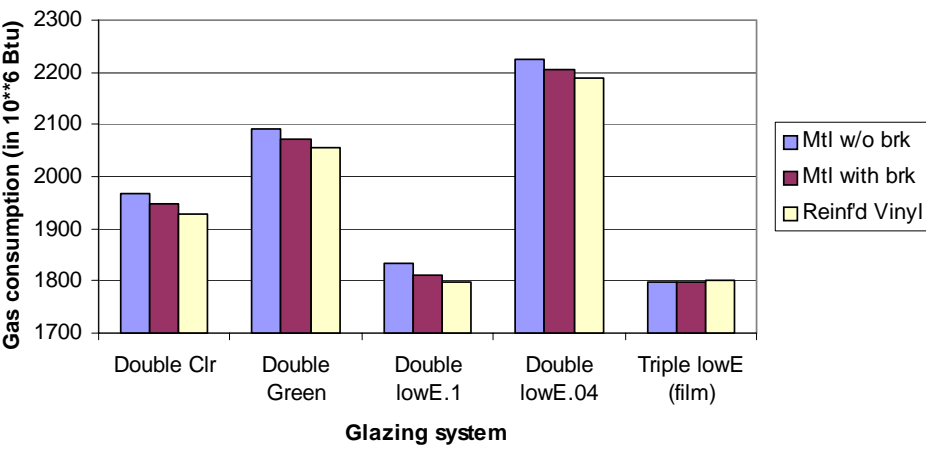
**Annual gas consumption in a typical office building - Miami**



**Annual gas consumption in a typical office building - Anchorage**



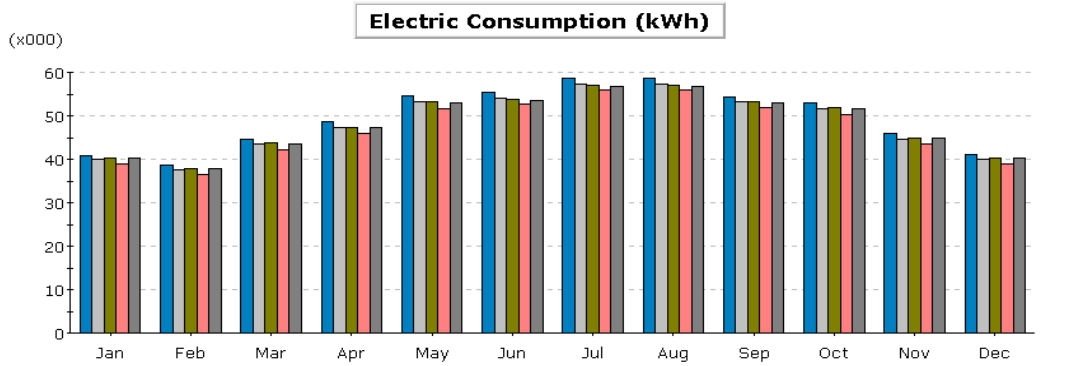
**Annual gas consumption in a typical office building - Atlanta**



## 2. High rise Residential Building – Input data assumptions

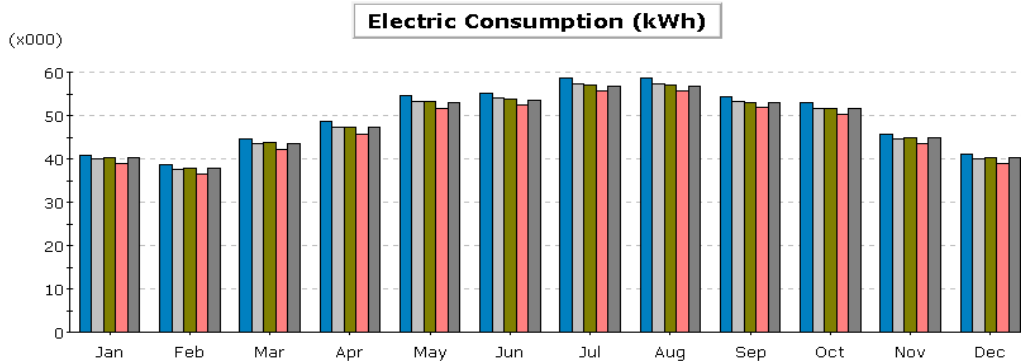
Model Parameter	Value
Shape	Rectangular, 112.5 ft x 80 ft
Conditioned floor area	72, 000 ft <sup>2</sup>
No floors	8
Floor to ceiling	9 ft
Plenum height	5 ft
Perimeter zone depth	25 ft
Window/wall ratio	20
Exterior wall construction	Metal frame brick wall with R-19 batt insulation
Roof construction	Built up metal frame roof with R-38 Batt Insulation
Lighting power density	0.5 W/ft <sup>2</sup>
Equipment power density	0.3 W/ft <sup>2</sup>
Design occupancy	625 sf/person
Infiltration (shell tightness)	Perimeter :0.038 cfm/ft <sup>2</sup> (ext wall area) Core: 0.001 cfm/ft <sup>2</sup> (floor area)
HVAC system	Packaged single zone DX with furnace
Thermostat setpoints	Heating: 68; Cooling: 78
Schedule	Typical US Residentail

Frame: Metal without thermal break



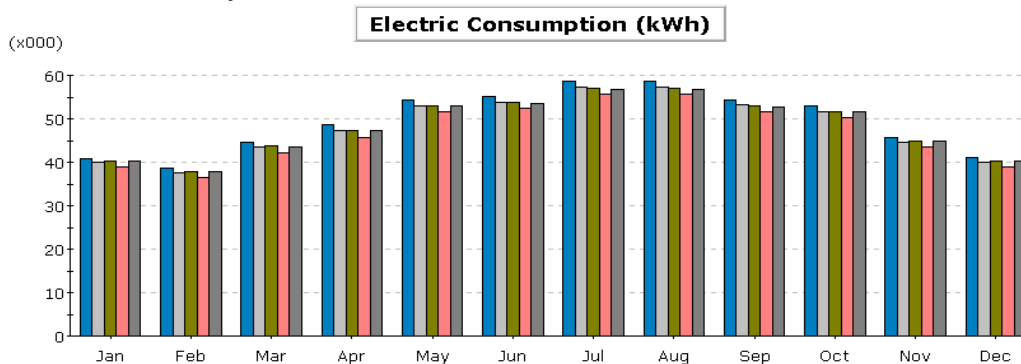
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	40.94	38.64	44.67	48.61	54.56	55.34	58.78	58.78	54.44	53.04	45.82	41.02	594.64
Run 2.	39.93	37.64	43.47	47.26	53.2	54.06	57.42	57.42	53.27	51.73	44.73	40.03	580.14
Run 3.	40.31	37.91	43.75	47.4	53.21	53.86	57.16	57.16	53.12	51.78	44.93	40.37	580.97
Run 4.	38.88	36.6	42.22	45.83	51.68	52.57	55.85	55.86	51.92	50.26	43.56	38.95	564.17
Run 5.	40.27	37.83	43.64	47.21	52.98	53.59	56.85	56.86	52.88	51.58	44.82	40.33	578.84

Frame: Metal with thermal break



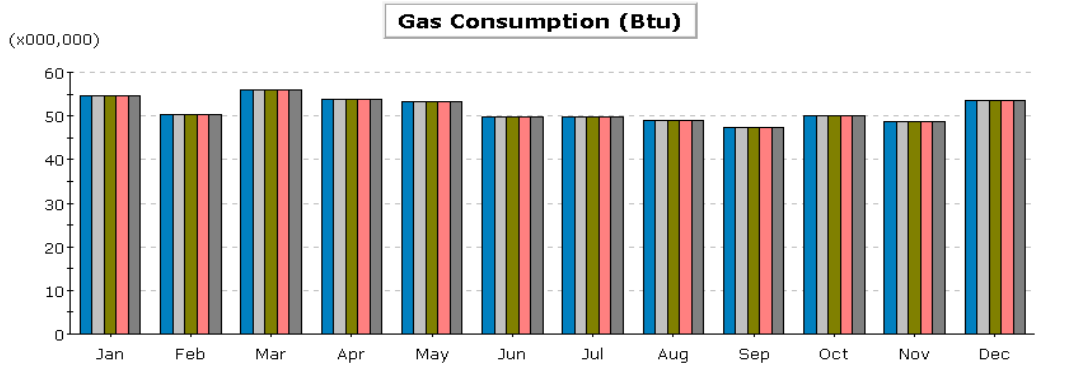
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	40.93	38.63	44.66	48.57	54.5	55.26	58.69	58.69	54.37	52.99	45.8	41.02	594.11
Run 2.	39.93	37.63	43.45	47.21	53.13	53.98	57.32	57.32	53.2	51.68	44.71	40.03	579.61
Run 3.	40.31	37.9	43.74	47.36	53.14	53.78	57.06	57.07	53.05	51.73	44.91	40.38	580.41
Run 4.	38.88	36.59	42.2	45.78	51.62	52.49	55.75	55.76	51.84	50.21	43.53	38.95	563.60
Run 5.	40.22	37.79	43.6	47.19	52.96	53.6	56.87	56.88	52.88	51.56	44.79	40.27	578.61

Frame: Reinforced Vinyl



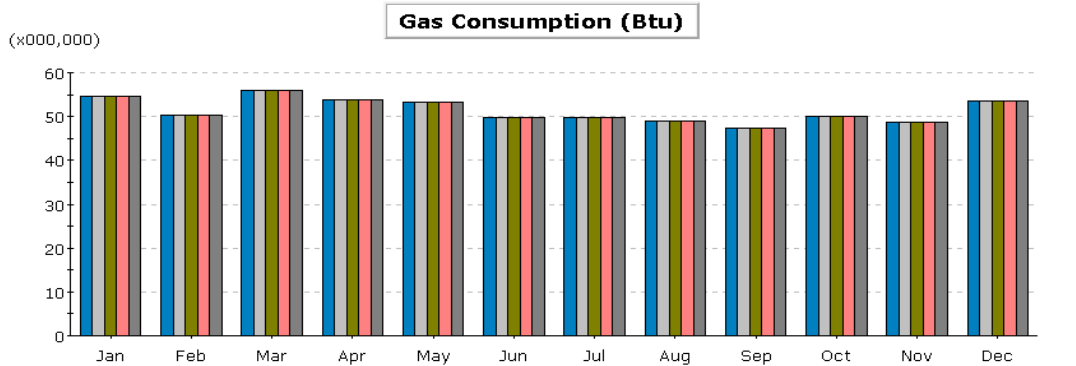
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	40.94	38.62	44.65	48.52	54.44	55.17	58.58	58.59	54.29	52.93	45.78	41.03	593.55
Run 2.	39.94	37.62	43.42	47.17	53.07	53.89	57.22	57.22	53.12	51.62	44.68	40.04	579
Run 3.	40.32	37.89	43.72	47.31	53.07	53.68	56.95	56.96	52.96	51.67	44.88	40.38	579.79
Run 4.	38.93	36.6	42.21	45.75	51.55	52.38	55.63	55.64	51.76	50.16	43.53	38.98	563.12
Run 5.	40.28	37.82	43.62	47.17	52.91	53.5	56.75	56.75	52.79	51.52	44.8	40.33	578.24

Frame: Metal without thermal break



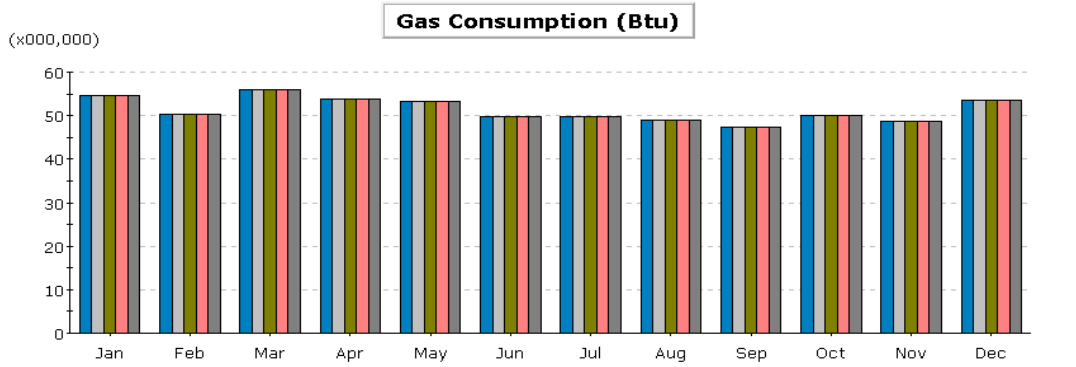
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 2.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 3.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 4.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 5.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87

Frame: Metal with thermal break



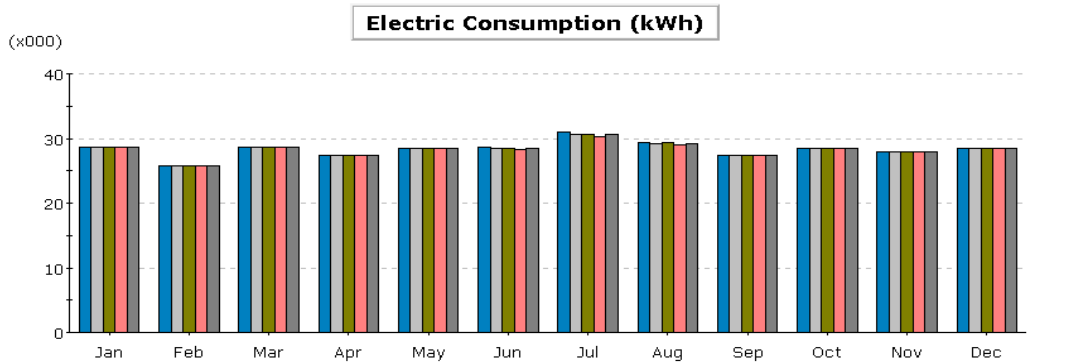
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 2.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 3.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 4.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 5.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87

Frame: Reinforced Vinyl



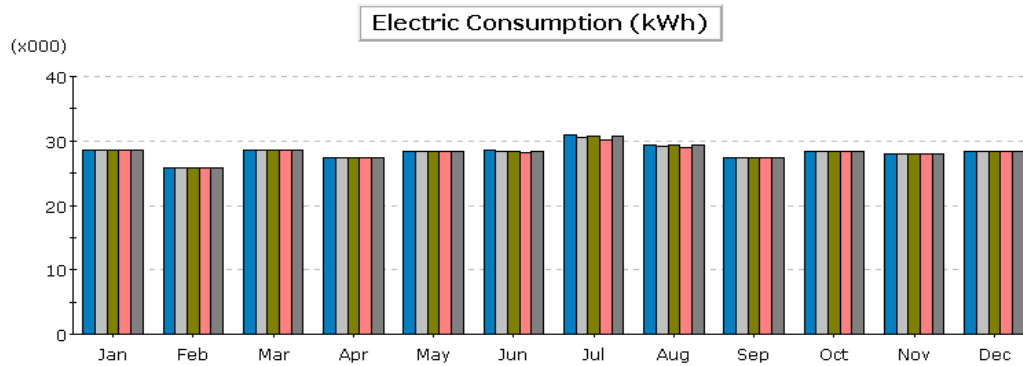
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 2.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 3.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87
Run 4.	54.51	50.22	55.92	53.87	53.35	49.7	49.89	48.97	47.29	49.91	48.77	53.47	615.87

Frame: Metal without thermal break



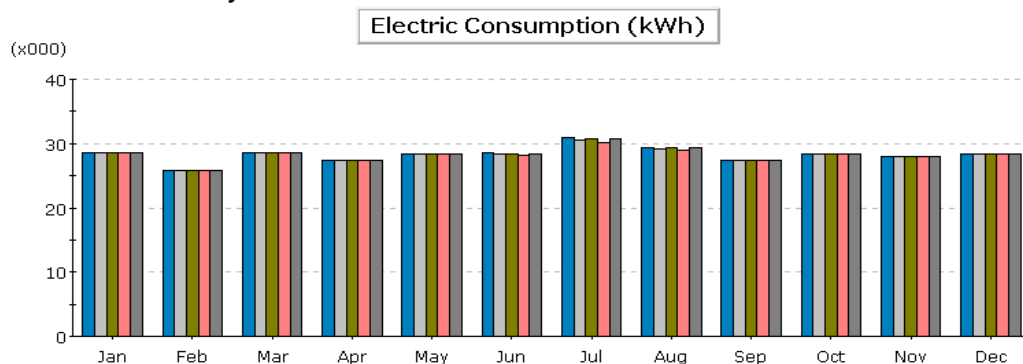
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	28.57	25.8	28.57	27.44	28.41	28.64	31.01	29.45	27.37	28.44	27.91	28.46	340.08
Run 2.	28.57	25.8	28.57	27.44	28.41	28.44	30.63	29.25	27.37	28.44	27.91	28.46	339.31
Run 3.	28.57	25.8	28.57	27.44	28.41	28.47	30.7	29.29	27.37	28.44	27.91	28.46	339.44
Run 4.	28.57	25.8	28.57	27.44	28.41	28.22	30.2	29.06	27.37	28.44	27.91	28.46	338.46
Run 5.	28.57	25.8	28.57	27.44	28.41	28.45	30.66	29.27	27.37	28.44	27.91	28.46	339.37

Frame: Metal with thermal break



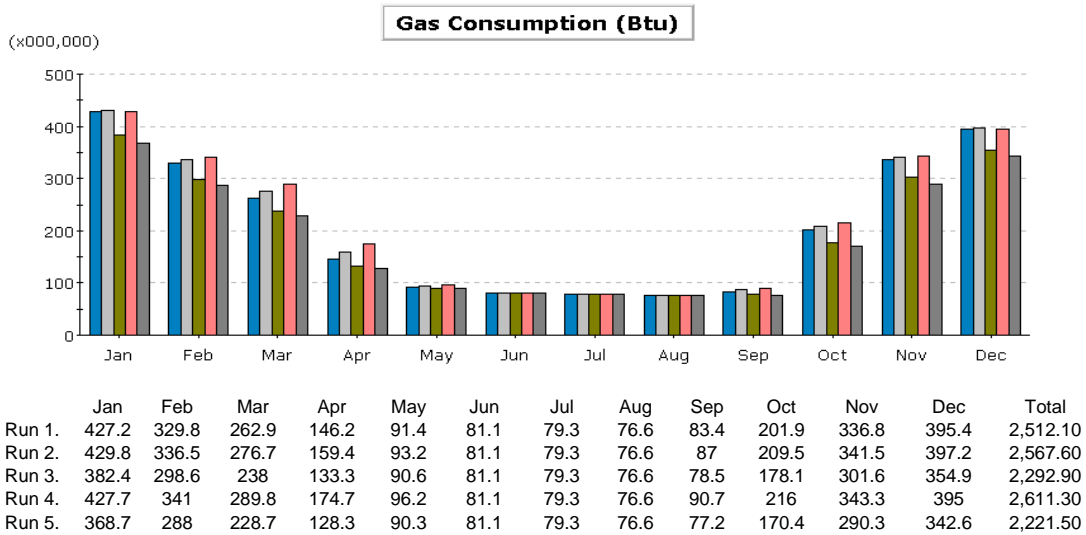
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	28.57	25.8	28.57	27.44	28.41	28.64	31	29.45	27.37	28.44	27.91	28.46	340.07
Run 2.	28.57	25.8	28.57	27.44	28.41	28.44	30.63	29.25	27.37	28.44	27.91	28.46	339.29
Run 3.	28.57	25.8	28.57	27.44	28.41	28.47	30.69	29.28	27.37	28.44	27.91	28.46	339.42
Run 4.	28.57	25.8	28.57	27.44	28.41	28.21	30.18	29.06	27.37	28.44	27.91	28.46	338.43
Run 5.	28.57	25.8	28.57	27.44	28.41	28.45	30.66	29.27	27.37	28.44	27.91	28.46	339.37

Frame: Reinforced Vinyl

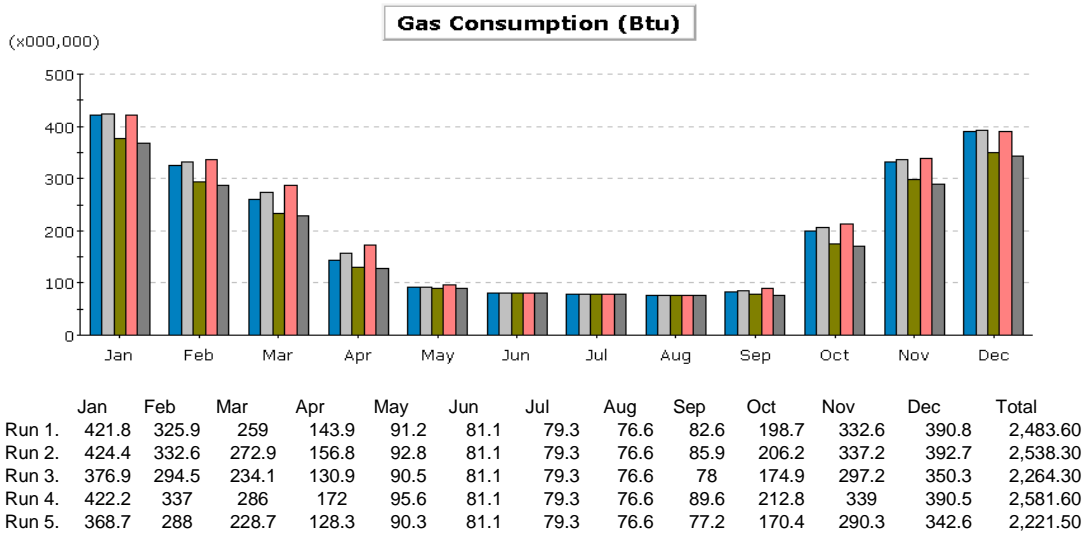


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	28.57	25.8	28.57	27.44	28.41	28.63	30.99	29.44	27.37	28.44	27.91	28.46	340.05
Run 2.	28.57	25.8	28.57	27.44	28.41	28.43	30.62	29.25	27.37	28.44	27.91	28.46	339.28
Run 3.	28.57	25.8	28.57	27.44	28.41	28.46	30.68	29.28	27.37	28.44	27.91	28.46	339.4
Run 4.	28.57	25.8	28.57	27.44	28.41	28.21	30.17	29.05	27.37	28.44	27.91	28.46	338.41
Run 5.	28.57	25.8	28.57	27.44	28.41	28.45	30.65	29.27	27.37	28.44	27.91	28.46	339.35

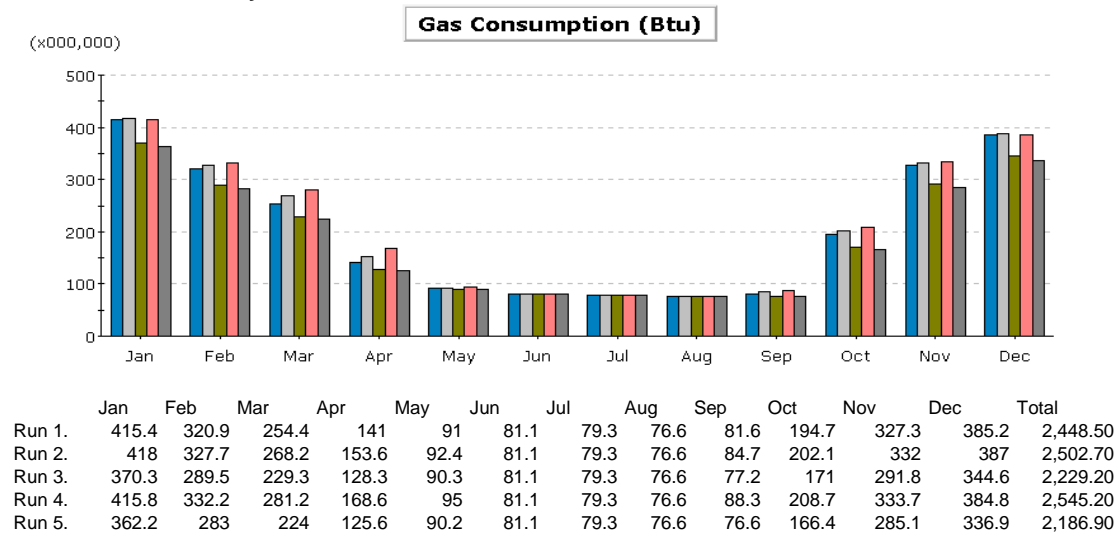
Frame: Metal without thermal break



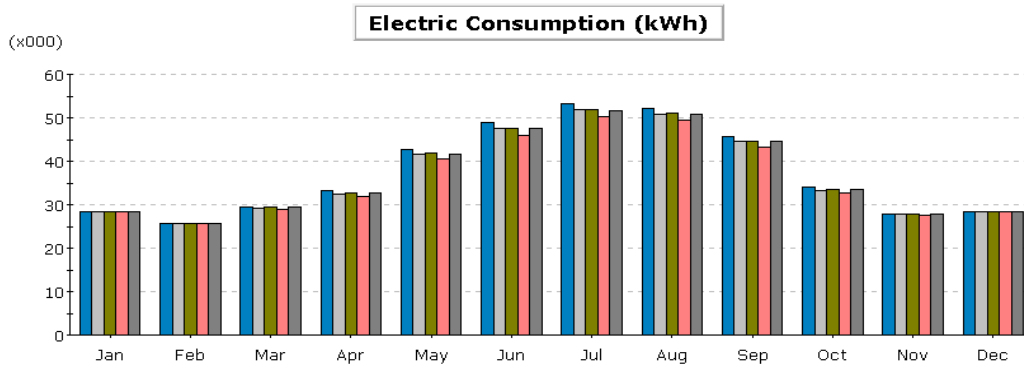
Frame: Metal with thermal break



Frame: Reinforced Vinyl

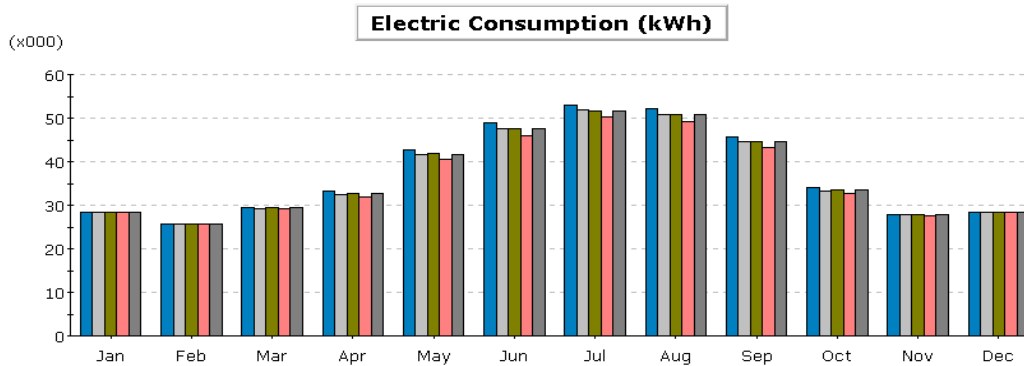


Frame: Metal without thermal break



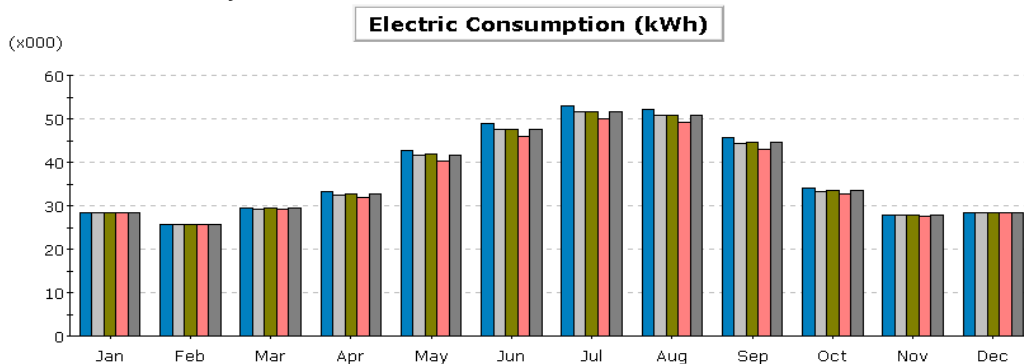
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	28.5	25.74	29.53	33.23	42.79	48.91	53.17	52.26	45.62	33.98	27.79	28.29	449.83
Run 2.	28.48	25.69	29.3	32.53	41.7	47.55	51.83	50.94	44.47	33.31	27.71	28.29	441.81
Run 3.	28.5	25.7	29.41	32.76	41.87	47.65	51.79	50.97	44.67	33.53	27.72	28.29	442.86
Run 4.	28.48	25.66	29.05	31.76	40.45	46.01	50.23	49.36	43.16	32.61	27.65	28.29	432.69
Run 5.	28.48	25.7	29.41	32.71	41.74	47.45	51.54	50.74	44.53	33.5	27.72	28.29	441.81

Frame: Metal with thermal break



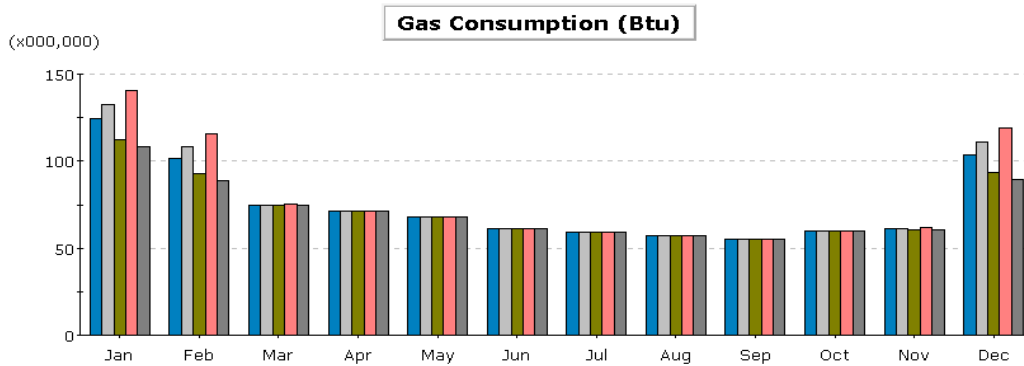
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	28.5	25.74	29.54	33.23	42.77	48.86	53.11	52.21	45.59	33.98	27.79	28.29	449.62
Run 2.	28.48	25.69	29.31	32.55	41.69	47.52	51.78	50.9	44.47	33.33	27.71	28.29	441.72
Run 3.	28.5	25.73	29.44	32.79	41.88	47.63	51.74	50.94	44.68	33.56	27.72	28.29	442.89
Run 4.	28.48	25.66	29.06	31.76	40.41	45.94	50.14	49.27	43.12	32.61	27.65	28.29	432.38
Run 5.	28.48	25.7	29.41	32.71	41.74	47.45	51.54	50.74	44.53	33.5	27.72	28.29	441.81

Frame: Reinforced Vinyl



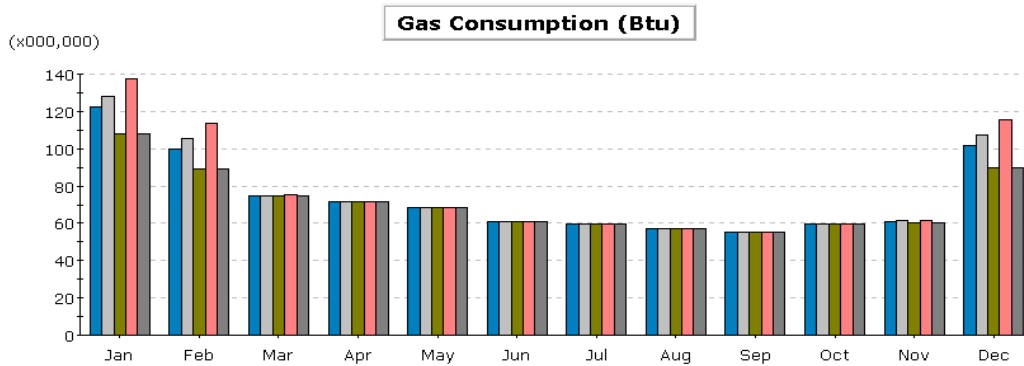
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	28.5	25.74	29.55	33.23	42.74	48.81	53.03	52.14	45.57	33.98	27.79	28.29	449.38
Run 2.	28.48	25.69	29.31	32.53	41.64	47.45	51.69	50.82	44.41	33.29	27.71	28.29	441.31
Run 3.	28.48	25.7	29.42	32.75	41.81	47.55	51.64	50.84	44.61	33.53	27.72	28.29	442.34
Run 4.	28.48	25.66	29.06	31.77	40.39	45.9	50.08	49.23	43.1	32.61	27.65	28.29	432.20
Run 5.	28.48	25.7	29.41	32.71	41.74	47.45	51.54	50.74	44.53	33.5	27.72	28.29	441.81

Frame: Metal without thermal break



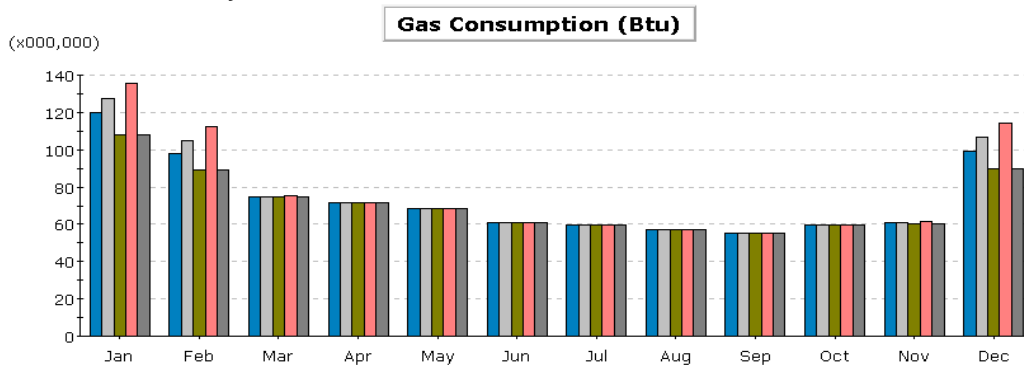
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	124.4	101.41	74.7	71.3	68.12	61.18	59.36	57.01	55.01	59.53	61.06	103.53	896.62
Run 2.	132.2	108.44	74.98	71.3	68.12	61.18	59.36	57.01	55.01	59.53	61.5	111.05	919.67
Run 3.	112.3	92.74	74.61	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.52	93.24	864.93
Run 4.	140.6	115.85	75.54	71.3	68.12	61.18	59.36	57.01	55.01	59.53	62.13	118.73	944.39
Run 5.	108	89.11	74.61	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.47	89.73	853.45

Frame: Metal with thermal break

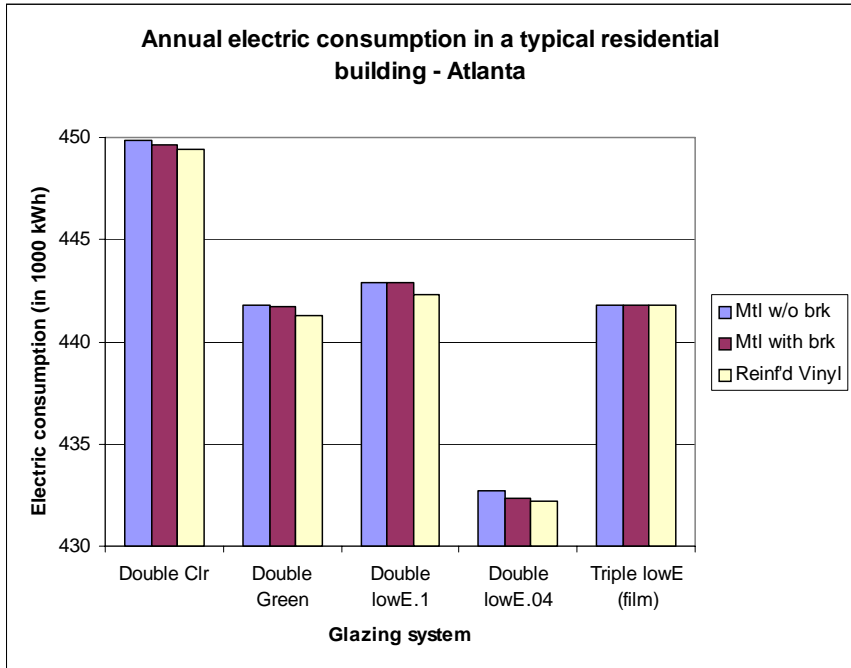
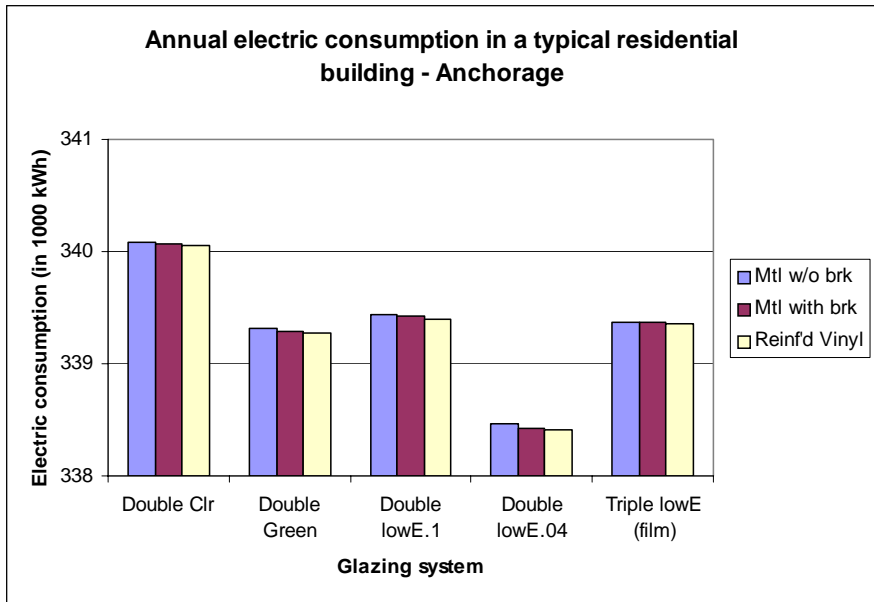
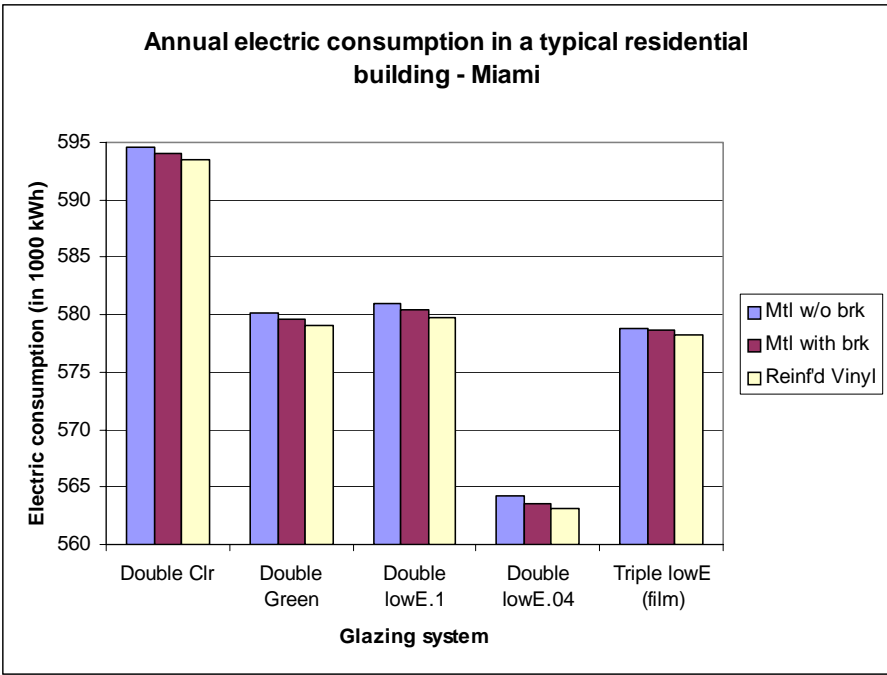


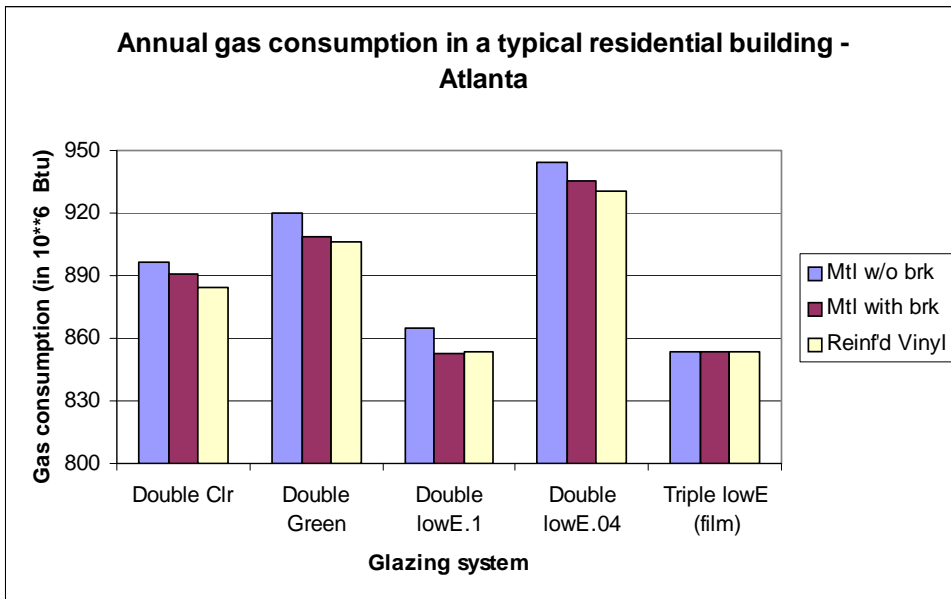
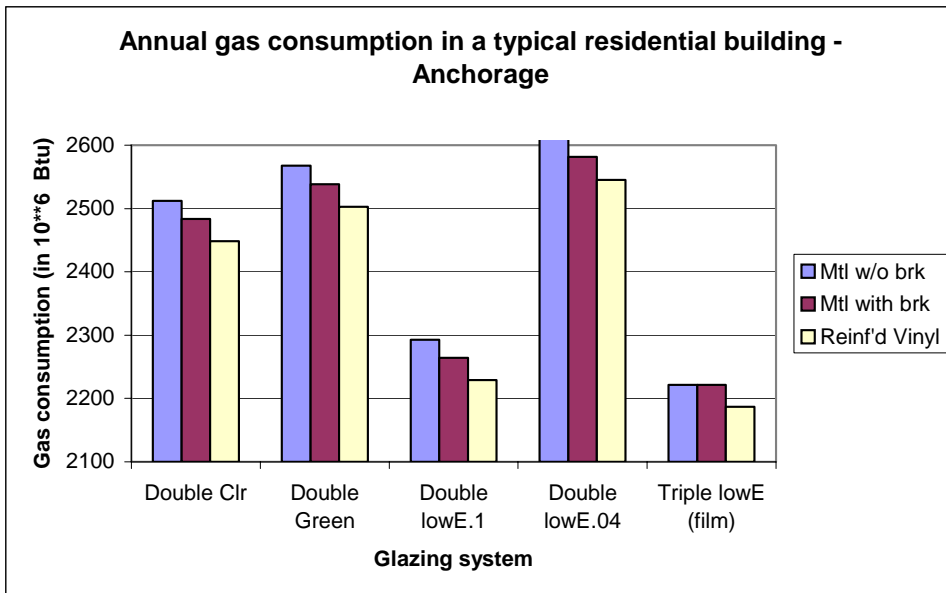
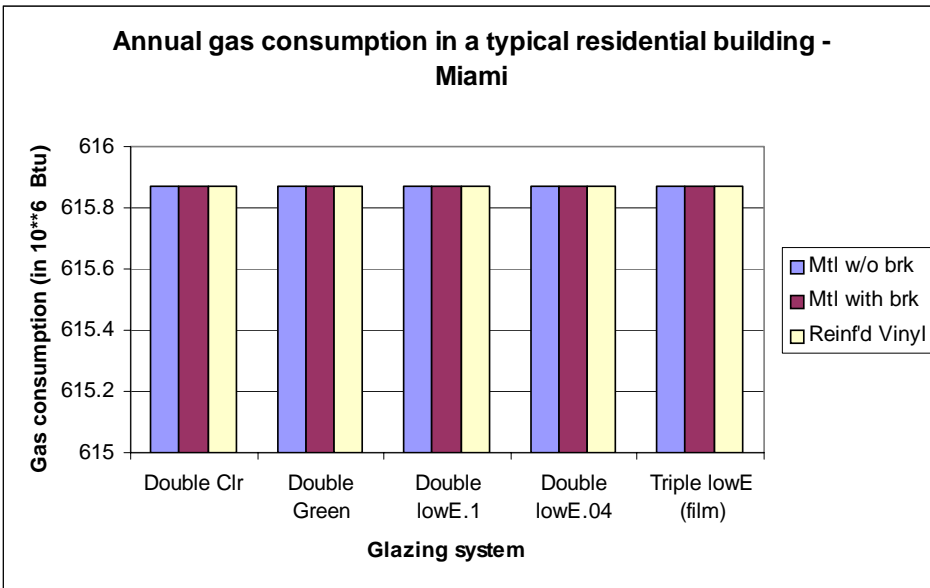
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	122.4	99.8	74.67	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.94	101.62	890.97
Run 2.	128.3	105.39	74.81	71.3	68.12	61.18	59.36	57.01	55.01	59.53	61.22	107.33	908.58
Run 3.	107.9	88.92	74.61	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.48	89.66	853.09
Run 4.	137.6	113.59	75.29	71.3	68.12	61.18	59.36	57.01	55.01	59.53	61.78	115.78	935.58
Run 5.	108	89.11	74.61	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.47	89.73	853.45

Frame: Reinforced Vinyl



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	120.1	97.91	74.63	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.78	99.26	884.20
Run 2.	127.6	104.77	74.76	71.3	68.12	61.18	59.36	57.01	55.01	59.53	61.18	106.47	906.25
Run 3.	108.2	89.11	74.61	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.48	89.66	853.52
Run 4.	135.6	112.23	75.15	71.3	68.12	61.18	59.36	57.01	55.01	59.53	61.58	114.04	930.14
Run 5.	108	89.11	74.61	71.3	68.12	61.18	59.36	57.01	55.01	59.53	60.47	89.73	853.45

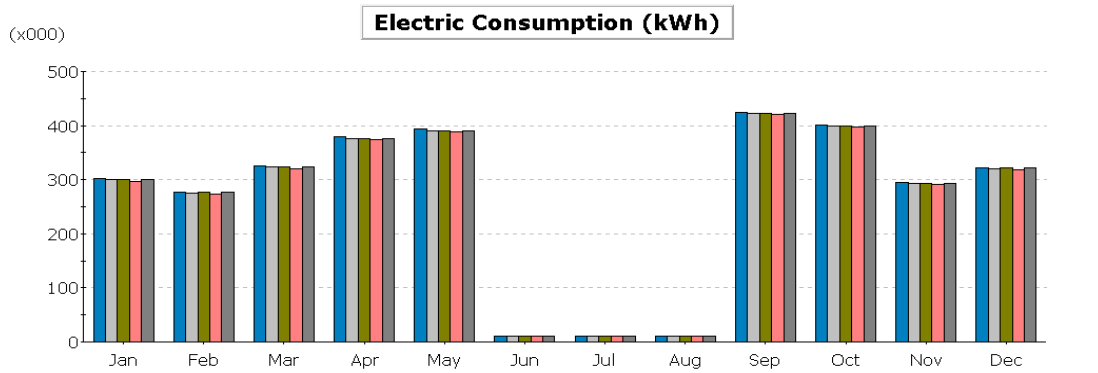




### 3. School/University - Input data assumptions

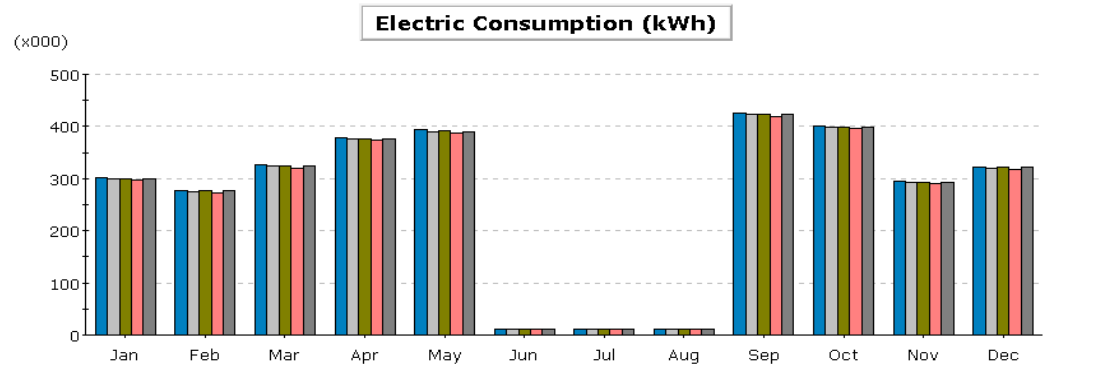
Model Parameter	Value
Shape	Square, 250 ft x 250 ft
Conditioned floor area	250, 000 ft <sup>2</sup>
No floors	4
Floor to ceiling	10 ft
Plenum height	3 ft
Perimeter zone depth	30 ft
Window/wall ratio	20
Exterior wall construction	Metal frame brick wall with R-19 batt insulation
Roof construction	Built up metal frame roof with R-18 polyurethane Insulation
Lighting power density	1.6 W/ft <sup>2</sup>
Equipment power density	1.0 W/ft <sup>2</sup>
Design occupancy	30 sf/person (class room)
Infiltration (shell tightness)	Perimeter :0.038 cfm/ft <sup>2</sup> (ext wall area) Core: 0.001 cfm/ft <sup>2</sup> (floor area)
HVAC system	PSZ DX with furnace
Thermostat setpoints	Heating:70/64; Cooling: 76/82
Schedule	Typical College schedule with two seasons

**Frame: Metal without thermal break**



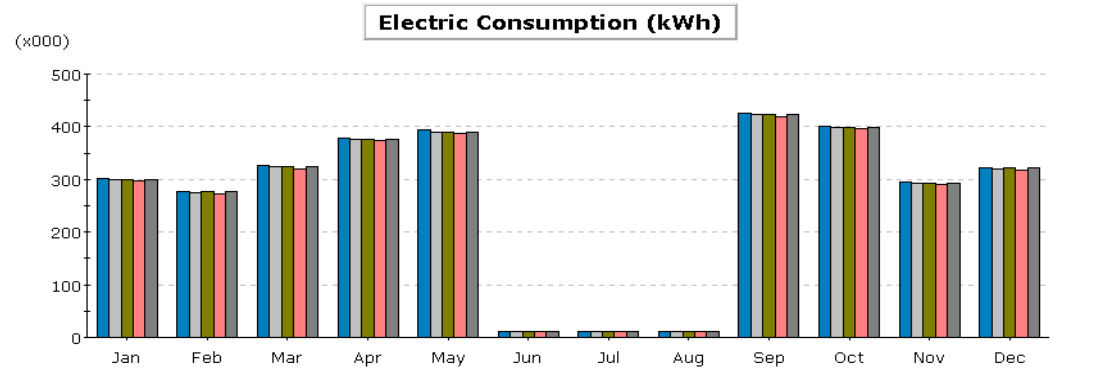
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	301.9	277.9	326.1	379	393.2	11.1	11.5	11.5	425.1	401.8	295.3	322.8	3,157.10
Run 2.	299.5	275.4	323.3	376.2	390.6	11.1	11.5	11.5	422.7	399.3	293	320.3	3,134.40
Run 3.	300.5	276.4	324.4	376.7	390.9	11.1	11.5	11.5	423.2	399.6	293.6	321.5	3,140.90
Run 4.	297.3	273.4	320.8	373.5	388.1	11.1	11.5	11.5	420	396.8	290.9	318	3,112.80
Run 5.	300.4	276.3	324.2	376.4	390.5	11.1	11.5	11.5	422.9	399.3	293.5	321.4	3,138.80

**Frame: Metal with thermal break**



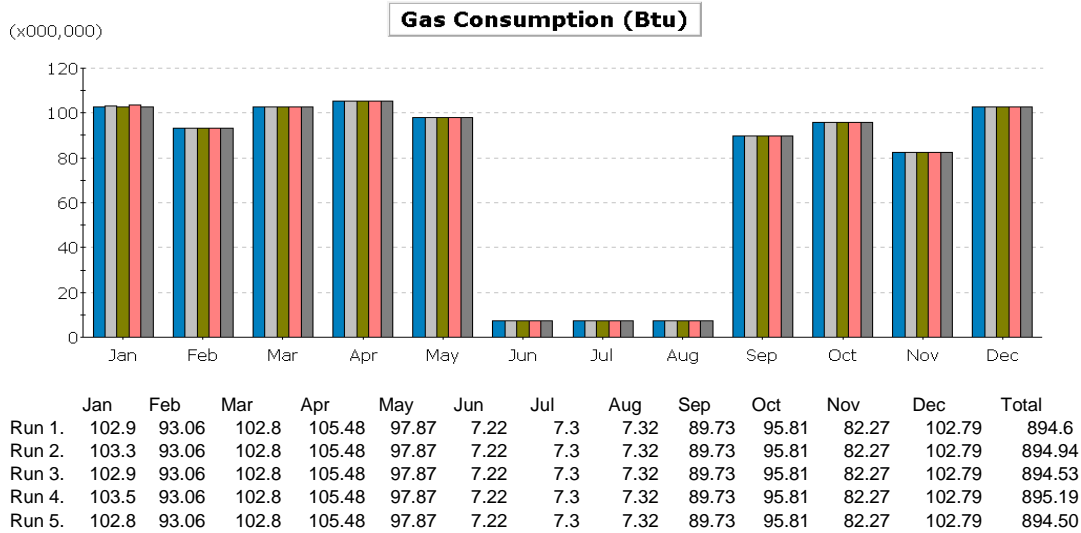
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	301.9	277.8	326.1	379	393.1	11.1	11.5	11.5	425.1	401.8	295.2	322.8	3,156.70
Run 2.	299.5	275.4	323.3	376.1	390.5	11.1	11.5	11.5	422.7	399.2	293	320.3	3,134.00
Run 3.	300.5	276.4	324.3	376.6	390.8	11.1	11.5	11.5	423.1	399.6	293.6	321.5	3,140.40
Run 4.	297.3	273.3	320.8	373.4	388	11.1	11.5	11.5	420	396.7	290.8	318	3,112.30
Run 5.	300.4	276.3	324.2	376.4	390.5	11.1	11.5	11.5	422.9	399.3	293.5	321.4	3,138.80

**Frame: Reinforced Vinyl**

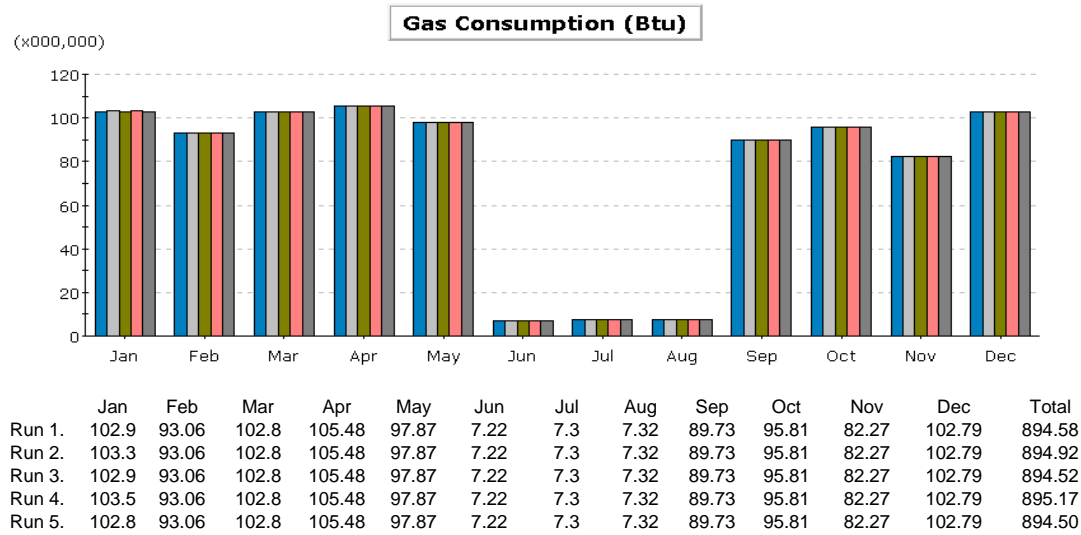


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	301.9	277.8	326.1	379	393.1	11.1	11.5	11.5	425.1	401.8	295.2	322.8	3,156.70
Run 2.	299.4	275.4	323.3	376	390.4	11.1	11.5	11.5	422.6	399.1	292.9	320.3	3,133.50
Run 3.	300.5	276.4	324.3	376.5	390.7	11.1	11.5	11.5	423	399.5	293.6	321.5	3,140.00
Run 4.	297.2	273.3	320.8	373.3	387.9	11.1	11.5	11.5	419.9	396.6	290.8	318	3,111.80
Run 5.	300.3	276.2	324	376.3	390.4	11.1	11.5	11.5	422.7	399.2	293.4	321.3	3,137.80

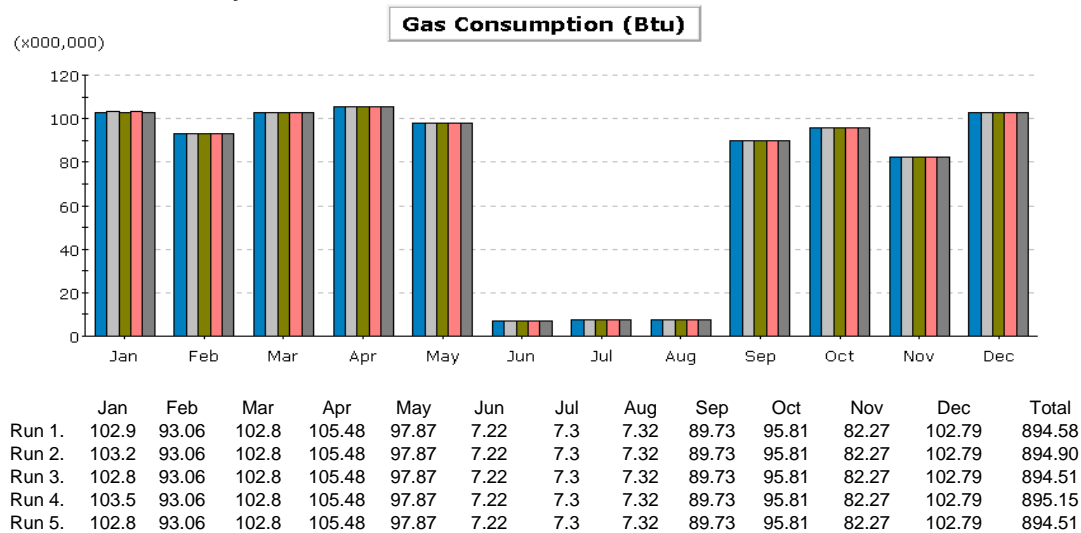
Frame: Metal without thermal break



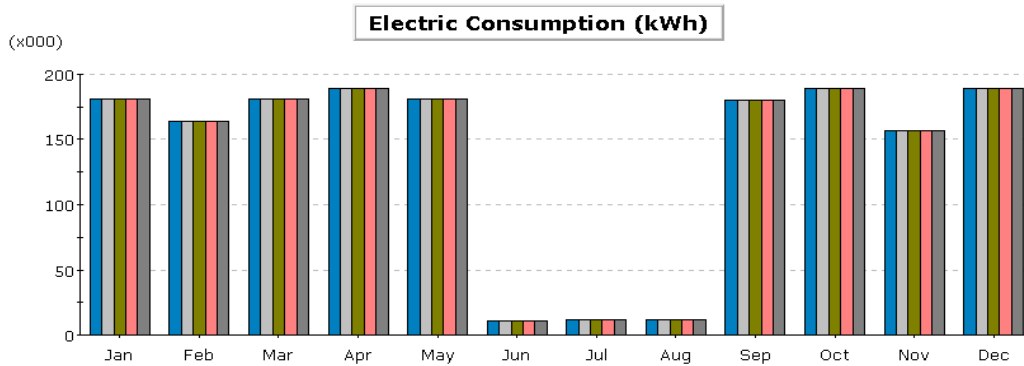
Frame: Metal with thermal break



Frame: Reinforced Vinyl

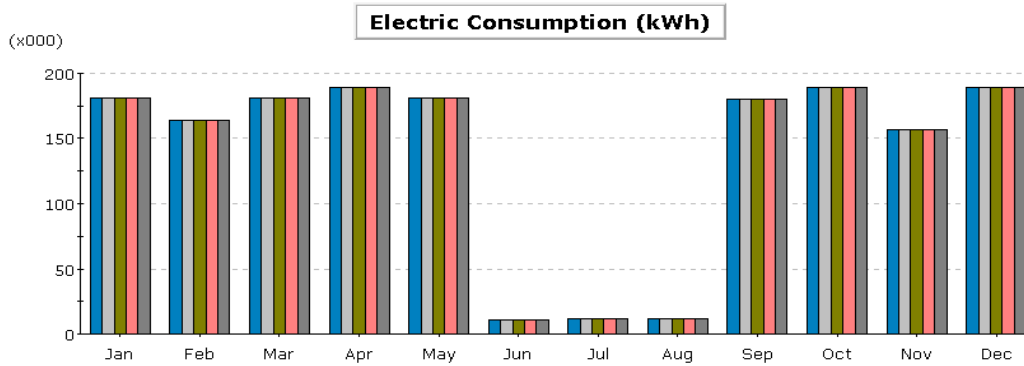


Frame: Metal without thermal break



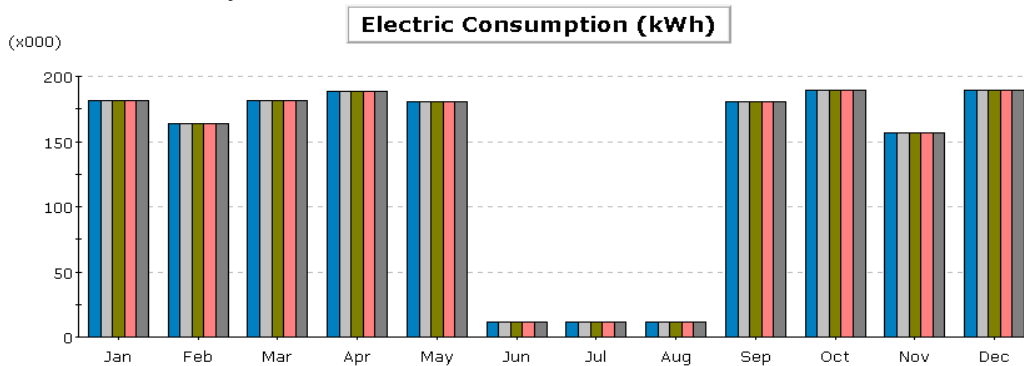
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.6	189.1	156.6	189.1	1,645.30
Run 2.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.6	189.1	156.6	189.1	1,645.30
Run 3.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30
Run 4.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.20
Run 5.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30

Frame: Metal with thermal break



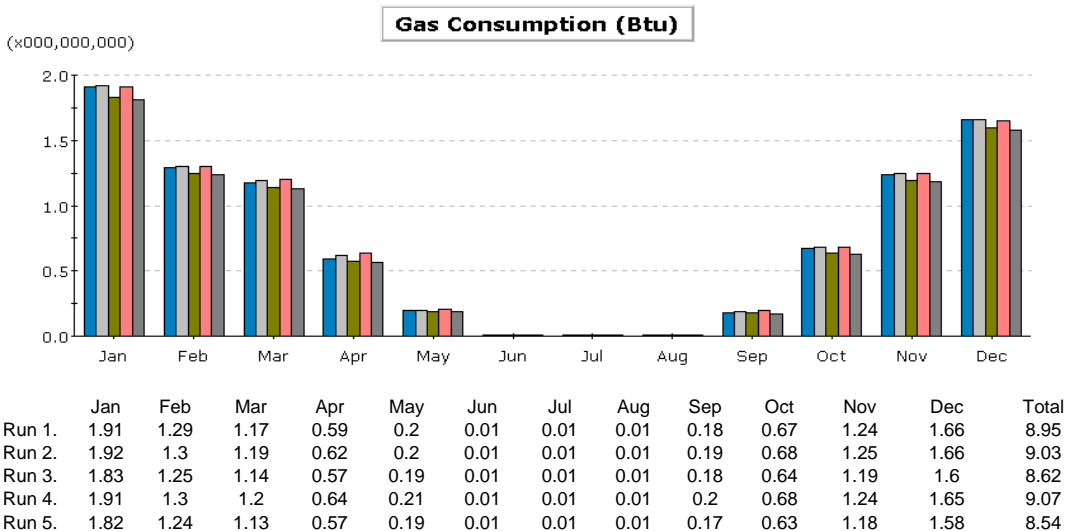
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.6	189.1	156.6	189.1	1,645.30
Run 2.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.6	189.1	156.6	189.1	1,645.30
Run 3.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30
Run 4.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.20
Run 5.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30

Frame: Reinforced Vinyl

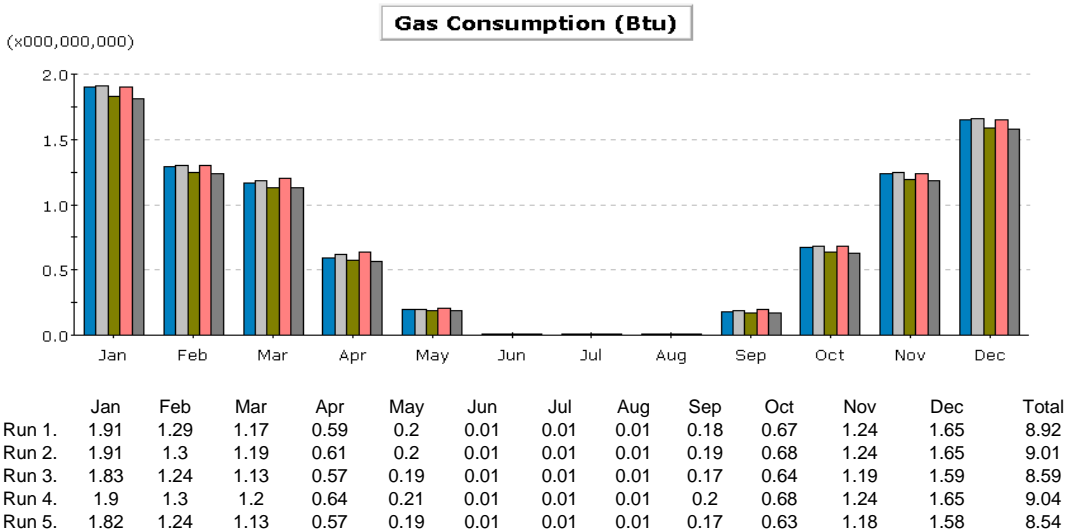


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.6	189.1	156.6	189.1	1,645.30
Run 2.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30
Run 3.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30
Run 4.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.20
Run 5.	181.1	163.8	181.1	188.7	180.9	11.2	11.5	11.5	180.5	189.1	156.6	189.1	1,645.30

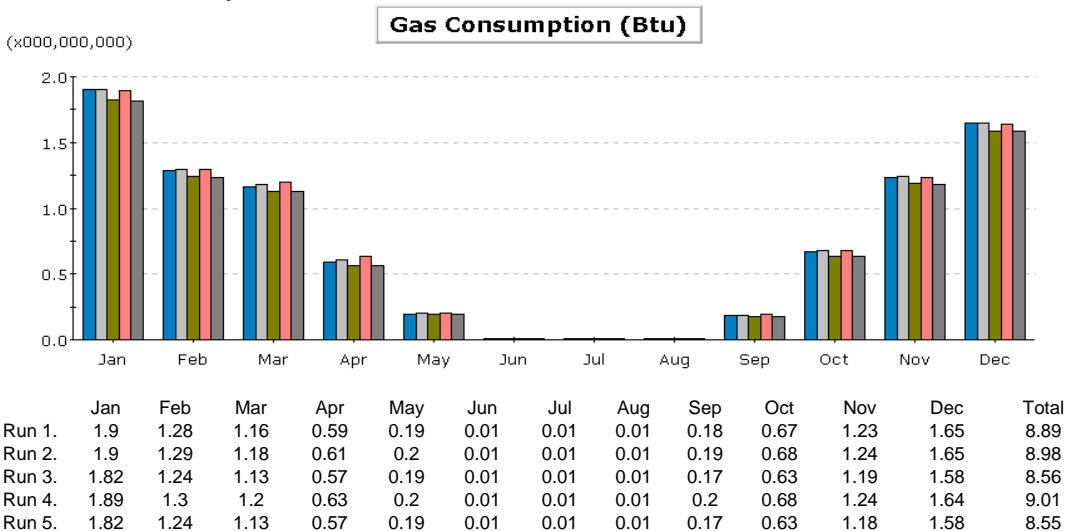
Frame: Metal without thermal break



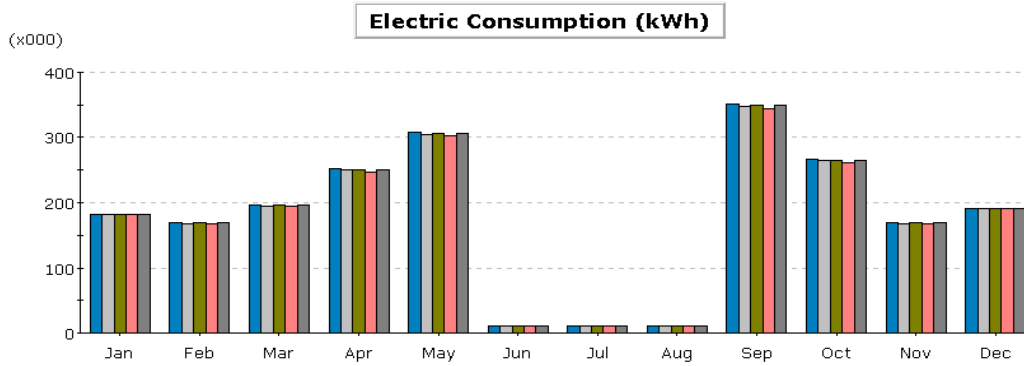
Frame: Metal with thermal break



Frame: Reinforced Vinyl

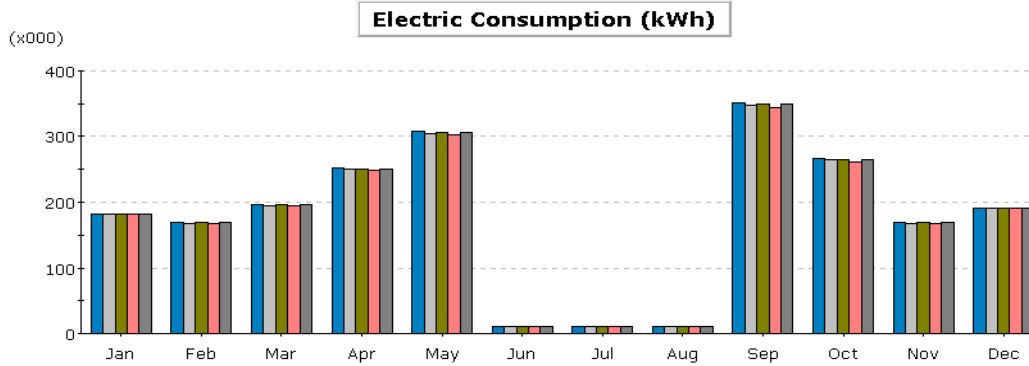


Frame: Metal without thermal break



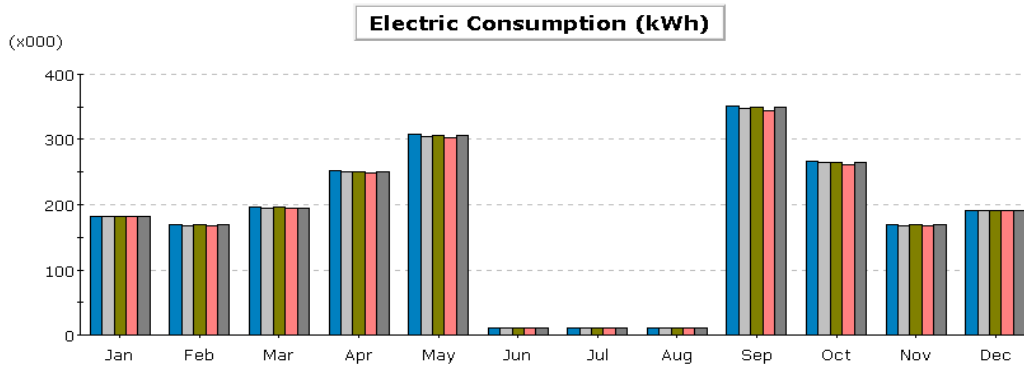
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	182.1	168.9	195.8	251.7	308.1	11.1	11.5	11.5	351.5	266.5	168.7	191.4	2,118.80
Run 2.	182	168.4	195.1	249.8	305.4	11.1	11.5	11.5	348.3	264.1	168	191.1	2,106.30
Run 3.	182.1	168.8	195.5	250.9	306.4	11.1	11.5	11.5	349.7	265.7	168.6	191.3	2,113.00
Run 4.	181.9	168.1	194.5	247.7	302.8	11.1	11.5	11.5	345	262.1	167.3	190.9	2,094.40
Run 5.	182.1	168.8	195.5	250.8	306.2	11.1	11.5	11.5	349.5	265.6	168.6	191.4	2,112.50

Frame: Metal with thermal break



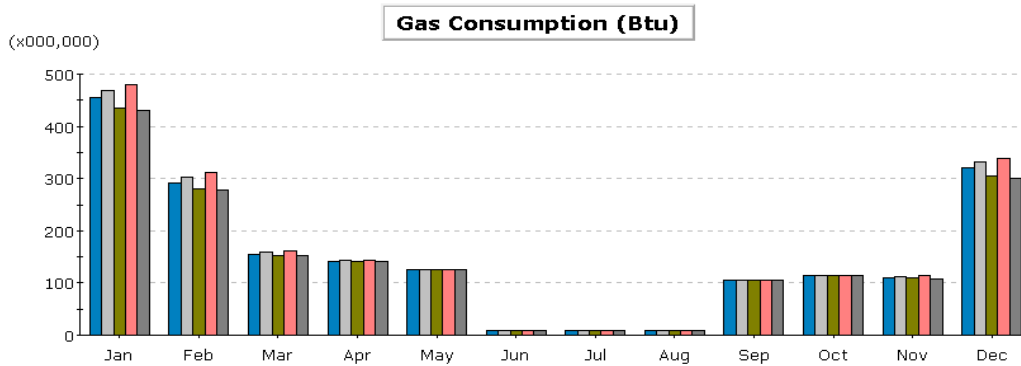
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	182.1	168.9	195.8	251.7	308.1	11.1	11.5	11.5	351.5	266.5	168.7	191.4	2,118.80
Run 2.	182	168.4	195.2	249.8	305.4	11.1	11.5	11.5	348.3	264.1	168	191.1	2,106.30
Run 3.	182.1	168.8	195.5	250.9	306.3	11.1	11.5	11.5	349.7	265.7	168.6	191.4	2,113.10
Run 4.	181.9	168.1	194.6	247.8	302.8	11.1	11.5	11.5	345	262.1	167.3	190.9	2,094.40
Run 5.	182.1	168.8	195.5	250.8	306.2	11.1	11.5	11.5	349.5	265.6	168.6	191.4	2,112.50

Frame: Reinforced Vinyl



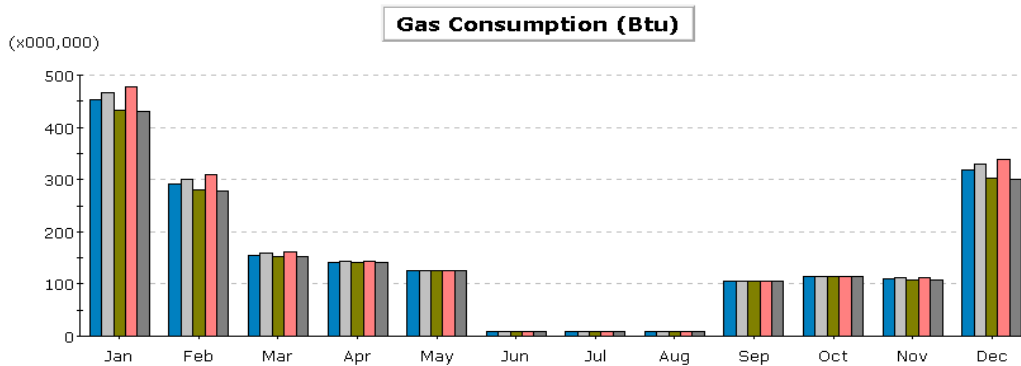
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	182.1	168.9	195.8	251.8	308	11.1	11.5	11.5	351.5	266.6	168.7	191.4	2,119.00
Run 2.	182	168.5	195.2	249.8	305.3	11.1	11.5	11.5	348.3	264.2	168.1	191.1	2,106.40
Run 3.	182.1	168.8	195.5	251	306.3	11.1	11.5	11.5	349.7	265.7	168.6	191.4	2,113.10
Run 4.	181.9	168.1	194.6	247.8	302.8	11.1	11.5	11.5	345	262.1	167.3	190.9	2,094.40
Run 5.	182.1	168.8	195.5	250.7	306	11.1	11.5	11.5	349.3	265.6	168.6	191.4	2,111.90

Frame: Metal without thermal break



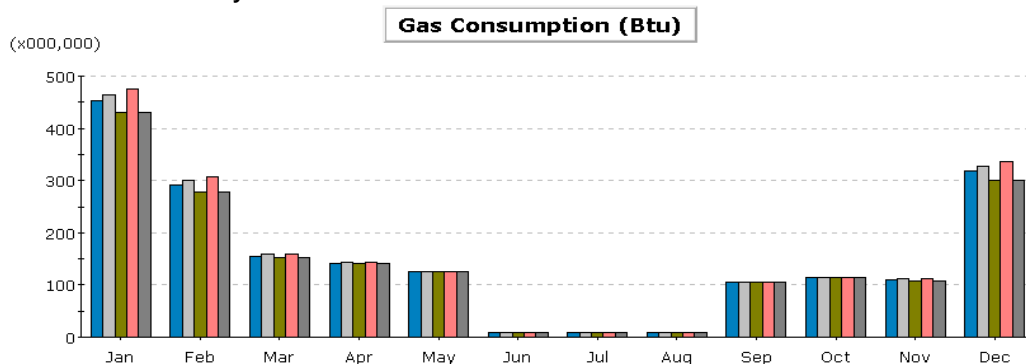
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	454.4	291.9	155.7	142.3	124.7	8	8	8.2	104.4	114.5	110.1	319.8	1,842.10
Run 2.	469.3	302.4	158.9	142.8	124.7	8	8	8.2	104.3	114.6	112	331	1,884.00
Run 3.	435.7	280.9	152.7	141.7	124.7	8	8	8.2	104.4	114.5	108.7	304.9	1,792.40
Run 4.	480.2	310.6	161.1	143.3	124.7	8	8	8.2	104.6	114.6	113.3	339.5	1,916.00
Run 5.	430.3	277.6	151.8	141.5	124.7	8	8	8.2	104.4	114.5	108.4	301.2	1,778.50

Frame: Metal with thermal break

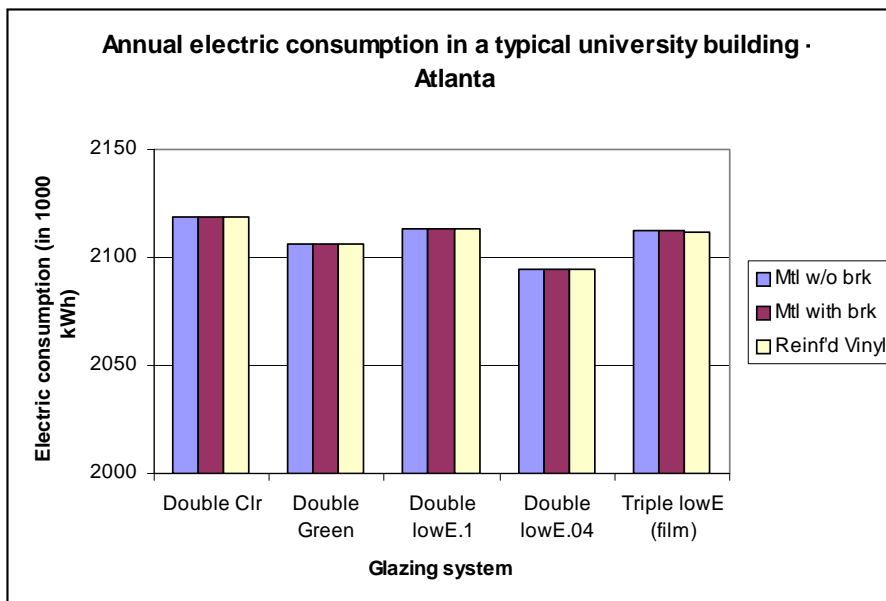
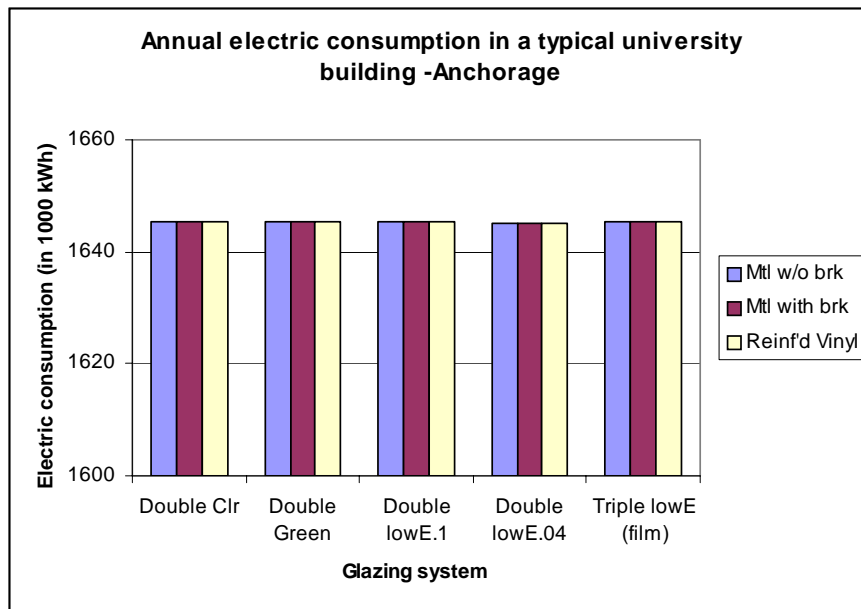
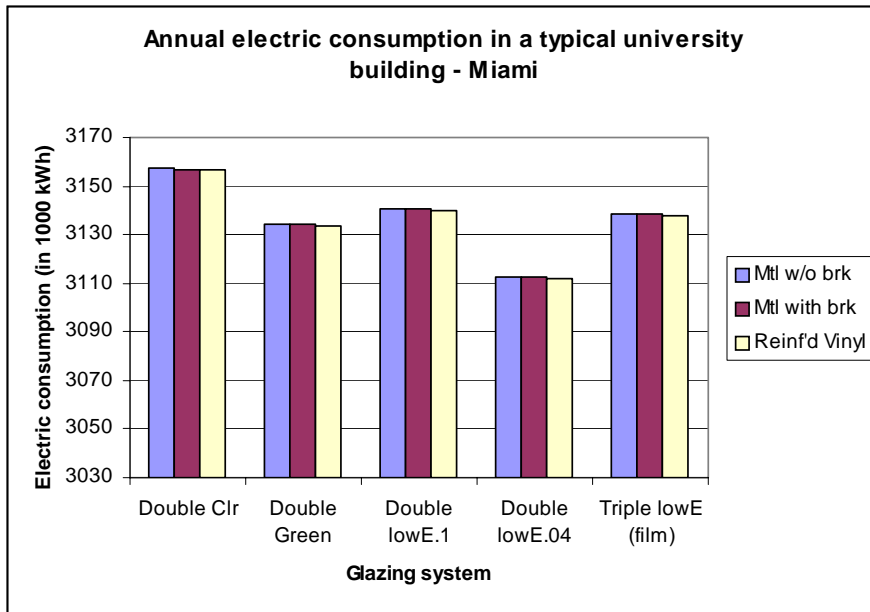


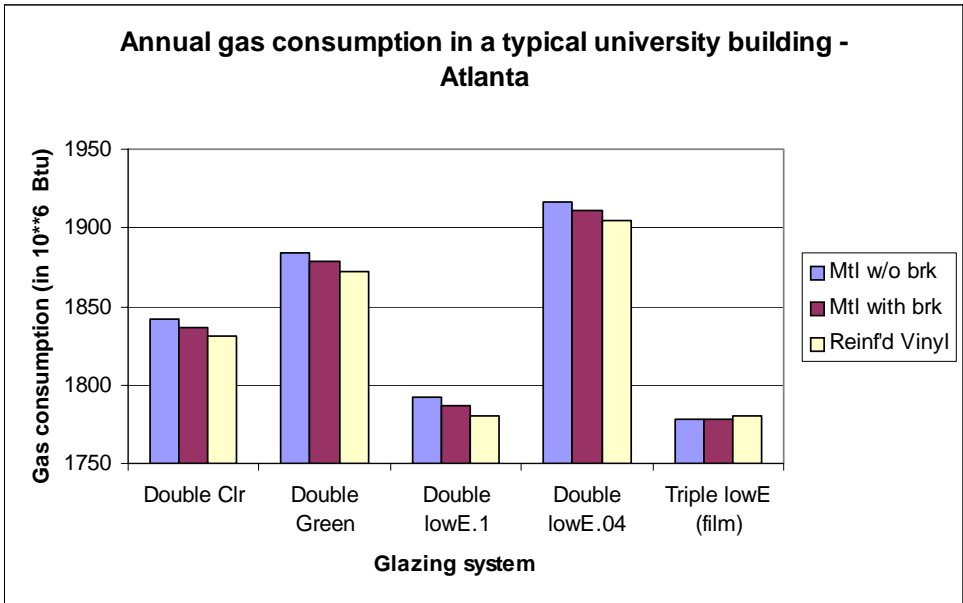
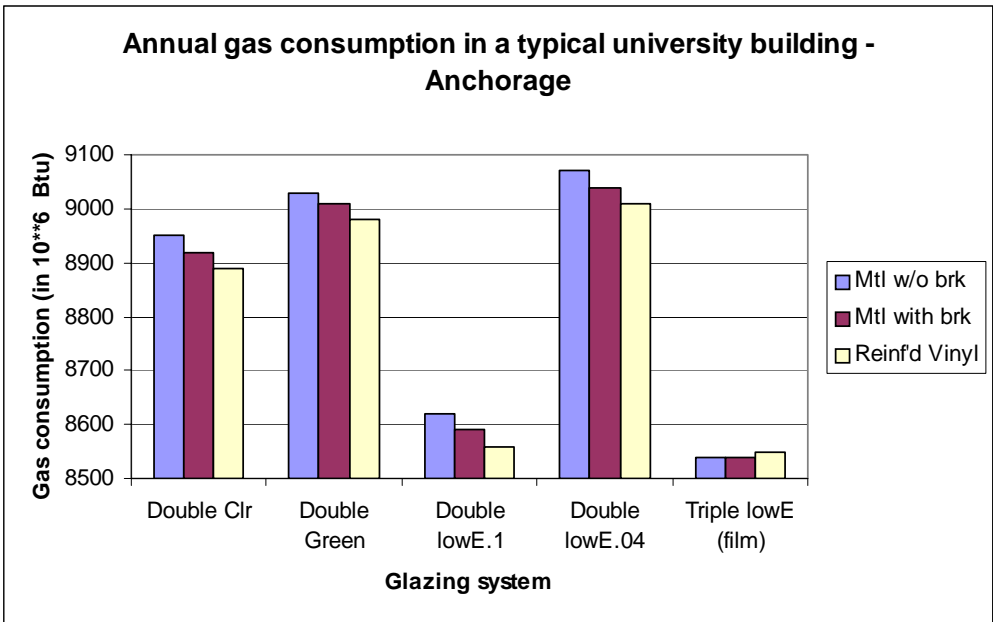
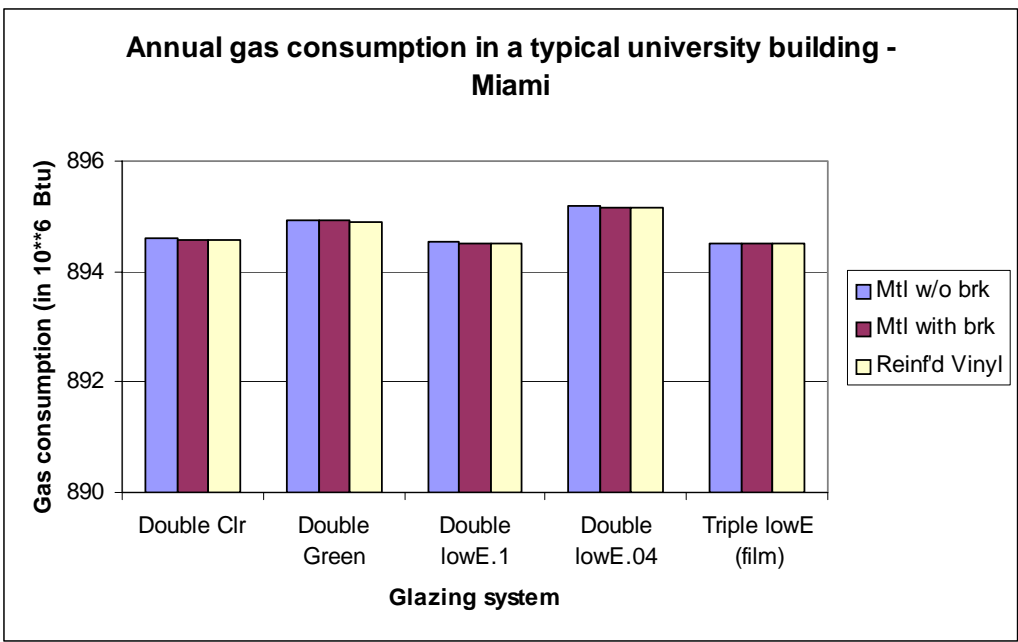
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	452.5	290.7	155.4	142.2	124.7	8	8	8.2	104.4	114.5	110	318.3	1,836.90
Run 2.	467.3	301.2	158.5	142.7	124.7	8	8	8.2	104.3	114.5	111.6	329.5	1,878.50
Run 3.	433.7	279.5	152.4	141.6	124.7	8	8	8.2	104.4	114.5	108.6	303.3	1,787.00
Run 4.	478.2	309.4	160.7	143.2	124.7	8	8	8.2	104.6	114.6	113.1	338	1,910.70
Run 5.	430.3	277.6	151.8	141.5	124.7	8	8	8.2	104.4	114.5	108.4	301.2	1,778.50

Frame: Reinforced Vinyl



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	450.2	289	155	142.1	124.7	8	8	8.2	104.5	114.5	109.8	316.6	1,830.60
Run 2.	465	299.7	158.1	142.7	124.7	8	8	8.2	104.3	114.5	111.4	327.5	1,872.10
Run 3.	431.2	277.9	151.9	141.5	124.7	8	8	8.2	104.4	114.5	108.4	301.5	1,780.20
Run 4.	475.9	307.9	160.3	143.1	124.7	8	8	8.2	104.6	114.6	112.9	336.3	1,904.30
Run 5.	431.1	278.1	151.9	141.5	124.7	8	8	8.2	104.4	114.5	108.5	301.5	1,780.40





**Cumulative Life-Cycle SAVINGS (negative entries indicate increased costs)**

Base:Double Clear

Office	Miami			Anchorage			Atlanta		
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	\$32,493	\$32,644	\$32,642	-\$13,602	-\$13,920	-\$14,772	\$8,408	\$8,405	\$8,630
Double LowE (e2=0.1)	\$20,832	\$20,756	\$20,800	-\$872	-\$1,662	-\$5,001	\$18,636	\$18,998	\$19,593
Double LowE (e2=0.04)	\$56,937	\$57,191	\$57,430	-\$36,957	-\$38,338	-\$39,782	\$2,666	\$7,183	\$8,203
Triple LowE (film)	-\$75,689	-\$56,925	-\$25,027	-\$100,087	-\$82,598	-\$53,383	-\$75,736	-\$58,032	-\$25,910
<b>Residential (Electrical heating)</b>									
Double Clear									
Double Green	\$67,260	\$68,242	\$65,958	-\$57,282	-\$56,577	-\$85,921	\$15,174	\$9,948	\$5,960
Double LowE (e2=0.1)	\$55,251	\$56,265	\$53,981	\$266,688	\$266,657	\$236,985	\$64,385	\$60,333	\$54,061
Double LowE (e2=0.04)	\$135,670	\$136,764	\$134,480	-\$102,209	-\$100,768	-\$129,909	\$17,749	\$10,625	\$9,081
Triple LowE (film)	\$9,325	\$18,143	\$33,877	\$298,768	\$274,758	\$250,176	\$16,482	\$20,170	\$29,986
<b>University</b>									
Double Clear									
Double Green	\$31,967	\$32,073	\$32,971	-\$9,337	-\$9,417	-\$19,967	\$58,208	\$16,609	\$17,067
Double LowE (e2=0.1)	\$17,306	\$17,381	\$18,264	\$12,029	\$12,000	\$0	\$46,646	\$5,046	\$5,535
Double LowE (e2=0.04)	\$55,407	\$55,542	\$56,500	-\$19,953	-\$19,935	-\$30,402	\$67,186	\$25,571	\$26,120
Triple LowE (film)	-\$58,577	-\$43,725	-\$16,138	-\$62,221	-\$48,440	-\$37,158	-\$30,683	-\$57,125	-\$30,095
<b>Residential (Gas Heating)</b>									
Double Clear									
Double Green	\$67,308	\$67,325	\$67,566	-\$4,369	-\$4,310	-\$4,280	\$26,878	\$26,807	\$27,125
Double LowE (e2=0.1)	\$55,331	\$55,445	\$55,718	\$12,031	\$12,165	\$12,329	\$21,949	\$21,407	\$22,217
Double LowE (e2=0.04)	\$135,638	\$135,783	\$135,156	-\$12,845	-\$12,694	-\$12,605	\$52,267	\$52,894	\$52,571
Triple LowE (film)	\$9,406	\$19,574	\$36,306	-\$37,095	-\$28,490	-\$10,353	-\$28,315	-\$18,673	-\$2,036

**Cumulative Electric SAVINGS (negative entries indicate increased energy consumption)**

Base:Double Clear  
(in 1000 kWh)

Office	Miami			Anchorage			Atlanta		
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	19.9	20.1	20.1	-1.1	-1.2	-1.5	10.1	10.2	10.2
Double LowE (e2=0.1)	17.9	17.9	18	-1.6	-1.7	-2	10.5	10.6	10.5
Double LowE (e2=0.04)	41.4	41.5	41.6	-3	-3.4	-3.7	20	20.2	20.2
Triple LowE (film)	20.3	19.8	20.1	-1.5	-1.7	-2	12.2	11.8	11.9

**Residential (Electric heating)**

	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	14.48	14.53	14.54	-9.36	-9.21	-9.09	4.24	5.04	4.47
Double LowE (e2=0.1)	13.65	13.71	13.74	46.91	46.87	46.76	12.64	13.33	12.43
Double LowE (e2=0.04)	30.48	30.54	30.43	-15.84	-15.54	-15.26	9.34	10.06	9.79
Triple LowE (film)	15.79	15.51	15.29	61.75	55.78	55.56	15.6	14.39	12.99

**University**

	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	22.7	22.7	23.2	0	0	0	12.5	12.5	12.6
Double LowE (e2=0.1)	16.2	16.3	16.7	0	0	0	5.8	5.7	5.9
Double LowE (e2=0.04)	44.3	44.4	44.9	0.1	0.1	0.1	24.4	24.4	24.6
Triple LowE (film)	18.3	17.9	18.9	0	0	0	6.3	6.3	7.1

**Residential (Gas heating)**

	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	14.5	14.5	14.55	0.77	0.78	0.77	8.02	7.9	8.07
Double LowE (e2=0.1)	13.67	13.7	13.76	0.64	0.65	0.65	6.97	6.73	7.04
Double LowE (e2=0.04)	30.47	30.51	30.43	1.62	1.64	1.64	17.14	17.24	17.18
Triple LowE (film)	15.8	15.5	15.31	0.71	0.7	0.7	8.02	7.81	7.57

**Cumulative Gas SAVINGS (negative entries indicate increased energy consumption)**

Base:Double Clear

(in kBtu)

Office	Miami			Anchorage			Atlanta		
	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	2010	2560	1560	-110000	-110000	-120000	-124100	-126300	-125200
Double LowE (e2=0.1)	10770	9800	9420	160000	160000	130000	134700	134400	131400
Double LowE (e2=0.04)	4780	4730	3690	-210000	-220000	-240000	-256400	-259400	-258400
Triple LowE (film)	11540	10480	9430	200000	180000	130000	170900	149900	127900

**University**

	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	-340	-340	-320	-80000	-90000	-90000	-41900	-41600	-41500
Double LowE (e2=0.1)	70	60	70	330000	330000	330000	49700	49900	50400
Double LowE (e2=0.04)	-590	-590	-570	-120000	-120000	-120000	-73900	-73800	-73700
Triple LowE (film)	100	80	70	410000	380000	340000	63600	58400	50200

**Residential (Gas heating)**

	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl	Mtl w/o brk	Mtl with brk	Reinf'd Vinyl
Double Clear									
Double Green	0	0	0	-55500	-54700	-54200	-23050	-17610	-22050
Double LowE (e2=0.1)	0	0	0	219200	219300	219300	31690	37880	30680
Double LowE (e2=0.04)	0	0	0	-99200	-98000	-96700	-47770	-44610	-45940
Triple LowE (film)	0	0	0	290600	262100	261600	43170	37520	30750