

Integrating Green Technologies for Clean Energy, Alternative Fuels and Waste Management in Transportation

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The Issues

- Transportation facilities & operations consume large quantities of petroleum-based products and other non-renewable and/or energy-intensive materials
 - Fuel
 - Asphalt Products
 - Geotextiles
 - Cement/Concrete
- Transportation facilities & operations also produce large quantities of waste and greenhouse gas emissions
 - Environment: landfill disposal, burning/air quality
 - Cost: disposal, transportation charges continue to grow
- Increasing regulatory constraints
- Stakeholder demands to be more sustainable
- Many agencies want to be “green” ...
but have no \$ for it!



The Opportunities – Research and Applied Solutions

- There is great opportunity for *research*/development in the areas of alternative financing and technology application/integration. Develop more “tools in the toolbox” for the transportation industrythat:
 - Are sustainable/green
 - Reduce power and natural resource consumption
 - Reduce air pollutant emissions
 - Reduce disposal costs by curbing the need for sending waste to landfills, with the associated risks from transportation and contaminant releases
 - Are, or should be, acceptable to regulators and stakeholders
 - Have been demonstrated elsewhere (even if not yet in the U.S. and/or not in the transportation industry)
 - Are scalable/flexible so can be fit to all types and sizes of transportation agencies



Green Waste/Energy Innovation Already Being Pursued By Others

“Net Zero” Energy, Waste, Water



- **Net Zero Energy:** A Net Zero Energy Installation (NZEI) is an installation that produces as much energy on site as it uses, over the course of a year.
- **Net Zero Waste:** A net zero waste installation is an installation that reduces, reuses, and recovers waste streams, converting them to resource values with zero landfill over the course of a year.
- **Net Zero Water:** A Net Zero Water Installation limits the consumption of freshwater resources and returns water back to the same watershed so not to deplete the groundwater and surface water resources of that region in quantity and quality over the course of a year.

Transportation agencies could integrate and/or selectively invest in the development of “Net Zero” type concepts, strategic plan elements and/or technologies that are now being pursued by military/federal agencies in the US.




Types of Green Solutions – Established, and *Emerging/Innovative

- **Rail and Bus Rapid Transit**
- **Waste Management (Alternatives to Landfills)**
 - *Gasification; other Waste-to-Energy/Waste-to-Heat Solutions; Recycling; and, Composting (incl. proprietary systems like *‘‘Gore’’)
- **Alternative Fuels**
 - Ethanol, Bio-diesel (*incl. grow/harvest from rights-of-way); Compressed Natural Gas; Plug-In Electric; and, *Hydrogen Fuel Cell Vehicles
- **Alternative Power**
 - Solar; Wind; Geothermal; *Waste-to-energy (see above); *Fuel Cells
- **Other Special Integrated Solutions**
 - for example, *SolarRoadways (see separate Presentation by Scott Brusaw)

Need to develop better integration as well as alternative contracts/funding for these options within transportation agencies/programs, and the necessary infrastructure. >>> Research needs?!



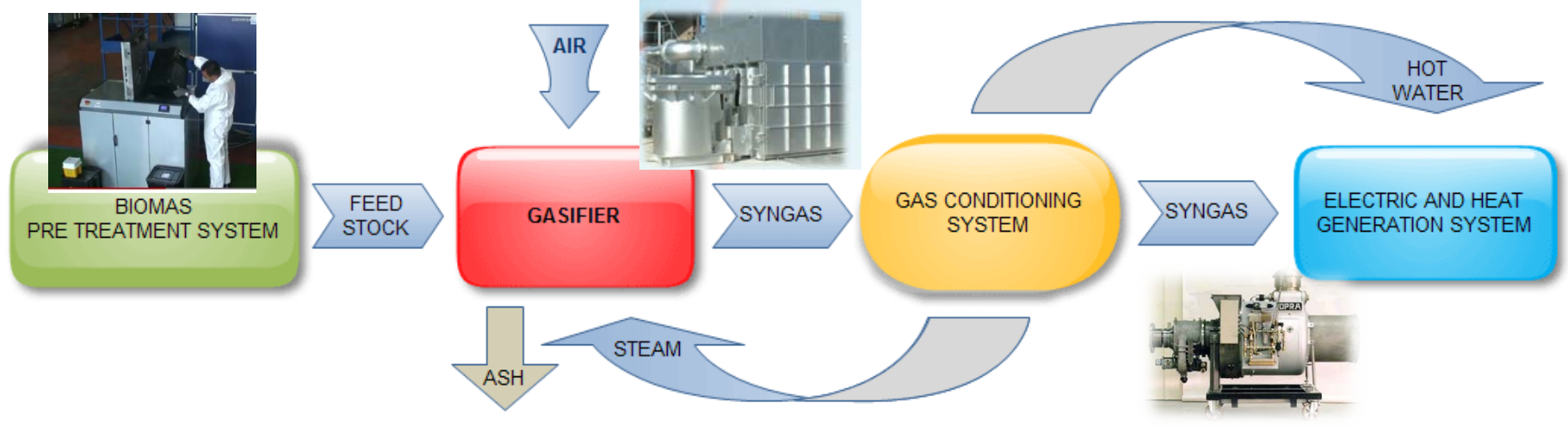


**SELECTED DETAILED
EXAMPLES OF
EMERGING
TECHNOLOGIES**



Organic Waste Management and Waste to Energy/Heat thru *Gasification*

Gasification process to generate Power and/or heat from transportation solid wastes (*vegetative debris, landscape wastes, road-kill, rest area wastes, office paper waste, etc.*)



Note: *Gasification is low emission and is NOT the same as incineration... but need the rules/programs in the US to reflect this, and R&D to address and other challenges. >>>Research Need?!*



Gasification Benefits

- *Clean* ...very low emissions
- *Scalable* ...1- 100s hundreds tons/day
- *Compact* ...small footprint, can be < 200 sq. ft.
- *Flexible* ...process a variety of wastes
- *Cost-effective* ...reduce costs for power/heat and for waste disposal
- *Energy Independence/Security* ... opportunities to use domestic resources and reduce reliance on the grid for power needs.
- *Efficient* ... With greater efficiencies and benefit to cost if you can integrate with thermal solar panels and/or co-locate Gasification such that you can directly use excess thermal energy from gasifier/generator (at asphalt plant, to heat buildings, for hot-water, etc.) >>> *Research Need?!*



Options for Feedstock Prep Prior to Gasification, OR for Waste Volume/Weight/Moisture Reduction



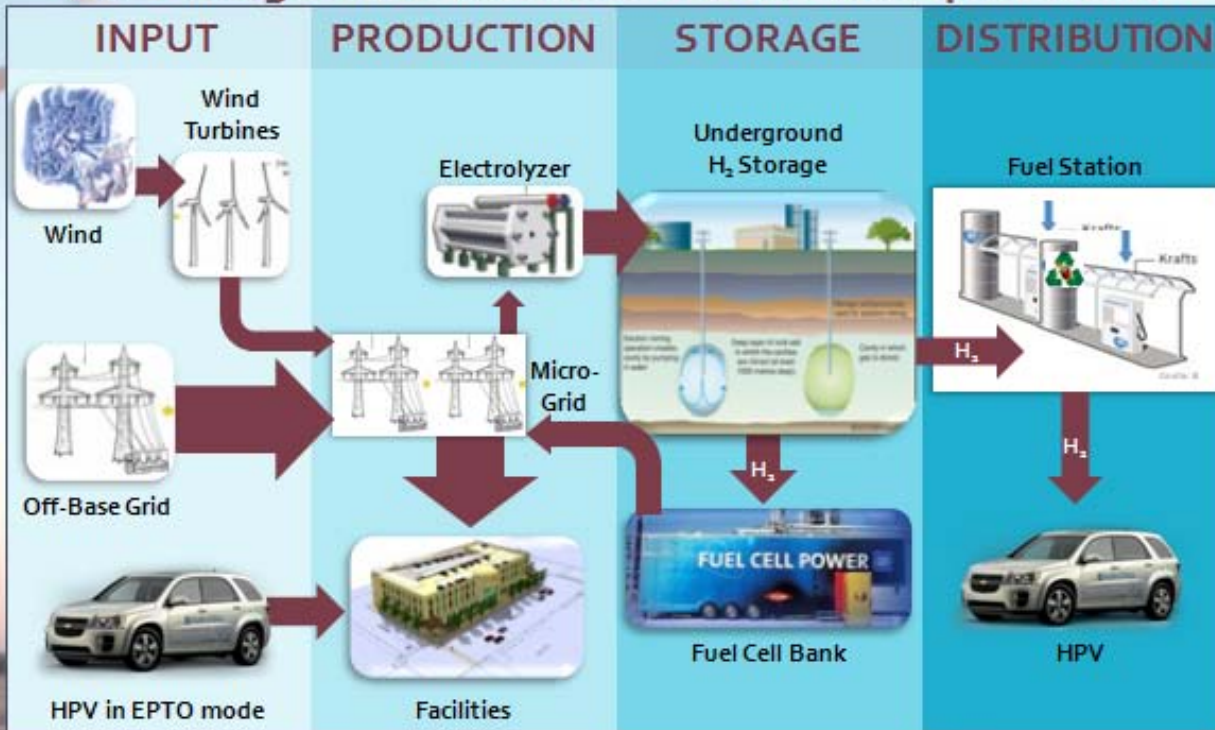
FEEDSTOCK PREP IS CRITICAL FOR GASIFICATION: NEED TO RESEARCH AND SELECT BEST METHOD BASED ON SITE CONDITIONS AND COST.

>>> Research Need ?!



Clean Fuel / Power Integration – Solar/Wind and H2 Vehicles

Conceptual Integration of Renewable Energy, H₂ Storage & H₂ Fuel Cell Vehicle Transportation



*Solar/Wind to
Energy, and
Hydrogen Vehicle
Fuel*



Improved Composting – The “Gore Cover”

There are newer, faster, more odor-free composting technologies that are currently used for food and yard/vegetative wastes that could be evaluated for management of transportation agency road-kill (and other organic) wastes.

COMPOSTING FOOD AND YARD WASTE WITH GORE™ COVER

Composting with GORE™ Cover means using the most up-to-date technology available, because it brings together various technologies that have hitherto appeared incompatible. Composting with GORE™ Cover is almost as economical as composting with open windrows and yet it is as safe to manage as in-vessel systems using highly technological structures and complies equally with the requirements of most licensing authorities. This is precisely what makes it ideal for treating Source Separated Organics and yard waste where a first-class final product is required. Even the authorising bodies generally recognised as the strictest in Europe and North America, such as Germany (TA Luft), UK (ABP-Regulation) and California have accepted GORE™ Cover as best available technology.



As a result there are more than 150 plants worldwide with throughputs of 6,500 t/a up to 160,000 t/a operating with our technology, and licensed to operate in accordance with Odour and Emission Control Laws. The combination of a membrane cover and controlled aeration allows a reliable composting process. Pressurised aeration ensures a sufficient supply of oxygen and proper temper-

ature management, while at the same time minimising odour and microbial emissions. Ultimately that leads to trouble-free operation of the plant even where the composition of the input varies – and in all climatic conditions. Ideal composting conditions with minimum energy consumption lead to reduced composting times, saving the operator space, effort and considerable cost. In this way

our technology offers significant increases in throughput for many plants, while using the same space.

Using GORE™ Cover to compost Source Separated Organics offers compliance with licensing requirements, operating safety, and an impossible-to-beat cost/performance ratio, all in one!



Biofuels – Feedstock Harvesting in Rights-of-way

First Green Project of Its Kind: Utah to Make Biofuel from Highway Crops

If the Green Experiment Works, Utah Could Generate 2.5
Million Gallons of Biofuel Each Year



[Aly Adair](#), Yahoo! Contributor Network
May 9, 2007 "Contribute content like this. [Start Here.](#)"

Crop	Planting Season	Days to Maturity	Pounds per acre	Expected Yield	Oil Content
Camelina	Spring and Fall	65-100	20-50	1500-2000	= 30 - 35%
Safflower	Spring and Fall	110-140	50 N/1000 lbs acre (150 units max)	1500-4000	= 38 - 45%
Canola (Rapeseed)	Spring and Fall	110-140	50 N/1000 lbs acre (150 units max)	1500-4000	= 38 - 45%
Sunflower	Spring	95 - 110	50 N/1000 lbs acre (150 units max)	1500 - 4000	= 35 - 45%
Field Mustard	Spring and Fall		50 lbs N/Acre	500 - 2000	= 35 - 45%
Flax	Spring		50 lbs N/Acre	500 - 2500	= 35 - 45%



Canola (*Brassica napus*) CANADIAN OIL LOW ACID



Biofuel

*Planting/Harvesting
in Highway or Other
Government Lands.*

Use for Diesel

*Blending for Vehicles
or Power Generation
Fuel.*



Camelina (*Camelina sativa*)



Safflower (*Carthamus tinctorius*)



Dwarf Sunflower (*Helianthus annuus*)



Tillage and Planting Equipment (small acreage)



Harvesting Equipment (small acreage)



Field Mustard (*Brassica napus*)



Flax (*Linum perenne*)



Tillage and Planting Equipment (large acreage)



Harvesting Equipment (large acreage)



THE Louis Berger Group, INC.



Feasibility of Energy Crops Grown on DoD Lands

Contacts

If there are any follow-up questions or needs,
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Thank You!

