FPO
Flameless Pressurized Oxy-combustion

ENVIRONMENTAL FRIENDLY
High efficiency
Competitive
Compact - Reduced Footprint
Flexible Fuel
Cycling Response

Problem Solving Innovative Technology

WYO/JCOAL – Gillette – September 21-22, 2017
FPO Combustion Premise

• Pressurized atmosphere of water and CO₂ under “volume expanded combustion” avoids traditional flame fronts
  – FPO combustion is more locally controllable with more uniform temperatures
  – Pressurized firing also improves cycle efficiency

• Conversion of carbon to CO₂ is over 99%

• Almost zero carbon content in incombustible products
  – Traditional: flying and falling ash particles
  – FPO: slag with near-zero carbon content and tiny particulate
**FPO block process scheme**

- **Fuel / Slurry Preparation**
- **Oxidation Reactor**
- **Quenchers**
- **Energy recovery**
- **Real-time Process Analyzer**
- **Blower**
- **Oxygen**
- **Vitrified Inert Slag**
- **Turbo Expander**
- **Power Island**
- **Economizer**
- **FGD / Neutralisation**
- **Water Condensation**
- **CO2 Purification and Liquefaction**
- **Clean Water**

**Firing**
- Few unit operations
- 1 block x 1 equipment
- Simple Easy to run

**Firing**
- Reduced Foot-print
  - 50 MWth = 25x18 m
  - 500 MWth = 120x80 m

**Power Island**
- **CO2 380 bar**
FPO
Novel Set of Performances

Clean fumes since combustor outlet

- No Dioxin, PCB, HPA, soot
- Ashes 100% transformed into vitrified beads
  zero carbon, non leaching HM
  fully inert
  salable to construction industry
- Water (clean) total recovery
- Ease in recovery commercial CO2
FPO

Novel Set of Performances

Clean fumes since combustor outlet

- Simplified process scheme
  reduced capital
- Pressurized firing
  high efficiency

Cost competitive
environmental performance
Flexible Fuel

- Firing of any type of fuel (gas, liquid, solid), waste, carbonaceous, oil heavies, biomasses
- Co-firing of separately fed streams at any relative proportion quantities
- Constant combustor performance from 5 to 100% load

Multi-task Business Ease
FPO
Novel Set of Performances

«Velox» Power Cycle

- Load uptake, and down to standby in less than 1 hour
- (Emergency) Firing block without concerns
- Producing from 100% Steam to 100% Power Steam up to SC Steam
- Fast response to grid demand, cycling
FPO
Novel Set of Performances

Waste to Product Only

From Municipal, Industrial Waste
- vitrified beads  
  construction industry
- power, steam  
  district heating/power
- commercial CO2  
  industrial grade
  food grade
FPO
Novel Set of Performances

Waste to Product Only

Capability to close complex, multi-process, industrial works to treat hazardous wastes to treat byproducts to match demand unbalances
FPO
Novel Set of Performances

Firing Hardware

- Few operations, compact, fully automated
  reduced footprint: $50\text{MW}_{\text{th}}$ 28 x 18 m
- Ancillary units: modules placed at any distance from firing core

Easy to locate
Ease for retrofit
FPO
Development Tools

5 MW\textsuperscript{th} Feasibility Pilot Unit (Italy)
in operation since 2005  more than 30,000 firing hours

Available for:
- joint dev. Projects
- feasibility trials
FPO Projects in Progress

Municipal waste to product only
Capacity 15 MW\textsubscript{th} – 80,000 t/yr municipal waste
Engineering completed
Location: Bari suburban area (Italy)
Funding + grants secured
Power, commercial vitrified ash and CO2 sold
No stack, no plum

Close to definitive permit concession
Coal CCS large pilot (USA)
Capacity: 50 MWth
Coal, low ranking coals and alkali lignite
Feasibility Study
Supported by DOE Project DE - FE0027771 to advanced coal CCS technologies
Feasibility completed Oct. 2018

In cooperation with: SwRI, EPRI, GE, Jacobs, PRA (UK)
FPO Projects in Progress

Oil heavies, coal, NG, CCS large pilot
Capacity: 50 MWth
Oil heavies, Coal, NG
Feasibility completed
Basic engineering in progress
Supported by Italian Government Grants
Project definitive launch expected by 2017 end

In cooperation with: Sotacarbo, ENEA (Italy)
ITEA is available to perform:
Preliminary feasibility/economics analysis of FPO development initiatives proposed by potential customer/partners.

THANK YOU FOR YOUR ATTENTION