Think Green.® Think Waste Management.

Pacific Southwest Organic Residuals Symposium
Closing the Loop: Energy & Fuel From Waste
September 15, 2010
Sacramento, California

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Director of Regulatory Affairs/West

Waste Management

Many Think that This is the Real Cause of Global Warming !!

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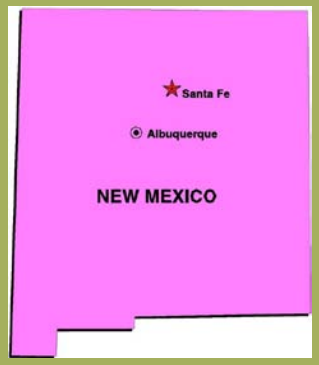
Maybe so . . . But <u>not</u> on the <u>Left</u> Coast !!!!



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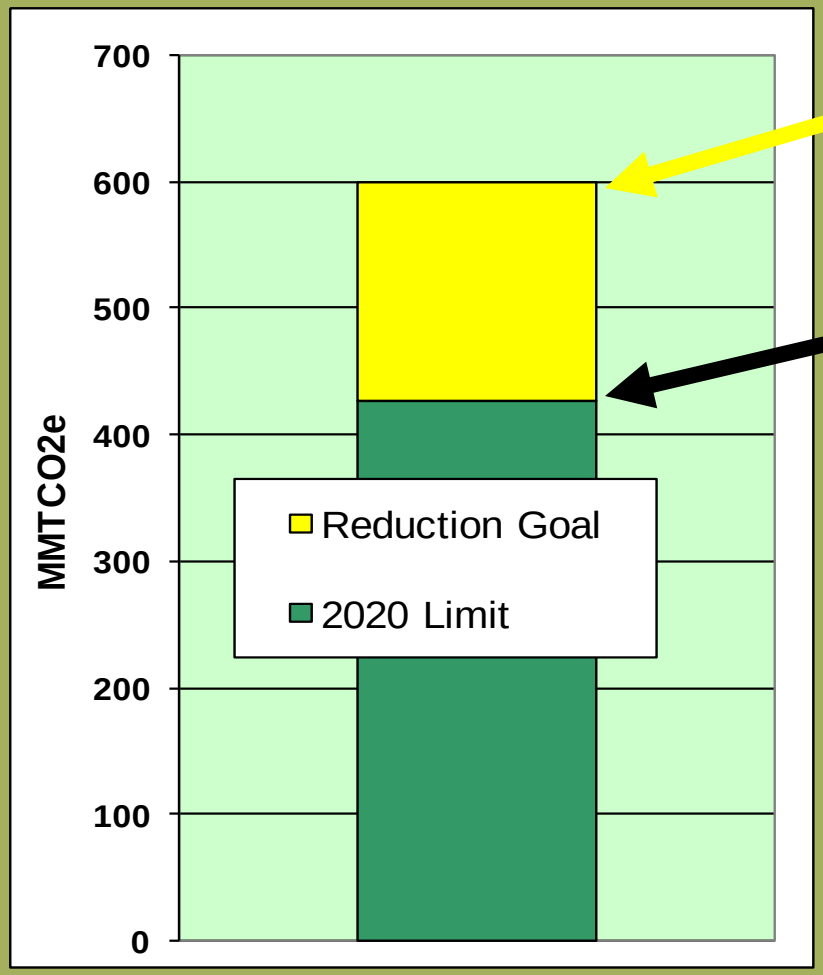
CA Statewide 1990 Emissions Level & 2020 Projection



- 2020 Projection – Business as Usual -- 600 MMTCO2e
- 1990 GHG emissions & 2020 limit is 427 MMTCO2e
- Difference equals reduction goal
  - Approximately 173 MMTCO2e
  - Approximately 30% reduction from 2020 level

Greenhouse Gas Regulation

- Cap & Trade Regulations drafted
  - 2012: 600 Power plants & large industry >25k MTCO2e
  - 2015: Other industry & transportation fuels
  - Revenues from auction of emission allocations?
  - Limitations on Tradable Offsets from Others?
  - Increased fuel & energy costs:
    - Opportunities to produce energy & fuel from waste?

Renewable Electricity Standard

- Governor EO: ARB to adopt a regulation by July 31, 2010, requiring the state's load serving entities to meet a 33 percent renewable energy target by 2020.
- Governor: ARB delay to Sept 2010.
- Failed Legislation – SB 722 (Simitian)
  - Instate vs. Out of State Renewable Energy Sources
  - Not ARB but CPUC for IOUs and CEC for POUs
  - 20% by 2012; 25% by 2016; and 33% by 2020
- Increase Value of Renewable Electricity?
  - What about CPUC Market Price Referent?

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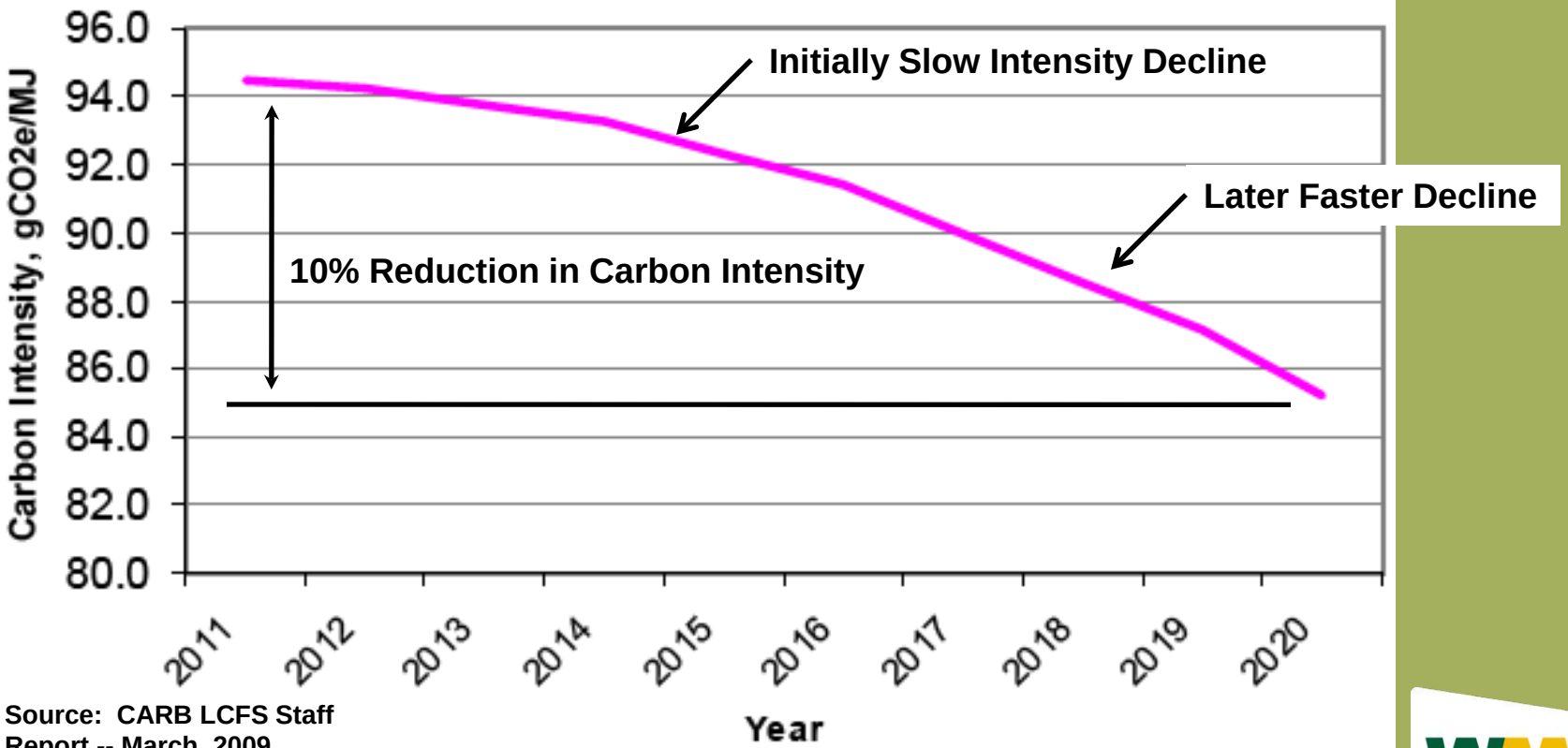
California Low Carbon Fuel Standard

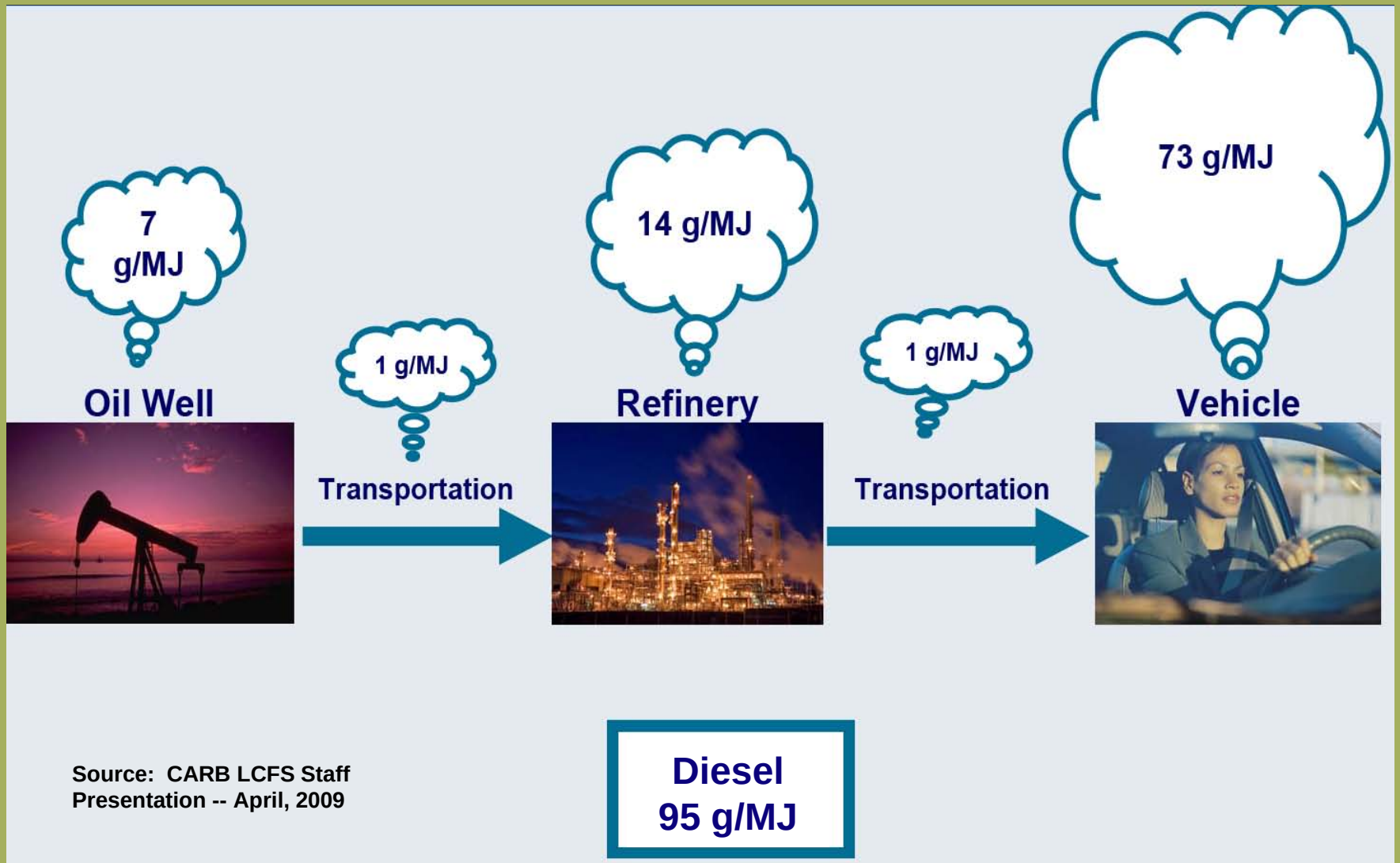
- 10 % Reduction in CA fuel carbon intensity by 2020
  - 2010 is baseline
  - All fuel producers
  - Reduction gradual and weighted to later years
- 16 MMTCO2e reductions expected by 2020
  - 10 % of AB 32 target
- Increase use of biofuels electricity & biodiesel

LCFS Carbon Intensity Standard



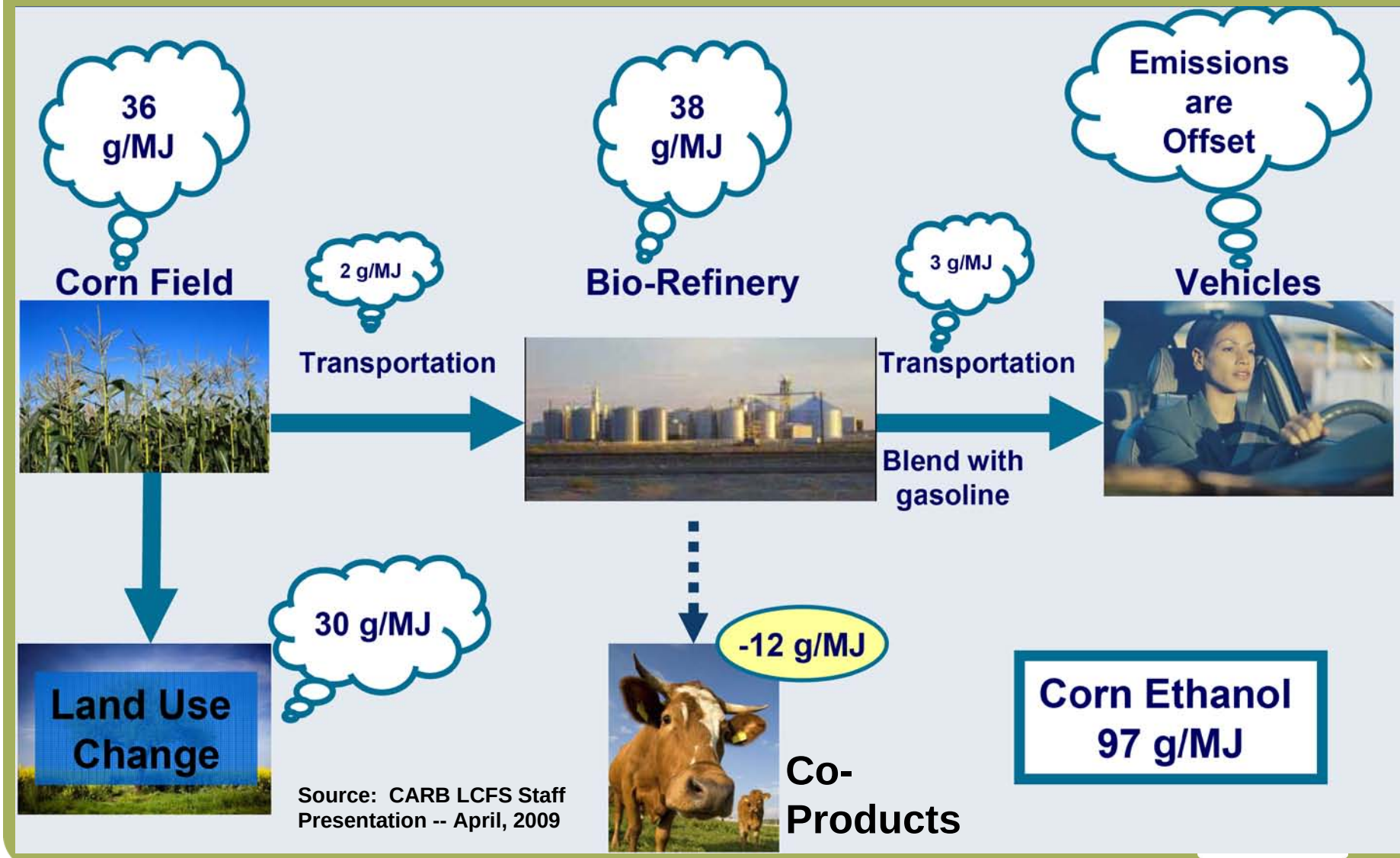
Source: CARB LCFS Staff Report -- March, 2009

Fuel "Well to Wheels" LifeCycle -- Diesel



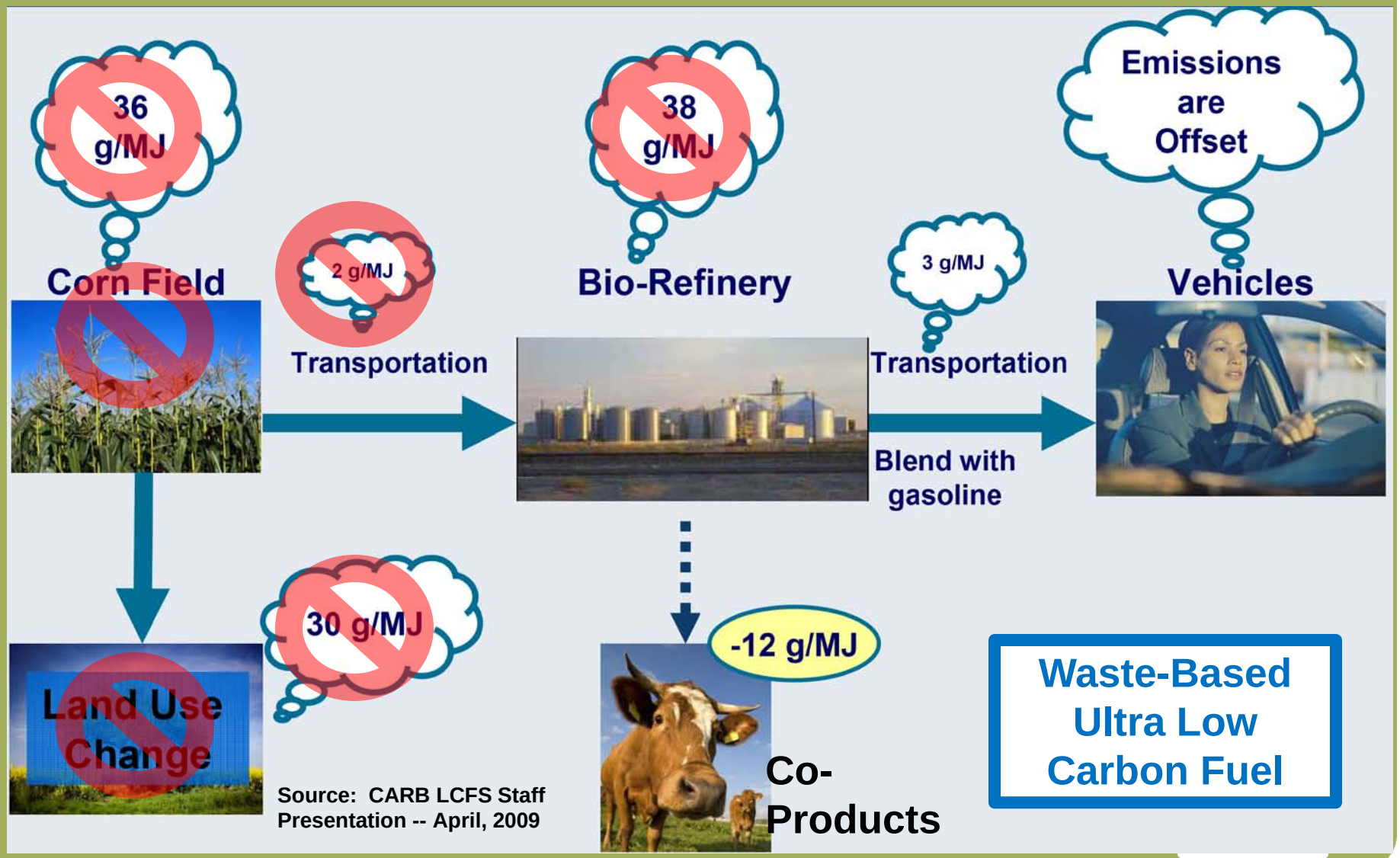
Source: CARB LCFS Staff Presentation -- April, 2009

Fuel "Field to Wheels" LifeCycle – Corn Ethanol



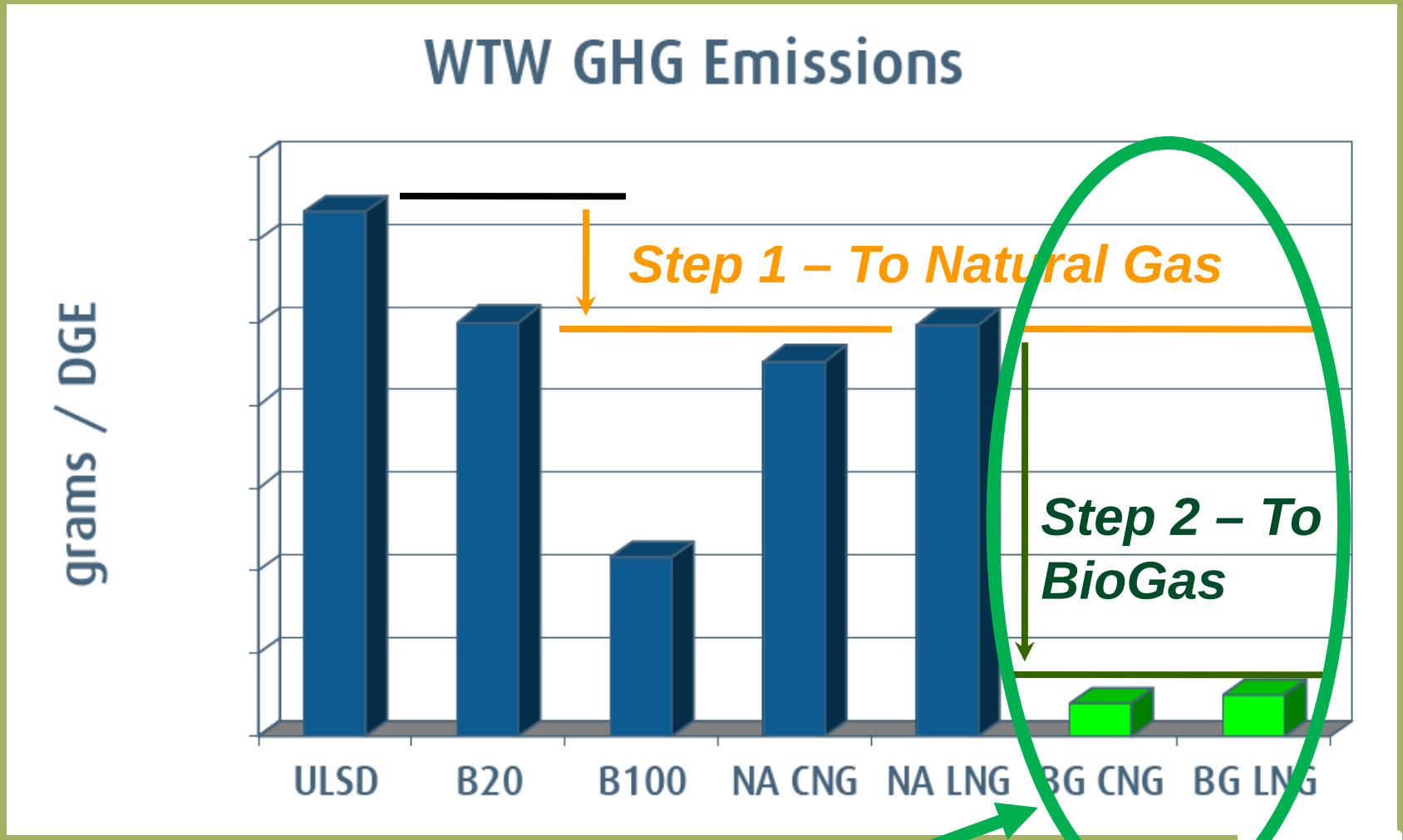
Source: CARB LCFS Staff Presentation -- April, 2009

Fuel "*Waste* to Wheels" LifeCycle – Waste Biomass



Source: CARB LCFS Staff Presentation -- April, 2009

Carbon Intensity of Alternative Fuels



WOW !! Look At Biogas !!

Think Green.® Think Waste Management.

So *What* is WM Doing About All This

????????

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Making Environmental Stewardship our Business

Company-wide Sustainability Goals – By 2020

- Double the amount of waste-derived energy we produce – power for 2 million homes
- Triple the volume of recyclable materials we process – 25 million tons
- Invest $5 billion to increase fleet fuel efficiency by 15% and reduce emissions by at least 15%
- Quadruple the number of sites certified by Wildlife Habitat Council – 100 sites and 25,000 acres of protected habitat

Annual Reporting of Our Progress !!

WM's Natural Gas Fleet (20% and growing!)

WM's California Truck Fleet:

- *Diesel – 2800*
- *LNG/CNG – 700*
- *Total -- 3500*

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Gee . . . Where Can We Find BioGas ?

Landfill Gas Collection System

- Landfill Anaerobic Decomposition of Organic Waste = Biogenic
- About half METHANE and half CARBON DIOXIDE as produced in the waste
- Nitrogen and Oxygen introduced by air intrusion
- 450 to 550 BTU per cubic foot of landfill gas
- Flow will increase while landfill is still open, and decrease when landfill closes

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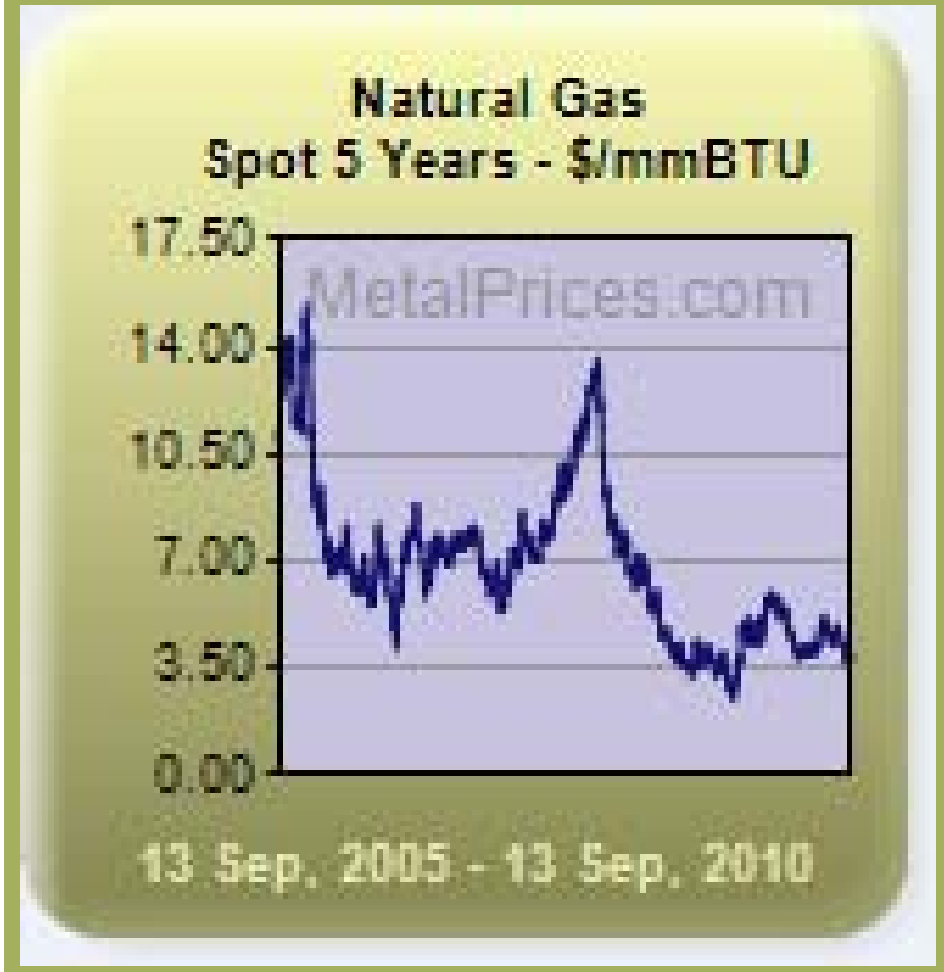
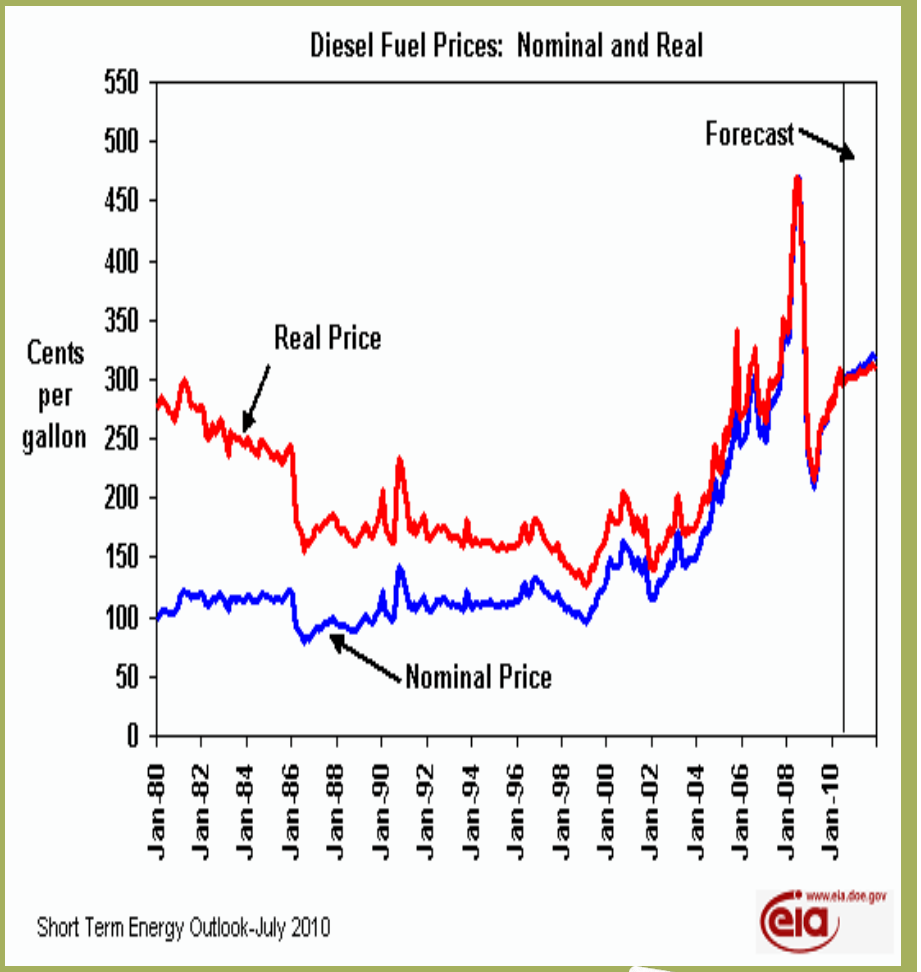
LFG to LNG

- Recovery and Utilization of Biomethane Landfill Gas for Transportation Fuel
- Altamont Landfill & Recycling Center, Fall 2009
- $15.5 million capital investment
- 13,000 Bio-LNG Gallons/day
- “Super Ultra Low Carbon Fuel” – lowest in CA
- Largest effort to introduce onsite liquefaction for landfill gas recovery in North America
- Utilize biogas resources and displace fossil fuels
- 2nd Plant planned for SoCal
- LFG to Pipeline CNG?

Challenge: Price of Fossil Fuel





WM Gas-to-Liquids (GTL)

- Purchased patent rights and assets from Alchem in 2007 to convert landfill gas to commercial grade bio-diesel
- Modified pilot 25 GPD unit to allow testing of various catalyst batches and new reformer design
- Beginning operation of 250 gallons per day LFG to hydrocarbon unit to replace 25 GPD unit
- Fabrication of 1,000 GPD unit expected pending positive results from 250 GPD unit

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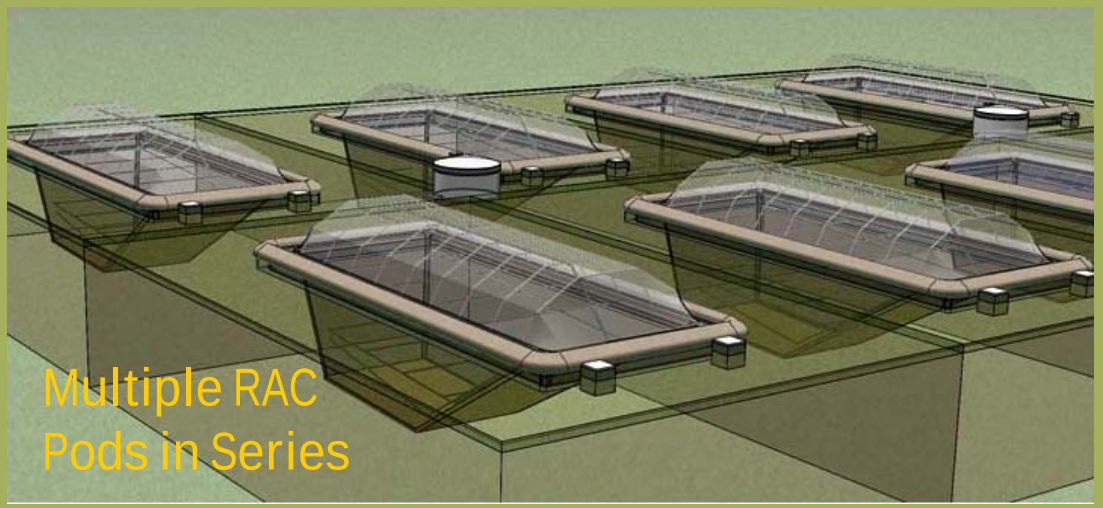
Renewable Anaerobic Composter (RAC)

Single RAC Pod

- Methane Gas Recovery
- Compost Co-Product

RAC POD Cross-Section (not to scale)



Multiple RAC Pods in Series

Pilot Projects in:

- Ohio
- Kentucky
- California

Garick – WM Majority Interest

- Leading "waste-to-market' (W2M) company focused on managing and converting organic waste (primarily food, manure, green waste and wood waste) into renewable energy and other products with commercial value.
  - Collect, process materials and distribute organic soils, composts and mulches;
  - Wood waste and green waste as a source of alternative energy;
  - Biomass conversion facilities using technologies such as pelletizing, anaerobic digestion, gasification and pyrolysis.

GARICK
WWW.GARICK.COM

W2M
WASTE TO MARKET

WM
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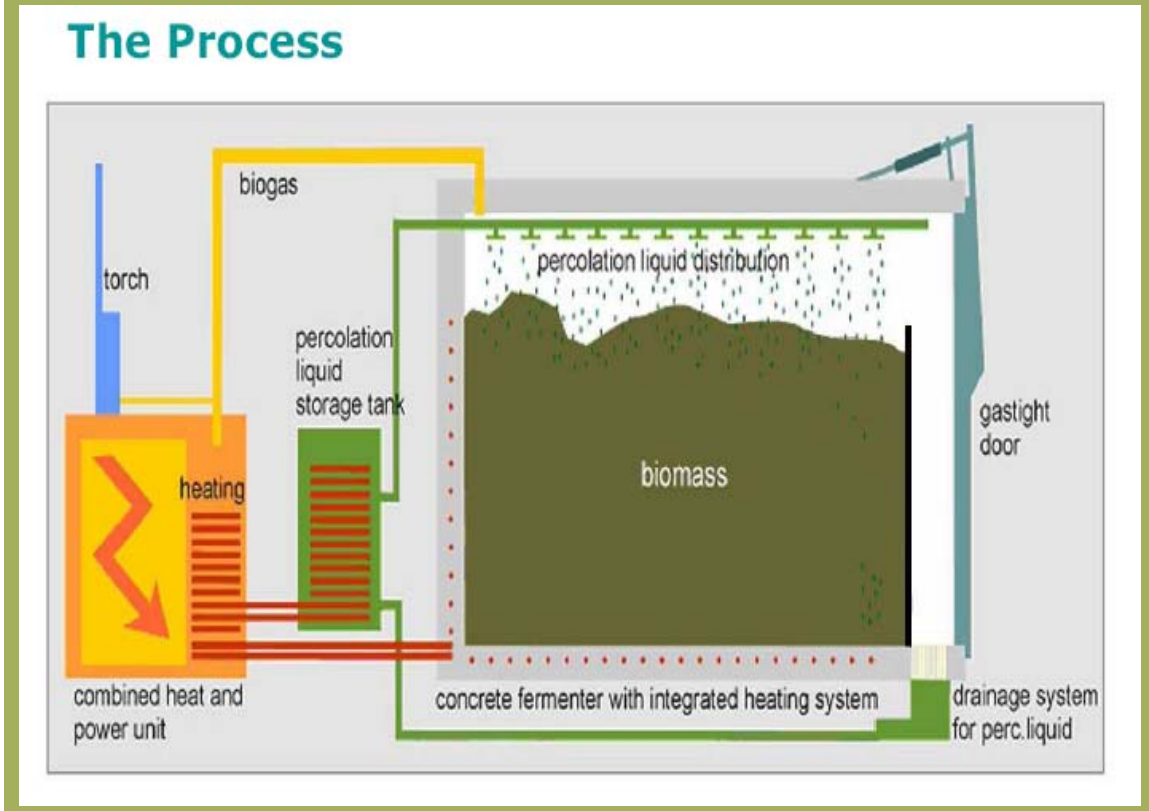
Anaerobic Digestion

Harvest Power

The dry fermentation process anaerobically (without oxygen) digests waste material to produce methane over a 28-day period.



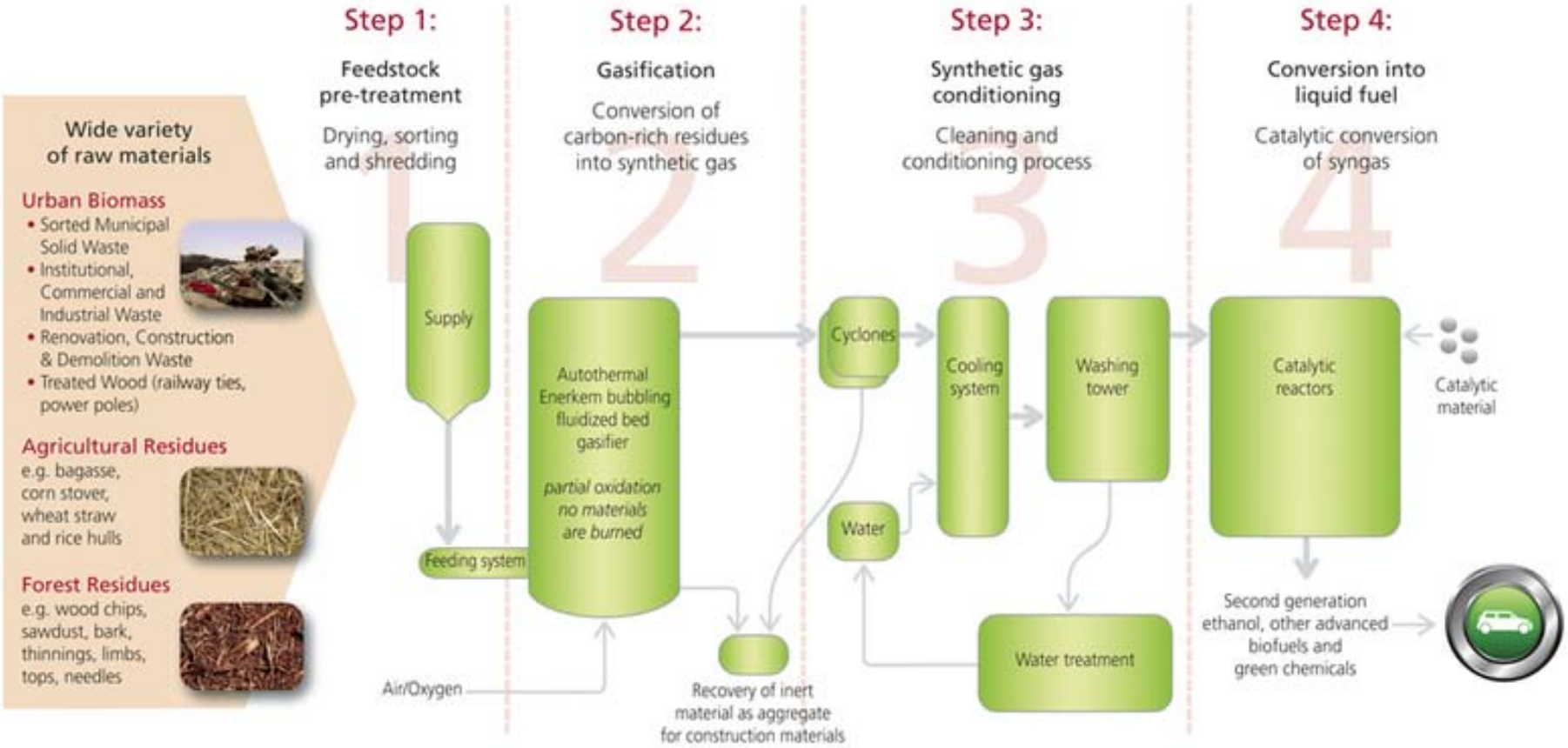
1) Waste material placed in an air-tight building for 28 days (typically 50/50 mix of yard/food waste)
2) Percolate and bacteria recirculated during digestion
3) Biogas collected and extracted at top of building,
4) Methane Gas cleaned and sold or burned for electricity

Terrabon

- Terrabon acid fermentation technology converts bio-organic waste into “green gasoline” and other non-fuel chemicals
- Flexible plant size placed strategically near available waste streams
- Completed a 5 ton per day pretreatment green gasoline processing plant
- Site engineering on a 55 ton per day pilot facility in Port Arthur, Texas
- WM has a right of first offer to supply organic waste streams and also has the right to invest in future projects
- Waste Management initially owns 10% of Terrabon

WM Organics: chemical conversion

Enerkem



Thermo-chemical gasification to produce syngas which converts into liquid fuels such as ethanol & biochemicals.

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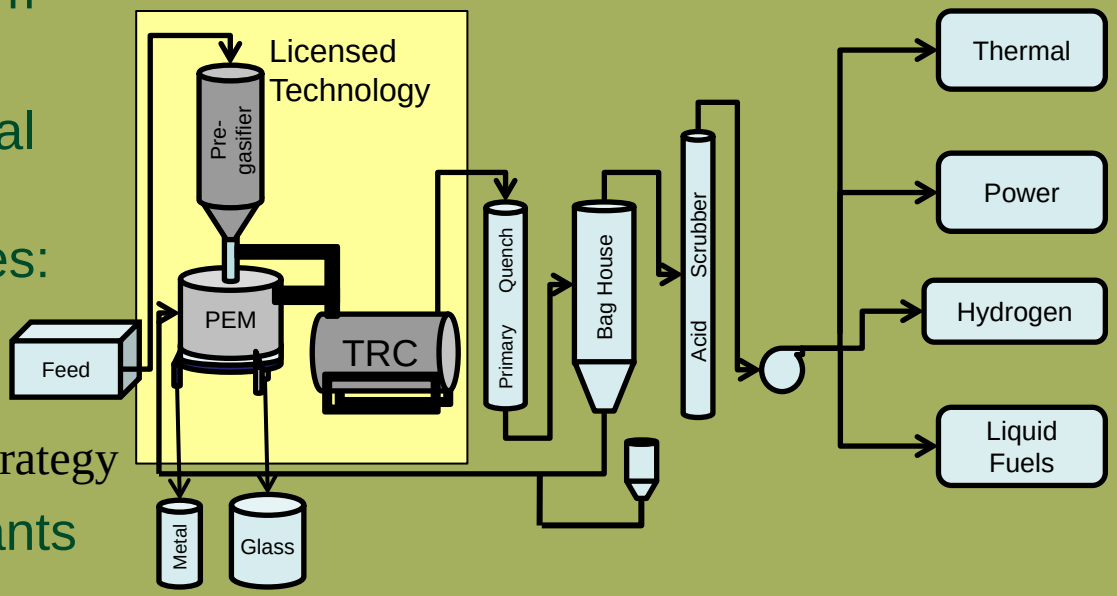
S4 Energy Solutions, LLC

- S4 Energy Solutions uses advanced plasma gasification technology to recover energy and useful by-products from waste.
- 25 tons-per-day commercial design at Columbia Ridge Landfill, OR; Project phases:
  - Small scale plant design and construction
  - Scale up and commercial strategy
- Goal of 125 – 250 TPD plants in a distributed model that process MSW and other waste materials.



JV:

California Incentive Programs

- AB 118 – Alternative and Renewable Fuel and Vehicle Technology
  - To develop and deploy innovative transportation fuels and technologies
  - CEC Funding ~ $110 million per year
  - Also Hybrid Technology program at CARB
    - $25 million/year

- Low Carbon Fuel Standard – January, 2011.
- Renewable Portfolio Standard & Renewable Electricity Standard
  - But, Market Price Referent Cap
- CAEATFA: SB 71 -- Sales and Use Tax Exclusion for Fuel Production
  - Possible New Program for Equipment to Generate Renewable Electricity
- Pending Cap and Trade Regulations
  - Potential Revenues for BioFuels & BioEnergy

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In Summary . . .

- What are drivers for energy/fuel from waste?
  - Fossil Fuel Prices
  - GHG Regulations (LCFS, C&T, RES)
  - Fiscal Incentives (AB 118, CAEATFA)
  - Public Concerns (Criteria/Toxic Pollutants, Facility Siting)
- What is WM currently doing?
  - Expanding LFG to Energy/Fuels
  - Investing in State of the Art Technologies
- What are the technologies of the future?
  - Anaerobic Digestion & Compost (Harvest Power, Garick)
  - Cellulosic Processes (Terrabon)
  - Gasification (Enerkem, S4)

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Any Questions?

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