Biomass for Electricity Generation

Table 3. Biomass Resources by Price: Quantities Assumed To Be Available in 2020

Price (2000 Dollars per Million Btu)	Quantities Available	Agricultural Residues	Energy Crops	Forestry Residues	Urban Wood Waste/ Mill Residues	Total
5.00	Trillion Btu	2,335	1,501	2,034	1,230	**7,100**
	Million Dry Tons	136	87	118	72	**413**
	Million Wet Tons	194	124	169	103	**590**
	Equivalent Capacity (Gigawatts)[a]	32	21	28	17	**98**
2.50	Trillion Btu	1,147	254	34	493	**1,928**
	Million Dry Tons	67	15	2	29	**113**
	Million Wet Tons	96	21	3	41	**161**
	Equivalent Capacity (Gigawatts)[a]	16	3	0	7	**26**
1.25	Trillion Btu	0	0	0	234	**234**
	Million Dry Tons	0	0	0	14	**14**
	Million Wet Tons	0	0	0	20	**20**
	Equivalent Capacity (Gigawatts)[a]	0	0	0	3	**3**

[a]Assuming biomass integrated gasification combined-cycle (BIGCC) technology. This is a hypothetical calculation based on the assumptions below and is not related to the capacity numbers reported in NEMS.

To convert from Btu to equivalent capacity:

- Assume efficiency of power plant = 33%, or plant heat rate = 3,413 Btu/kWh/0.33 = 10,342 Btu/kWh;
- Assume capacity factor of plant = 80%, or hours of operation = 8,760 × 0.8 = 7,008 hours/year.

For a resource estimate of 7,100 trillion Btu, equivalent capacity can be calculated as:
$7{,}100 \times 10^{12}$ Btu × 1 kWh/10,342 Btu × 1/7,008 hr × 1 MW/1,000 kW × 1 GW/1,000 MW = 98 GW.
For a resource estimate of 1,928 trillion Btu, equivalent capacity can be calculated as:
$1{,}928 \times 10^{12}$ Btu × 1 kWh/10,342 Btu × 1/7,008 hr × 1 MW/1,000 kW × 1 GW/1,000 MW = 26 GW.
For a resource estimate of 234 trillion Btu, equivalent capacity can be calculated as:
234×10^{12} Btu × 1 kWh/10,342 Btu × 1/7,008 hr × 1 MW/1,000 kW × 1 GW/1,000 MW = 3 GW.

To convert from Btu to million dry tons:

- Assume energy content of biomass = 8,600 Btu/lb (dry).

For a resource estimate of 7,100 trillion Btu, biomass quantity can be calculated as:
$7{,}100 \times 10^{12}$ Btu × 1 lb (dry)/8,600 Btu × 1 ton (dry)/2,000 lb × 1 million dry ton/10^6 dry tons = 413 million dry tons.
For a resource estimate of 1,928 trillion Btu, biomass quantity can be calculated as:
$1{,}928 \times 10^{12}$ Btu × 1 lb (dry)/8,600 Btu × 1 ton (dry)/2,000 lb × 1 million dry ton/10^6 dry tons = 113 million dry tons.
For a resource estimate of 234 trillion Btu, biomass quantity can be calculated as:
234×10^{12} Btu × 1 lb (dry)/8,600 Btu × 1 ton (dry)/2,000 lb × 1 million dry ton/10^6 dry tons = 14 million dry tons.

To convert from million dry tons to million wet tons:

- Assume moisture content of biomass = 30 percent.

For a resource estimate of 413 million dry tons, biomass quantity in wet tons can be calculated as:
413 million dry tons × 1 wet ton/0.7 dry ton = 590 million wet tons.
For a resource estimate of 113 million dry tons, biomass quantity in wet tons can be calculated as:
113 million dry tons × 1 wet ton/0.7 dry ton = 161 million wet tons.
For a resource estimate of 14 million dry tons, biomass quantity in wet tons can be calculated as:
14 million dry tons × 1 wet ton/0.7 million dry ton = 20 million wet tons.

Source: Personal communication with Marie Walsh, Oak Ridge National Laboratory, and Kevin Comer, Antares Group, Inc.