A Flexible Three-Stage Thermochemical Conversion Process

Vander Tumiatti
Sea Marconi Technologies

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A Flexible Three-Stage Thermochemical Conversion Process

Vander Tumiatti, Sea Marconi Technologies (Turin, Italy)
Sea Marconi Key Information

- **Foundation**: 1968, by Vander Tumiatti in Turin Italy
- **Mission**: Protection of company assets (mainly electrical transformers) and environmental resources
- **Activities**: Research, Technologies, Services and Products for Energy & Environment
- **Clients**: > 3,000 users in the energy, industry and service sectors in Europe, South America and other countries
- **Human resources**: 100+ employees: engineer, doctors (chemistry, mechanics, economics, ICT, etc.) and qualified technicians
- **Diagnostics**: lab Accreditation, EN ISO 17025, Databases, hi-tech instruments
- **Decontamination**: on site Mobile Units (DMU) different sizes
- **Quality**: ISO 9001, Globe
- **Patents**: EEC, USA, others countries patented processes
- **R & D**: Qualified by Italian Ministry of University and Scientific Research
- **Experts**: members in WGs (IEC, CEN, CIGRE)
Sustainable Solutions for Energy & the Environment

Sea Marconi Core Business: Life Cycle Management of Electrical Transformers

Research

Technologies

Products

Services
Where we are

Homécourt – France  
2002

Karlsruhe – Germany  
2007

Collegno (Turin) – Italy  
1968

Seclì (Lecce) – Italy  
1992

Buenos Aires – Argentina  
2004

Barakaldo – Spain  
2002
More than a decade of R&D in a nutshell

- Outside its core business, in the last 15+ years Sea Marconi started to investigate and to develop technologies for the thermochemical conversion of carbonaceous feedstock, from electronic scrap to biomass, waste tires, MSW, ...

- Developed, designed and manufactured several subsequent technological generations

- Main common feature: **steel spheres** as heat carrier to supply energy to the process

- Current result: a **compact** (containerized) **multistage** pyro-gasification unit with a high **flexibility** in terms of feedstock and output

5 key functions:
- Transport of material
- Heat transfer
- Mixing
- Milling
- Catalytic action
Development of the newest generation

Concept (2009)

Patent (2010)

Design (2012)

Manufacturing (2013)

Supply of main components (2013)

Final delivery (end of 2013)
The basic concept of the technology was developed by Sea Marconi since 2009, based on the experience made during two European Projects (Haloclean® intermediate pyrolysis technology). Patented on 2010.

The new **modular** technology is built on different **interconnected** reactors with a common design (rotary reactors), but with different internal devices, depending on the specific function to be implemented (pyrolysis, oxidation, gasification)

Pyrolysis and gasification can be both realized depending on the application
Process description

Biomass (T=20°C)

Pyrolysis

Primary tars + steam + gas
(T ≈ 600°C)

Steel balls (T≈700°C)

Char outlet (if required)

Gasification

Steel balls + char

Air (+ steam)

Char oxidation

Syngas + steam + tertiary tars (aromatics) + flying ashes
(T=800°C)

Ashes

Air

Chania, 1 Oct 2015
Pyrolysis reactor

Outside

Inside
Heating of steel balls (char partial oxidation)

Rotary distributor for oxidizing agents (air)

Oxygen measurement probe
Gasification of vapor phase

External housing

Rotary reactor
Gas treatment (cooling and tar removal)

Current “conventional” solution: cyclone + venturi scrubber and water quench (Implemented on a removable skid/module: can be easily replaced!)

An innovative (patent pending) gas cleaning technology (module) has been developed

- “Dry” cleaning (no water as cooling medium)
- Heat recovery from hot syngas (improved overall efficiency)

Already tested downstream a conventional fixed bed gasifier with good results
Control room and electrical cabinets

Can be also monitored, controlled and re-programmed remotely
Containerized for a easier logistics...

100 kg/h first prototype before being shipped to the installation site after a complete acceptance test at Sea Marconi premises.
... and installation
Pilot plant during operations

Syngas being flared
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Chania, 1 Oct 2015