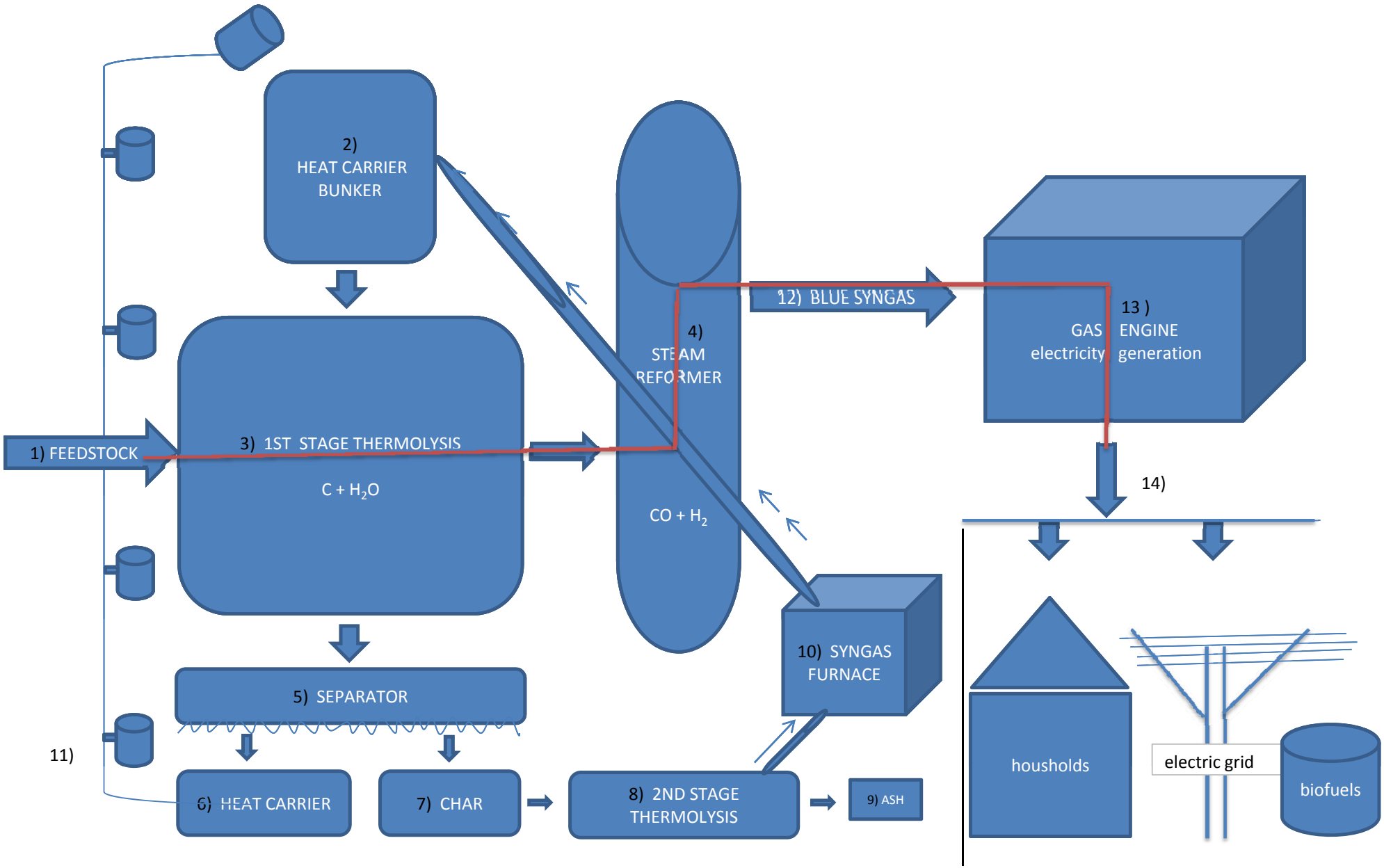
CONCORD BLUE REFORMER™



Concord Blue Reformer

The Concord Blue REFORMER (CBR) turns conventional waste to energy upside down. Instead of burning the feedstock our REFORMER reforms or converts the waste feedstock into a high value, undiluted blue syngas under the exclusion of oxygen by use of proven thermolysis. Thermolysis, also called thermal decomposition is a chemical reaction of a carbonaceous material such as plastic whereby heating the substance it breaks up into at least two chemical substances. The blue syngas can be used in gas engines to produce high efficiency clean renewable energy. Typical incineration, gasification and pyrolysis technologies combust or partially combust the waste material, this however produces a low value, diluted, impure (dirty) gas which can only be combusted to fire low efficiency steam turbines. Our blue syngas can be used to produce high efficiency clean renewable energy as well as pure hydrogen for fuel cells and cars or a biofuel such as ethanol. The CBR is a closed-loop, self sustaining multi-feedstock, scalable and modular waste to energy solution.

0) First the waste truck drives onto the weigh bridge, then it dumps the waste into the storage facility within an enclosed building with a vacuum system to avoid odors & noise, equipped to hold a maximum of 7 days worth of waste feedstock. The storage facility automatically feeds the conveyor belt which takes the feedstock through a 2cm shredder.

   Fully automated, the shredded material then goes through a sieve and magnet loop in order to take out all inert materials such as metals, aluminum, glass and rock. If the waste feedstock has moisture content of more than 30%, our system recognizes this and dries the feedstock to the desired level automatically by use of waste heat from the process.

1) The feedstock is automatically fed **1)** via a screw conveyor to the **3)** Thermolysis Vessel.

2) Vessel **2)** is the Heat Carrier Bunker which is filled with hot ceramic balls. These hot balls are the heat carrier medium that give off the required heat to our process. The heat carrier balls fall through the **3)** thermolysis vessel mixed in together with the feedstock. This guarantees equal heat distribution within the entire vessel to ensure full

decomposition. The heat carrier balls are heated up by using the hot flue gas from combusting the syngas generated within the CBR.

3) The "heart" of the CBR is the thermolysis vessel. Here at between 450° Celsius – 650° Celsius under full exclusion of oxygen the feedstock thermally decomposes into about 80% product gas. Thermolysis, also called thermal decomposition is a chemical reaction of a carbonaceous material such as plastic whereby heating the substance it breaks up into at least two chemical substances. The chemical reaction in our case is C+H2O → CO & H2. The remaining 20% is the non-volatile fraction – CHAR – which is then again thermolysed in our **8)** second stage thermolysis vessel to produce further syngas . The CBR operates only at atmospheric pressure in every plant component.

4) The 80% product gas generated in the thermolysis vessel **3)** is led on to **4)** the steam reformer. Here at approximately 1050° Celsius the product gas is refined to a clean hydrogen rich syngas. The main job of the reformer is to crack down any contaminants mainly tars.

5) Below the **3)** thermolysis vessel the heat carrier balls are separated from the char by use of a simple drum sieve.

6) After the heat carrier balls are separated from the char in the **5)** drum sieve, the balls are shortly stored in a insulated feeding unit which automatically loads the bucket elevator which take up the balls back into the **2)** heat carrier bunker.

7) The char that is separated in the **5)** drum sieve is moved to a char storage unit and from there to the **8)** 2nd Stage Thermolysis Vessel. If the input material is agricultural waste then the char we produce can be sold as biochar.

8) In the **8)** 2nd stage thermolysis vessel we again thermally decompose the remaining carbonaceous material at a high temperature of around 900° Celsius. This vessel too works exclusively under full exclusion of oxygen.

9) Whatever the ash content in the initial feedstock is, will be the ash content left over at the end of our process. The ash is automatically filled into conventional 3 ton silos (sacks).

CONCORD BLUE

10) In the **10)** syngas furnace we combust the syngas which we produce in the second stage thermolyser to heat up the heat carrier balls. The hot flue gases from this go directly into the heat carrier bunker to (p)re- heater. This is the only form of heat or energy the system needs in order to continuously operate self sufficiently.

11) The bucket elevator is fed from beneath the drum sieve underneath the thermolyser. The bucket elevator is a well insulated chain type loop elevator system which takes the heat carrier balls back up into the pre heater **2)** heat carrier bunker.

12) The refined blue syngas coming from the steam reformer goes through a standard gas cleaning and cooling step.

13) The refined syngas is now ready for use. The blue gas can be either used as a replacement or as a blender for natural gas, used to generate electricity in conventional reciprocating gas engines, to produce pure hydrogen or to produce just about any type of biofuel such as methanol, ethanol, bio diesel, etc. The syngas consists of roughly 50% hydrogen, 20%CO, 20%CO2 & 10%CH4 and has a calorific value of around 12MJ/kg.