NO MORE LANDFILLS

The Use of Startech Environmental's Plasma Converter System to Bio-Fuels Production and Electricity

Wembley Stadium
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The Startech Bristol Connecticut Facility

MINISTRY OF DEFENCE

de&s

What Categories of Waste may be Converted into **Clean Energy**?

- Hazardous Waste….

  More than 120kg / Capita per yr in the EU.

- Nonhazardous Waste….

  Now over 600 kg / Capita per yr in the EU.

- Future Infrastructure….

  Will have to double.

STARTECH regards all wastes produced by industrial societies as valuable renewable resources that will help to offset the need for the ecosphere's limited virgin resources.

Examples of Waste that can be readily converted into **Clean Energy**:

Most Organic Waste may be converted into an alternative form of energy:

- **PCBs or other Chlorinated Organics;**
- Medical/Pharmaceutical Wastes;
- Scrap Tires & Mixed non-recyclable Plastics;
- Household Hazardous & Non-Hazardous Waste;
- Industrial Hazardous Waste;
- Refinery & Petrochemical Wastes;
- Used Mineral & Vegetable Oils;
- Natural and stranded gas;
- Oil Sludge.

The Plasma Converter System Offers a

Total Solution.

The PCS converts hazardous & non-hazardous organic and inorganic wastes and by-products into safe valuable commodities such as

Diesel, Ethanol, Electricity or Hydrogen.

Why the Startech Plasma Converter System (PCS)?

- Can process waste materials in any form;
- Can process Natural and Stranded Gas;
- Can process Oil Sludge:
- Safer than environmental standards;
- Safe and irreversible destruction;
- Recycles wastes into valuable commodity products;
- Revenue potential on front and back-ends;
- Stationary and transportable systems available;
- Systems available in multiple sizes and multiple feed systems;
- Startech Syngas Production can be used to produce Diesel, Electricity, Ethanol, Hydrogen or sold as is.

How The Plasma Converter System (PCS) Works

Forces gas through an electrical field to ionize the gas into a plasma which conducts electricity;

Intensity of plasma excites and breaks apart the molecular bonds: *"molecular dissociation"*

Recycles waste into commodity products: *clean synthetic gas, metals and silicates;*

Achieves volumetric reduction: *more than 300 to 1;*
***Safer than US environmental standards by orders* of magnitude.**

Principal Advantages

Greatly *reduces cost and risk* associated with hazardous waste generation;

Can process *any and all waste* (material) in all forms;

***Far superior & Safer performance* than current environmental standards;**

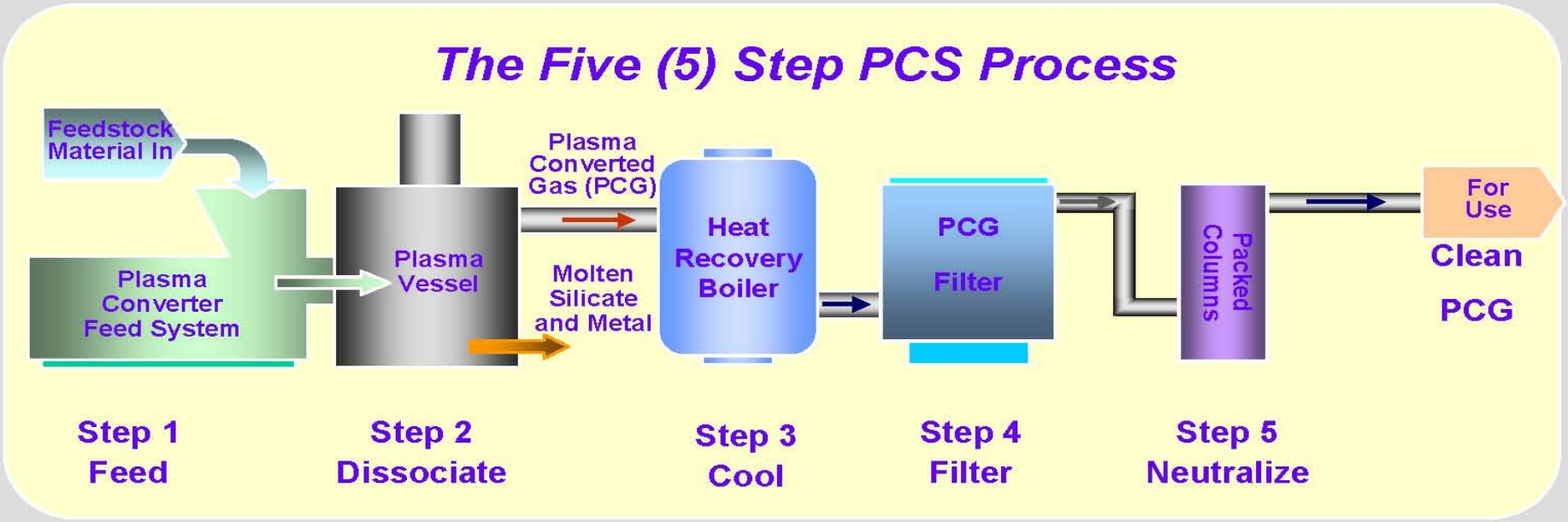
Recycles wastes into *valuable commodity products;*

Systems from hundreds of *pounds* per day *to* Plants of thousands of *tons* per day;

***Stationary,* transportable and *mobile* systems;**

Safe and irreversible *destruction of* even the most *deadly wastes*.

The Plasma Converter System 5 Step Process:



Step 1

- Feed:
  - ✓ Solids
  - ✓ Liquids
  - ✓ Gases

Step 2

- Dissociate: reducing atmosphere in sealed vessel, below atmospheric pressure.

Step 3-5

- Cool
- Filter
- Neutralize

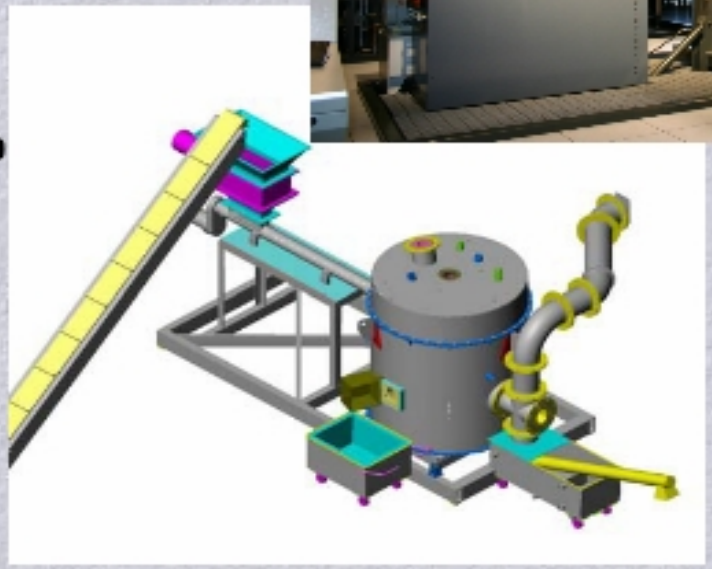
PCS Process Step 1 - Feed

Loss-in-Weight Liquid Feed:

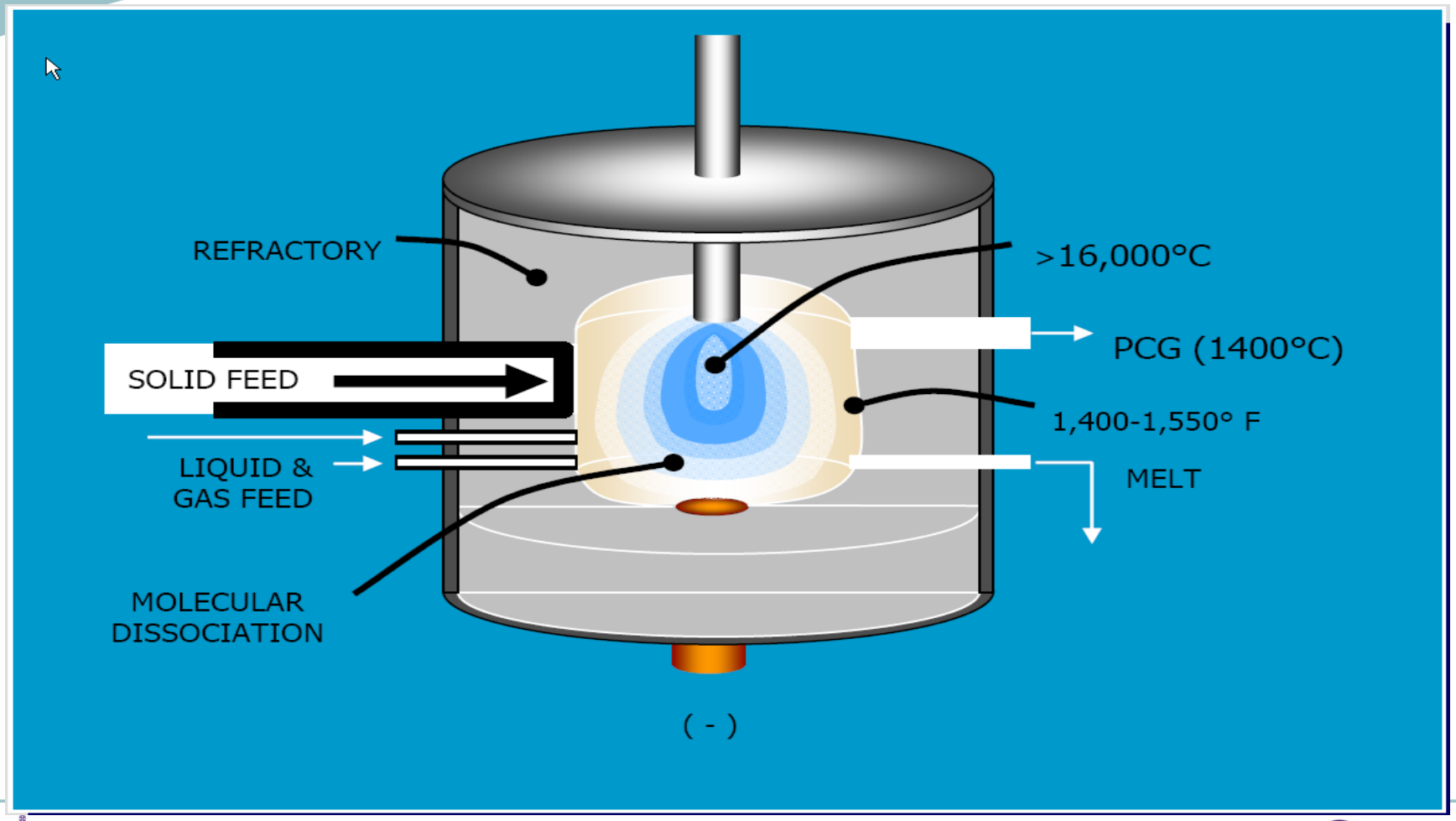
- Feed from drums or tank
- Peristaltic pump with dedicated transfer hose
- Metered steam blend and injection into vessel

Multiple automatic solid Feed configurations availab based on feed materials:

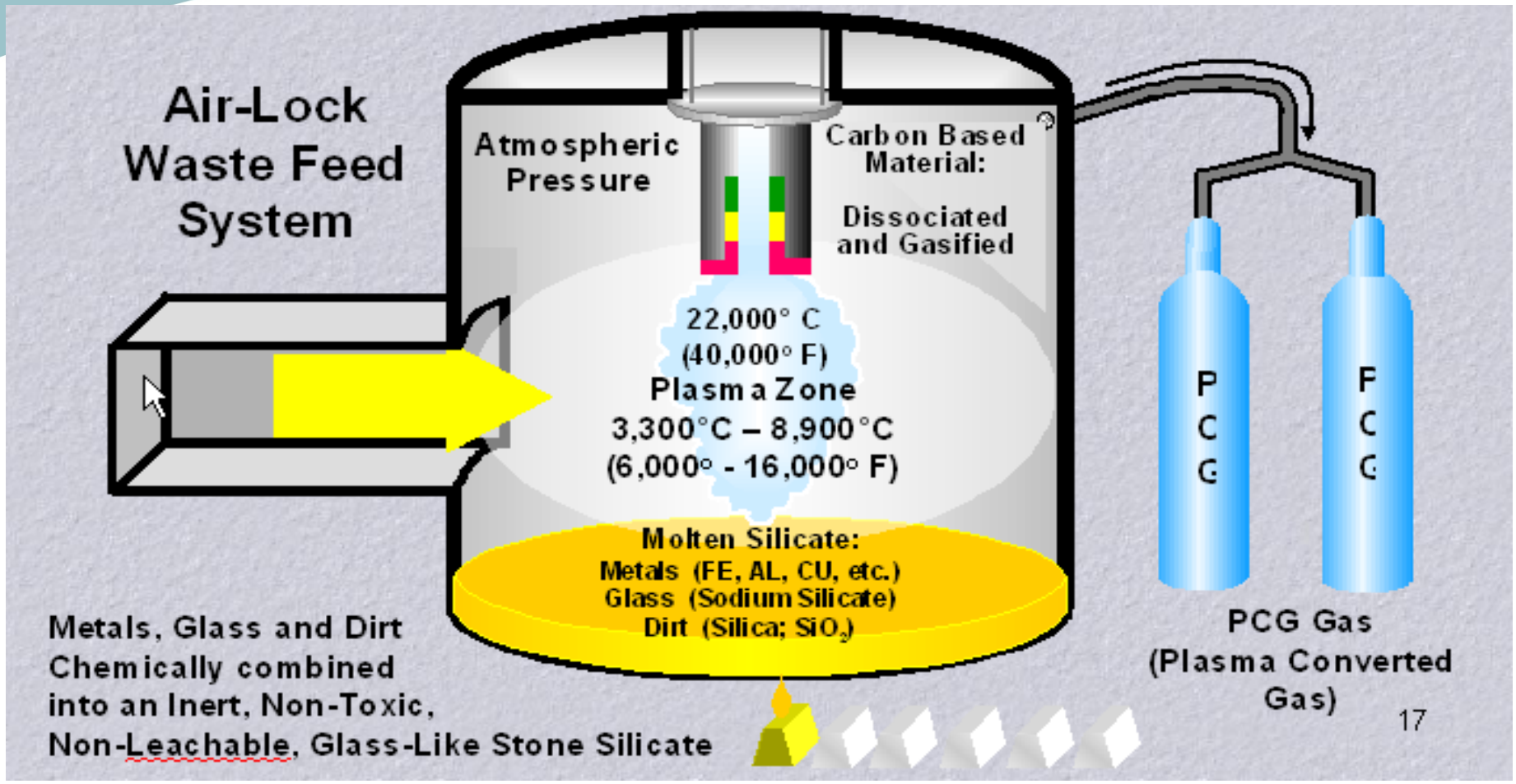
- Ram Feed
- Shredder
- Conveyor
- Auger
- Rotary Valve



PCS Process Step 2 - Dissociate

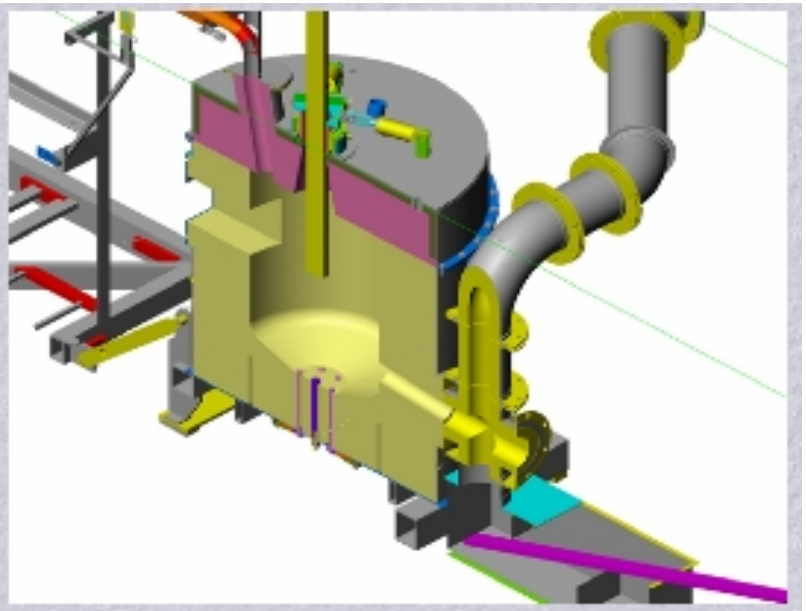


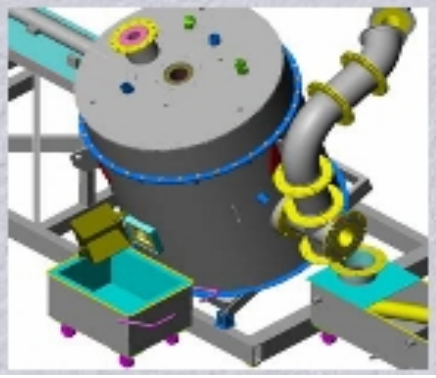
Plasma Converter System Chamber

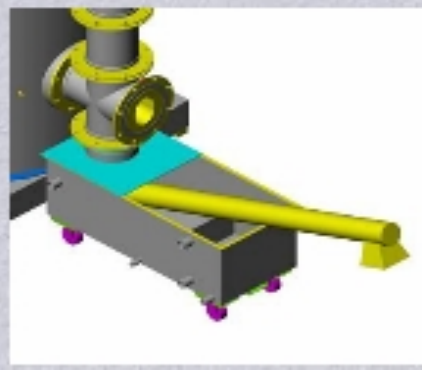


The Plasma Vessel

- **Vessel**
  - ✓ Two segment design
    - ➢ Main Vessel
    - ➢ Vessel Lid
  - ✓ Refractory lined walls
  - ✓ Sealed, negative pressure operation
  - ✓ Single PCG and melt exit port
- **Melt Removal**
  - ✓ Melt/Quench Cart
    - ➢ Continuous melt removal into water-cooled cart
    - ➢ Auger screw design
  - ✓ Tilt removal to side

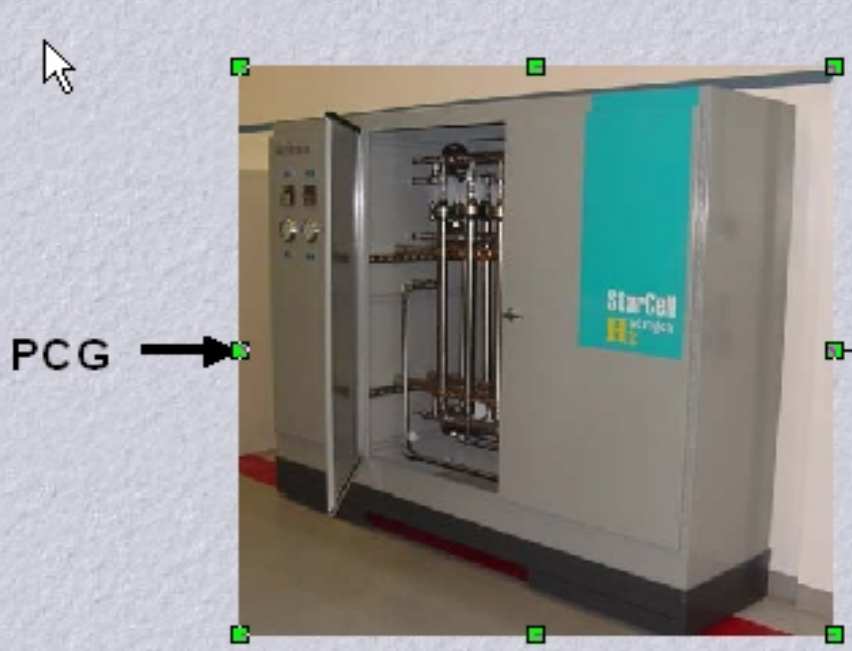






PCG to Hydrogen: StarCell™

- Startech's patented StarCell™ technology uses ceramic metal-oxide membranes to produce pure hydrogen from the hydrogen-rich PCG.



H_2

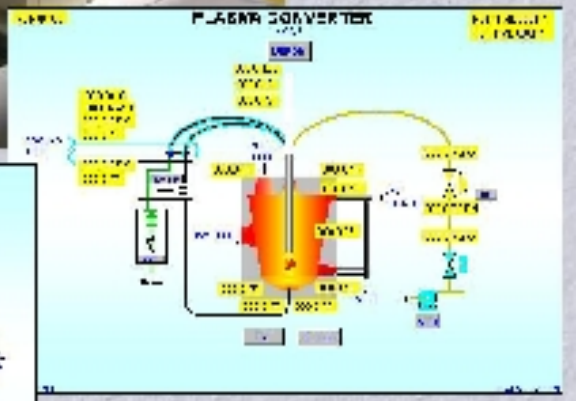
Fuel Cell

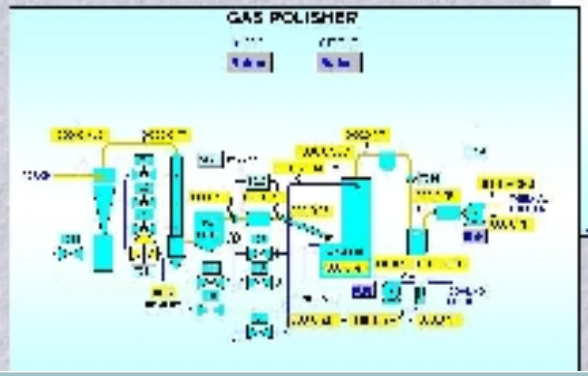
H_2

Hydrogen Fuelled Truck

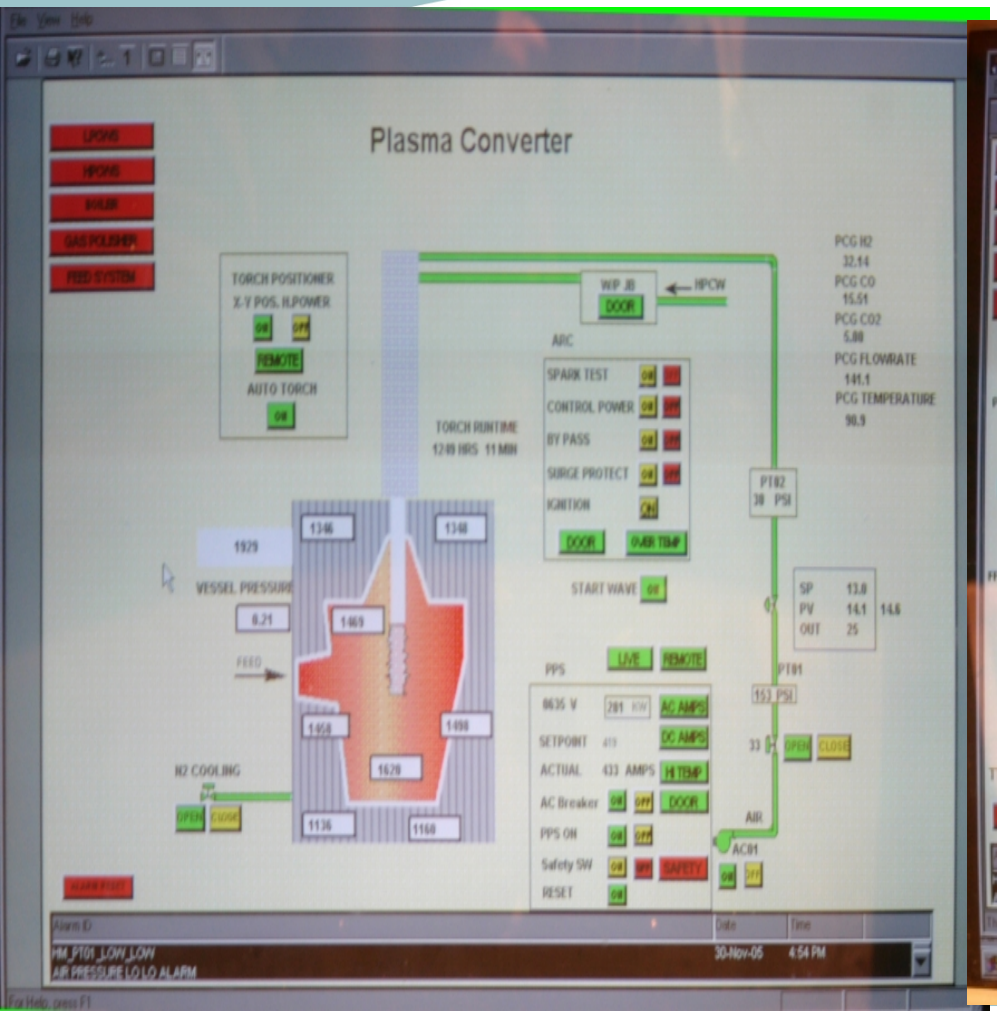
PCS Process Utilities: Control System

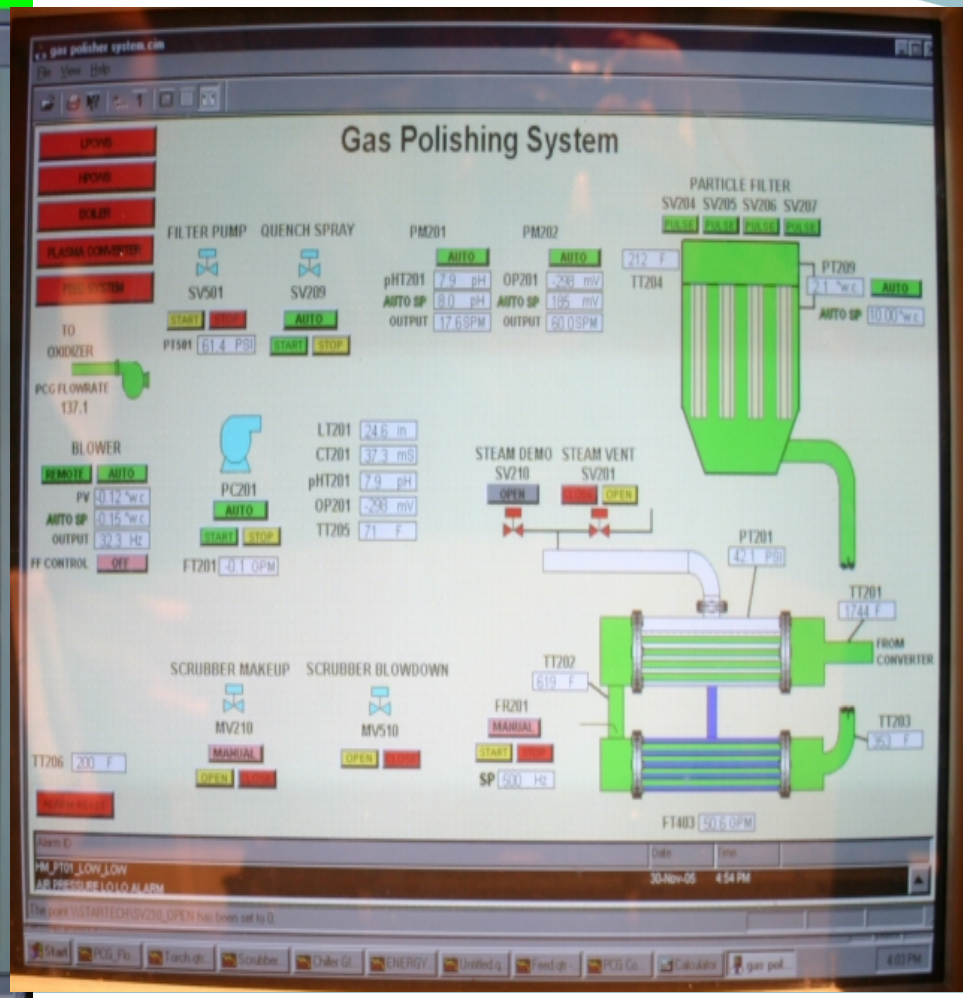
- PLC Based control system;
- Skid Mounted Control Panels with Remote I/O;
- Centralized Operator Station;
- PC Based Human Machine Interface;
- Real-Time Video and Process Monitoring.





Total Process Control





SYN-DIESEL

Synthesis Gases (PCG, Plasma Converted Gas)™ produced by the PCS can be used to produce **SYN-DIESEL, HYDROGEN OR ETHANOL**;

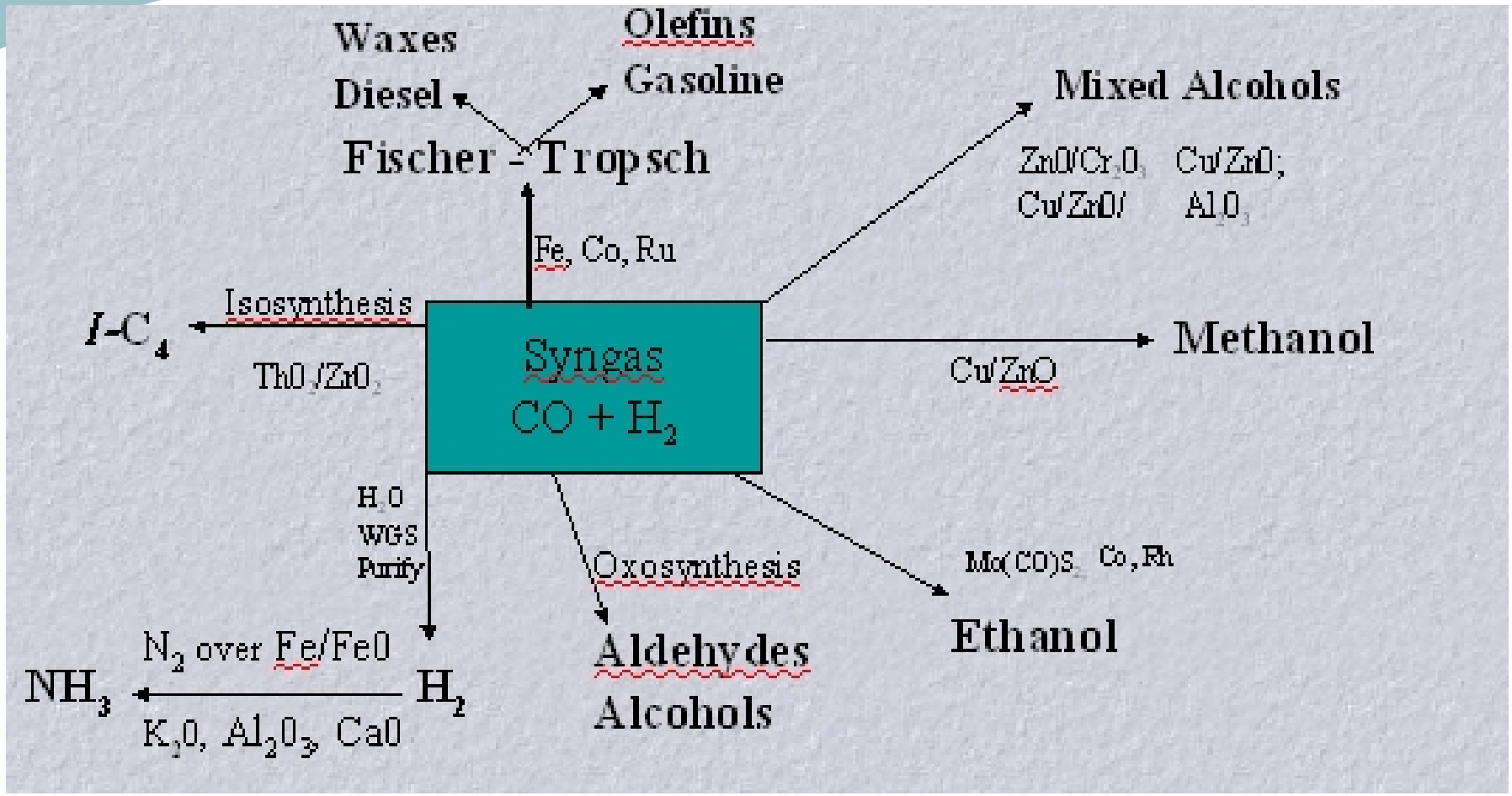
"Spent Tyres and Plastics to Diesel" plants utilising Startech's Plasma Converter System as the "Front End" to Produce Syngas to feed a UK proprietary Gas to Liquid Technology for the production of Diesel;

On-going negotiations are currently taking place with other strategic partners to provide Gas to Liquid technology in Europe. the Middle East and Africa.

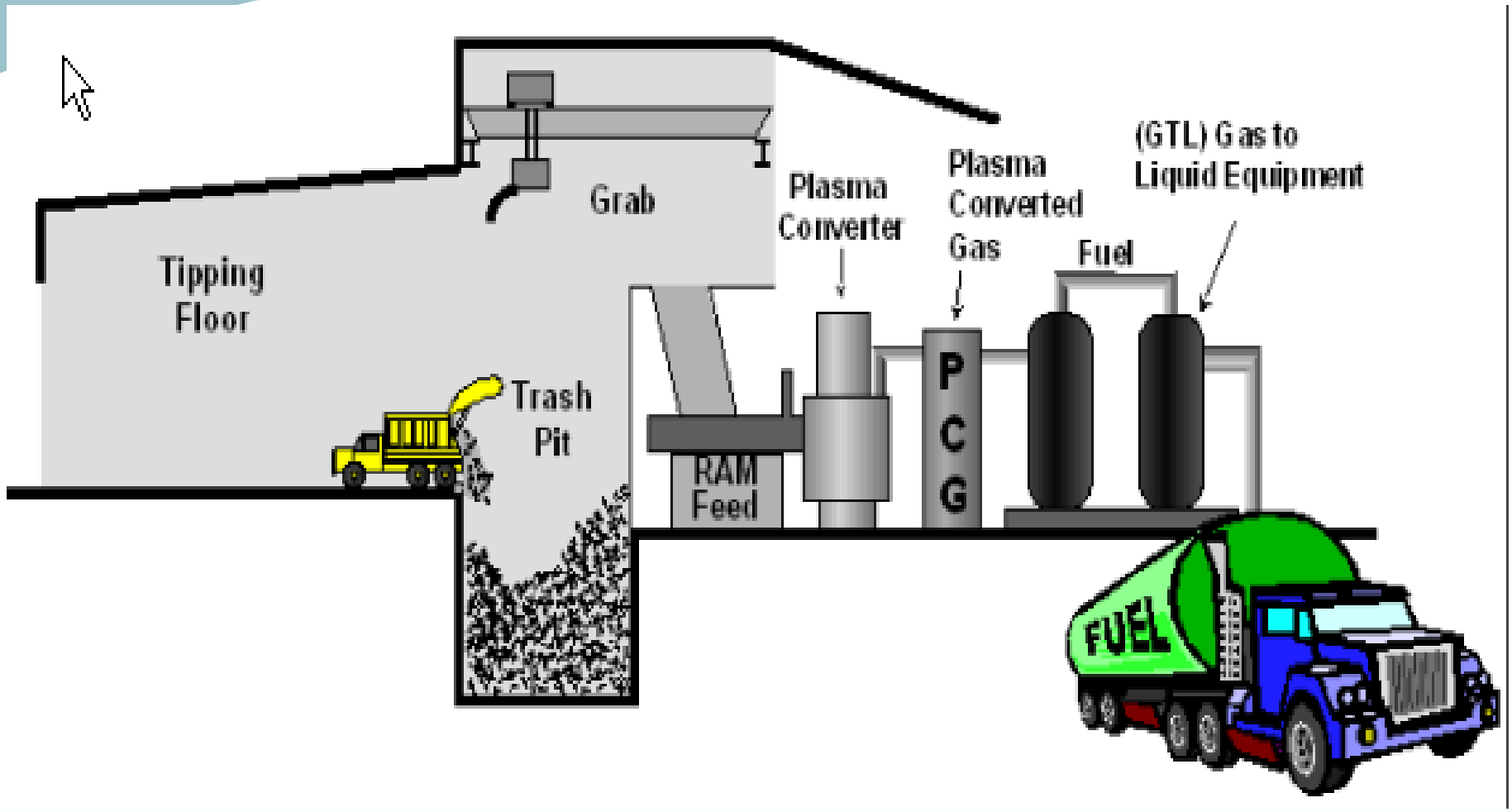
EXAMPLE OF SYN-DIESEL PROCESS

- **St**artech 300 ton a day Plasma Converter System would be purchased and used to transform tyres, plastics and used oils to Synthesis Gas;
- A compressor would be purchased to increase the bar rate for the Modified Fischer Tropsch Process;
- The MFT would be purchased under license to manufacture the waxes and the cracking process to manufacture the syn-diesel;
- A steam turbine would be purchased to take the steam from the Startech PCS and the MFT process to make additional electricity to the National Grid;
- Storage tanks would be purchased for the Syn-Diesel and any additional equipment purchases needed for the operation of the plant;
- Production rate of roughly 1200 barrels of immediately usable clean syn-diesel and 300 barrels of Naphtha and lubes will be produced daily;
- Conversion of Synthesis Gas to Hydrogen can also be made using the Startech PCS and Starcell;

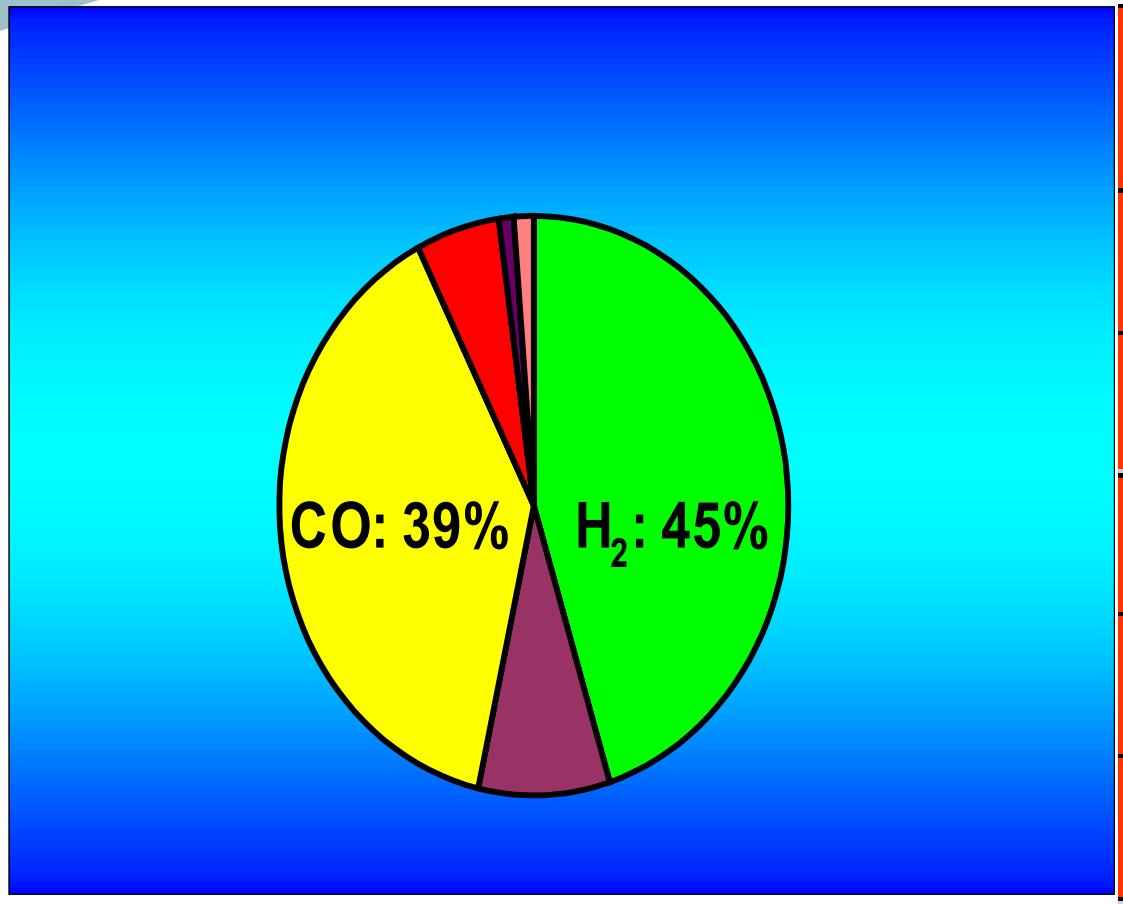
Potential Derivatives via Catalytic conversion of Syngas



All types of organic waste

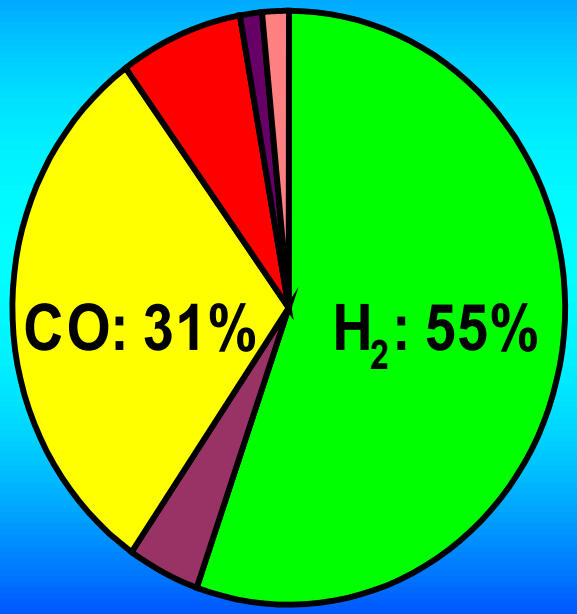


Medical/Pharmaceutical Waste



H_2	45.3%
N_2	8.3%
CO	38.8%
CO_2	5.5%
CH_4	0.8%
O_2+Ar	1.3%

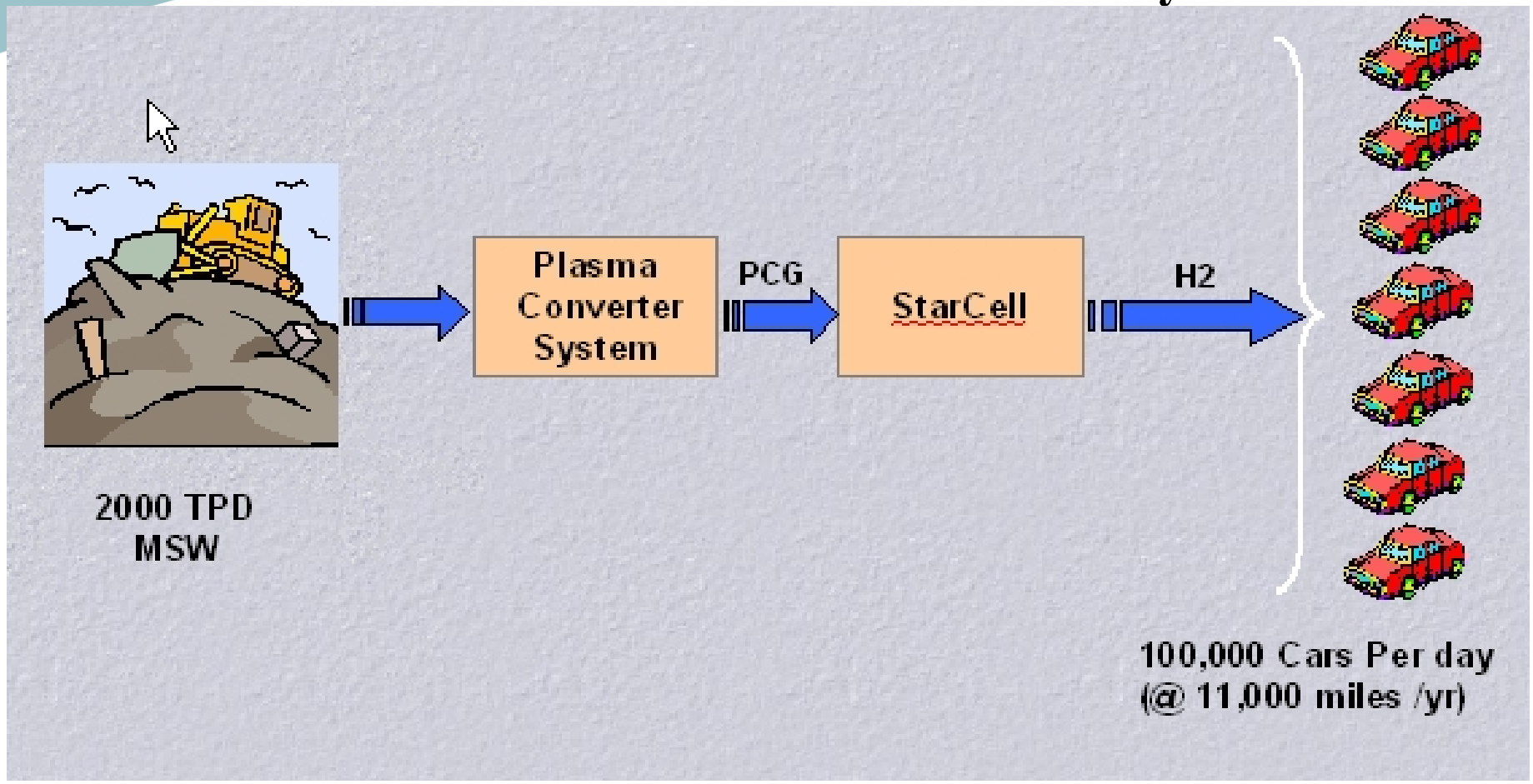
End-of-Life Electronics (E-Waste)



H_2	55.2%
N_2	4.2%
CO	30.5%
CO_2	7.3%
CH_4	1.0%
O_2+Ar	1.8%

The Hydrogen Story

Cars Driven Per Day From 2000 TPD Plasma / StarCell Facility



The Startech PCS: Advantages

- WHY STARTECH

❑ Reducing Vessel Atmosphere

✓Dioxins/furans (<0.05ng TEQ/Nm3);

✓NOx (<50ppm);

✓ 1/10th the gas flow of an oxidizing system, allowing much higher efficiency gas cleaning;

✓The United States, Japan, South Africa, and other countries recognize that the **Startech PCS is not an incinerator**.

The Startech PCS: Advantages

- Low Capital Cost:

•The Gas Polisher does not require a secondary combustion chamber (as in oxidizing systems);

•Smaller equipment is required to handle lower gas flow volumes;

•Standardized designs/components allow shorter delivery schedule;

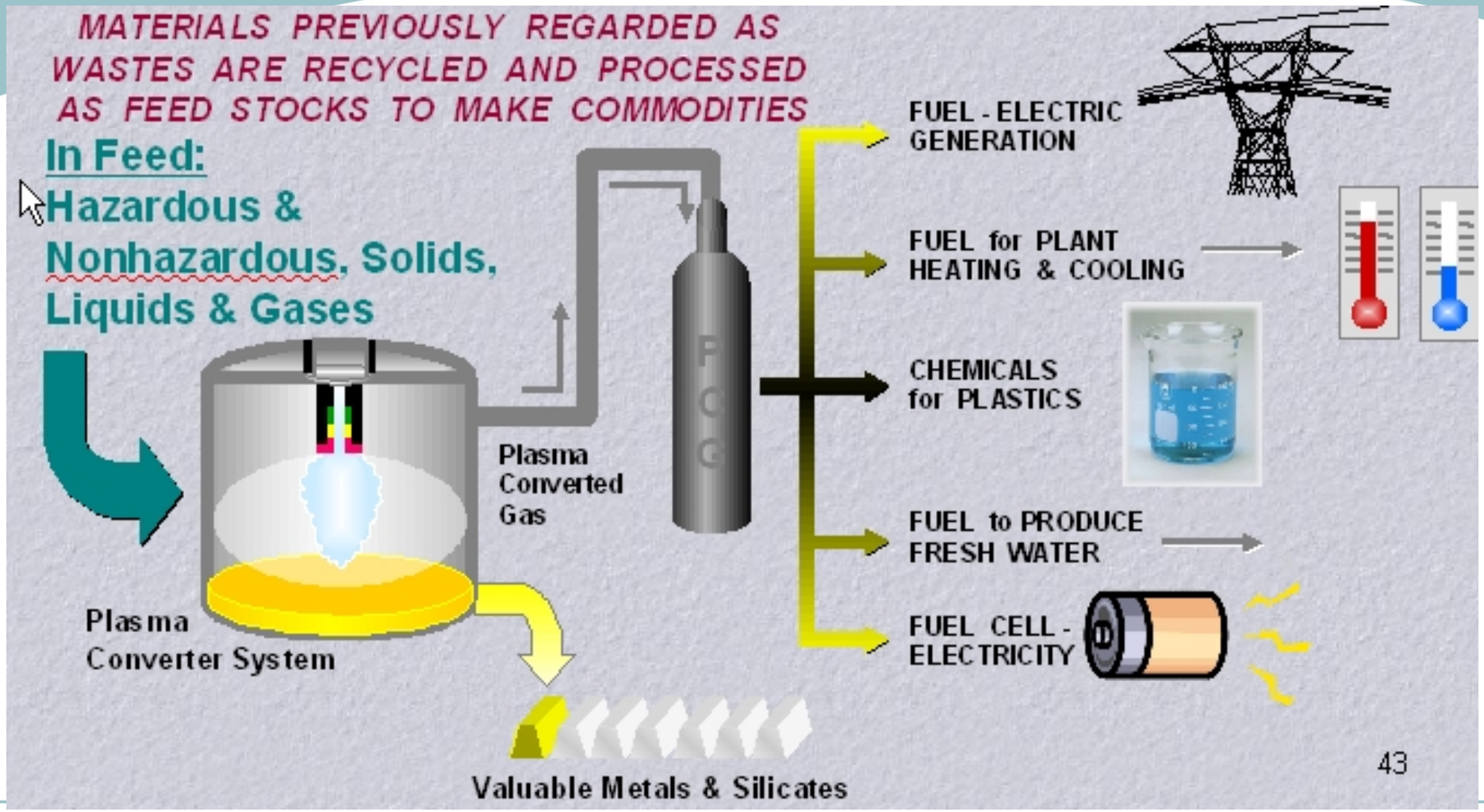
•Skid-mounted modular equipment for lower installation cost;

•Standard commercial off-the-shelf (COTS) components.

The Startech PCS: Advantages

- Low Operating Cost:
  - All chemicals required for the system are inexpensive and readily available;
  - Energy efficient;
  - Highly automated;
  - Low maintenance;
  - Potential for sale of valuable products.

Environmental Uses and Safety

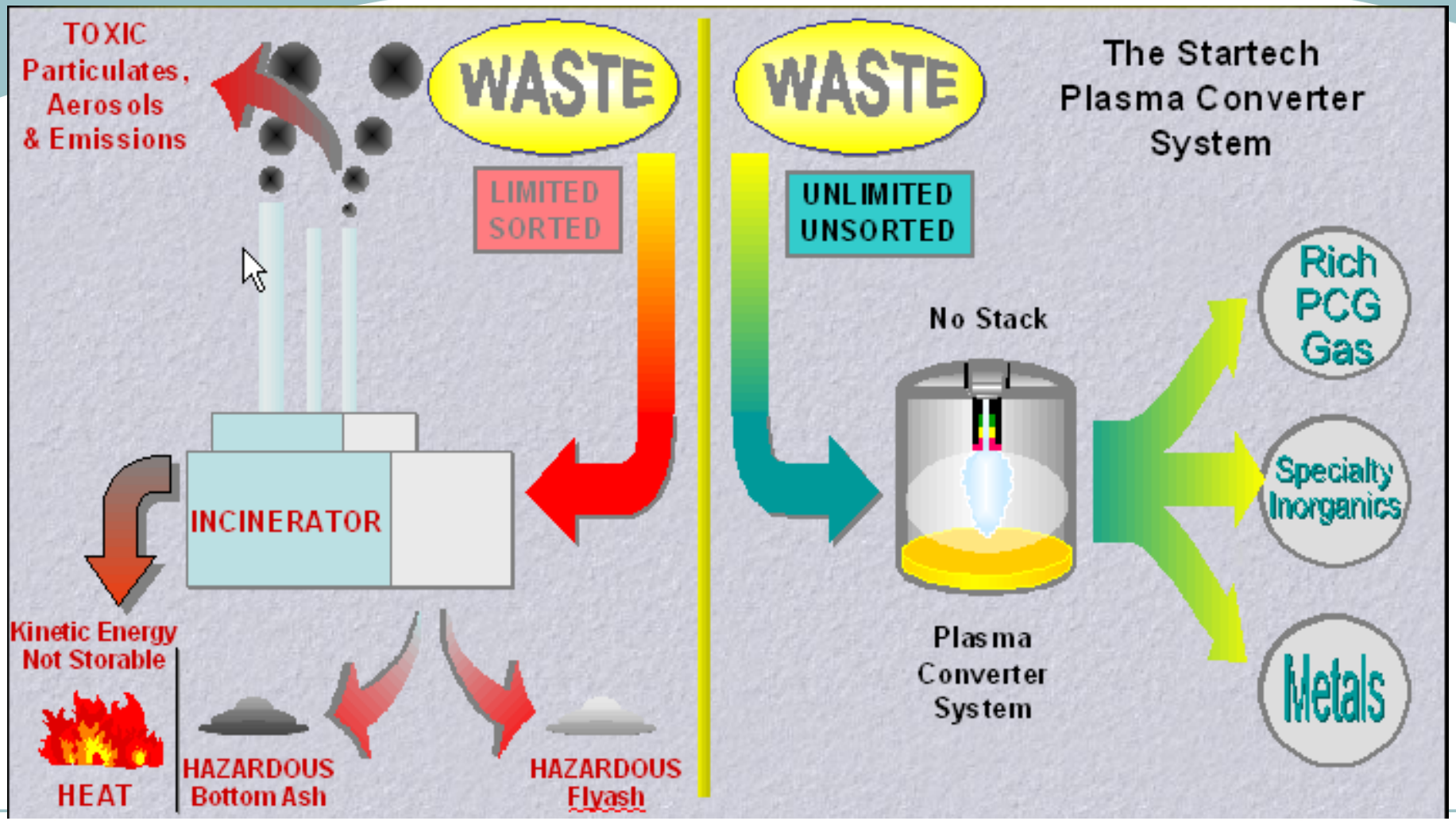


Commodity Products Recovered

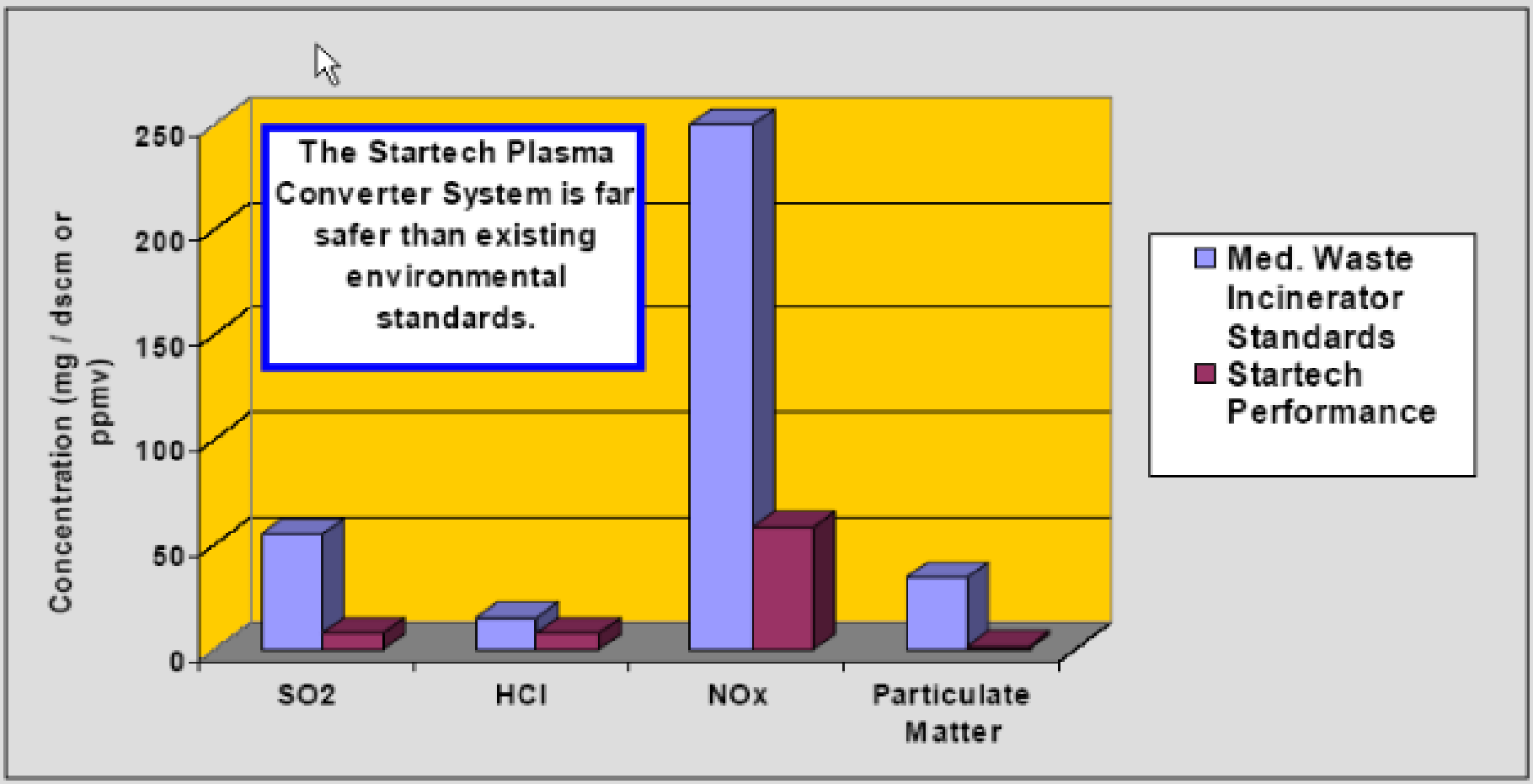
The PCS processes natural gas, wastes or biomass in such a way that the elemental components of the feedstock can be recovered in from one to three distinct phases:

- **Synthesis Gas** (PCG, Plasma Converted Gas)™ is produced in a **"One Step High Temperature Total Gasification Process"** and drawn from the chamber;
- **Inorganic, glass-like Silicates** that form a separate layer above the liquid metal (if there is a sufficient quantity of metal in the feedstock, with small quantities of metal encapsulated in the silicate stone); and
- **Metallic Elements,** if in sufficient quantities, which collect at the base of the chamber.

How The Plasma Converter System Differs From Incinerators

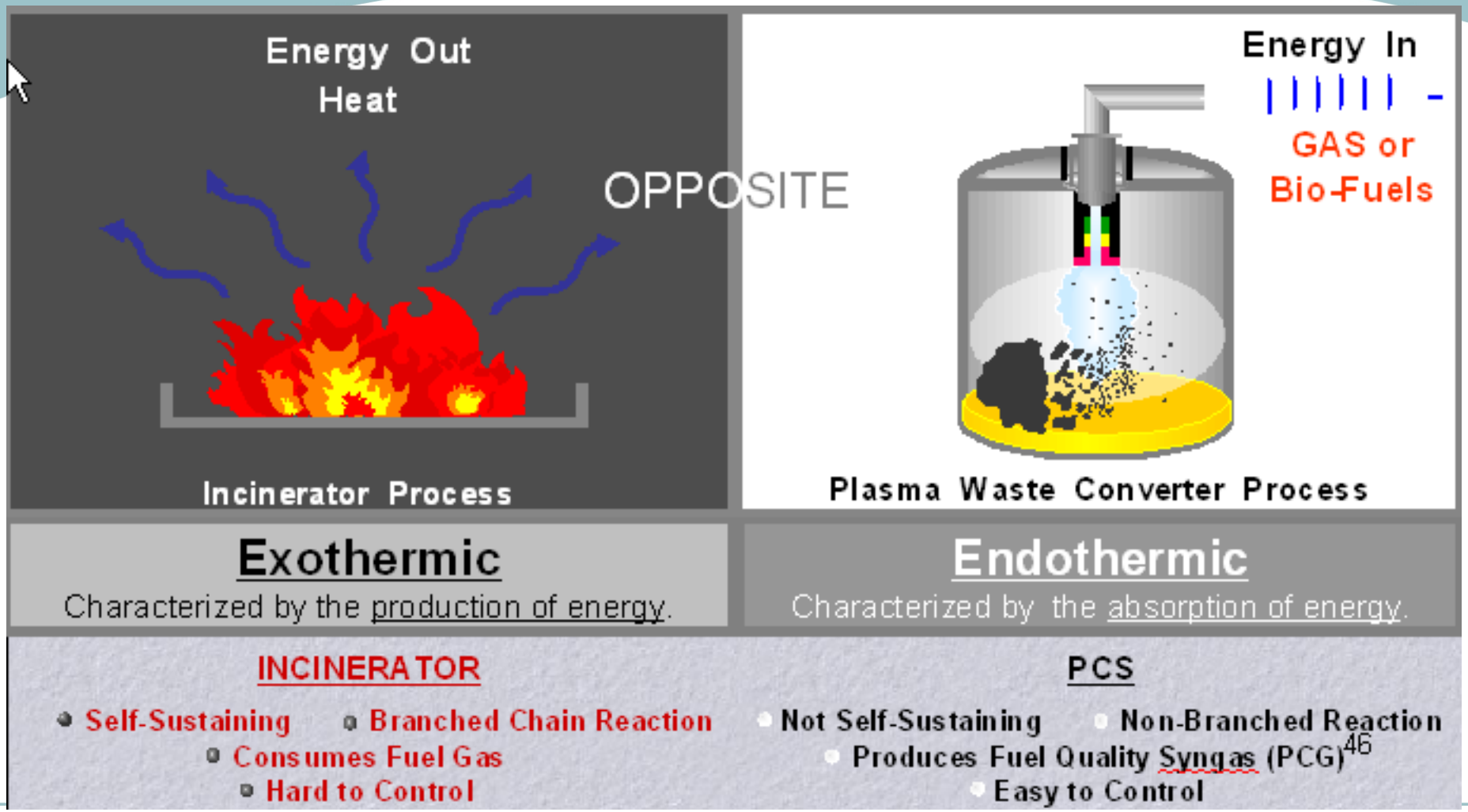


Far Safer then CURRENT STANDARDS



Emissions from burner when PCG is used as a fuel gas.

Incinerators & Plasma Converter Systems Are As Different As Night And Day



A Successful System Must:

- Be SAFER than current standards;
- Be able to process ANYTHING;
- Be able to destroy wastes IRREVERSIBLY.

Summary

- PCS processes a wide range of feedstock;
- Achieves irreversible destruction;
- Safer than environmental standards;
- Produces valuable PCG synthesis gas;
- Electric power, ethanol, syn-diesel, hydrogen & other products;
- Revenue potential on front and back-ends;
- PCS manufactured in a range of standard sizes;
- Won the Wall Street Journal Gold Award for the best Base Material Recycling System in the world (Nov. 15, 2004)

PERAS GROUP END OF PRESENTATION

STARTECH
ENVIRONMENTAL CORP.