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Appendix for ECM 3: Envelope Improvements

I. Energy Savings Calculations

ECM 3 Envelope Improvement Recreation Center Savings Calculation

Recreation Center

651 10th Avenue

AIR LEAKAGE:

Door(s)	380	1/16	1.98 sq ft
Door(s)	40	1/16	0.21 sq ft
Roof / Wall	700	3/32	5.47 sq ft
Roof / Wall	160	1/16	0.83 sq ft
Roof / Level	80	1/32	0.21 sq ft
Roof / Wall	120	1/16	0.63 sq ft

Total 9.32 sq ft 0.87 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.101	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.680	Natural Gas	100%	
				Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	130			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	4180.25	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	67 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	90%	0.89	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	1559.05	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 3421 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 2297 KWh EC 128 calc.

Union Colony Civic Center

701 10th Avenue

AIR LEAKAGE:

Door(s)	380	1/16	1.98 sq ft
Door(s)	20	1/16	0.10 sq ft

Total 2.08 sq ft 0.19 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.100	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.710	Natural Gas	100%	
	$0.000		0%	Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	140			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	3135.1875	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	66 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	80%	1.00	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	375.19	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 695 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 553 KWh EC 128 calc.

ECM 3 Envelope Improvement Senior Center Savings Calculation

Senior Center

1010 6th Street

AIR LEAKAGE:

Door(s)	200	3/32	1.56 sq ft
Window(s)	100	1/32	0.26 sq ft
Roof / Level	120	1/32	0.31 sq ft
Roof / Wall	520	1/16	2.71 sq ft
Roof / Wall	40	1/16	0.21 sq ft

Total 5.05 sq ft 0.47 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.088	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.830	Natural Gas	100%	
	$0.000		0%	Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	130			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	3762.225	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	69 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	80%	1.00	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	844.85	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 1877 Therms SafetyFactor = 0.4 Gas Heating Loss = 751 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 1245 KWh EC 128 calc.

ECM 3 Envelope Improvement FunPlex Savings Calculation

FunPlex

1501 65th Avenue

AIR LEAKAGE:

Door(s)	600	1/16	3.13 sq ft
Roof / Wall	400	3/32	3.13 sq ft
Roof / Wall	330	3/32	2.58 sq ft
Door(s)	20	1/16	0.10 sq ft
Roof / Level	80	1/32	0.21 sq ft

Total 9.14 sq ft 0.85 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.090	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.530	Natural Gas	100%	
	$0.000		0%	Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	140			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	4180.25	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	66 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	80%	1.00	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	1646.15	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 4063 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 2426 KWh EC 128 calc.

ECM 3 Envelope Improvement Lincoln Park Annex Savings Calculation

Lincoln Park Annex

919 7th Street

AIR LEAKAGE:

Door(s)	280	1/16	1.46 sq ft
Door(s)	20	1/16	0.10 sq ft

Total 1.56 sq ft 0.15 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.102	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.720	Natural Gas	100%	
	$0.000		0%	Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	110			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	4180.25	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	70 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	80%	1.00	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	221.09	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 546 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 326 KWh EC 128 calc.

ECM 3 Envelope Improvement Police Headquarters Savings Calculation

Police Headquarters

2875 10th Street

AIR LEAKAGE:

Door(s)	100	3/32	0.78 sq ft
Roof / Wall	840	1/16	4.38 sq ft
Roof / Wall	200	1/32	0.52 sq ft
Window(s)	150	1/32	0.39 sq ft
Door(s)	140	3/32	1.09 sq ft
Window(s)	30	1/32	0.08 sq ft
Roof / Wall	100	1/16	0.52 sq ft
OH - Door(s)	90	3/32	0.70 sq ft

Total 8.46 sq ft 0.79 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.087	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.700	Natural Gas	100%	
	$0.000		0%	Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	100			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	4180.25	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	69 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	90%	0.89	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	1088.72	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 2389 Therms Safety Factor = 0.5 Gas Heating Loss = 1195 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 1604 KWh EC 128 calc.

ECM 3 Envelope Improvement Police HQ Secondary Building Savings Calculation

Police HQ Secondary Building

810 30th Avenue

AIR LEAKAGE:

Door(s)	320	1/16	1.67 sq ft
Roof / Wall	740	1/16	3.85 sq ft
OH - Door(s)	200	1/16	1.04 sq ft

Total 6.56 sq ft 0.61 sq meter

Values, Constants, Assumptions.

Cooling Cost	$0.086	Electricity		K is a factor determining building style, ranging from 100 to 150.
Heating Fuel	$0.730	Natural Gas	100%	
	$0.000		0%	Low K is very efficient with central mass, high K is open ware house or many wings.
Building K	140			
Wind Pressure Factor	6.535		Per EC 128	
Heating Deg Days	4180.25	Celsius	Per EC 128	
Cooling Deg Days	281	Celsius	calculated based on	66 degree base temp in F.
% of bldg. to be cooled	100%			
% mechanical EFF.	90%	0.89	This factor is the anticipated variation of a mechanical efficiently of 80%.	
conversion	0.355		Convert therms to mtrs cubed multiply by (.355)	
conversion	3.6		convert Kw to MJ divide price by 3.6	
COP	2.5		Coefficient of Performance for Air Conditioning or Geo-Thermal.	
Flow Rate "Q"	1181.85	CFM	Infiltration Flow Rate	

Calculations

Non-Electric Heat Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) x (9/5) x 0.075 x .0243 x 60 x 24) / (100,000 x Eff %)

Gas Heating Loss = 2593 Therms

Electrical Heating Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (HDD) / (3.6 x Fuel Factor of 10)

Electrical Heating Loss = 0 KWh EC 128 calc.

Cooling Loss = ((Bldg Leakage sq mtrs) x (bldg k factor) x (Wind P Factor) x (CDD)) / ((Fuel Factor of 10) x (3.6) x (COP))

Cooling Loss = 1742 KWh EC 128 calc.