

Table S1. The solar irradiation values for building and window types in Erzurum and Antalya

City	Month	Type-A/C						Type-B/D					
		Type-0	Type-1	Type-2	Type-3	Type-4	Type-5	Type-0	Type-1	Type-2	Type-3	Type-4	Type-5
Erzurum	January	3,508.26	4,073.87	4,356.67	4,639.48	4,790.26	4,941.05	1,949.04	2,263.26	2,420.37	2,577.49	2,661.26	2,745.03
	February	6,066.06	7,010.41	7,482.58	7,954.75	8,245.89	8,537.04	3,370.03	3,894.67	4,156.99	4,419.31	4,581.05	4,742.80
	March	6,884.59	7,943.45	8,472.88	9,002.31	9,344.42	9,686.53	3,824.77	4,413.03	4,707.16	5,001.28	5,191.34	5,381.40
	April	6,545.23	7,550.97	8,053.83	8,556.70	8,882.79	9,208.88	3,636.24	4,194.98	4,474.35	4,753.72	4,934.88	5,116.04
	May	6,801.44	7,823.74	8,334.90	8,846.05	9,205.53	9,565.00	3,778.58	4,346.52	4,630.50	4,914.47	5,114.18	5,313.89
	June	8,421.54	9,644.02	10,255.26	10,866.50	11,350.81	11,835.12	4,678.63	5,357.79	5,697.37	6,036.95	6,306.01	6,575.07
	July	9,983.61	11,436.07	12,162.31	12,888.54	13,459.76	14,030.97	5,546.45	6,353.37	6,756.84	7,160.30	7,477.64	7,794.99
	August	11,136.44	12,868.94	13,735.18	14,601.43	15,137.01	15,672.58	6,186.91	7,149.41	7,630.66	8,111.91	8,409.45	8,706.99
	September	10,734.91	12,546.51	13,452.31	14,358.11	14,746.31	15,134.51	5,963.84	6,970.28	7,473.50	7,976.73	8,192.39	8,408.06
	October	8,091.12	9,519.69	10,233.98	10,948.27	11,183.75	11,419.23	4,495.07	5,288.72	5,685.55	6,082.37	6,213.19	6,344.02
	November	5,374.56	6,335.17	6,815.48	7,295.78	7,441.64	7,587.50	2,985.87	3,519.54	3,786.38	4,053.21	4,134.25	4,215.28
	December	2,887.60	3,372.97	3,615.65	3,858.34	3,964.51	4,070.68	1,604.22	1,873.87	2,008.70	2,143.52	2,202.51	2,261.49
Antalya	January	5,424.97	6,384.18	6,863.79	7,343.39	7,500.03	7,656.68	3,013.87	3,546.77	3,813.21	4,079.66	4,166.69	4,253.71
	February	6,567.51	7,689.16	8,249.99	8,810.82	9,036.25	9,261.68	3,648.62	4,271.76	4,583.33	4,894.90	5,020.14	5,145.38
	March	7,560.04	8,815.10	9,442.63	10,070.16	10,362.32	10,654.49	4,200.02	4,897.28	5,245.90	5,594.53	5,756.85	5,919.16
	April	8,122.43	9,423.82	10,074.52	10,725.21	11,081.65	11,438.10	4,512.46	5,235.45	5,596.95	5,958.45	6,156.47	6,354.50
	May	8,271.30	9,545.92	10,183.23	10,820.54	11,229.31	11,638.08	4,595.17	5,303.29	5,657.35	6,011.41	6,238.51	6,465.60
	June	8,499.02	9,756.96	10,385.93	11,014.89	11,481.76	11,948.62	4,721.68	5,420.53	5,769.96	6,119.39	6,378.75	6,638.12
	July	9,541.89	10,964.78	11,676.22	12,387.66	12,902.23	13,416.80	5,301.05	6,091.54	6,486.79	6,882.04	7,167.91	7,453.78
	August	10,971.59	12,724.11	13,600.37	14,476.63	14,962.97	15,449.30	6,095.33	7,068.95	7,555.76	8,042.57	8,312.76	8,582.95
	September	11,077.14	12,972.35	13,919.96	14,867.57	15,244.75	15,621.93	6,153.97	7,206.86	7,733.31	8,259.76	8,469.31	8,678.85
	October	9,109.27	10,720.92	11,526.75	12,332.57	12,594.69	12,856.81	5,060.71	5,956.07	6,403.75	6,851.43	6,997.05	7,142.67
	November	7,220.66	8,529.79	9,184.35	9,838.92	10,018.09	10,197.26	4,011.48	4,738.77	5,102.42	5,466.07	5,565.60	5,665.14
	December	5,111.01	6,038.18	6,501.76	6,965.35	7,091.69	7,218.04	2,839.45	3,354.54	3,612.09	3,869.64	3,939.83	4,010.02

Table S2. Cost difference detail for Type-A (Erzurum)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,528.81	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	3,220.91	94.08	5,685.87	4,070.26	3.02	241.95	2,023.04	2.35	72.12	1,713.85	538.12	925.20	85.50
Type-2	70.56	4,831.36	70.56	4,264.40	5,994.27	4.44	356.31	3,034.57	3.53	108.17	2,528.62	793.95	1,387.81	128.25
Type-3	94.08	6,441.81	47.04	2,842.94	8,029.40	5.95	477.29	4,046.09	4.71	144.23	3,385.54	1,063.01	1,850.41	171.00
Type-4	117.60	8,052.27	23.52	1,421.47	10,201.04	7.56	606.37	4,662.65	5.42	166.21	4,245.98	1,333.18	2,684.35	248.07
Type-5	141.12	9,662.72	-	-	12,372.68	9.16	735.46	5,415.75	6.30	193.06	5,106.42	1,603.34	3,518.28	325.13

Table S3. Cost difference detail for Type-A (Antalya)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,032.75	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	3,220.91	94.08	5,355.16	846.65	0.63	50.33	5,752.14	6.69	205.05	409.65	125.98	823.46	76.10
Type-2	70.56	4,831.36	70.56	4,016.37	1,165.63	0.86	69.29	9,762.73	11.35	348.01	589.74	181.36	1,235.19	114.15
Type-3	94.08	6,441.81	47.04	2,677.58	1,588.95	1.18	94.45	13,016.97	15.14	464.02	794.56	244.35	1,646.92	152.20
Type-4	117.60	8,052.27	23.52	1,338.79	2,349.51	1.74	139.66	15,056.24	17.51	536.71	1,002.96	308.44	2,362.16	218.29
Type-5	141.12	9,662.72	-	-	3,110.07	2.30	184.87	17,095.51	19.88	609.40	1,211.36	372.53	3,077.40	284.39

Table S4. Cost difference detail for Type-B (Erzurum)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,528.81	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	3,458.54	94.08	5,685.87	2,421.46	1.79	143.94	1,112.05	1.29	39.64	1,012.93	318.05	474.26	43.83
Type-2	70.56	5,187.81	70.56	4,264.40	3,566.56	2.64	212.01	1,668.07	1.94	59.46	1,494.49	469.25	711.39	65.74
Type-3	94.08	6,917.07	47.04	2,842.94	4,777.29	3.54	283.97	2,224.10	2.59	79.28	2,000.96	628.27	948.53	87.66
Type-4	117.60	8,646.34	23.52	1,421.47	6,063.86	4.49	360.45	2,553.82	2.97	91.04	2,509.37	787.91	1,368.91	126.50
Type-5	141.12	10,375.61	-	-	7,350.43	5.44	436.93	2,959.40	3.44	105.49	3,017.79	947.54	1,789.28	165.35

Table S5. Cost difference detail for Type-B (Antalya)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,032.75	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	4,478.45	94.08	5,355.16	1,258.72	0.93	105.44	3,169.76	3.69	112.99	414.55	127.49	468.96	43.34
Type-2	70.56	6,717.67	70.56	4,016.37	1,783.74	1.32	151.96	4,754.65	5.53	169.49	597.08	183.62	703.43	65.01
Type-3	94.08	8,956.90	47.04	2,677.58	2,413.10	1.79	204.68	6,339.53	7.37	225.98	804.35	247.36	937.91	86.68
Type-4	117.60	11,196.12	23.52	1,338.79	3,229.81	2.39	257.40	6,963.85	8.10	248.24	1,013.61	311.71	1,270.29	117.39
Type-5	141.12	13,435.35	-	-	4,046.53	3.00	310.12	7,588.18	8.83	270.50	1,222.87	376.07	1,602.66	148.11

Table S6. Cost difference detail for Type-C (Erzurum)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,528.81	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	3,238.45	94.08	5,685.87	3,966.67	2.94	235.79	2,017.16	2.35	71.91	1,674.55	525.78	905.51	83.68
Type-2	70.56	4,857.67	70.56	4,264.40	5,841.42	4.33	347.23	3,025.75	3.52	107.86	2,470.62	775.74	1,358.26	125.52
Type-3	94.08	6,476.90	47.04	2,842.94	7,824.76	5.80	465.12	4,034.33	4.69	143.81	3,307.89	1,038.63	1,811.02	167.36
Type-4	117.60	8,096.12	23.52	1,421.47	9,944.61	7.37	591.13	4,644.54	5.40	165.56	4,148.68	1,302.62	2,623.69	242.46
Type-5	141.12	9,715.35	-	-	12,064.45	8.94	717.14	5,391.29	6.27	192.18	4,989.47	1,566.62	3,436.35	317.56

Table S7. Cost difference detail for Type-C (Antalya)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,032.75	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	3,238.45	94.08	5,355.16	846.65	0.63	50.33	5,746.26	6.68	204.84	409.65	125.98	803.77	74.28
Type-2	70.56	4,857.67	70.56	4,016.37	1,165.63	0.86	69.29	9,753.91	11.34	347.70	589.74	181.36	1,205.65	111.42
Type-3	94.08	6,476.90	47.04	2,677.58	1,588.95	1.18	94.45	13,005.21	15.13	463.60	794.56	244.35	1,607.53	148.56
Type-4	117.60	8,096.12	23.52	1,338.79	2,349.51	1.74	139.66	15,038.13	17.49	536.06	1,002.96	308.44	2,301.50	212.69
Type-5	141.12	9,715.35	-	-	3,110.07	2.30	184.87	17,071.05	19.85	608.53	1,211.36	372.53	2,995.47	276.82

Table S8. Cost difference detail for Type-D (Erzurum)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,528.81	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	3,726.69	94.08	5,685.87	2,007.13	1.49	119.31	1,088.53	1.27	38.80	855.71	268.68	395.48	36.55
Type-2	70.56	5,590.04	70.56	4,264.40	2,955.16	2.19	175.66	1,632.79	1.90	58.20	1,262.50	396.41	593.23	54.82
Type-3	94.08	7,453.38	47.04	2,842.94	3,958.73	2.93	235.32	2,177.06	2.53	77.61	1,690.35	530.75	790.97	73.10
Type-4	117.60	9,316.73	23.52	1,421.47	5,038.13	3.73	299.48	2,481.38	2.89	88.45	2,120.16	665.70	1,126.27	104.08
Type-5	141.12	11,180.07	-	-	6,117.53	4.53	363.64	2,861.55	3.33	102.01	2,549.97	800.65	1,461.56	135.07

Table S9. Cost difference detail for Type-D (Antalya)

Building Types	Initial Investment Costs							Costs of Energy Consumption						
	P1 (window)		P2 (wall)		P3 (heating system)			P4 (cooling system)			P5 (natural gas)		P6 (electricity)	
	[m ²]	Cost (\$)	[m ²]	Cost (\$)	[kcalh ⁻¹]	[m]	Cost (\$)	[kcalh ⁻¹]	[kW]	Cost (\$)	[m ³ year ⁻¹]	Cost (\$)	[kWhyear ⁻¹]	Cost (\$)
Type-0	-	-	141.12	8,032.75	-	-	-	-	-	-	-	-	-	-
Type-1	47.04	4,495.99	94.08	5,355.16	1,258.72	0.93	74.82	3,146.24	3.66	112.15	414.55	127.49	390.18	36.06
Type-2	70.56	6,743.99	70.56	4,016.37	1,783.74	1.32	106.03	4,719.37	5.49	168.23	597.08	183.62	585.27	54.09
Type-3	94.08	8,991.99	47.04	2,677.58	2,413.10	1.79	143.44	6,292.49	7.32	224.31	804.35	247.36	780.36	72.11
Type-4	117.60	11,239.98	23.52	1,338.79	3,229.81	2.39	191.99	6,891.41	8.01	245.66	1,013.61	311.71	1,027.65	94.97
Type-5	141.12	13,487.98	-	-	4,046.53	3.00	240.54	7,490.34	8.71	267.01	1,222.87	376.07	1,274.94	117.82