

Estimation of Energy Content of Municipal Solid Waste





Problem Statement

Determine the Energy Value of a Typical Municipal Solid Waste With an Average Composition Shown in Table 1.

It is recommended that you use an electronic spreadsheet when you do this problem.





Table 1. Waste Composition

Component	Wet Weight, lb	Percent MC
Food Waste	8	70
Paper	28	6.1
Cardboard	8	5
Plastics	9	4.4
Textiles	1	10
Rubber	0.8	0
Leather	0.8	12.5
Garden trimmings	22	60
Wood	3	60
Glass	8	2.5
Metals	11.4	1.8



Step 1:

- Determine energy content using data in Table 2



Table 2. Average Heat Values

Component	Heat Value, Btu/lb Dry Weight
Food Waste	2000
Paper	7200
Cardboard	7000
Plastics	14000
Texttiles	7500
Rubber	10000
Leather	7500
Garden trimmings	2800
Wood	8000
Glass	60
Metals	300



Step 3: Determine Dry Weight of Waste Components

- Since Table 2 is based on dry weight, from typical moisture contents, adjust for moisture content.



Table 3. Dry Weight of MSW

Component	Wet Weight, lb	Dry Weight, lb
Food Waste	8	2.4
Paper	28	26.3
Cardboard	8	7.6
Plastics	9	8.6
Textiles	1	0.9
Rubber	0.8	0.8
Leather	0.8	0.7
Garden trimmings	22	8.8
Wood	3	1.2
Glass	8	7.8
Metals	11.4	11.2





Step 4: Calculate the Energy Content of MSW

Total Energy = (Solid waste, lb) *
(Energy Content, Btu/lb)

Table 4 provides the total energy content in Btu.



Table 4. Total Btu content

Component	Wet Weight, lb	Dry Weight, lb	Btu
Food Waste	8	2.4	4800
Paper	28	26.3	
Cardboard	8	7.6	
Plastics	9	8.6	
Textiles	1	0.9	
Rubber	0.8	0.8	
Leather	0.8	0.7	
Garden trimmings	22	8.8	
Wood	3	1.2	
Glass	8	7.8	
Metals	11.4	11.2	
Total			



Table 4. Total Btu content

Component	Wet Weight, lb	Dry Weight, lb	Btu
Food Waste	8	2.4	4800
Paper	28	26.3	189360
Cardboard	8	7.6	53200
Plastics	9	8.6	120400
Textiles	1	0.9	6750
Rubber	0.8	0.8	8000
Leather	0.8	0.7	5250
Garden trimmings	22	8.8	24640
Wood	3	1.2	9600
Glass	8	7.8	468
Metals	11.4	11.2	3360
Total			425828



Step 5: Determine the Specific Btu Content (Btu/lb)

Specific Energy content =
total energy, Btu/ total waste, lb

From Table 4, Total energy = 425800 Btu

Solid Waste = 100 lb

Specific Energy Content = 425800/100 Btu/lb
= 4258 Btu/lb
~ 4300 Btu/lb





Class Example

Component	Wet Weight, lb
Food Waste	10
Paper	32
Cardboard	7
Plastics	6
Textiles	2
Rubber	1
Leather	2
Garden Trimmings	18
Wood	5
Glass	7
Metals	10

Repeat the example with the waste composition shown.

How does moisture content impact Btu content?

What potential conflicts can you see with respect to waste to energy vs recycling?





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Last updated July 2004 by Dr. Reinhart

