

Organic Waste to Fuels & Energy: Thermal Conversion Technologies

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Presentation at Workshop:

**Helping NYS address its climate goals
through thermochemical conversion**

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Cornell University, Ithaca, NY

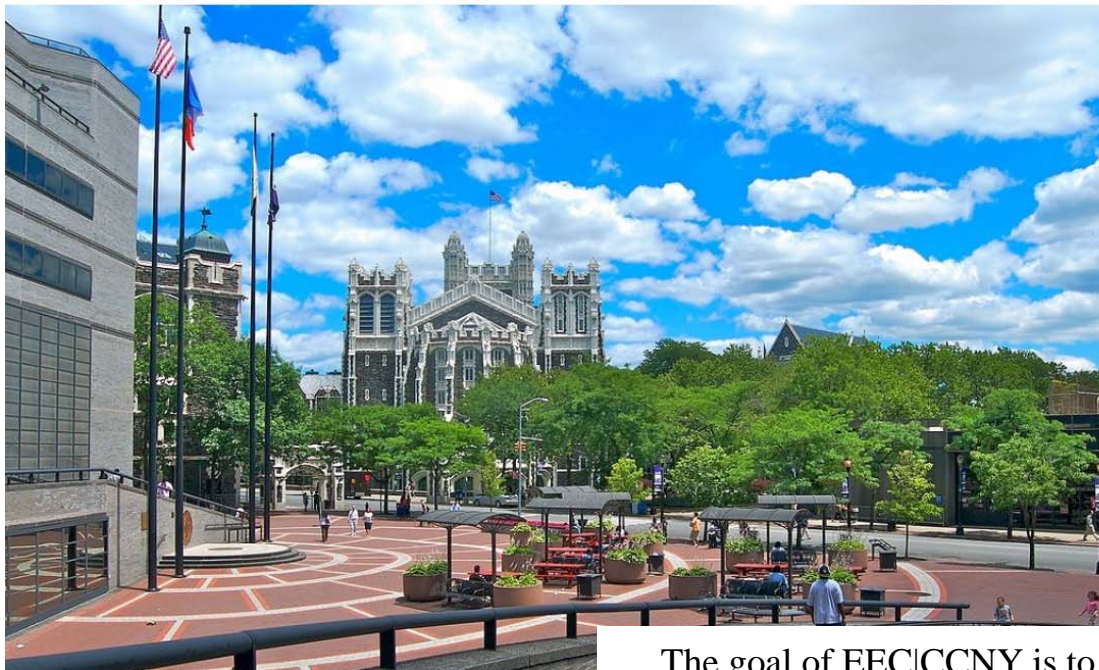


EEC | CCNY



Earth Engineering Center
CITY COLLEGE of NEW YORK

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Welcome to the EEC
at CCNY!

Engineering of Earth's energy and
material resources for responsible
utilization and preservation

The goal of EEC|CCNY is to bring to bear rigorous engineering solutions that enable responsible use of **energy and materials** for the advancement of society. Through industry collaborations and research sponsorship EEC|CCNY develops novel solutions to some of the world's most pressing problems. EEC|CCNY routinely engages students with industry professionals enabling a holistic approach to creative realistic, forward-looking applications. The reach of EEC|CCNY is international in scope with many projects connecting international students and companies with a global presence.

Thermal Conversion

Pyrolysis

- *No air or oxygen*
- *Only heat (external or internal)*
- *Want liquid, Gases not desired*
- *Pollutants in reduced form (H₂S, COS)*
- *High Char*
- *Scale: ~ 10 tons/day*

Gasification

- Low air or oxygen
- Can use water/CO₂
- Want Gases (CO/H₂), liquid not desirable
- Pollutants in reduced form (H₂S, COS)
- Char @ Low T
- Vitrified Slag @ high T
- **Scale: ~ 100 tons/day**

Combustion

- Excess air
- Gases (CO₂ & H₂O)
- Pollutants in oxidized form (SO_x, NO_x, etc)
- Bottom & fly ash produced

Incineration

- Destroy Hazardous Material

Waste-to-Energy

- Reduce MSW & Make Energy
- **Scale: ~ 1500 tons/day**

Increase in self-heating



*No additional Oxygen (only heat)
Unconverted solid will remain!*



Pyrolysis Unit

*Some additional Oxygen (or air)
Heat added or comes from reactions*



Gasification Unit

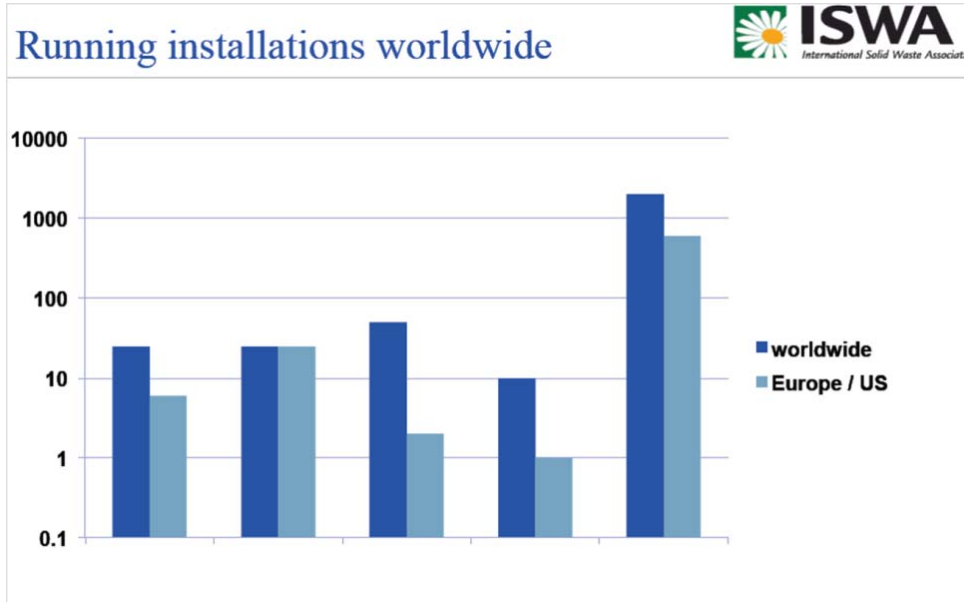
NYS workshop July 2019

*Much additional Oxygen (or air)
Heat comes from reactions*

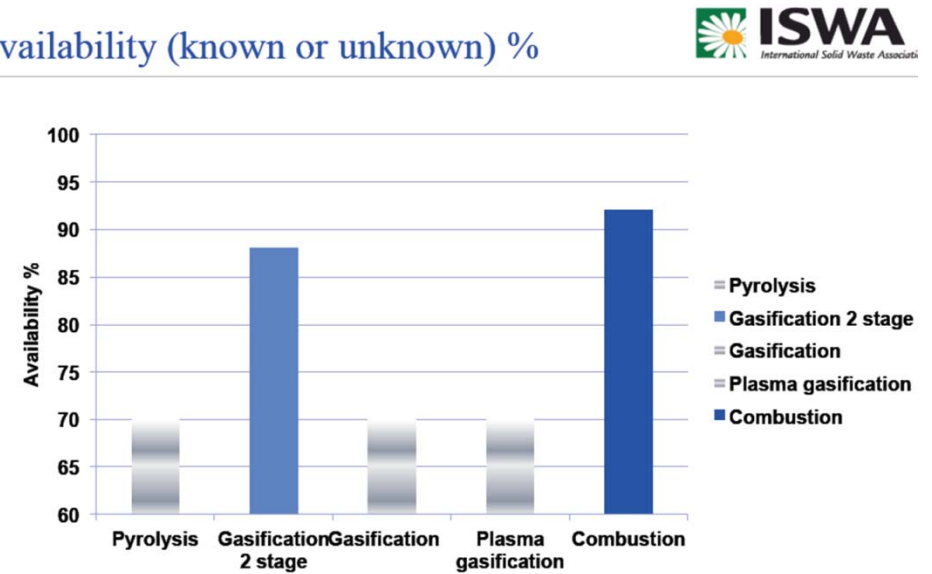


WTE Unit

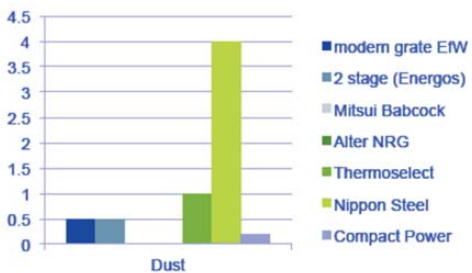
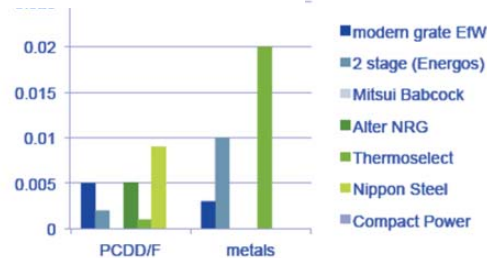
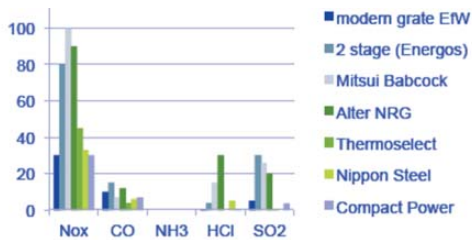
Thermal Technologies Global Perspective



Availability (known or unknown) %



Emissions of All Thermal Technologies



Requirements prior to project development

Reference plant operations

Feedstock processed

Full-economics

Independent Engineering due diligence

Commissioning Timeline

Char Production

- Charcoal is made by pyrolysis of wood at 400-500 °C

Biochar/Non-Energy



diynatural.com

High in carbon content

Produced via plant and waste feedstock pyrolysis

Withdrawal of atmospheric carbon dioxide

Uses:

- Soil Amendment
- Enhanced nutrient retention capacity
- Reduces total fertilizer requirements
- Catalysis

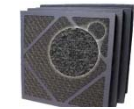
Activated Carbon Applications



cocarb.com



nature.com



Capacitors

Filtration

Air & Water

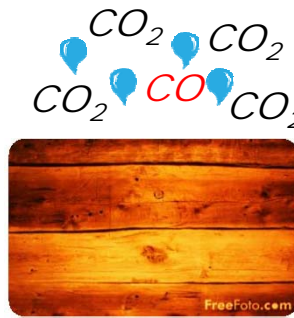


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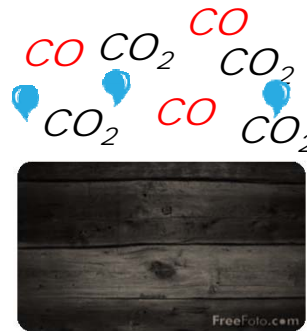
Electronics



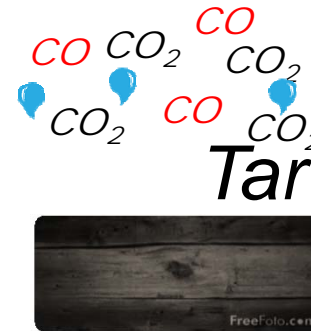
100 °C



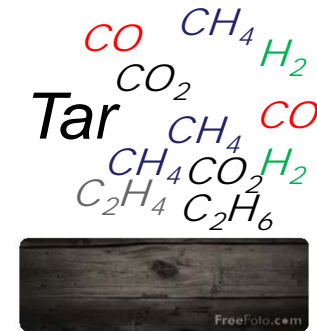
230-250 °C



280 °C



290-350 °C

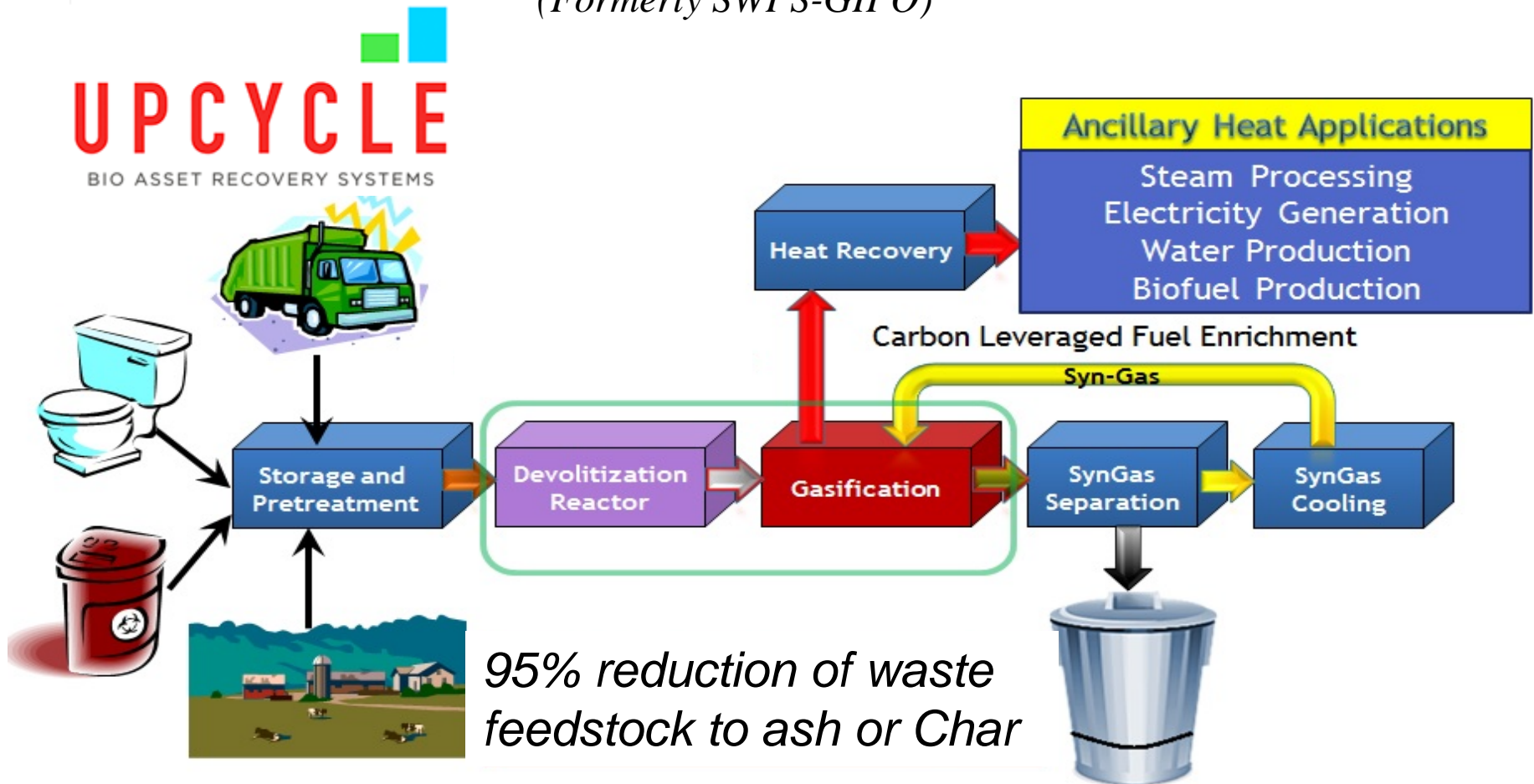


415-500 °C

**All of these applications require a solid carbon product with specific properties.
High temperature processing may be used to tailor those properties.**



(Formerly SWPS-GIPO)



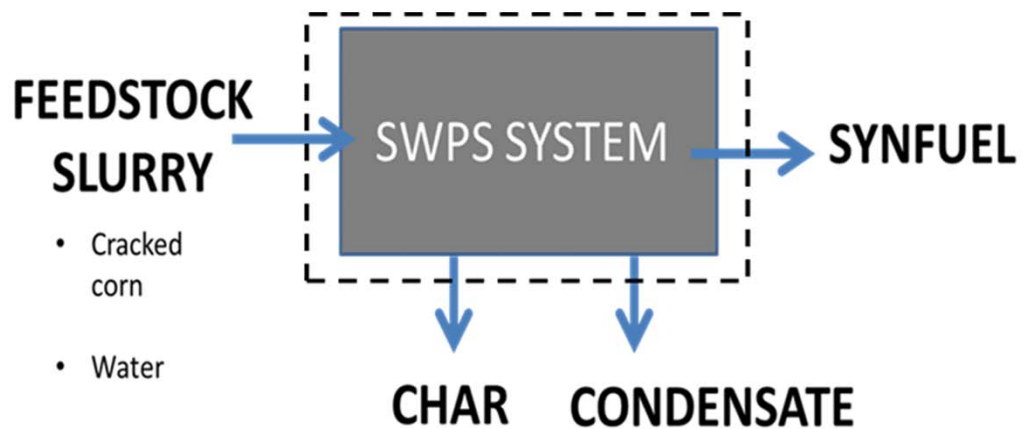
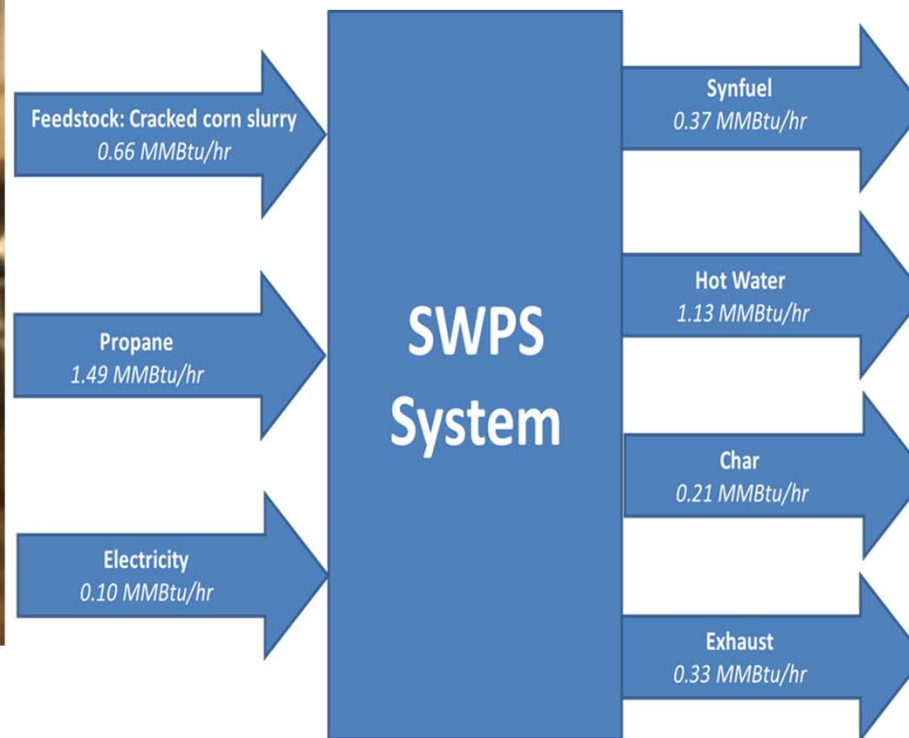
It is possible to process 15 tons of wet waste a day, with low-carbon emissions. A 95% potential asset yield. Water. Energy. Minerals. Small footprint compared to traditional methods.

One Unit processes 15 tons or more of agricultural wet waste per day.

UpCycle Details



Prototype @ CCNY, Commercial in Saugerties NY



*3 Dry TPD Equivalent Intake
Up to 85% water content
Gasification with water/steam
55% Hot water production
18% Fuel gas production
10% Char production*

Demonstrations to Fuel Gas



Wet
Ground
Corn Cobs



Ground
Meat &
Packaging



Grain
Stillage



First Customer!



Waste Conversion

\$208,000 per year savings

Heat Supply

Appx. \$300,000 per year savings



Thank You

