

OVERVIEW OF THE 3R CLEAN MULTI FUEL PROCESS

The 3R Process CLEAN MULTI FUEL

The 3R process is a cost efficient preventive pre-treatment of low-grade solid multi fuels by low temperature carbonization in downsized reductive environment for removal of hazardous air pollutants prior burning and improvement of burning efficiency of the revitalized solid fuel power plant-CHP up to 300 MW capacity.

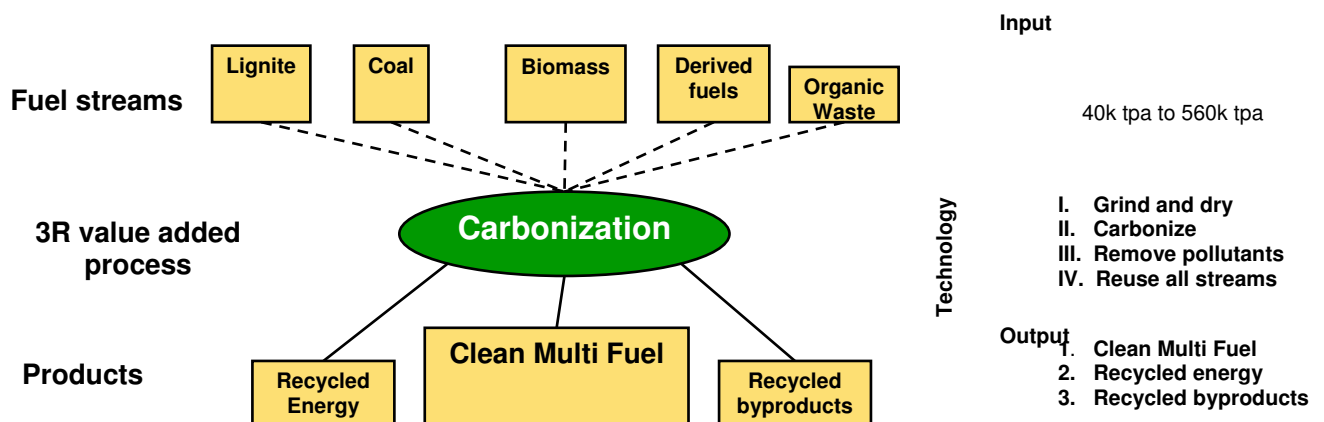
The 3R technology has been developed to meet the open – liberalized energy and co-generation market demands and has been implemented by the support of the EUROPEAN UNION DG Energy and Transport contract No: EU FP5 NNE5/363/2001

CONCEPTS:

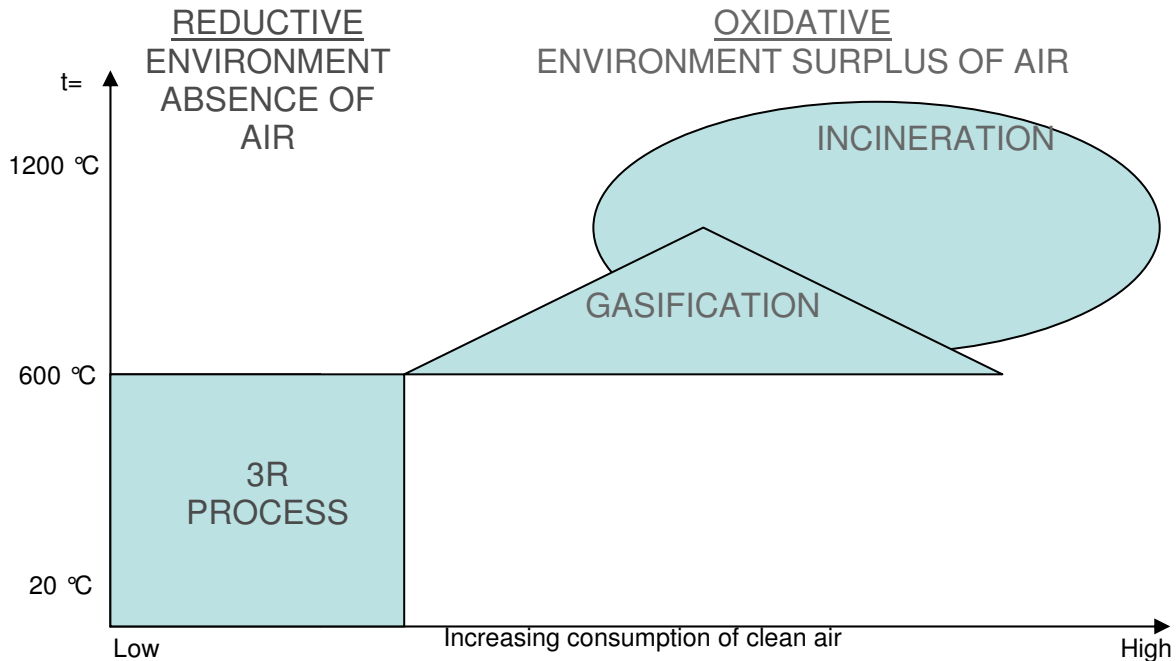
- Prevention versus „end of pipe” solution, resulting
 - Guaranteed and competitive long term clean energy supply
 - Providing compatibility between development of open – liberalized energy market and the objectives of the environmental protection
 - Providing overall cost savings for sustainable clean energy production
- Separated material stream treatment versus „all in one flow”
- Improve safety and recycle-reduce-reuse all streams
- Flexible feed choice application from regionally available feed supply
- Improving overall cost efficiency for green energy production

3R Low Temperature Carbonization – Overview

The key component of the 3R method and apparatus is an indirectly heated horizontally arranged closed cycle operating rotary kiln, where material is safely separated in absence of air and decomposed into gas-vapour and solid phase. The hazardous air pollutants, such as Sulphur, Chlorine and Mercury are removed in the gas-vapour phase and separately treated – recycled in downsized environment, while Clean Multi Fuel – Clean Coal is utilized in boiler.



Overview of the Thermal Treatment Technologies and the position of the 3R carbonization process: the 3R process is NOT an incineration



Overview of the Thermal Treatment Technologies and the position of the 3R carbonization process: the 3R process is NOT an incineration

- ✓ The **revolutionary horizontally arranged indirectly fired rotary kiln** provides a highly efficient and flexible thermal separation process which is not an incineration.
- ✓ **Process performance with flexible feed choice** (with variations in flow, composition and concentration of toxic volatile input compounds) treated by **flexible safe process conditions**.
- ✓ **Modular system design** from 40,000 tons per annum throughput capacity block to 14 x 40 k tpa = 560,000 tpa (70 t/h).
- ✓ **Link or bolt-on** to operating power plant as per local demand
- ✓ **Providing significant improvement of overall cost efficiency**
- ✓ **Containing no exotic technical solutions and materials**

3R process description abstract

The multi fuel feed stream is dried to < 15 % weight volume moisture content and homogenized to 0-5 mm particle size dimension. The carbonization is processed in the continuously fed indirectly heated 3R rotary kiln with material core temperature up to 600 °C in absence of air.

The separated gas-vapor phase, containing volatile compounds and hazardous air pollutants, is continuously removed and in a post combustor burned off under 1250 °C and minimum 2 sec. residence time. Due to the reductive environment, post burner and fast cooling options, creation and recreation of dioxins are prevented.

The solid phase Clean Multi Fuel „Clean Coal” is introduced into the power plant boiler feed system for clean energy production.

The heat is recovered and flue gas is cleansed in a high efficient multi venturi off-gas scrubber. Mercury (if any) is separated from the flow and process water is treated with lime, whereas clean gypsum is achieved containing no ash and heavy metals which is contrary to the traditional residual management where the gypsum contains both ash and heavy metals. The comprehensive process is integrated linked or bolt-on to an operating solid fuel power plant, and can be operated in an independent mode as well.

The advantages of the 3R process

- ✓ Reductive thermal treatment in **downsized environments** („downsized” refers to lower volume of off-gas treatment by pretreatment option compared to conventional off-gas treatment by „end of pipe” option)
- ✓ **Safe and cost efficient treatment** of volatile toxic components with variations in flow, composition and concentration.
- ✓ **No creation and recreation of dioxins** and furan gases during the process.
- ✓ **Designed to cost efficiently meet installation demands and conditions** of existing industrial units: modular installation option per block.
- ✓ **Flexible operation** and maintenance.
- ✓ **Providing near zero emission solution**: comprehensive recycling and reuse of all material streams.
- ✓ **Improving overall cost efficiency** of the green energy production as per „open energy market” demand conditions.

The application advantages of the Clean Multi Fuel end product

Clean Multi Fuel is introduced into the boiler system, while hazardous air pollutants, such as Sulphur, Chlorine and Mercury have already been removed prior to burning in a separate treatment process.

- ✓ Simplifying „end of pipe” off-gas treatment process and decreasing **the capital intensity for the off-gas treatment process installations**.
- ✓ Providing cost efficient solution for **residual recycling and reuse**.
- ✓ **Reducing boiler corrosion** and improving process safety.
- ✓ **Improving burning and boiler efficiency**
- ✓ **Improving overall cost efficiency** of the green energy production.

3R process and project status

