Technikon
Green Energy Development

TECHNIKON

November 16, 2009

Technikon'sRenewable Energy Testing Center

60,000 sq. ft. Energy Application Validation and Development Laboratory

TECHNIKON

- Formed in 2000 after the closure of McClellan Air Force Base
- Operating four major DoD Programs for the US Army
- Commercial work:
  - Energy Projects
  - Air Emission Studies
  - Hi-Tech Metals Projects

RETC - Reutilization of Government Investment

- Testing and Validation Model developed under the 1994-2006 Casting Emission Reduction Program (DoD and Auto companies)
- 180+ processes and products validated for energy efficiency and environmental impact
- $40+ million infrastructure investment by DoD being used in the RETC program
- Technikon'sfacilities, measurement capability and staff are trained for new program
- Currently funded by DoD and private sources

Core Competency: Evaluation of High Temperature Processes

High Temperature Processes

- Melting Metal
- Furnaces
- Gasification

Precision Measurement Technologies

- Environmental Measurement
- Energy Measurement
- Productivity and Quality Measurement

RETC's Approach to the Evaluation of Technologies

RETC provides entrepreneurs Industrial shops and technical support for faster scalability evaluation

Emerging technologies converting biomass are measured for:

- Energy efficiency
- Environmental impact
- Economic viability

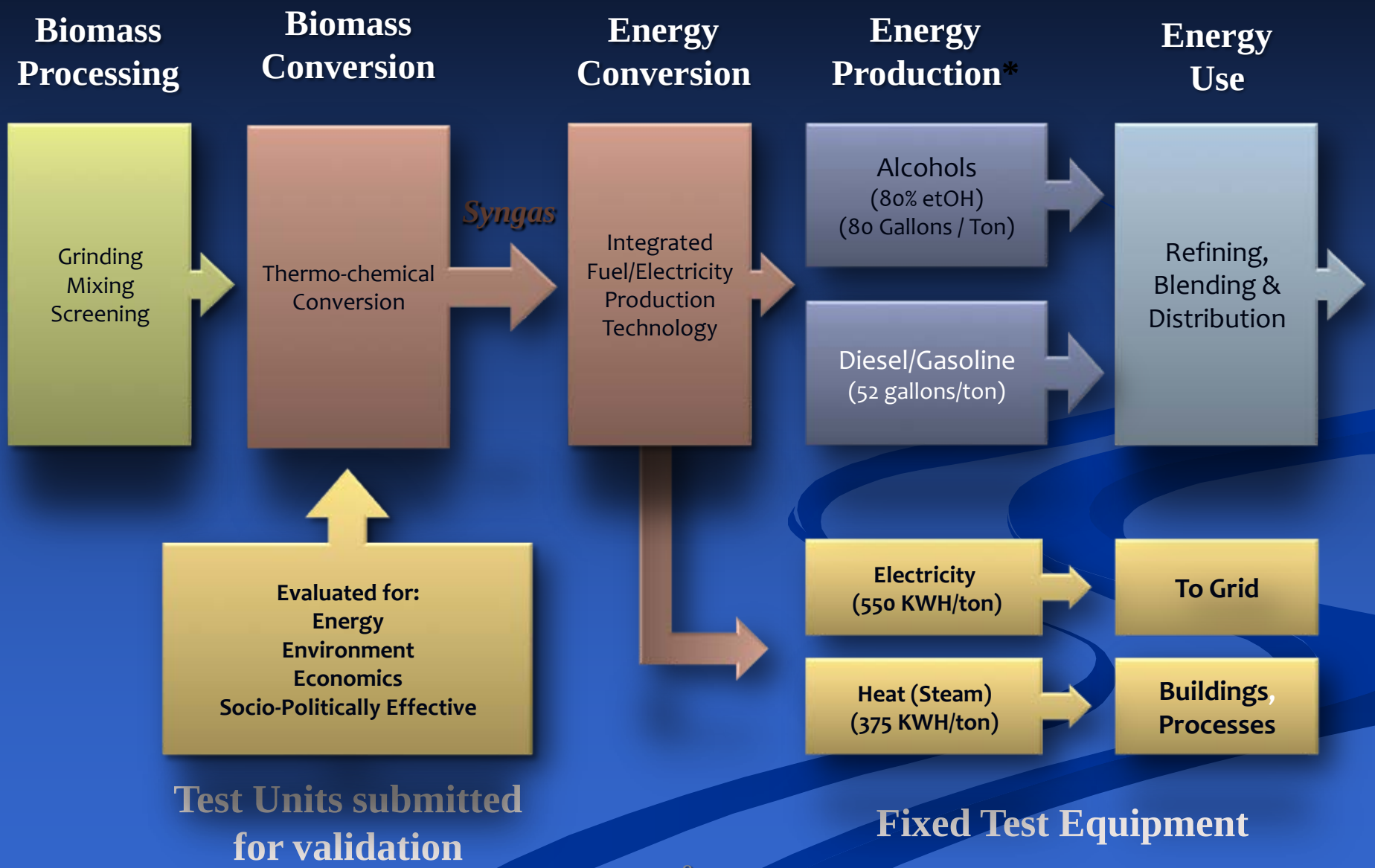
Renewable Technology Acceleration Concept

- Increasing number of clean technologies from universities and entrepreneurs
- VC & capital money not readily available until a pilot and data have been demonstrated
- Most innovators create only one or two parts of larger industrial system
- RETC allows “plug-and-play” synergy with before and after components

Why Thermal Chemical Focus

- Plant and skills available
- Thermal Chemical Conversion converts biomass to syngas (mix of CO, H2, Methane and CO2)
- Advantage:
  - *Economic* – Maximum use of feedstock
  - *Robustness* –Less sensitive to feedstock variations
  - *Viability* - Highest probable success rate, best projected ROI and modular/mobile design capability

RETC System Evaluation Example

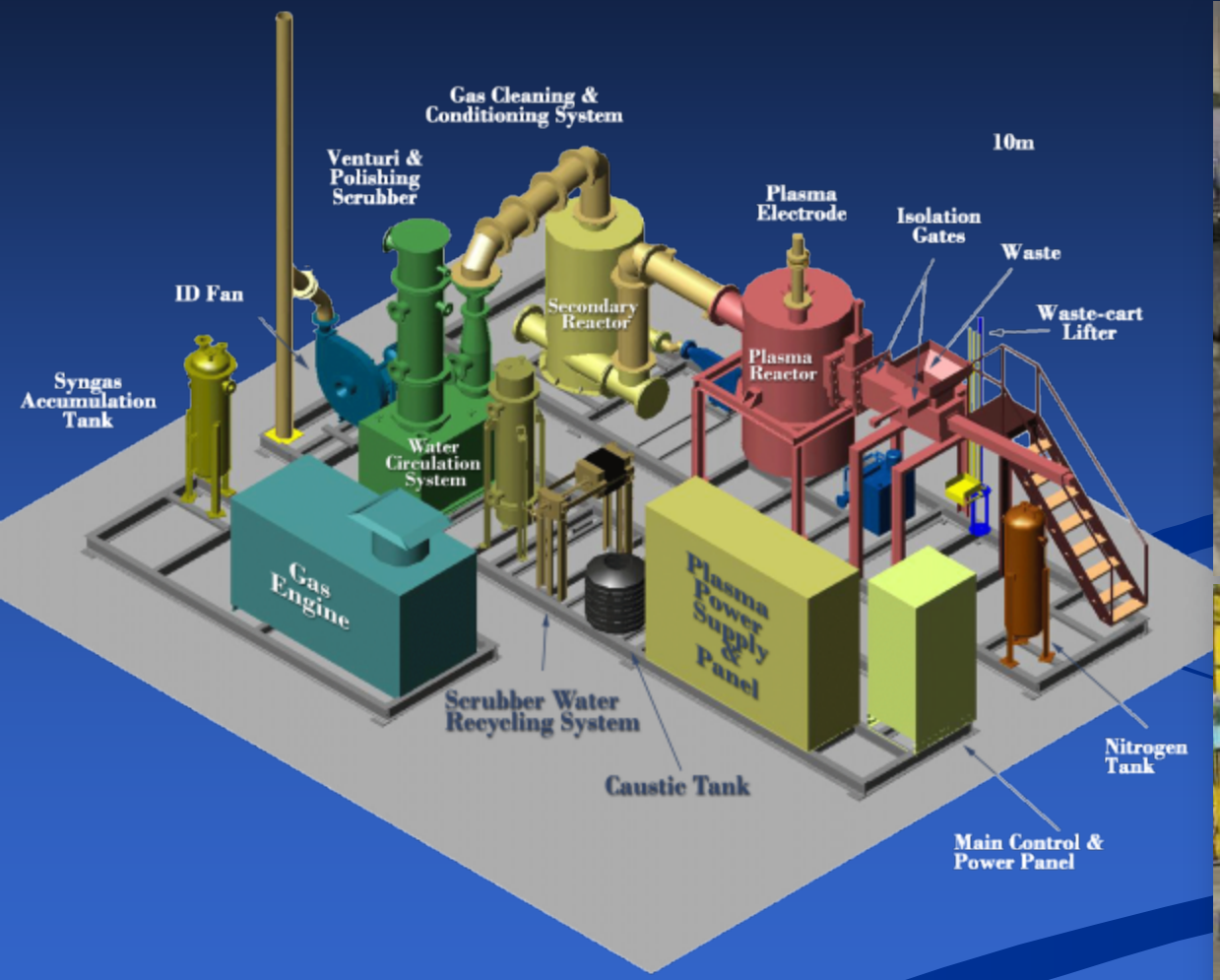


*Energy production data calculated for dry wood @ 8,500 BTU/lb

Energy Technology Stakeholders

- Four Companies have over $4 Million in equipment installed at RETC
- Five more companies in queue for evaluation
- Each company provides one component of a full renewable energy system
  - Gasification Systems
  - Syngas to Electricity Generator
  - Syngas to Diesel Fuel using Dry Catalyst
  - Algae production for carbon capture and bio-oil

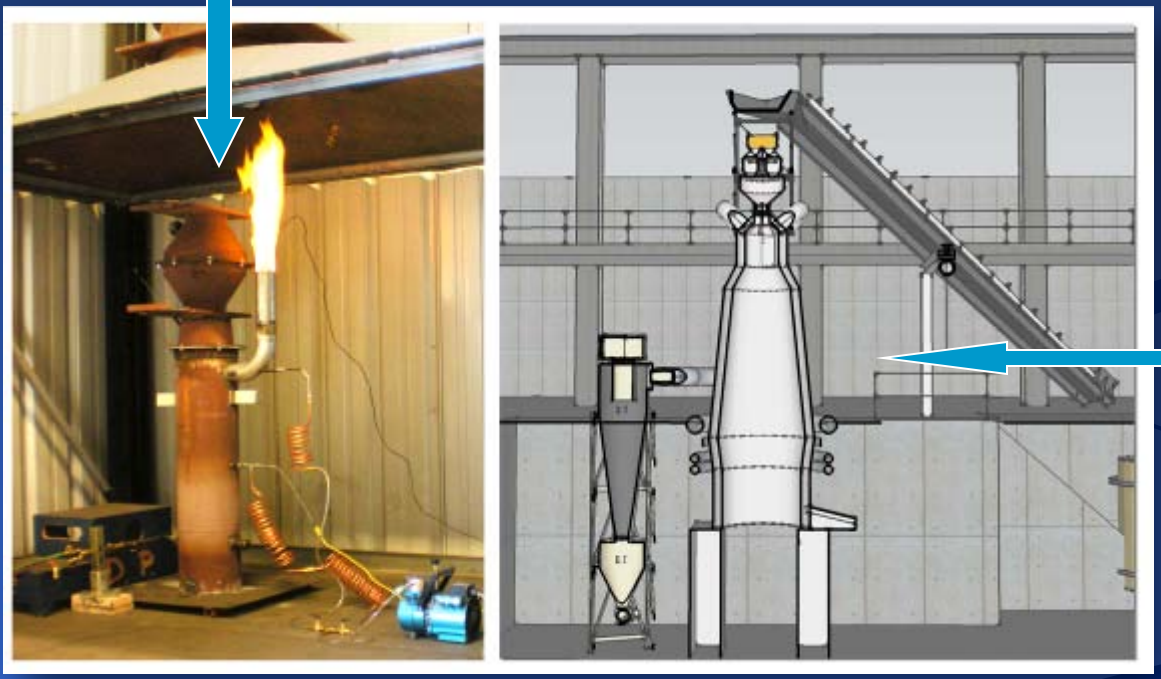
PEAT Plasma Gasifier and Generator

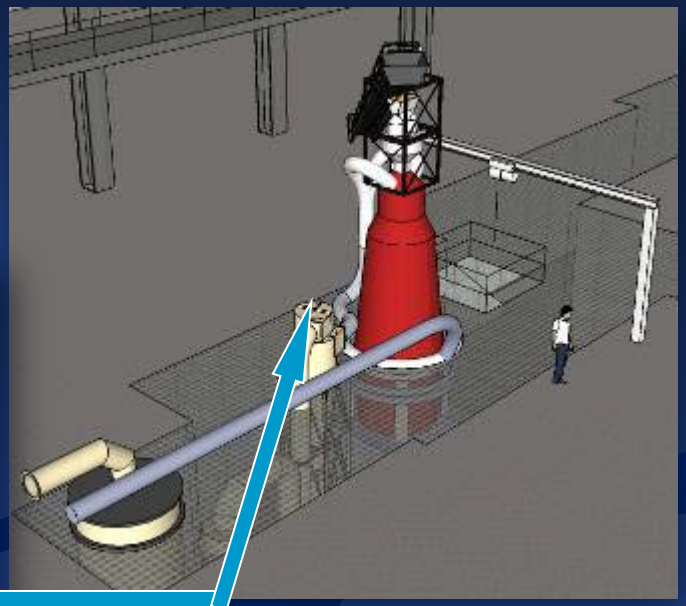


Sierra Energy Gasifier

for large scale electrical generation

Lab Scale Unit Installed





Future Sierra Energy's furnace design to be located at RETC

Pacific Renewable Fuels

Syngas to Liquid Fuel Demo Unit

- Factory built, modular systems that can be quickly assembled at the plant site.
- Designed to operate 24/7 with little down time.
- Produce a variety of fuels (diesel, ethanol, others) depending on the catalyst used.
- Co-produce fuels, electricity and process steam to maximize plant energy efficiencies up to 60%.

Ternion Bio Industries

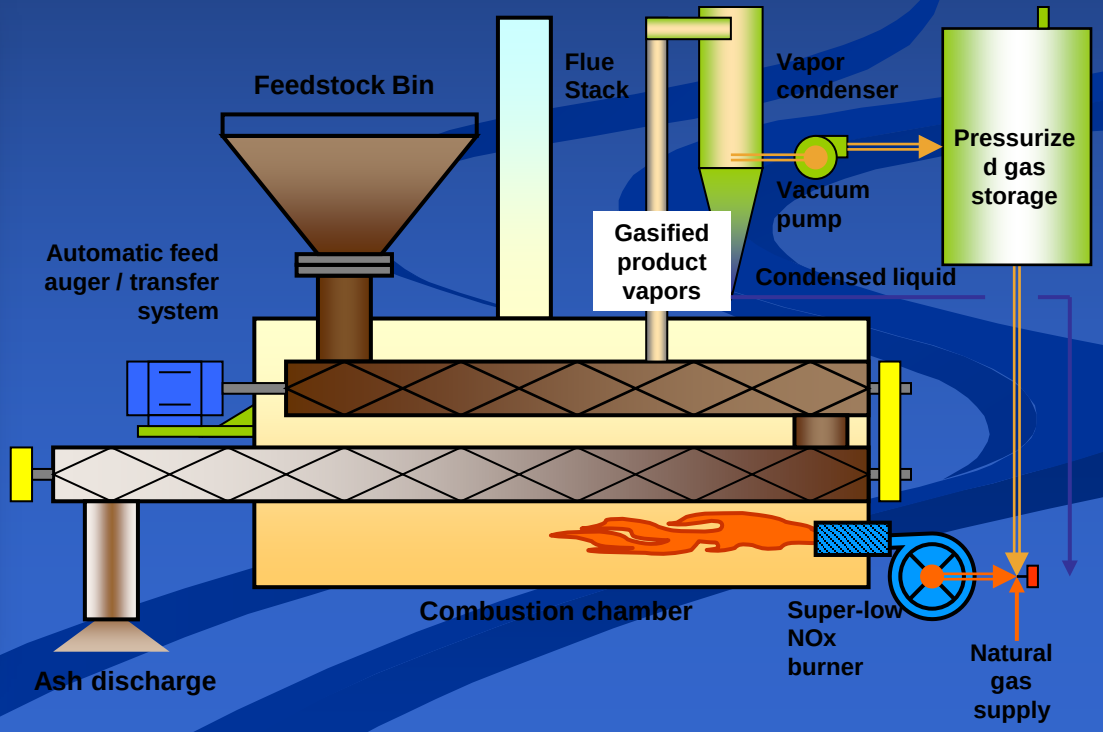
Utilization of Algae to control CO2 Emissions

- Photo Bioreactors that provide a controlled algae environment
- Vertical Scalable Systems
- Carbon Dioxide (CO2) used to “feed” any strain of algae
- Producing high-quality raw material for beneficial algae-based products and fuels

Small Gasification to Fuel System

2 to 24 tons per day of biomassper unit

- EDCI Pyrolysis retort system with a separate gas-handling skid tested and gas to liquid fuel system.
- Tested by RETC for wood chips to fuel in April 09



Bionic Microwave Liquid Fuel System

10 to 50 tpd of biomass per unit

Wood or Ag Biomass

Catalyst

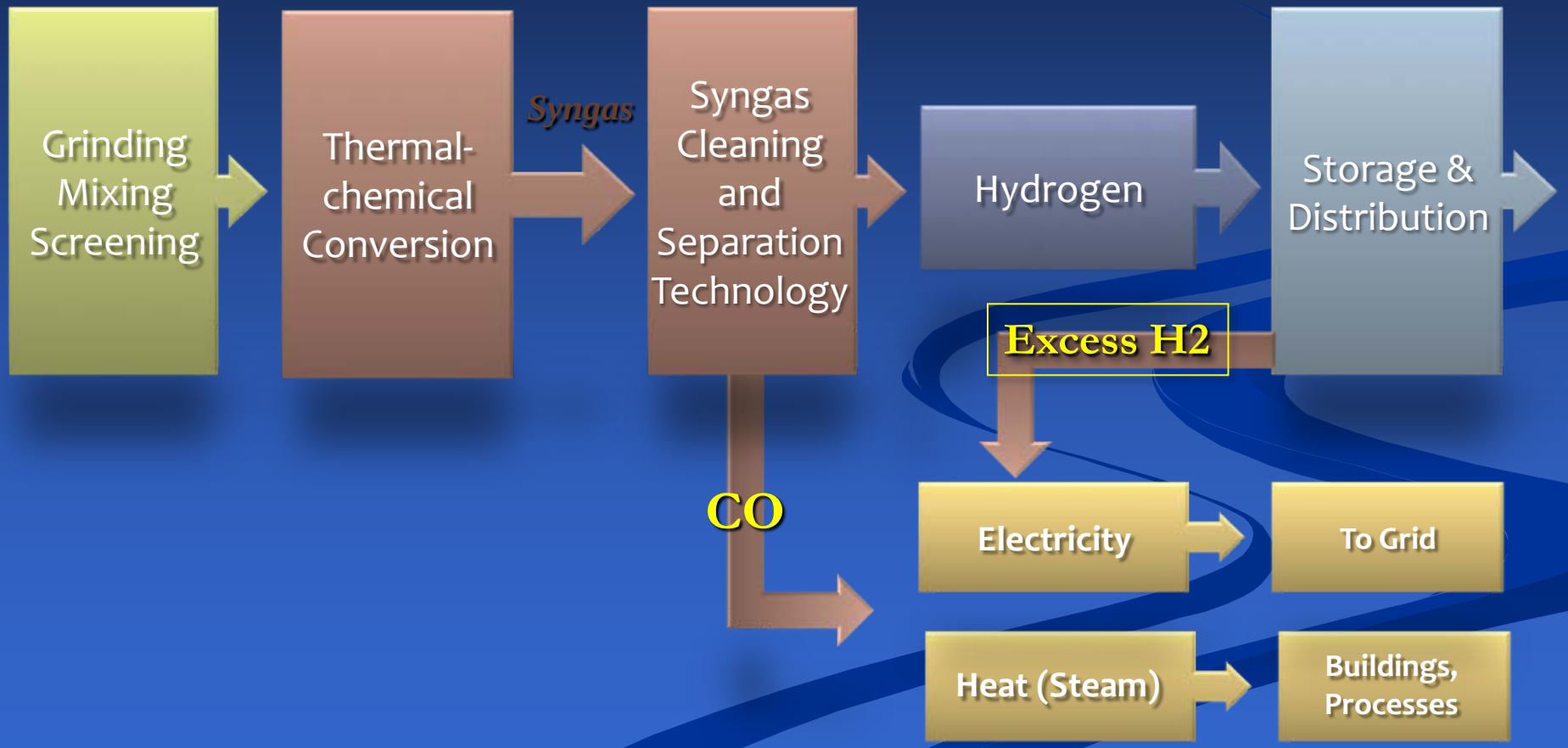
Wood Pellets

Diesel fuel

Microfuel low temperature MW plant

>60% efficiency

Example of Components in Biomass to Electricity and Hydrogen Fueling Station



*Energy production data calculated for dry wood @ 8,500 BTU/lb

Advantages of the RETC Approach

- Leverages government funding with private sector funding
- Uses partnering as a method to bridge technology gaps
- Existing infrastructure saves development costs and shortens time to market
- Fills a missing gap between R&D and Commercialization
- Gets VC and Equity funding interest much faster