

CHG:
*A Major Contributor to
World Renewable Energy*

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Genifuel

Feedstocks

- **Beer fermentation bottoms (brewer's spent grain)**
- **Ethanol fermentation bottoms (fuel production)**
- **Food processing factory wastes**
- **Algae fuel residuals (algae after lipid extraction)**
- **Water weeds from remediation programs**
- **Dairy wastes (manure, processing wastes)**
- **Wastewater solids**
- **Waste from pulp and paper processing**
- **Many others**

CHG World Feedstocks

Millions of cubic meters/y methane

FEEDSTOCK	WORLD	USA
Cattle Manure	60,972	3,857
Dairy Cow Manure	30,486	1,929
Pig Manure	24,389	1,543
Food Proc. Waste	83,000	14,625
Algae Bottoms*	106,382	33,808
Wastewater Solids	4,617	1,660
Beer Bottoms	2,216	391
Other**	4,000	1,500
TOTAL	316,062	59,313

* Assumes algae production to supply 5% of liquid fuels

** Other includes barley ethanol bottoms, water plant remediation, etc. Also includes corn ethanol bottoms not sold as DDG

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CHG World Feedstocks

Millions of MCF (MMBtu)/y methane

FEEDSTOCK	WORLD	USA
Cattle Manure	2,152	136
Dairy Cow Manure	1,076	68
Pig Manure	861	54
Food Proc. Waste	2,930	516
Algae Bottoms*	3,757	1,193
Wastewater Solids	163	59
Beer Bottoms	78	14
Other**	141	53
TOTAL	11,158	2,093

* Assumes algae production to supply 5% of liquid fuels

** Other includes barley ethanol bottoms, water plant remediation, etc. Also includes corn ethanol bottoms not sold as DDG

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CHG World Feedstocks

Electricity Production in TWh*

FEEDSTOCK	WORLD	USA
Cattle Manure	280	18
Dairy Cow Manure	140	9
Pig Manure	112	7
Food Proc. Waste	382	67
Algae Bottoms	490	155
Wastewater Solids	21	8
Beer Bottoms	10	2
Other**	18	7
TOTAL	1,453	273

* TWh is terawatt hours. Terawatt = 1×10^{12} watt; assumes 42% efficiency

** Other includes barley ethanol bottoms, water plant remediation, etc.

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CHG Potential Output in Perspective

- **Worldwide CHG production could equal (2010):**
 - 7.6% of fossil natural gas production
 - 7.7% of electricity production
 - 3.9 times the electricity produced by wind
- **Like wind, the source of energy (feedstock) is free, or in many cases even less since it avoids costs of disposal and/or environmental cleanup of wastes**
- **CHG power is base load and dispatchable--higher value than wind power**
- **Production is highly distributed throughout world**

CHG Conclusion

- **Based on more than 30 years of well-documented development and tested with many feedstocks**
- **Best method available today to make renewable fuel or electricity from wet biomass**
- **Technology capable of substantial contribution to world's renewable energy balance**