



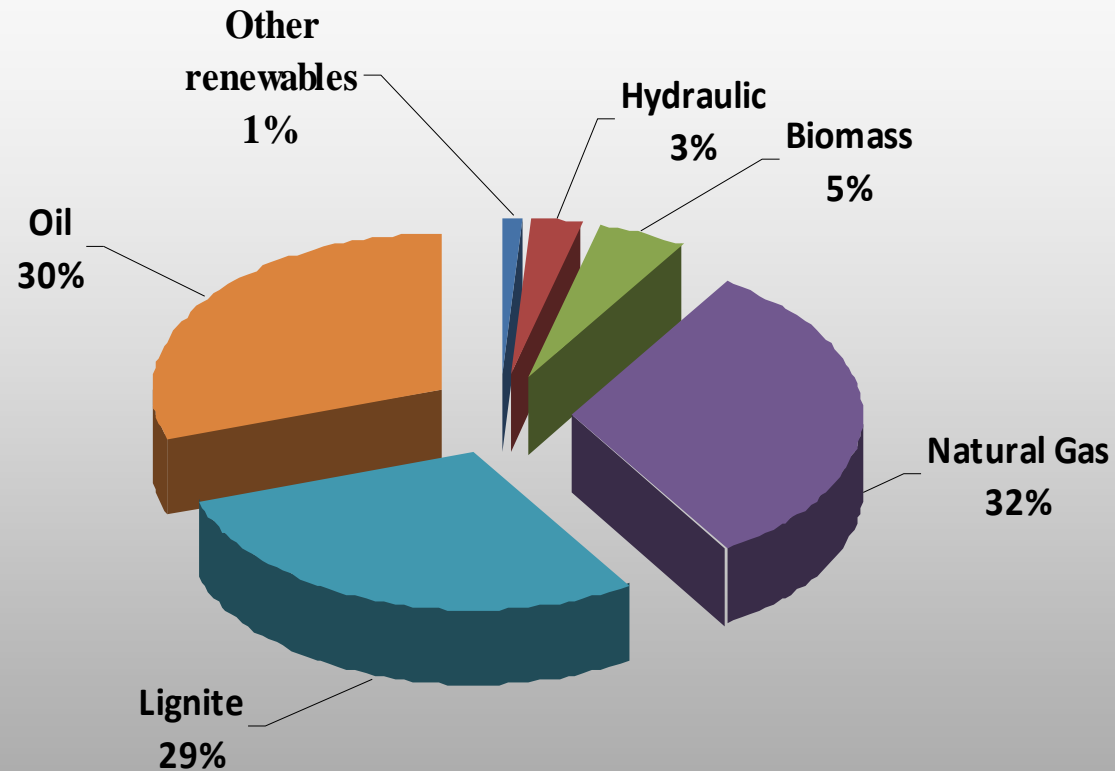
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**Country Update  
Turkey**

**Hakan Karataş, Serhat Gül  
TUBITAK MRC, Energy Institute, Kocaeli, Turkey**

# Turkey Energy Consumption Profile

## Turkey Primary Energy Consumption\*



Lignite, biomass, hydraulic and renewables are the national energy sources of Turkey.

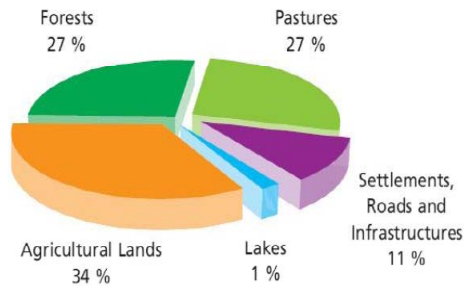
However, oil and natural gas are import energy sources which are totally 62 % of the energy demand.

## Biomass Potential of Turkey

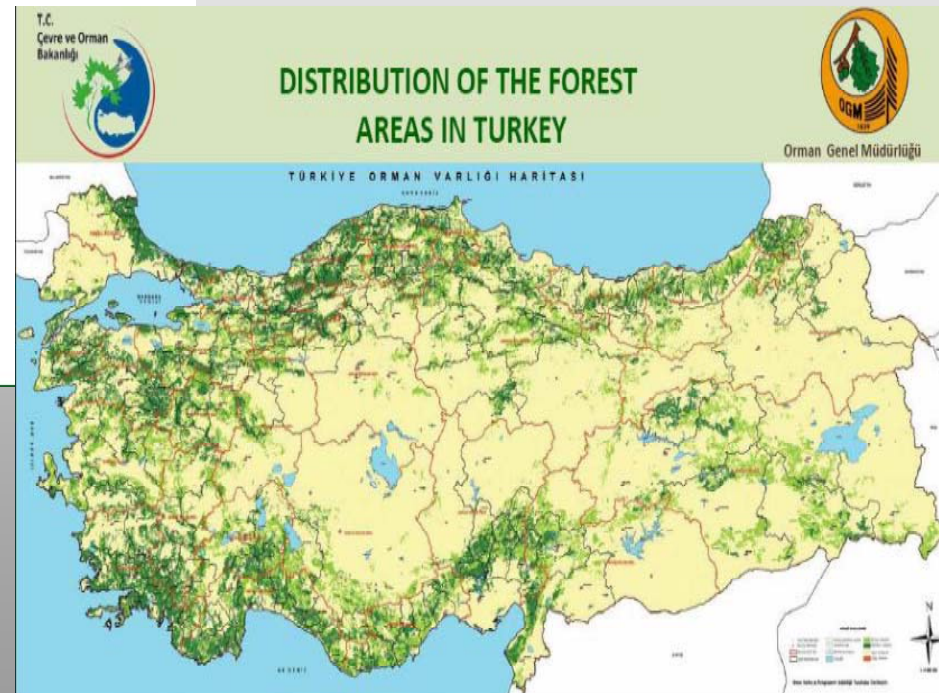
- The annual biomass energy potential of Turkey is estimated as 32 Mtoe.
- The total recoverable biomass energy potential is estimated as 17 Mtoe.
- The total biomass consumption in Turkey was 4,8 Mtoe/year (2008)
- The recoverable biomass energy potential come from:
  - Agricultural residues,
  - Forestry and wood processing residues,
  - Animal wastes,
  - Municipal wastes.
- The largest portion of this product is used in rural areas for heating and cooking in a primitive way.

# Biomass Potential of Turkey

## Status of The Land Use in Turkey



Turkey has about 21,7 million hectares forest area, This is about 27,2 percent of the country's land area.



# Biomass Gasification Activities in MRC

## About Policy

Electricity selling price regulations that are generated with the usage of the renewable energy sources (hydraulic, wind, geothermal, biomass, solar).

Renewable electricity production is supported by feed-in rates. The feed-in rates for the different types of renewable electricity generation are;

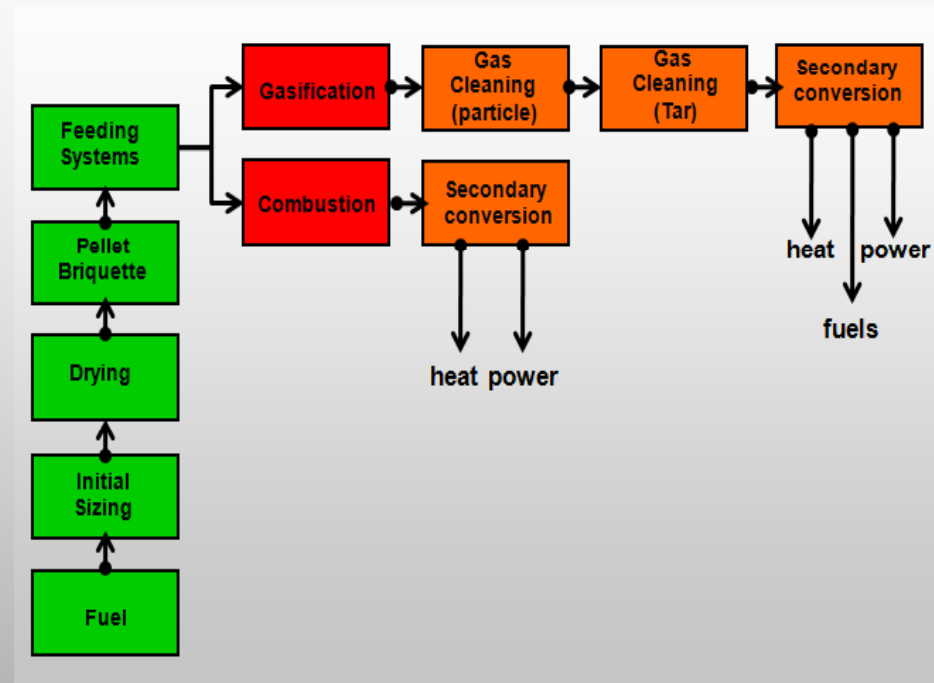
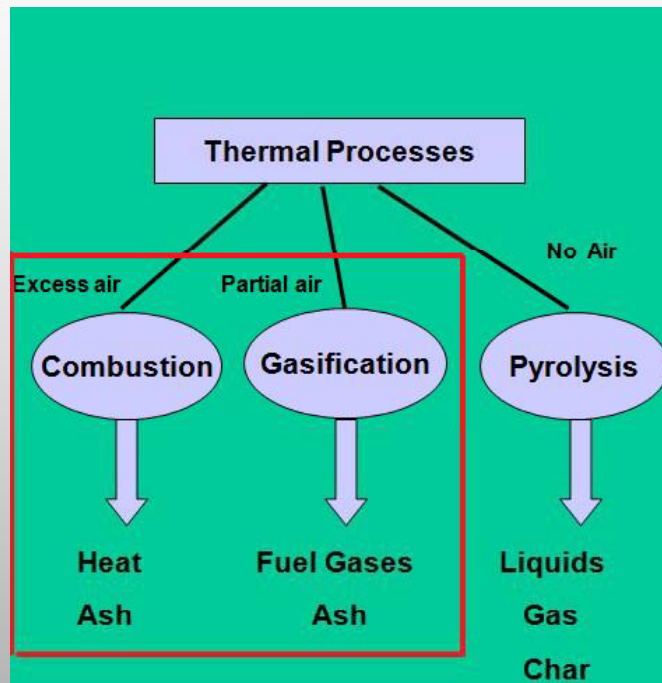
Electricity generation with different renewable energy sources	Selling prices ( \$ cent/kWh)
a. Hydraulic Power	7.3
b. Wind Power	7.3
c. Geothermal Power	10.5
d. Biomass/Biogas Power	13.3
e. Solar Power	13.3

This selling price is for both gasification and combustion applications. Legislation has been recently approved by Turkish Assembly at the end of 2010.

With this attempt, Turkey is newly on the way of subsidizing renewable energy entrepreneurs and of increasing the usage of biomass as well.

# Introduction of MRC - Combustion/Gasification Group

## Gasification/Combustion of Biomass/Coal Group Activities



Group is focusing on the combustion and gasification technologies of solid fuels.

Auxiliary infrastructures for gasification has been developed. ( fuel preparation, feeding systems, etc.)

Gas cleaning technologies are developed. ( particle, tar, H<sub>2</sub>S, etc. )

Power application is studied with the integration of gasifier unit with gas engine.

# Biomass Gasification Activities in MRC

## Gasification/Combustion of Biomass/Coal Group Activities

### Current Laboratory Scale Test Facilities;

- Bubbling fluidized bed gasifier ( 20 kW<sub>fuel</sub> )
- Fixed bed gasifier ( 40 kW<sub>fuel</sub> )
- Circulating fluidized bed combustor ( 20 kW<sub>th</sub> )
- Circulating Fluidized bed combustor ( 35 kW<sub>th</sub> )
- Circulating Fluidized bed gasifier ( 150 kW<sub>fuel</sub> )

### Current Pilot Scale Test Facilities;

- Bubbling fluidized bed gasifier ( 450 kW<sub>fuel</sub> )
- Fixed bed gasifier ( 300 kW<sub>fuel</sub> )
- Circulating Fluidized bed combustor ( 750 kW<sub>th</sub> )

### Under construction test facilities;

- Pressurised bubbling bed gasifier (1100 kW<sub>fuel</sub>)

### Laboratory Scale Test Facilities



BFBG - 20



CFBC - 20



CFBC - 35



FBG - 40

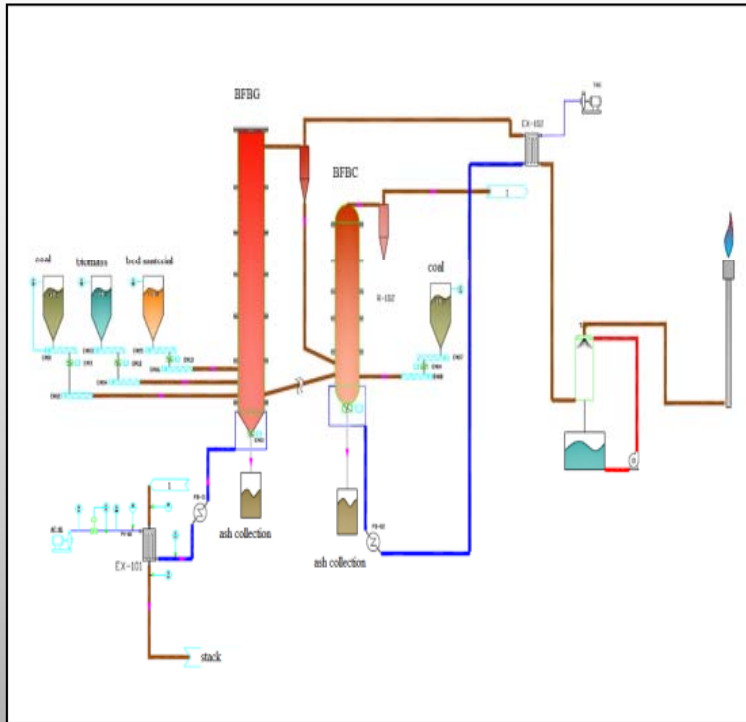
# Site Visit : TUBITAK Plants-1





# Biomass Gasification Activities in MRC

## Pilot Scale Gasification System



### 450 kW<sub>fuel</sub> Bubbling Bed Gasifier

Capacity (kW <sub>fuel</sub> )	450
Fuel feeding (kg/h)	100
Diameter (cm)	45
Height (cm)	650
Pressure	atmospheric



### 150 kW<sub>th</sub> Bubbling Bed Combustor

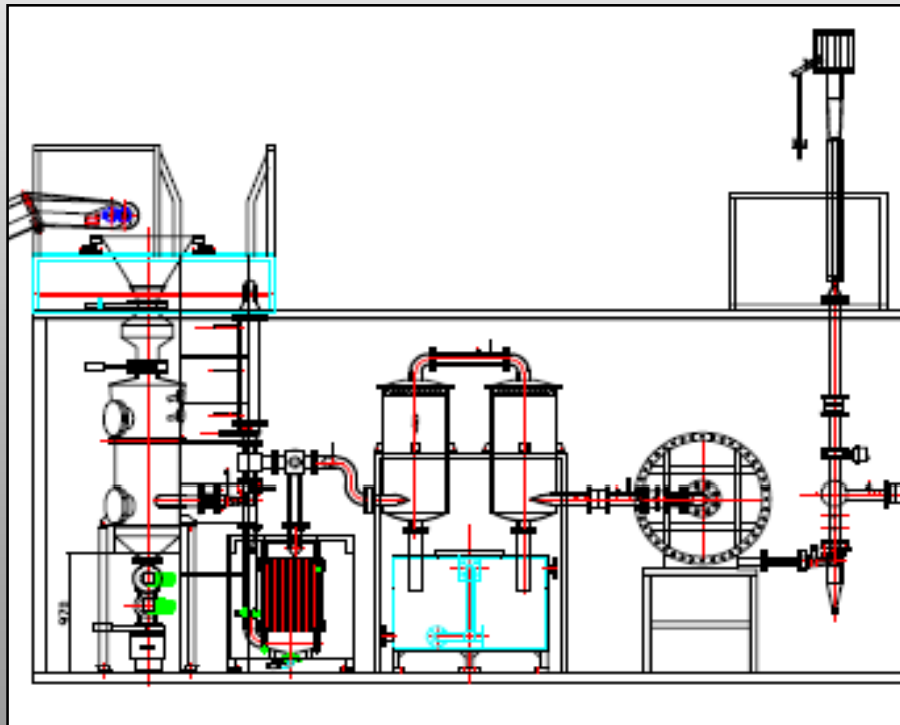
Capacity (kW <sub>th</sub> )	150
Fuel feeding (kg/h)	30
Diameter (cm)	26
Height (cm)	550
Pressure	atmospheric

# Biomass Gasification Activities in MRC

## Pilot Scale Gasification System

### 300 kW<sub>fuel</sub> Fixed Bed Gasifier

Capacity (kW <sub>fuel</sub> )	250
Fuel feeding (kg/h)	60
Diameter (cm)	100
Height (cm)	300
Pressure	atmospheric



# Site Visit : TUBITAK Plants-2

## A-CFB-C (750 kW-th)



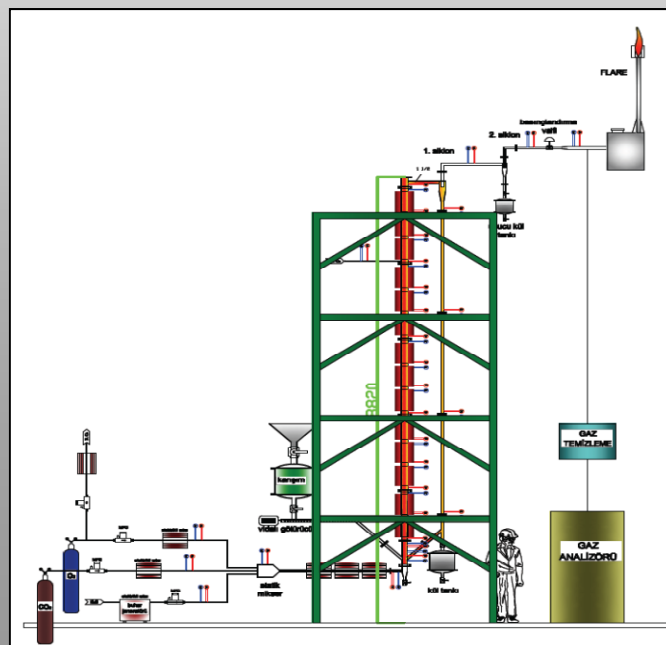
### 750 kW<sub>fuel</sub> Circulating Fluidized Bed Combustor

Capacity (kW <sub>fuel</sub> )	750
Fuel feeding (kg/h)	300
Diameter (cm)	45, rectangular
Height (cm)	1200
Pressure	Athmospheric
Fuel	Biomass/Coal

## Laboratory scale CFB-BFB gasifier & Gas Cleaning System

### 150 kW<sub>fuel</sub> CFB-BFB Gasifier

Capacity (kW <sub>fuel</sub> )	150 @O <sub>2</sub> /Steam gasification
Fuel feeding (kg/h)	30
Diameter (cm)	10
Height (cm)	750
Pressure	Athmospheric
Gasification agent	Air / O <sub>2</sub> +Steam



## Laboratory scale CFB-BFB gasifier – Problems&Solutions



## Laboratory scale CFB-BFB gasifier – Problems&Solutions



## Laboratory scale CFB-BFB gasifier – Problems&Solutions



## Laboratory scale CFB-BFB gasifier – Problems&Solutions





# Biomass Gasification Activities in MRC

## Trigen - Liquid Fuel Production form Coal/Biomass Mixtures

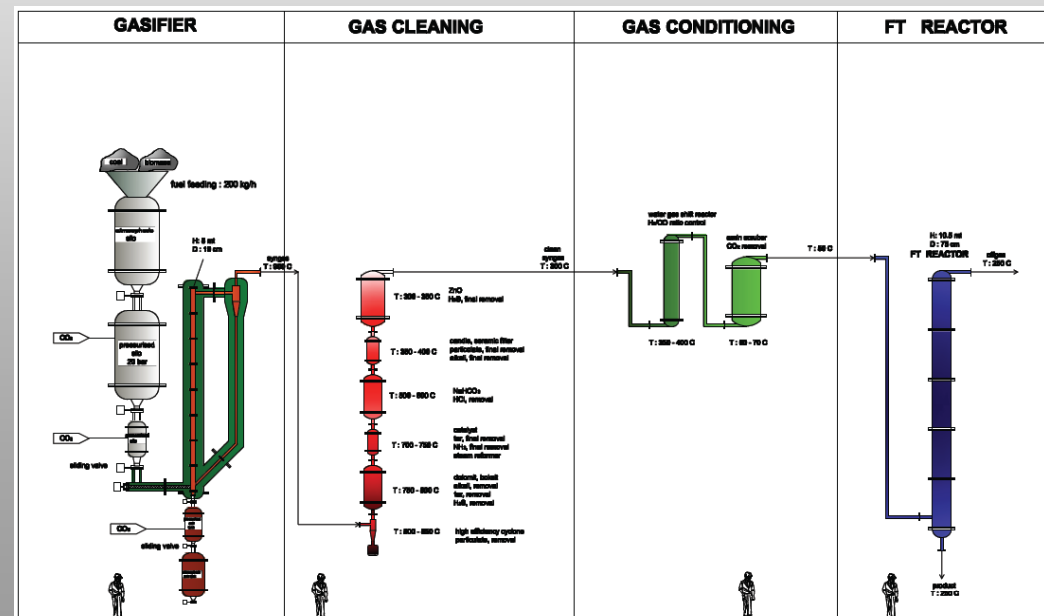
**Project Duration:** 4 Years (2009 – 2013)

**Supporting bodies:** Nationally Funded

**Project partners :** MRC, 2 Universities, 2 private company

### Aim Of The Project

- to produce more economic, efficient and clean liquid fuels from coal and biomass,
- to enhance the utilization of the widespread national resources for sustainable development and energy security,
- to develop technologies to be used in industry,
- to demonstrate the outcomes in pilot scale.



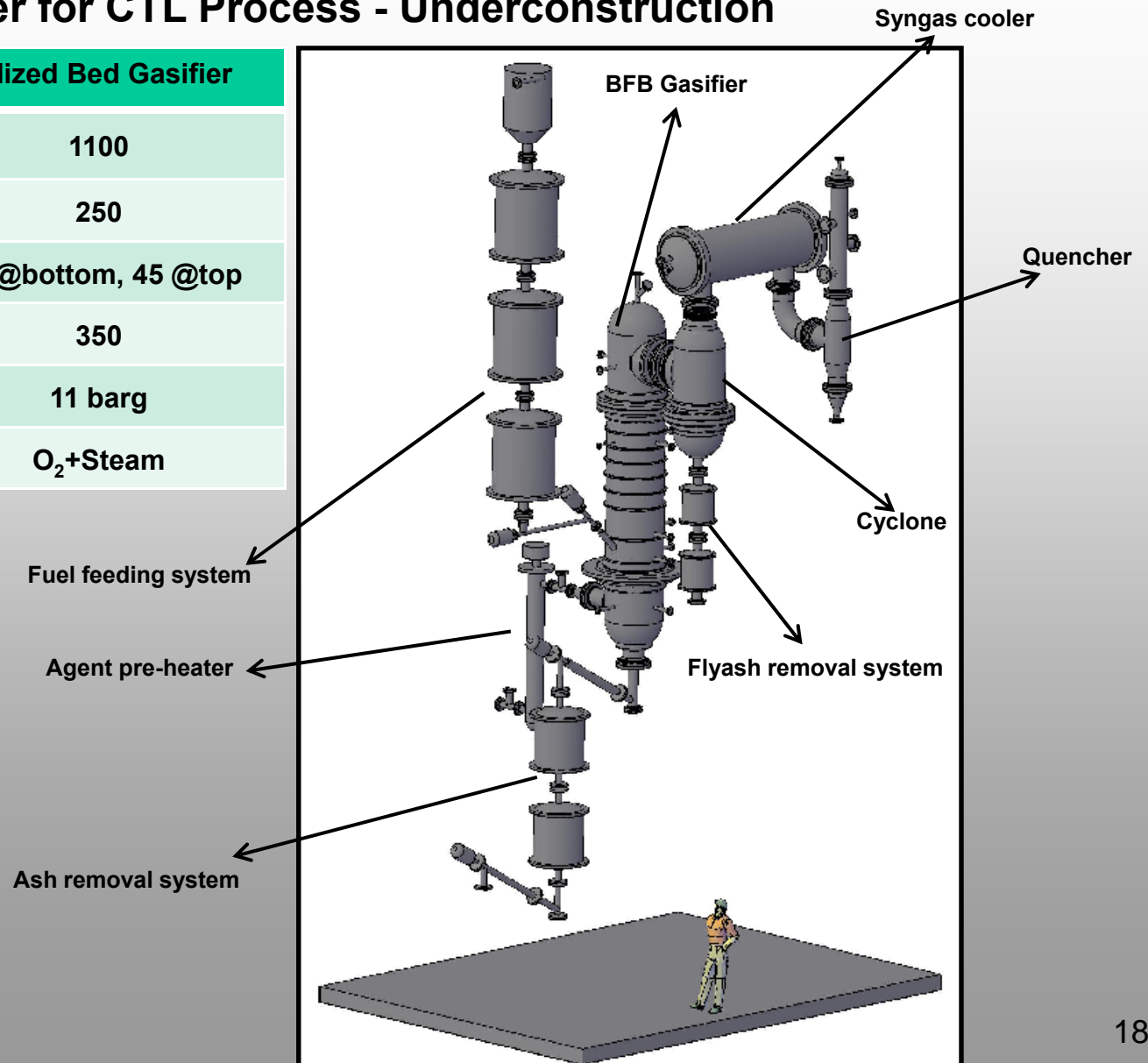
General scheme of the project

# Biomass Gasification Activities in MRC - Updates

## Pilot Scale Gasifier for CTL Process - Underconstruction

### 1,1 MW<sub>fuel</sub> Bubbling Fluidized Bed Gasifier

Capacity (kW <sub>fuel</sub> )	1100
Fuel feeding (kg/h)	250
Diameter (cm)	30 @bottom, 45 @top
Height (cm)	350
Pressure	11 barg
Gasification agent	O <sub>2</sub> +Steam



**Thank You...**

**View of Pilot Scale Gasification and Combustion systems**



**Serhat.Gul@mam.gov.tr**