



Report Monthly Energy Use

As part of a long-term energy plan, after baselining energy use across their portfolio of accounts and facilities, municipalities should track the changes in their energy use over time. This strategy shows municipalities and municipal light plants how to develop monthly energy reports, building on available data in MassEnergyInsight (MEI) to institutionalize the practice of reviewing energy consumption and expenditures on a regular basis, and identify opportunities for efficiency upgrades.

Since different energy types have different units of measure, in order to compare them a common measurement must be used, in this case, Btus (British thermal units). For reference, the following conversion factors are used to compare physical fuel units with Btus:

Energy Unit Conversion Factors		
Fuel Type	Units	Factor
Electricity	MMBtu/kWh	0.003412
Natural Gas	MMBtu/therm	0.1
Fuel Oil	MMBtu/gallon	0.139
Propane	MMBtu/gallon	0.091

Referenced Datasets

The following two datasets are available in each municipality's MEI account under the "View Report" tab. Datasets in MEI can be exported as Excel files under "Export > Crosstab."

- MassEnergyInsight "Data Loaded - Detail"
- MassEnergyInsight "Annual Usage Patterns"

Implementation Steps

1. Find Monthly Municipal Energy Consumption by Fuel Type.

Use the “Annual Usage Patterns” dataset to determine the monthly energy use by fuel type for each fiscal year.

Sheet 1 – Monthly Energy Use					
	A	B	C	D	E
1		Electric (kWh)	Electric (kWh)	Gas (therms)	Gas (therms)
2		FY 2011	FY 2012	FY 2011	FY 2012
3	July	450,125	414,325	4,701	3,801
4	August	353,372	370,813	2,844	4,223
5	September	436,226	387,430	3,535	3,686
6	October	439,407	452,951	4,354	4,854
7	November	472,799	415,025	40,269	30,360
8	December	453,242	435,515	90,697	39,787
9	January	453,242	435,515	125,689	120,657
10	February	531,282	486,796	165,760	122,244
11	March	497,115		107,889	61,926
12	April	445,783		53,580	33,017
13	May	528,472		34,934	15,247
14	June	413,861		10,344	5,856

2. Adjust Building Energy Consumption for Historical Weather Conditions.

Refer to the Simple-Ratio Weather Normalization method to correct the heating fuel consumption for each municipal building for the following heating fuel types:

- Natural Gas
- Fuel Oil

Sheet 1 – Monthly Energy Use							
	A	B	C	D	E	F	G
1		Electric (kWh)	Electric (kWh)	Gas (therms)	Gas (therms) - Normalized	Gas (therms)	Gas (therms) - Normalized
2		FY 2011	FY 2012	FY 2011	FY 2011	FY 2012	FY 2012
3	July	450,125	414,325	4,701	4,438	3,801	4,459
4	August	353,372	370,813	2,844	2,685	4,223	4,954
5	September	436,226	387,430	3,535	3,337	3,686	4,324
6	October	439,407	452,951	4,354	4,110	4,854	5,694
7	November	472,799	415,025	40,269	38,014	30,360	35,612
8	December	453,242	435,515	90,697	85,618	39,787	46,670
9	January	531,282	486,796	125,689	118,651	120,657	141,531
10	February	497,115		165,760	156,478	122,244	143,393
11	March	445,783		107,889	101,848	61,926	72,639
12	April	528,472		53,580	50,580	33,017	38,729
13	May	413,861		34,934	32,978	15,247	17,885
14	June	445,624		10,344	9,765	5,856	6,869

3. Find Monthly Municipal Energy Expenditure by Fuel Type.

Use the “Annual Usage Patterns” dataset to determine the monthly energy cost by fuel type for each fiscal year. There may be more than one column associated with the same fuel type under the same fiscal year in the “Annual Usage Patterns” dataset. The additional columns represent energy cost associated with a competitive supplier. Aggregate all energy costs for the same fuel type before creating the “Monthly Energy Cost” table.

Sheet 2 – Monthly Energy Cost					
	A	B	C	D	E
1		Electric (kWh)	Electric (kWh)	Gas (therms)	Gas (therms)
2		FY 2011	FY 2012	FY 2011	FY 2012
3	July	\$501,283	\$467,826	\$10,714	\$7,134
4	August	\$396,191	\$417,182	\$7,452	\$8,807
5	September	\$491,992	\$434,087	\$8,723	\$7,872
6	October	\$497,578	\$506,009	\$9,165	\$9,291
7	November	\$534,645	\$464,066	\$74,051	\$51,252
8	December	\$510,177	\$488,816	\$178,286	\$66,759
9	January	\$596,439	\$545,497	\$246,746	\$228,411
10	February	\$557,400	\$467,826	\$326,479	\$230,960
11	March	\$500,676		\$209,280	\$92,589
12	April	\$590,648		\$84,808	\$50,479
13	May	\$464,254		\$50,340	\$23,132
14	June	\$501,731		\$16,898	\$9,947

4. Find Monthly Building Energy Consumption by Fuel Type.

Use the “Data Loaded-Detail” dataset to determine the monthly building energy use by fuel type for each fiscal year.

Sheet 3 – Monthly Building Energy Use								
	A	B	C	D	E	F	...	BI
1					FY 2008	FY 2008		FY 2012
2	Department	Complex	Facility	Fuel (units)	July	August		January
3	School Department		High School	Electric (kWh)	212,600	206,400		174,400
4	School Department		High School	Gas (therms)	463	4,112		32,254
5	School Department		Middle School	Electric (kWh)	46,400	39,200		52,000
6	School Department		Middle School	Gas (therms)	186	249		1,452
21	Country Club	Country Club	Main Building	Electric (kWh)	28,960	33,120		12,960
22	Country Club	Country Club	Garage	Gas (therms)	57	56		2,398

5. Find Building Energy Consumption for Given Month.

Find the column for the given month (e.g., Sheet 3, Column BI) on “Sheet 3 – Monthly Building Energy Use” and determine the energy use for each building by fuel type for the given month on a new “Sheet 4 – Building Energy Use.” Convert the consumption in physical units to MMBtus. Remember to normalize the consumptions values of all building heating fuel use using the Simple Ratio Weather Normalization method.

Sheet 4 – Building Energy Use – January 2012					
	A	B	C	D	E
1		Electricity (kWh)	Electricity (MMBtus)	Natural Gas (therms)	Natural Gas (MMBtus) – Weather Normalized
2	Elementary School	25,440	87	7,342	861
3	Middle School	41,280	141	22,026	2,584
4	High School	17,680	60	8,460	992
5	Police Station	24,000	82	4,044	474

6. Aggregate Total Energy Consumption for Each Building for Given Month and Insert Floor Area for Each Building.

Use the “Sum” function to determine the total energy consumption for each building for the given month. Insert a column to identify the floor area in square feet using information from MEI for each building.

Sheet 4 – Building Energy Use – January 2012							
	A	B	C	D	E	G	H
1		Floor Area (sq.ft)	Electricity (kWh)	Electricity (MMBtus)	Natural Gas (therms)	Natural Gas (MMBtus) – Weather Normalized	Total MMBtus
2	Elementary School	60,000	25,440	87	7,342	861	948
3	Middle School	96,000	41,280	141	22,026	2,584	2,725
4	High School	330,000	17,680	60	8,460	992	4,378
5	Police Station	29,430	24,000	82	4,044	474	604

7. Create Monthly Energy Report Template.

Create a new sheet, “Energy Report,” and set the “View” setting as “Page Layout” to view the document as printed pages for formatting purpose.

8. Create General Monthly Energy Use Summary Table.

Use “Sheet 1 – Monthly Energy Use” and “Sheet 2 – Monthly Energy Cost” to create a table that summarizes the monthly energy use and monthly energy cost for the given month and the historic energy use for the same month in previous fiscal years. Remember to normalize the consumptions values of all building heating fuel use using the Simple Ratio Weather Normalization method.

Sheet 5 – Energy Report – Page 1							
	A	B	C	D	E	F	G
1	Town of X						
2	Monthly Energy Report – January 2012						
3							
4	Monthly Energy Use						
5			Electricity		Natural Gas		Total
6			kWh	MMBtus	Therms	MMBtus	MMBtus
7	Jan 2012	Energy Use	486,796	1,661	120,657	14,153	15,814
8		Cost	\$486,796		\$228,411		\$715,207
9	Jan 2011	Energy Use	531,282	1,813	125,689	11,865	13,678
10	Jan 2010	Energy Use	1,135,410	3,874	115,268	11,672	15,546
11	Jan 2009	Energy Use	585,959	1,999	82,369	7,569	9,569

9. Determine Distribution of Energy Expenditure by Fuel Type.

Create a pie chart that identifies the energy expenditure for each fuel type using the cost (blue cells) in the “Monthly Energy Use” summary table.

Sheet 5 – Energy Report – Page 1							
	A	B	C	D	E	F	G
1	Town of X						
2	Monthly Energy Report – January, 2012						
3							
4	Monthly Energy Use						
5			Electricity		Natural Gas		Total
6			kWh	MMBtus	Therms	MMBtus	MMBtus
7	Jan 2012	Energy Use	486,796	1,661	141,531	14,153	15,814
8		Cost	\$486,796		\$228,411		\$715,207
9	Jan 2011	Energy Use	531,282	1,813	118,651	11,865	13,678
10	Jan 2010	Energy Use	1,135,410	3,874	116,723	11,672	15,546
11	Jan 2009	Energy Use	585,959	1,999	75,695	7,569	9,569
12							
13	Energy Consumption by Fuel Type						
14							
15	<p>A pie chart titled "Energy Consumption by Fuel Type" showing the distribution of energy expenditure. The chart is divided into two segments: a larger green segment representing Electricity at 68%, and a smaller orange segment representing Natural Gas at 32%. A legend to the right of the chart identifies the colors: a green square for Electricity and an orange square for Natural Gas.</p>						
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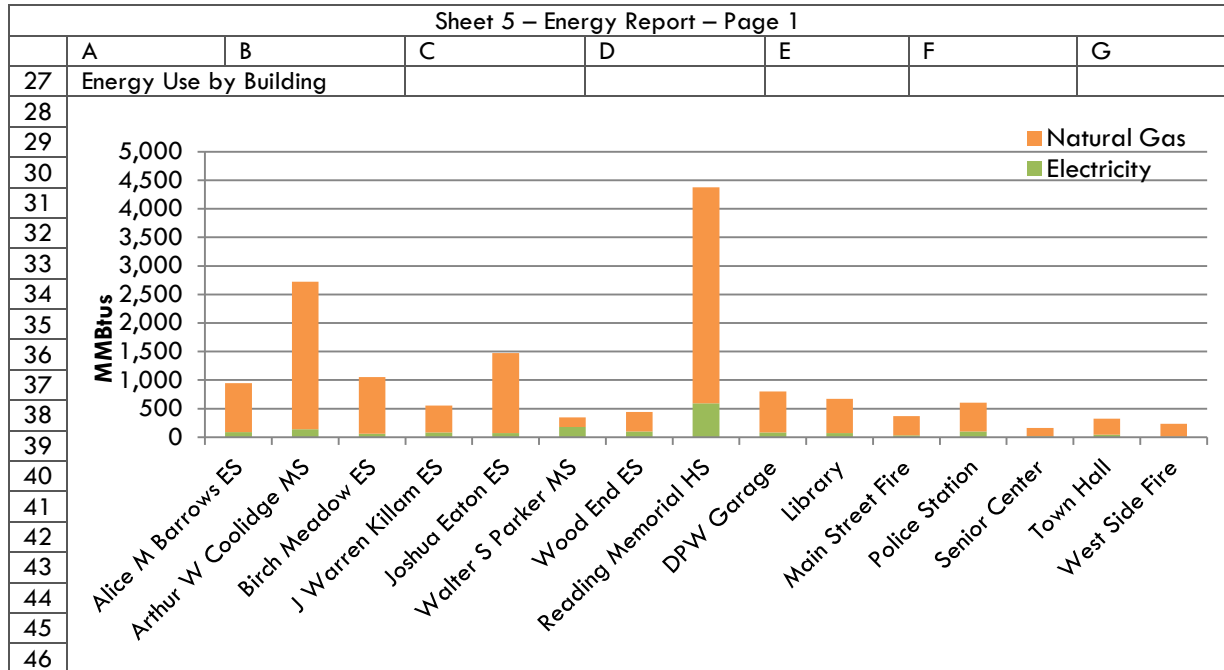
10. Compare Energy Consumption for Given Month with Previous Records.

Create a bar chart that demonstrates the energy consumption for the given month this year and previous fiscal years for each fuel type in MMBtus (blue cells) in the “Monthly Energy Use” summary table.

Sheet 5 – Energy Report – Page 1							
	A	B	C	D	E	F	G
1	Town of X						
2	Monthly Energy Report – January, 2012						
3							
4	Monthly Energy Use						
5			Electricity		Natural Gas		Total
6			kWh	MMBtus	Therms	MMBtus	MMBtus
7	Jan 2012	Energy Use	486,796	1,661	141,531	14,153	15,814
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11	Jan 2009	Energy Use	585,959	1,999	75,695	7,569	9,569
12							
13	Energy Consumption by Fuel Type			Annual Energy Use Pattern			
14							
15	<p>A pie chart illustrating the distribution of energy consumption by fuel type. The chart is divided into two segments: a larger green segment representing Electricity at 68%, and a smaller orange segment representing Natural Gas at 32%.</p>			<p>A stacked bar chart showing the annual energy use pattern in MMBtus for January from 2009 to 2012. The y-axis represents MMBtus, ranging from 0 to 20,000. The x-axis lists the years: Jan 2012, Jan 2011, Jan 2010, and Jan 2009. Each bar is composed of two segments: a bottom green segment for Electricity and a top orange segment for Natural Gas. The total height of the bars decreases from 2010 to 2012, with 2012 having the lowest total energy use.</p>			
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11. Create Snapshot of Energy Consumption by Building by Fuel Type.

Create a bar chart that demonstrates the energy consumption for each building by fuel type using Electricity MMBtus (Column D) and Gas MMBtus - Weather Normalized (Column F) on “Sheet 4 - Building Energy Use.”



12. Create Building Energy Efficiency Summary Table.

Create a table on a new page on “Sheet 5 - Energy Report”. Insert the floor area for each building (Sheet 4, Column B) and the total energy consumption (Sheet 4, Column G) from “Sheet 4 - Monthly Energy Use” into the energy efficiency table. Determine the energy efficiency (Sheet 5, Column E) of each building by converting the Total MMBtus (Column D) to kBtus and dividing the consumption by the floor area of each building (Sheet 5, Column C).

Example: Calculate the energy efficiency for Elementary School (Cell E3).

$$E3 = D3 * 1000 / C3$$

Sheet 5 – Energy Report – Page 2

	A	B	C	D	E	F
1	Building Energy Efficiency					
2			Floor Area (sq. ft)	Total (MMBtus)	Energy Efficiency (kBtus/sq.ft)	
3		Elementary School	60,000	948	=D3*1000/C3	
4		Middle School	96,000	2,725	28	
5		High School	330,000	4,378	13	
6		Police Station	29,430	604	21	

13. Create Snapshot of Building Energy Efficiency.

Under the “Buildings to Target” section of the “View Report” tab in MEI, export the “Efficiency and Use” chart for the current fiscal year.

SHEET 5 – Energy Report – Page 2						
	A	B	C	D	E	F
1	Building Energy Efficiency					
2			Floor Area (sq. ft)	Total (MMBtus)	Energy Efficiency (kBtus/sq.ft)	
3		Elementary School	60,000	948	16	
4		Middle School	96,000	2,725	28	
5		High School	330,000	4,378	13	
6		Police Station	29,430	604	21	
8						
9	<p>Efficiency and Use</p> <p>Use (MMBTU)</p> <p>Building Subcategory</p> <ul style="list-style-type: none"> Administration Indoor Recreation Library Other Public Safety Public Works School Vehicle Maintenance Bui.. 					
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Facility Energy Summary

Follow steps 14 through 18 to create an energy summary for each facility identified in the municipal building inventory.

14. Create Facility Energy Consumption Summary.

On a new page in “Sheet 5 – Energy Report,” create a table that summarizes the electricity and heating fuel consumption for each facility for the current and past fiscal years using the information from “Sheet 3 – Monthly Building Energy Use.” Convert the physical units to MMBtus. Remember to normalize the consumption values of all building heating fuel use using the Simple Ratio Weather Normalization method.

Sheet 5 – Energy Report – Page 3					
	A	B	C	D	E
1	Facility Energy Use Summary				
2	School Department				
3					
4	Elementary School				
5	Year Built:		Floor Area:	60,000	
6		Electricity		Natural Gas	
7		kWh	MMBtus	therms	MMBtus
8	Jan 2012	25,440	87	7,342	861
9	Jan 2011	29,160	99	8,256	779
10	Jan 2010	69,600	237	6,403	648
11	Jan 2009	28,140	96	6,454	593

15. Aggregate Total Energy Consumption for All Fuel Types for Each Building.

Use “Sum” function to determine the total energy consumption in MMBtus for each building.

Sheet 5 – Energy Report – Page 3						
	A	B	C	D	E	F
1	Facility Energy Use Summary					
2	School Department					
3						
4	Elementary School					
5	Year Built:		Floor Area:	60,000		
6		Electricity		Natural Gas		Total MMBtus
7		kWh	MMBtus	therms	MMBtus	
8	Jan 2012	25,440	87	7,342	861	948
9	Jan 2011	29,160	99	8,256	779	879
10	Jan 2010	69,600	237	6,403	648	886
11	Jan 2009	28,140	96	6,454	593	689

16. Compare Building Energy Consumption for Given Month with Previous Records.

In the “Facility Energy Use” summary table, create a bar chart that demonstrates the building energy consumption for the given month in current and past fiscal years for each fuel type in MMBtus (blue cells).

Sheet 5 – Energy Report – Page 3																										
	A	B	C	D	E	F																				
1	Facility Energy Use Summary																									
2	School Department																									
3																										
4	Elementary School																									
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6		Electricity		Natural Gas		Total																				
7		kWh	MMBtus	therms	MMBtus	MMBtus																				
8	Jan 2012	25,440	87	7,342	861	948																				
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17. Determine Building Energy Efficiency for Given Month in Current and Past Fiscals Years.

Find the building energy efficiency value by converting the total energy consumption (Column F) to kBtus and dividing the value by the building floor area in square feet.

Example: Calculate the building energy efficiency for January 2012 (Cell G8).

$$G8 = F8 * 1000 / \$D\$5$$

Sheet 5 – Energy Report – Page 3							
	A	B	C	D	E	F	G
1	Facility Energy Use Summary						
2	School Department						
3							
4	Elementary School						
5	Year Built:		Floor Area:	60,000			
6		Electricity		Natural Gas		Total	Energy Efficiency
7		kWh	MMBtus	therms	MMBtus	MMBtus	kBtus/sq. ft
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11	Jan 2009	28,140	96	6,454	593	689	
12							
13	Annual Use Pattern						

18. Compare Building Energy Use Intensity for Given Month with Past Months.

In the “Facility Energy Use” summary table, create a scatter graph that demonstrates the building energy consumption and energy efficiency for the given month in current and past fiscal years (blue cells). Set total energy consumption (Column F) as the y value and energy efficiency (Column G) the x value.

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