Quantification of Climate Neutral & Greenhouse Gas Emissions Using ASTM D6866

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Climate Neutral CO_2

(biogenic CO_2)

It's recently respired CO_2

Plants recently removed it from the air

It's a byproduct of biomass incineration

It doesn't count toward GHG inventories

It can be subtracted from GHG inventories

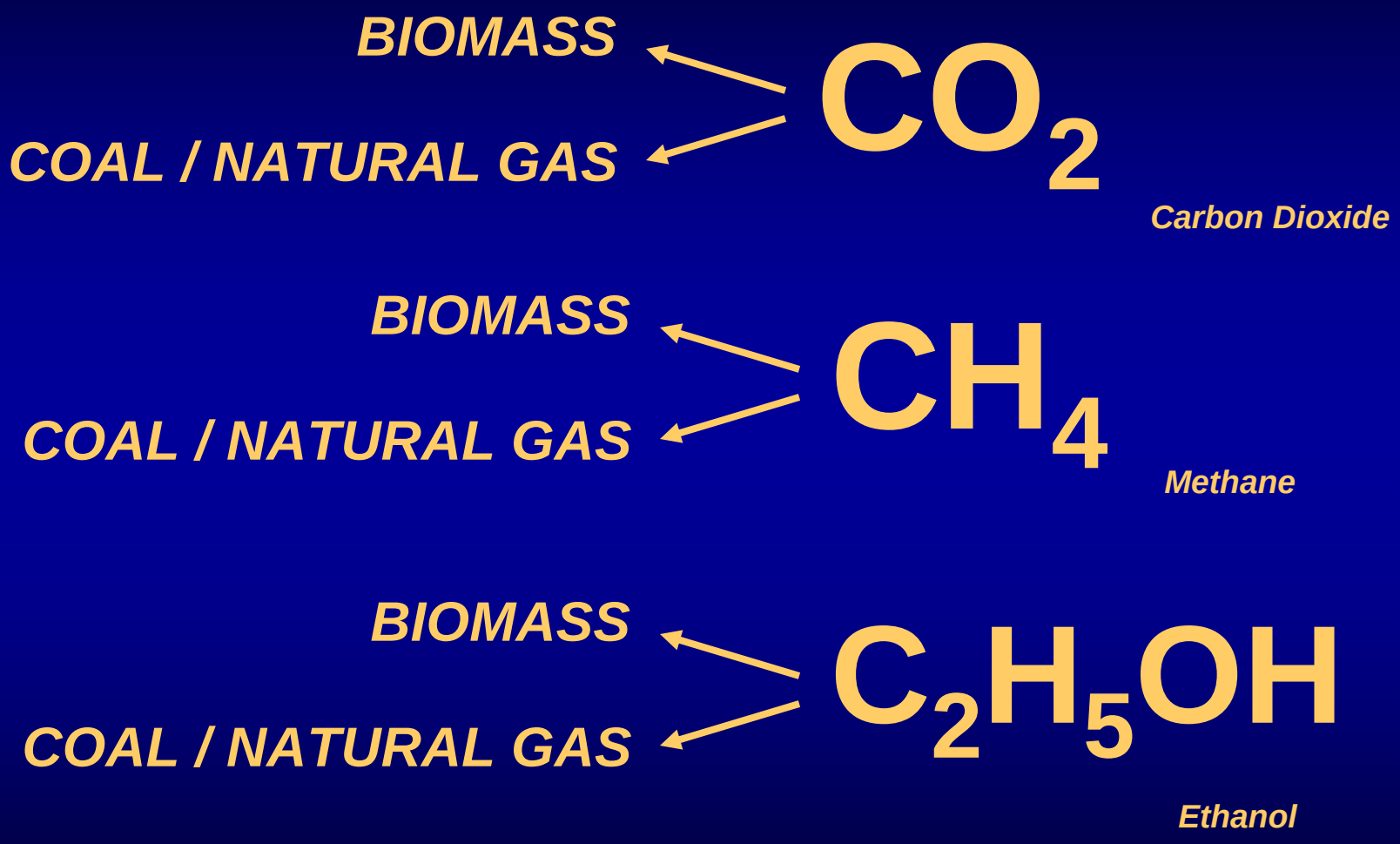
It has value in the trading markets

(Precedence in definition is set : RFS – bioethanol industry)

The solution to systematically monitoring, regulating, trading and calculating califoric value from carbon based inventories is obvious.

Nature has embedded carbon with a tracer.

ASTM D6866 measures this natural tracer.



They're not the same!

Nature's

"carbon tracer"

is the difference

Carbon-14

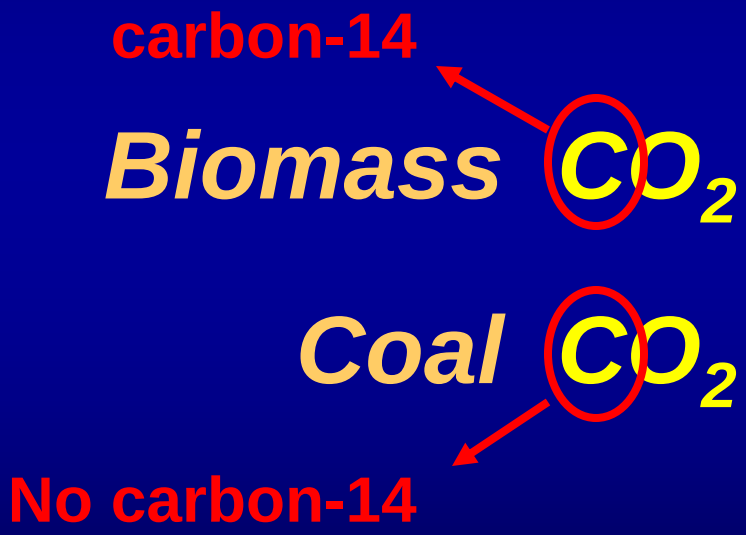
It's naturally occurring.

It's in all biomass.

It's absent in fossil fuels.

ASTM D6866 measures it.

They're NOT the same!



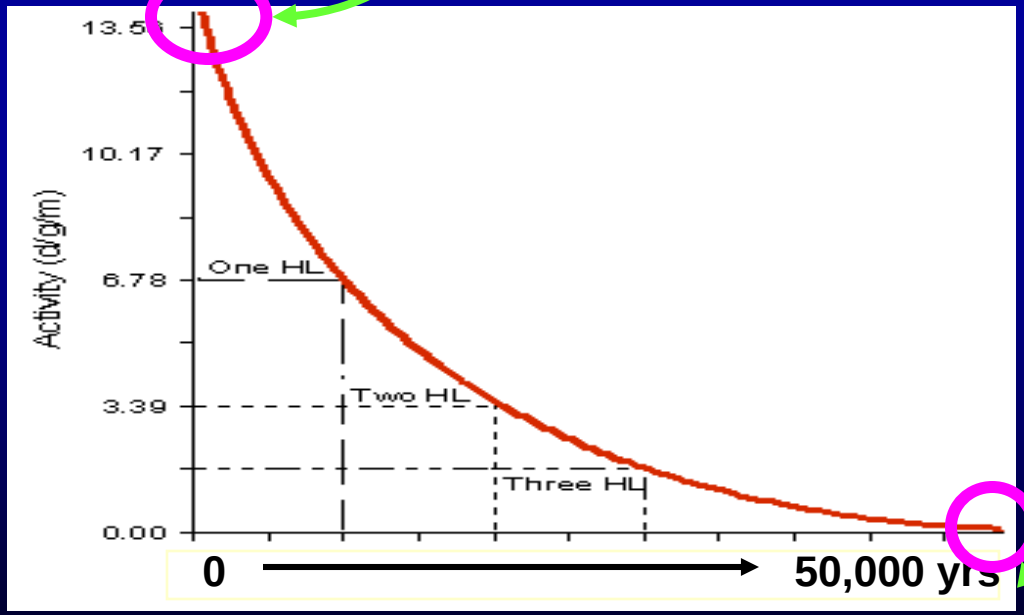
Carbon-14 is ubiquitous in all living things.

But it doesn't stick around.

It slowly and gradually decays away after death, so that by 50,000 years there's none left.

Ergo….coal and natural gas don't have any carbon-14 whereas biomass does.

100% renewable



The Radiocarbon Decay Curve

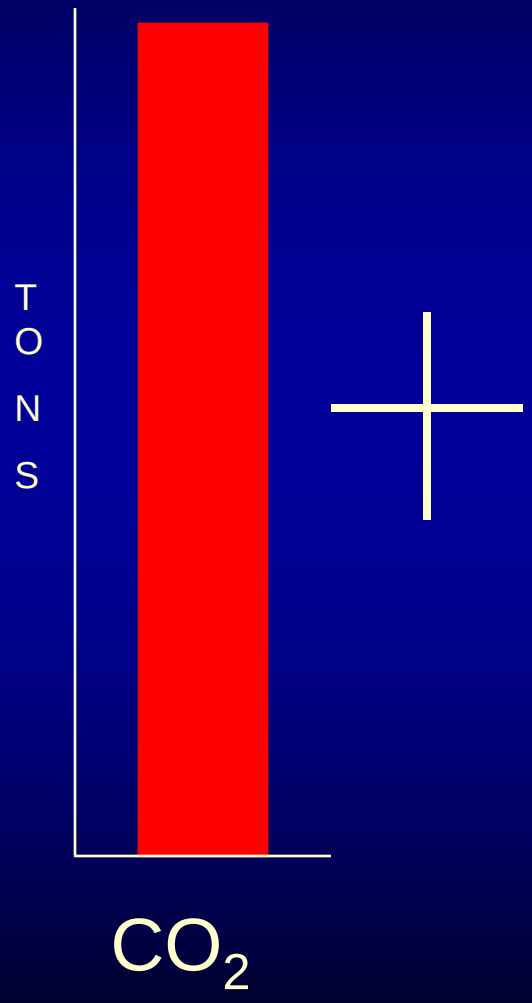
0% renewable

BETA

Verification of Biogenic Carbon / Carbon-neutral CO_2

Conventional biomass – CO_2 inventory accounting

(WTE, co-firing facilities)



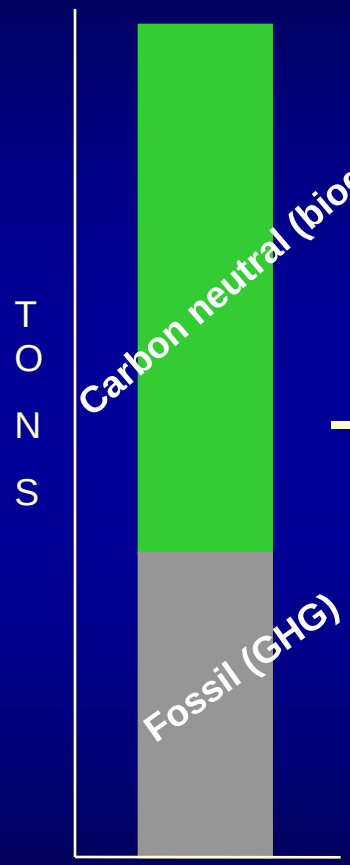
Complicated physical characterization of the feed stock

Sorting, cutting, sectioning, and weighing raw fuel

Labor intensive, expensive, burdensome

ASTM D6866 biomass – CO2 inventory accounting

(WTE, co-firing facilities) **Measure CO_2 in the stack effluent**



CO_2

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ASTM D6866 biomass – CO2 inventory accounting

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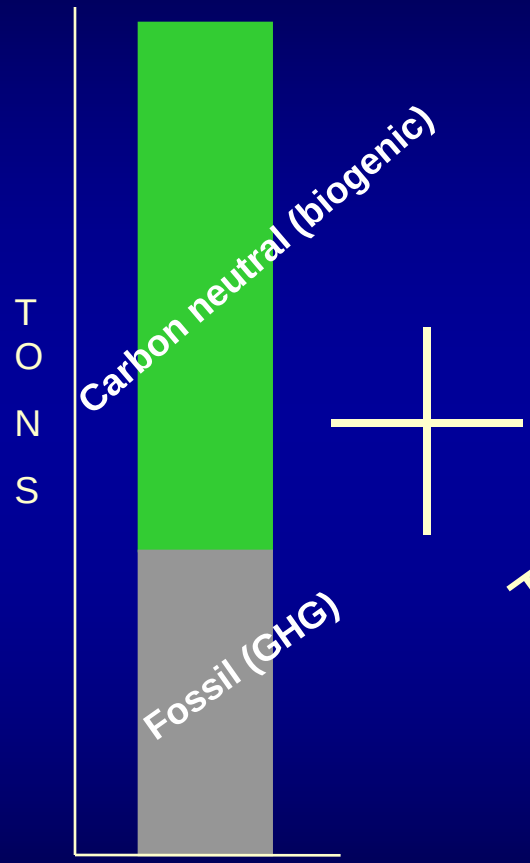
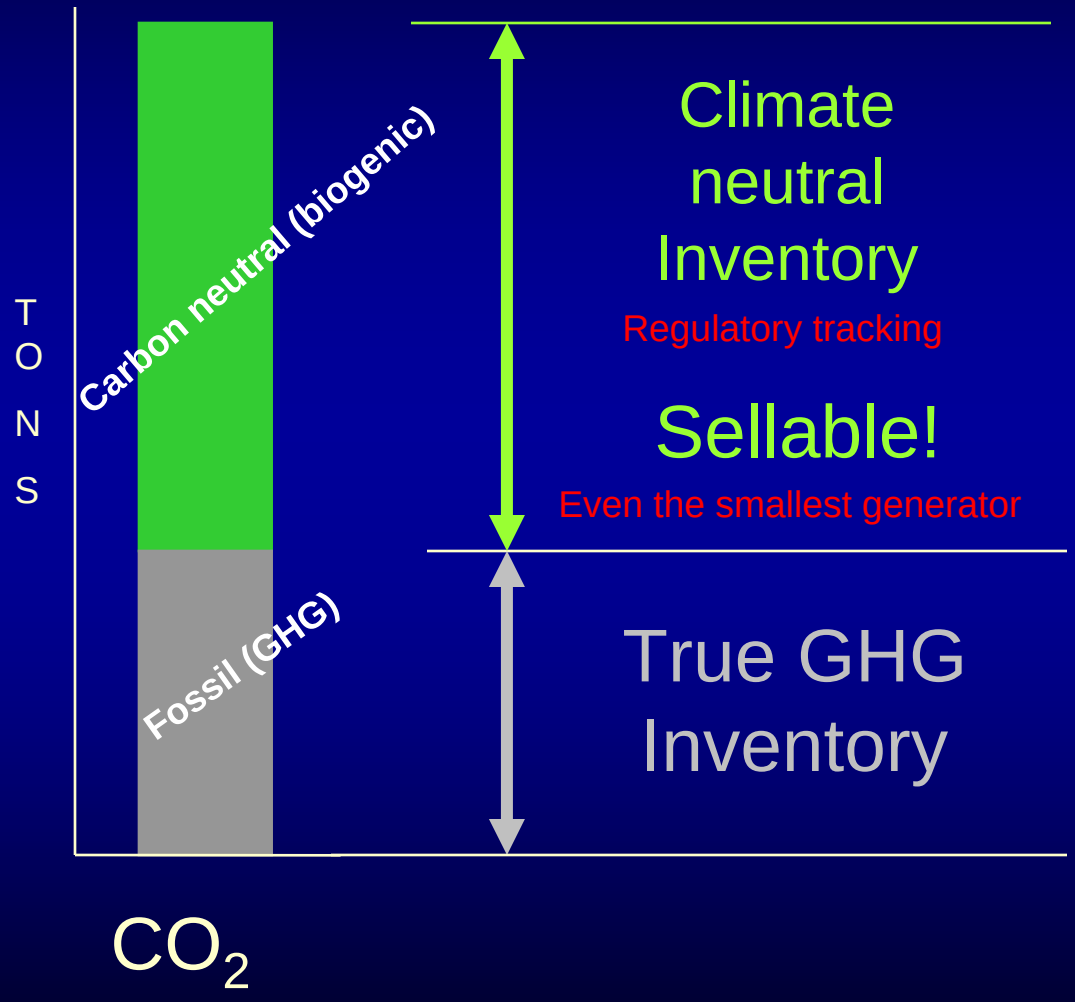
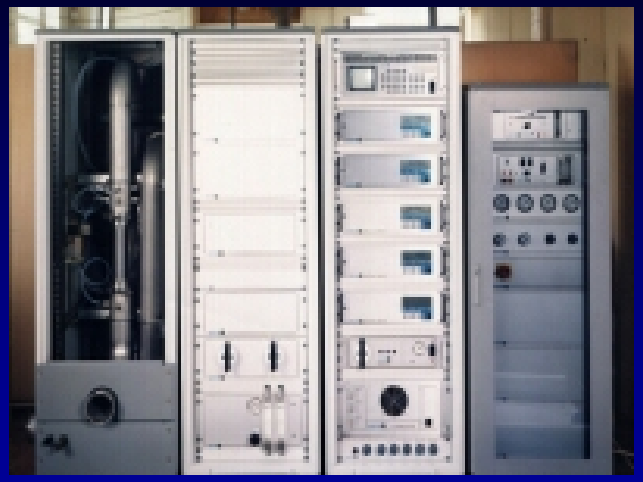


Throw it in the boiler !

ASTM D6866 biomass CO_2 determination

(WTE, co-firing facilities) **CO_2 analysis of stack effluent**



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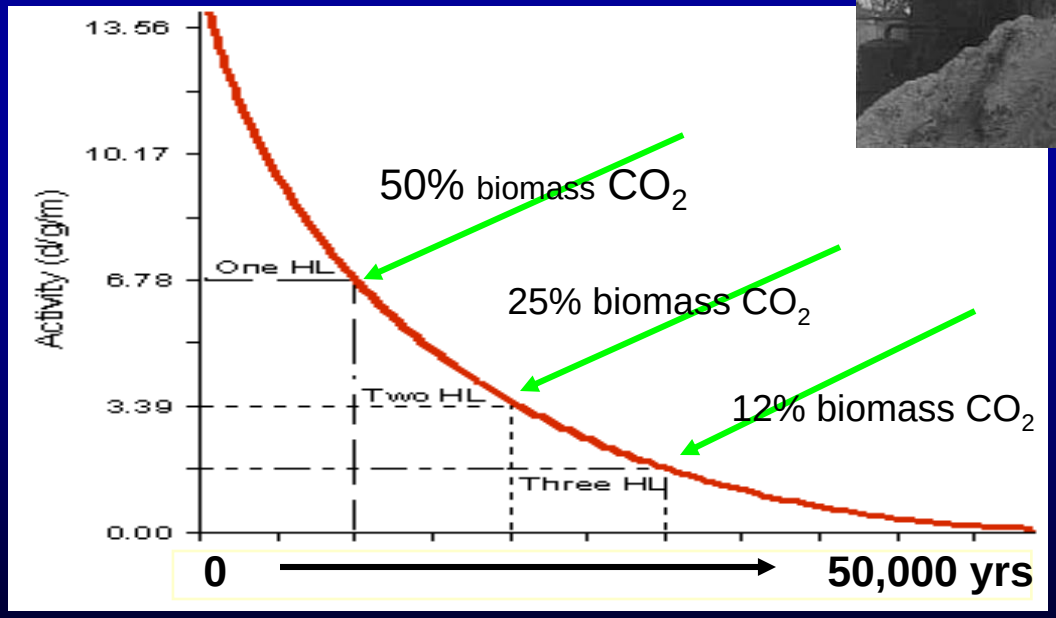

13.56
10.17
6.78
3.39
0.00
Activity (d/g/m)
One HL
Two HL
Three HL
50% biomass CO2
25% biomass CO2
12% biomass CO2
0
50,000 yrs

142083 tons - CO_2 emissions

	Conventional Analysis	ASTM D6866
	75000 tons biofuel 25000 tons fossil fuel	Biomass CO2 = 48.4 %
Tons combined fuel	100000	100716
Tons carbon neutral CO2	68750	69252
Tons greenhouse gas	73333	73830
Tons bio-fuel	Known	75547
Tons fossil fuel	Known	25169
% biomass CO2	48.4 %	Known
% greenhouse gas	51.6 %	Known
Method of determination	Sorting, characterizing, weighing raw fuel	Single analysis of 1000cc's of bulk stack effluent

Califoric Value (CV) from biomass CO_2 content

Citing Dr. Nicholas Themelis, Director Earth Engineering Center Columbia University, and Chair of the Waste to Energy Research and Technology council (WTERT)

"The C14 test will show what fraction of the carbon in the MSW is biogenic. Then by using an assumed average chemical formula for the biogenic fraction (e.g., WTERT uses $C_6H_{10}O_4$) and one for the petrochemical fraction, and also the fraction of these materials in the MSW, one can arrive at a Net Calorific Value per ton of MSW"

Califoric Value (CV) from biomass CO_2 content

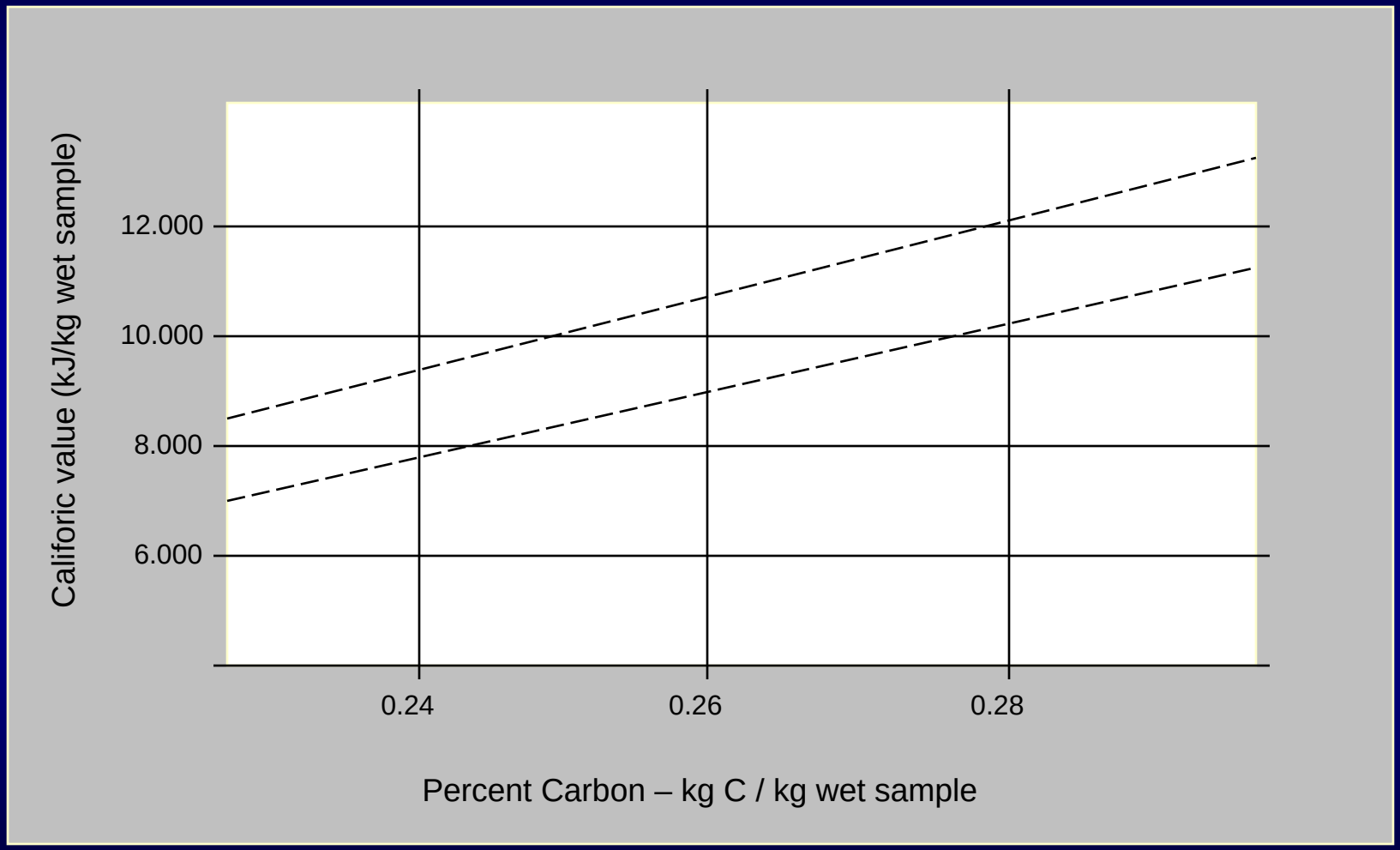
Johann Fellner, et. al., "Balance Method" Institute for Water Quality, Resource, and Management, Vienna Austria

Operating data gathered from WTE plants shows that CV of wet samples exist within ranges directly correlating to carbon content.

For Example : CV from wet sample biomass feedstock with 25% carbon

8200 – 10200 kJ / kg

Califoric Value (CV) from biomass CO2 content



Califoric Value (CV) from biomass CO_2 content

Gross califoric value

% biofuel - % carbon

% fossil fuel - % carbon

Well characterized CV from the fossil fuel

$$\text{Net CV}_{(\text{biomass})} = \text{Gross CV} - \text{CV}_{(\text{fossil fuel})}$$

THE VALUE PROPOSITION

REGULATORS

- *A direct measure of carbon to satisfy carbon directed legislation*
- *A single number-tracking parameter for comparison across industries*
- *Greatly simplified and understandable reports*

THE VALUE PROPOSITION

VERIFIERS

- *A greatly simplified auditing tool*
- *A single number value directly related to both climate neutral and greenhouse gas emissions*
- *Greatly simplified and understandable reports*

THE VALUE PROPOSITION

TRADING MARKETS

- *A simplification of basis for valuation*
- *A single number value directly related to carbon neutral inventory*
- *Greatly simplified and understandable reports*

THE VALUE PROPOSITION

BIOMASS ELECTRICITY GENERATORS

- *THROW IT ALL INTO THE BOILER*
- *COST SAVINGS!*
- *SIMPLIFIED REPORTING*
- *INCREASED EFFICIENCY*
- *ENHANCED FEEDSTOCK FLEXIBILITY*
- *A BETTER WAY TO MEET REGULATIONS!*

Reporting

An “Easy” Visual

Easy Inter-comparison

Instinctively Obvious

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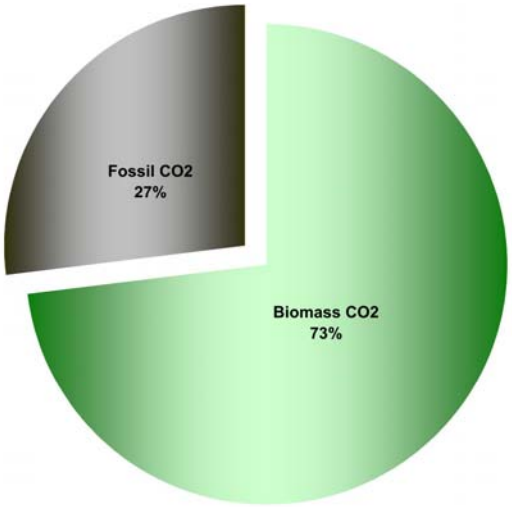
Report of Biomass CO2 Content Analysis using ASTM-D6866

Submitter:	ABC Company
Submitter Label:	Gas Bag 1
Laboratory Number:	Beta-00001
Material Analyzed:	CARBON DIOXIDE
Date Received:	October 13, 2006
Date Reported:	October 17, 2006

Biomass CO2: (carbon-neutral CO2) **73% *** (renewable carbon to total carbon)

Proportions Biomass CO2 vs. Fossil CO2 indicated by C14 content



* ASTM-D6866 cites precision on the mean Biomass CO2 Result as +/- 3% (absolute). This is the most conservative estimate of error in the measurement of complex biomass containing solids and liquids based on empirical results. Real precision for readily combustible and homogenous materials (e.g. gasoline) and especially samples recieved as CO2 (e.g. flue gas or CEMS exhaust) can be as low as +/- 0.5-2%. The result only applies to the analyzed material. Fluctuations in carbon content within a batch of product, gasoline or flue gas must be determined separately (e.g. averaged measurements of multiple solids or liquids, and single measurement of the combination of gas aliquots collected over time). The accuracy of the result as it applies to the analyzed product, fuel, or flue gas relies upon all the carbon in the analyzed material originating from either recently respired atmospheric carbon dioxide (within the last few decades) or fossil carbon (more than 50,000 years old). "Percent biomass" specifically relates % renewable (or fossil) carbon to total carbon, not to total mass or molecular weight. Mean Biomass CO2 estimates greater than 100% are assigned a value of 100% for simplification.

Who is looking at ASTM D 6866? - Regulatory

OFGEM	*(UK - regulating ROCs)*
RGGI	*(Regional Greenhouse Gas Initiative)*
RPS	*(Renewable Portfolio Standards)*
EU	*(CEN) - Emissions Trading Directive*
ARB	*(California Air Resources board)*
EPA	*(RFS)*

Who is looking at ASTM D 6866? – Industry

- *REA (UK – Renewable Energy Association)*
- *All Party Climate Group (UK)*
- *VCS (Voluntary Carbon Standard) – VCU*
- *EPRI*
- *Power plants (WTE, Co-firing, dedicated biomass)*
- *Cement Industry*
- *Biogenic Methane Industry*
- *Industry Giants (Waste Management)*
- *Verifiers*
- *Trading Brokers – CDM – Clean Development Mechanism*
- *Equipment Manufacturers*

How much does it cost?

Expect ~ $600.00 per analysis

(Off-setting labor, liabilities and hazards associated with feedstock characterization)

How long does it take to get a result?

As little as 2-3 days

Booth # 77
in the main exhibit hall

Copies of this Presentation

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