



Biomass waste gasifier of Tellhow EST

7000Kg/h

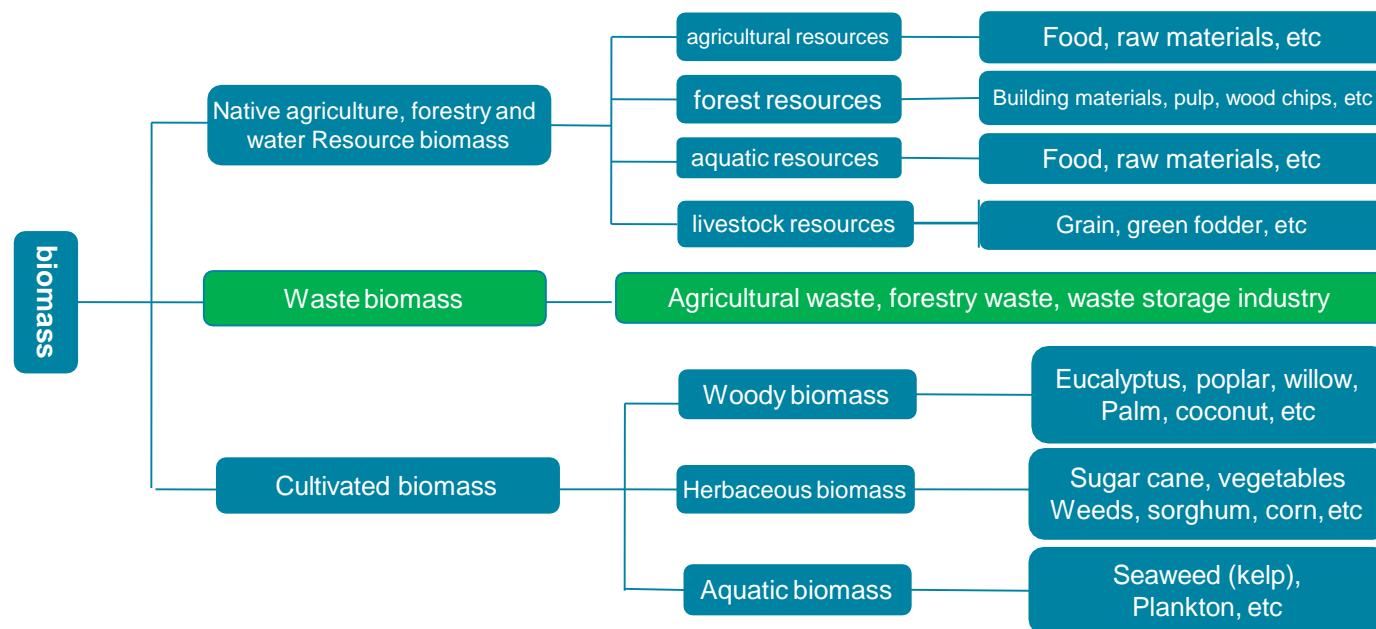
Gaseous fuels (such as natural gas) are currently the best energy sources in the energy industry. Not only are they easy to transport, but they can also be used at lower costs to obtain higher revenue from power generation or heating. However, gaseous fuel mining is relatively difficult and expensive, so it has not been promoted and used in many countries. However, many countries have sufficient biomass raw materials but lack natural gas. For example, countries in Southeast Asia, West Africa, the Caribbean, Northern Europe, South America and other regions.

There are two ways to convert biomass feedstock into gaseous fuel. One is to generate biogas through an anaerobic method, which is more suitable for biomass raw materials with high moisture content, such as manure, food waste, etc. The other is to generate syngas through rapid pyrolysis, which is more suitable for biomass raw materials with low moisture content, such as straw, fruit shells, wood chips, branches, and even waste tires.

The technology jointly developed by Tellhow EST and ENN Gas can quickly convert biomass feedstock into gaseous fuel. The fuel can provide customers with industrial furnace fuel, steam, electricity and other energy sources. The fuel with the same calorific value is only 25-30% of natural gas. It is a very competitive technology.

Tellhow EST can provide customers with biomass waste gasification equipment, and can also provide customers with back-end heating, power generation, carbon-based fertilizers and other complete solutions.

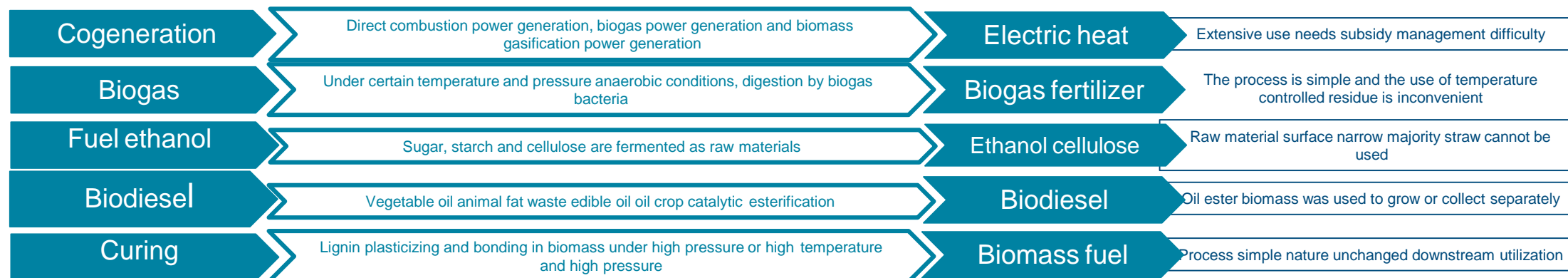




## ENN optimization principle of biomass technology



## Currently commonly used biomass comprehensive utilization technology





Analysis based on the demand from ENN

Scattered

burning :



Polluting the environment-forbid

Generate electricity :

Subsidized life and death  
larger scale depends on subsidies

SDBF:

High cost and easy to use  
Price influences market acceptance

Heat supply:

Price constraints on raw materials and products  
Equipment adaptability



Products: heat, electricity  
Waste: ash, flue gas

Product: biogas (mainly methane)

By-product: application of biogas residue fertilizer

Hydrolysis enzyme, anaerobic fermentation

Wet process, affected by temperature, utilizing environment and product applications

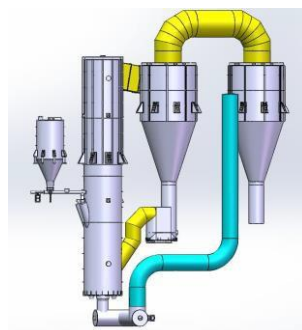
fermentation

direct combustion



Pyrolytic cracking

gasify



Fluidized bed fixed bed gasification  
Gas calorific value is low, efficiency is less than 70%

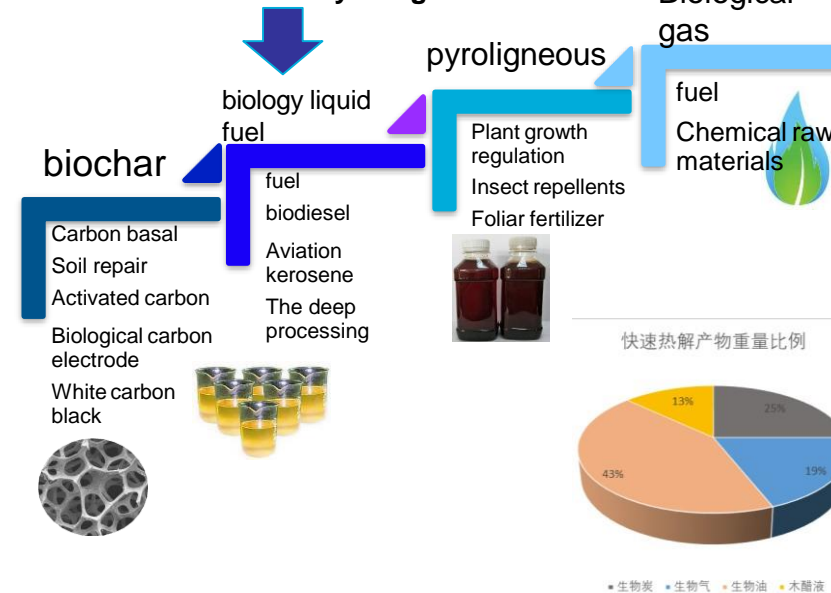
Product: low calorific value biogas  
Waste: carbon ash, smoke

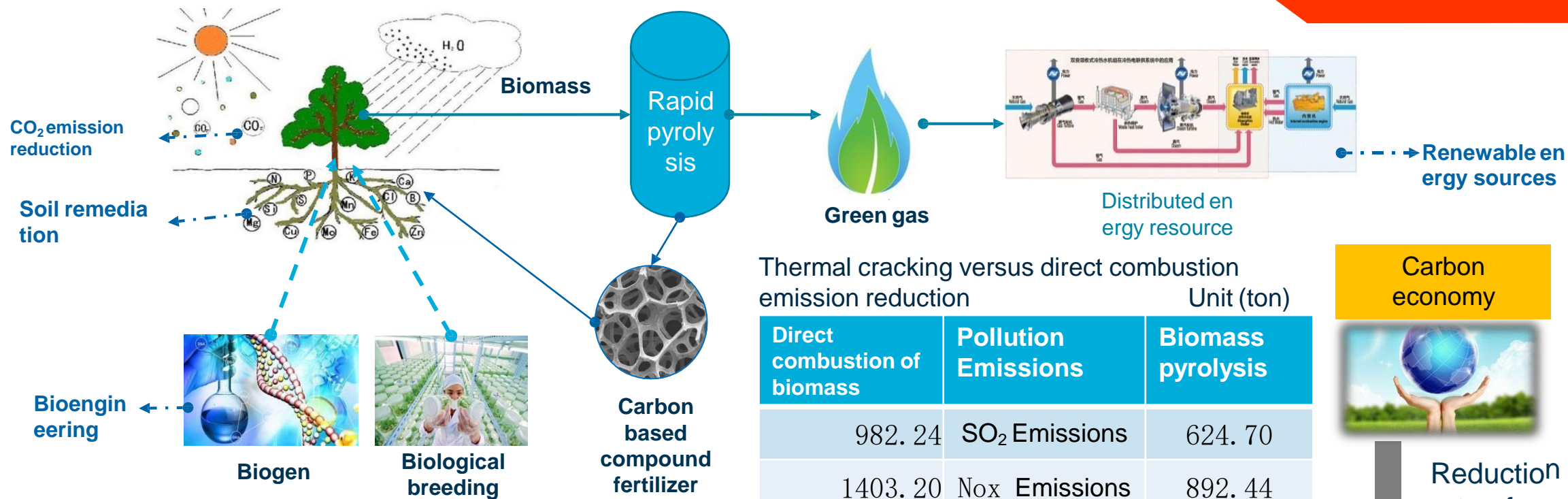


Based on the analysis of advanced technology, maturity, investment, flexibility and difficulty of technology acquisition of pyrolysis units, the development direction of ENN is vertical rapid pyrolysis units.

thermal cracking

conversion efficiency is over 80%, and the technical difficulty is high





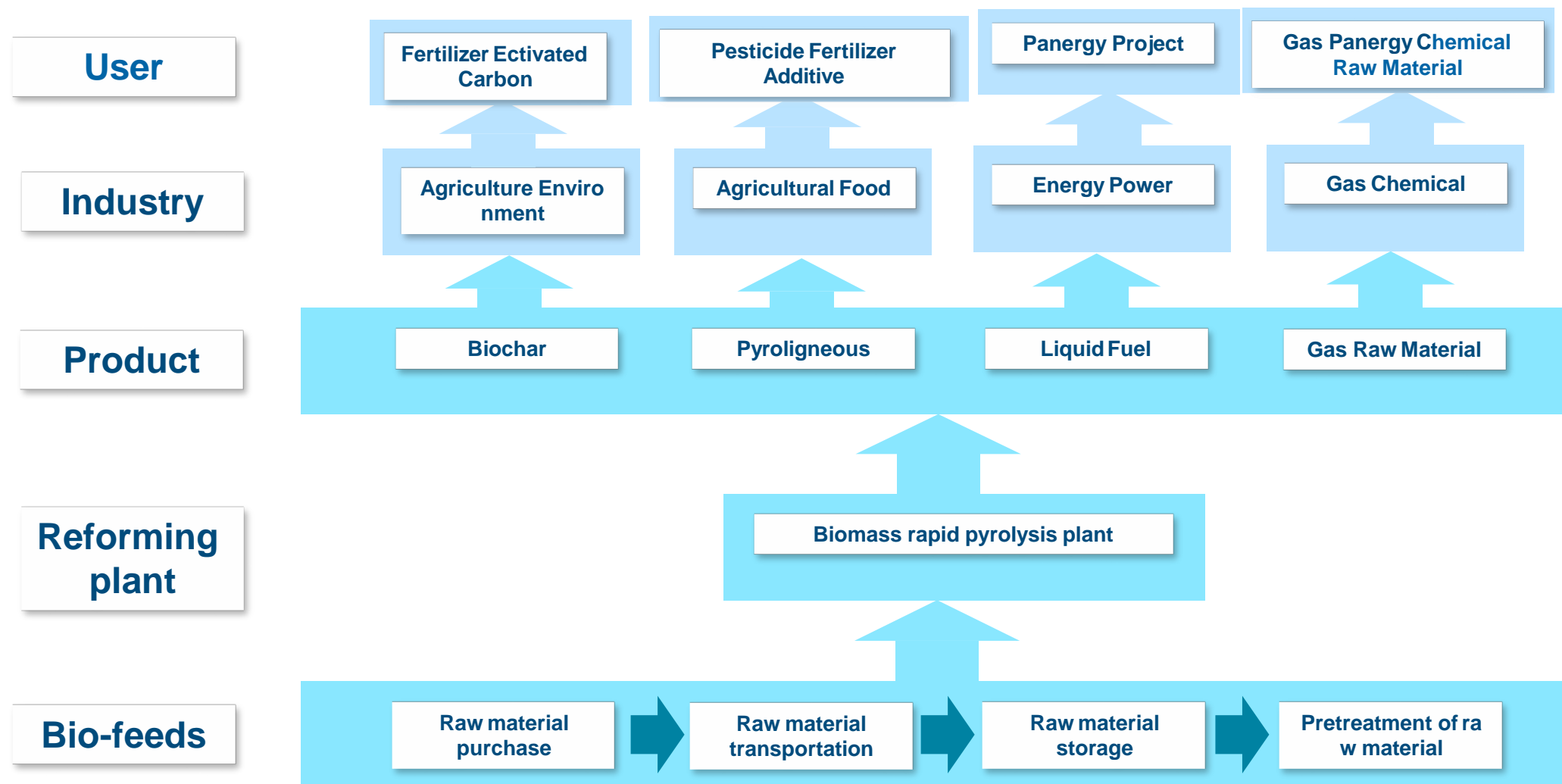
Thermal cracking versus direct combustion emission reduction Unit (ton)

Direct combustion of biomass	Pollution Emissions	Biomass pyrolysis
982.24	SO <sub>2</sub> Emissions	624.70
1403.20	Nox Emissions	892.44
280.64	Dust discharge	178.49
	fixed carbon content	7315

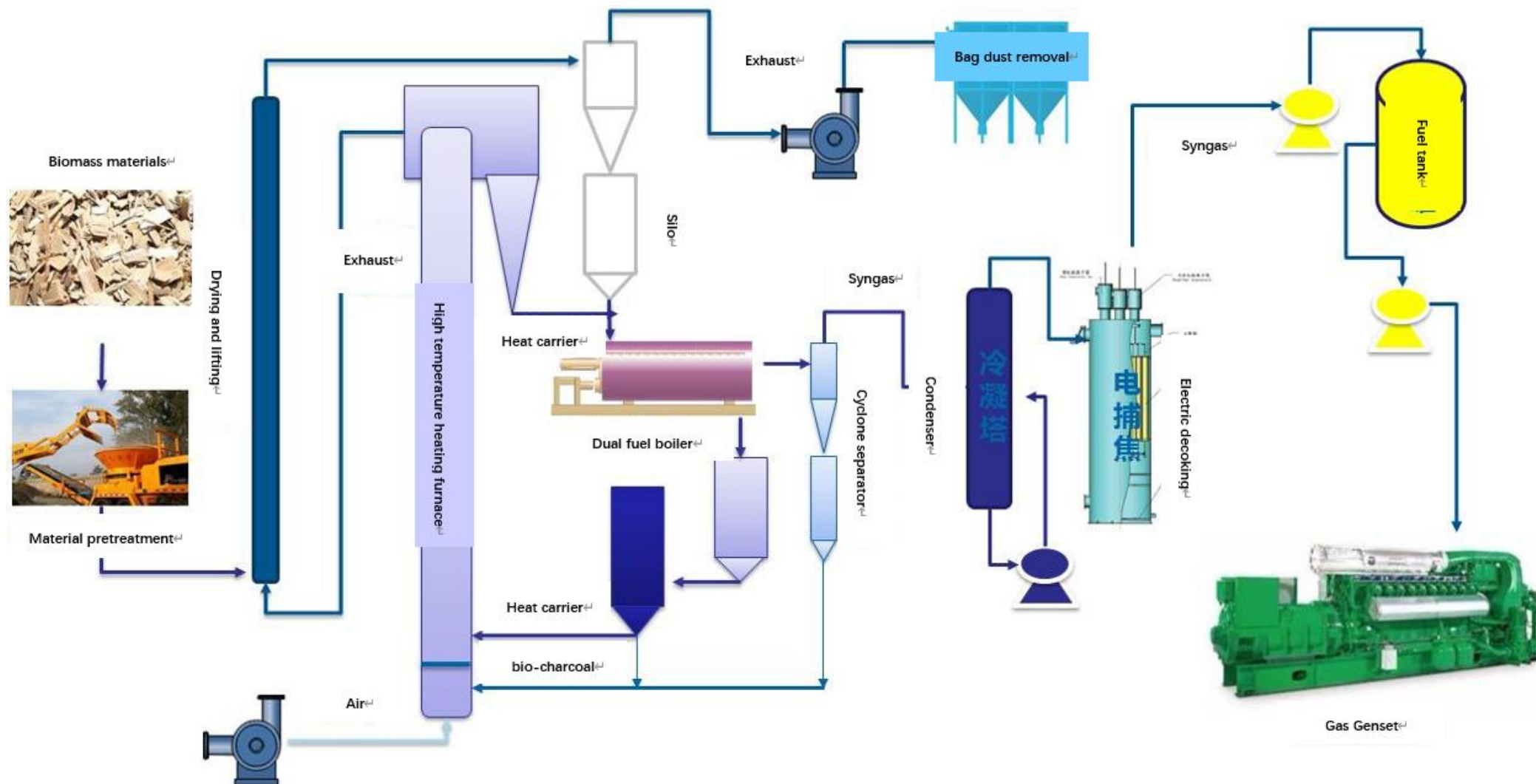
Compared with direct equivalent biomass combustion, the thermal cracking unit with a capacity of 50,000 tons/year has an obvious effect on emission reduction and carbon reduction under the same ultra-low emission standard.

Biomass rapid pyrolysis technology is in line with the ENN energy concept

- A technology that changes the way agricultural resources are used;
- A technology to change biomass energy patterns and energy habits of enterprises;
- A negative carbon emissions, green technology;



# Schematic diagram of gasifier





## Introduction

- Brand new heating concept.

The ceramic ball is used as the heating medium, and the biomass material is heated by the heating medium. It can ensure that the raw materials are heated uniformly, and almost no air enters during the heating process. There is almost no ineffective gas such as nitrogen in the synthesis gas.

- The heating medium is heated by the dual-fuel boiler. After the heating medium is mixed with the biomass material, the biomass material is decomposed into combustible gas and carbon.
- The combustible gas enters the storage tank after dust removal, cooling, dehydration, and pressurization.
- The carbon particles and the heating medium (ceramic balls) are separated by a cyclone separator, the carbon particles are sent to the carbon bin, and the heating medium (ceramic balls) re-enters the boiler to continue heating.
- The flue gas of the boiler is used to dry and dehydrate the biomass material.
- Because there is no nitrogen, the calorific value of combustible gas is very high, which can reach 17.95MJ/Nm<sup>3</sup>.
- Due to the high heating temperature (750-900 degrees), there is almost no tar in the combustible gas, which is conducive to the direct use of gas engines.



1

## Industrialization of fast pyrolysis equipment with an annual capacity of 100,000 tons

A

Some project realizes the technical transformation of the 30,000 tons/year fast pyrolysis device and carries out the process demonstration and verification.

B

Mudanjiang project carried out 50,000-ton standard demonstration project, completed equipment iteration, demonstration and promotion.

C

According to the model of Harbin project, develop a fast pyrolysis equipment with a capacity of 100,000 tons/year, which can produce all the fuel gas.

December 2018, the core equipment of the 30,000 ton scale device had been improved. In June 2019, the design of 50,000 tons of core equipment will be completed, and in October 2019, the design of 100,000 tons of full-production gas equipment will be completed to form a series of products.



2

## Meet the customer to adapt the modular combination of raw materials

A

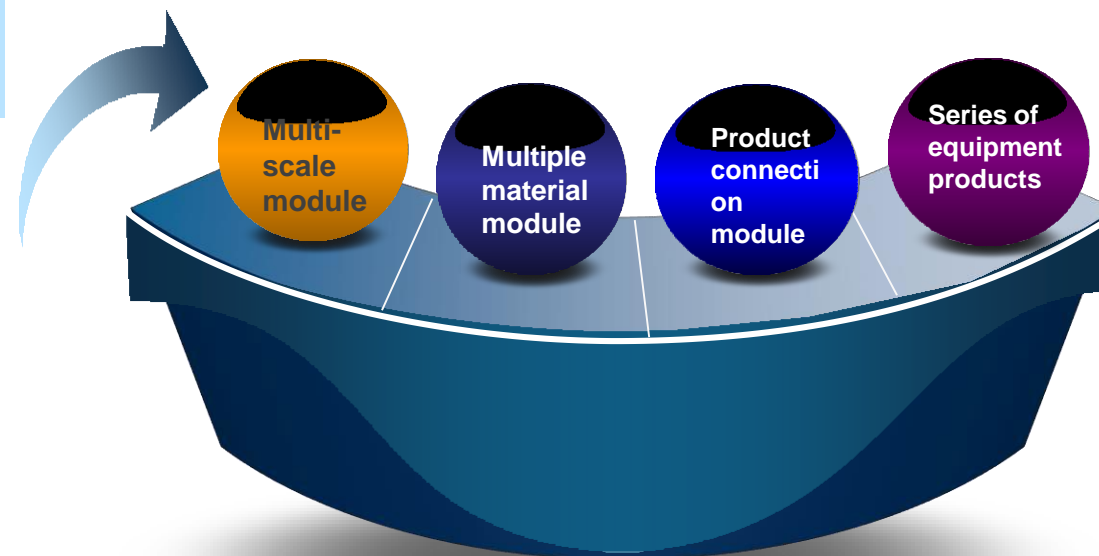
Ensure manufacturing quality, core equipment integration ability, form a series of products, obtain some patents.

B

Biomass rapid pyrolysis equipment can adapt to different resource conditions, meet the needs of all types of users, flexible module combination, reduce the cost, conducive to the promotion of different scenes.

C

R&d and introduction of ancillary equipment, downstream products can be coupled with equipment. Forming the ecosystem whole system equipment manufacturing module.



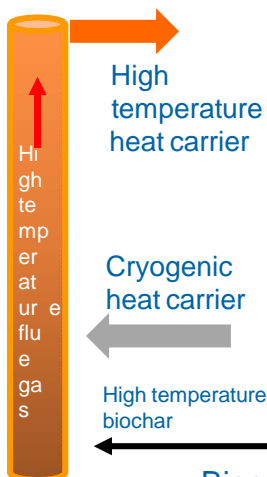
Hot flue gas furnace is flexible  
Choose different raw materials  
according to the market

Fluidized bed flue gas furnace provides  
heat source for the device

Biomass crushing  
material



Biomass fuel



High  
temperature  
heat carrier

Cryogenic  
heat carrier

High temperature  
biochar



Rapid pyrolysis plant

Biogas

Bio-oil

Oil gas  
burner

Biological  
gas



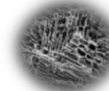
Pyrolygneous



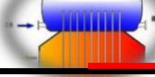
Biology liquid fuel



Biochar



Waste heat  
steam



Biogas outsourcing or pipeline gas



Bio-liquid fuel point for replacement of gas



Organic agricultural raw  
materials

Supply steam heating to customers

- Using biomass to reduce costs.
- Using biogas produced by the system.
- Use of system generated bio-liquid fuels.
- Heat transfer system biochar and utilize latent heat.

Wide range of biomass Strong regulation ability Energy is no longer tied to agriculture

Biomass pyrolysis coupled coal-fired power generation  
Energy + agricultural circular economy can be formed in the countryside

To solve the problem of gas source and price of pan energy project, the product and output can be adjusted according to the demand

## Diversification of raw materials

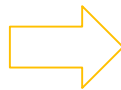
- Biomass
- Old rubber tyre
- Organic waste

## Strong system fuel adaptation

- Biomass
- Biological carbon powder
- Biology liquid fuel
- Biogas
- Equipment of waste heat

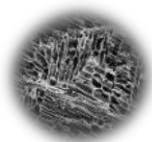


Biological gas



- Alternative natural gas (calorific value 4000-4500 kcal)
- Micro - turbine triple supply/internal combustion engine power generation
- PSA or PSA+ to produce hydrogen (hydrogenation station, fuel cell, chemical industry)
- Separation of methane to produce natural gas

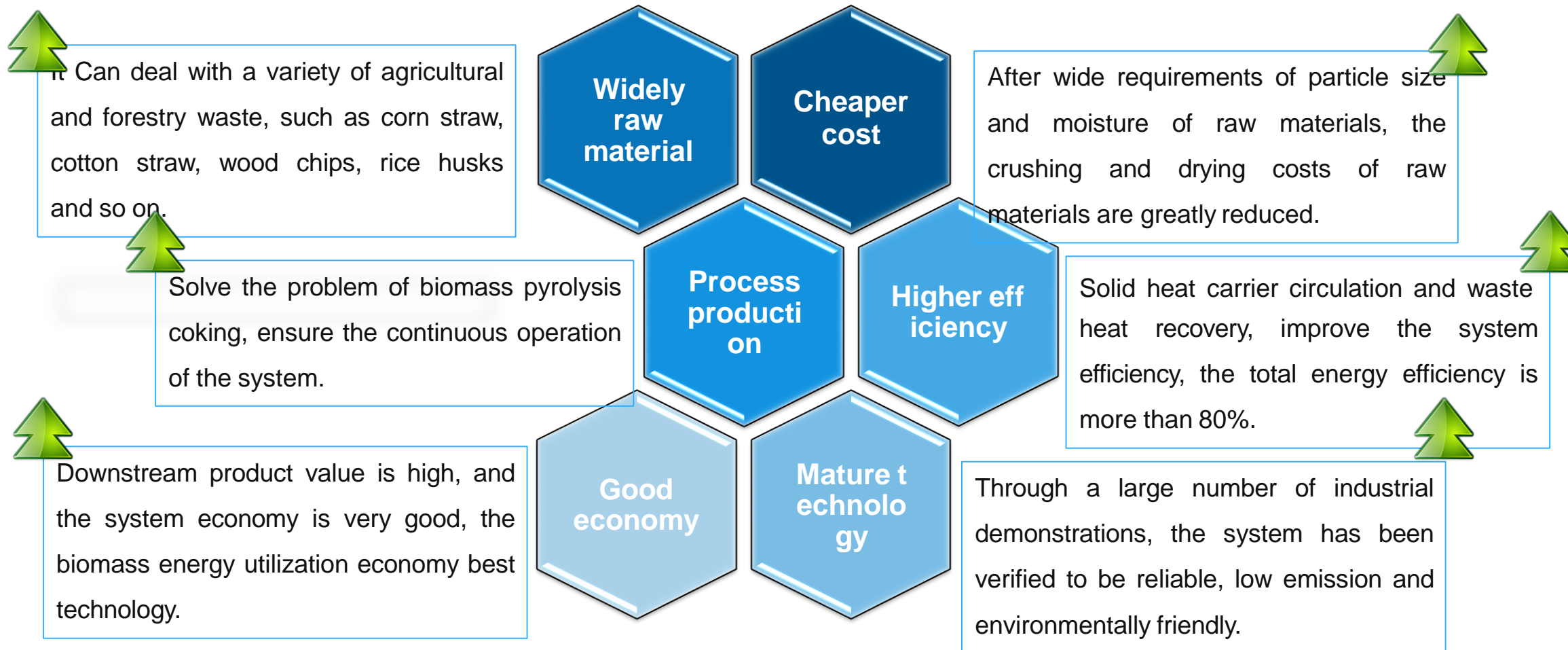
Component	750°C	900°C
CH <sub>4</sub>	14.39%	14.74%
CO	51.84%	36.03%
H <sub>2</sub>	8.46%	31.60%
CO <sub>2</sub>	13.20%	12.75%
N <sub>2</sub>	2.57%	2%
O <sub>2</sub>	0.77%	0.5%
CnHn	6.52%	1.14%
Effective gas	81.2%	83.51%
Calorific kcal/kg	4124	3342



Biochar



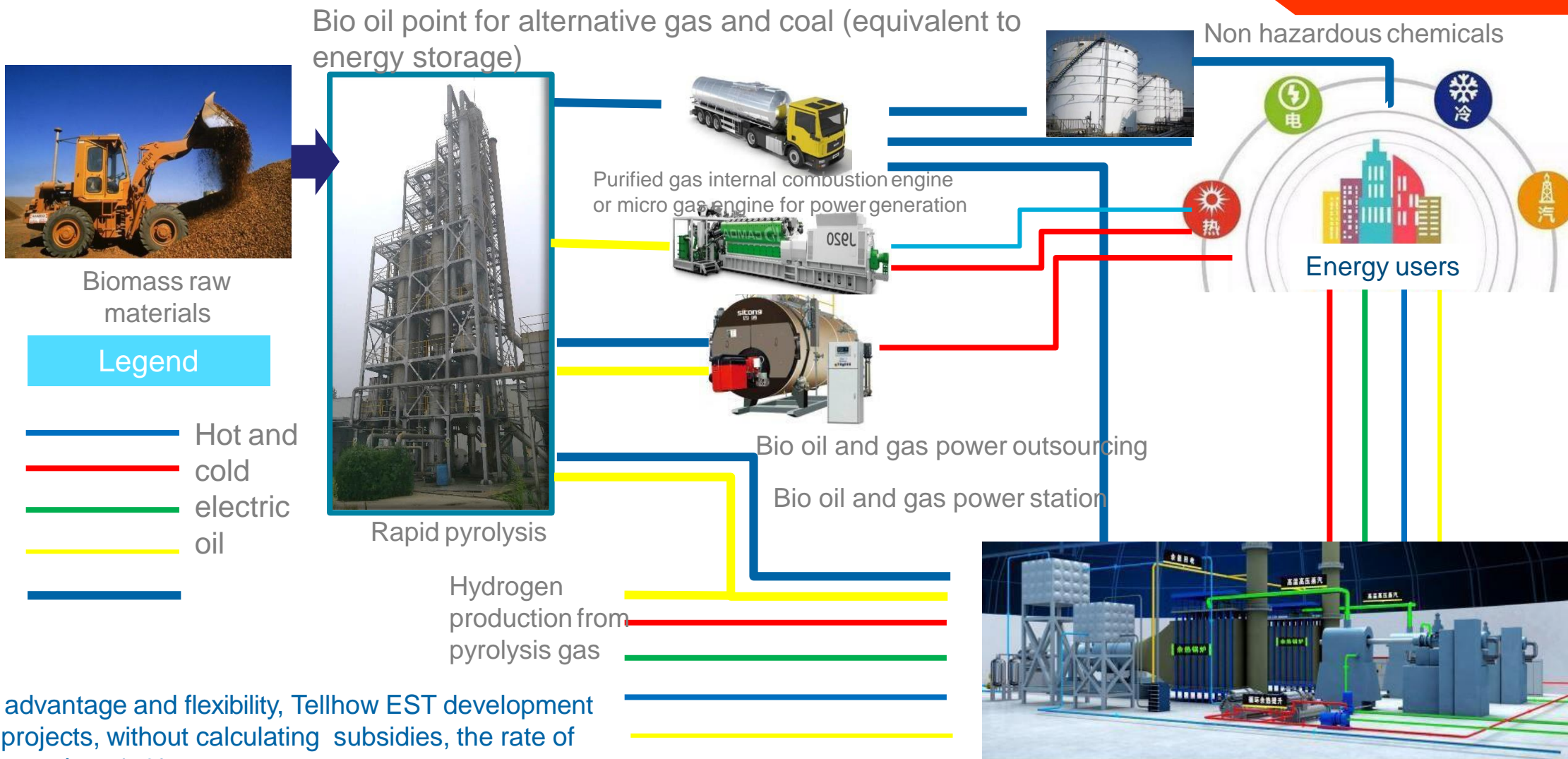
Self-powered system  
Carbon base fertilizer  
Activated carbon raw material  
Refined carbon material  
Charc





The main components of a typical gaseous fuel are as follows:

[illegible]



With cost advantage and flexibility, Tellhow EST development of similar projects, without calculating subsidies, the rate of return is more than 15%.

## Analysis on the most favorable operation scenario of project operation

**Scenario Description:** Corncob fuel is used as heat source and corncob is also used as pyrolysis raw material. The replaced biogas is produced by gas boiler of brewery, and all steam is consumed in the zone.

Item	Amount
Corncob usage (10 <sup>4</sup> tons)	7.68
Steam production (10 <sup>4</sup> tons)	17.30
Steam demand (t/h)	24.72
Biochar production (10 <sup>4</sup> tons)	0.86
Yield ratio(%)	First year 80, others 100

FIRR (after income tax)	34.34%
FNPV (after income tax i = 12%)	7996.1
Static investment recovery period (yr) (after income tax)	2.84
Dynamic investment recovery period (yr) (after income tax)	3.71
Financial internal rate of return on project investment(after income tax)	89.00%
Financial net present value of project investment (after income tax i = 12%)	9263.4

## Analysis on the most unfavorable operation scenario of project operation

**Scenario Description:** Biochar can not be fully utilized. It is first burned as a heat source of the device and sold out. In the first three years, according to the current load calculation, the steam consumption in the later period is all.

Item	First 3 yrs	Later yrs
Corncob usage (10 <sup>4</sup> tons)	4.45	6.54
Steam production (10 <sup>4</sup> tons)	11.79	17.30
Steam demand (t/h)	16.84	24.72
Biochar production (10 <sup>4</sup> tons)	0.26	0.38
Yield ratio(%)	68	100

FIRR (after income tax)	16.00%
FNPV (after income tax i = 12%)	1317.5
Static investment recovery period (yr) (after income tax)	6.03
Dynamic investment recovery period (yr) (after income tax)	10.32
Financial internal rate of return on project investment(after income tax)	29.66%
Financial net present value of project investment (after income tax i = 12%)	2567.2

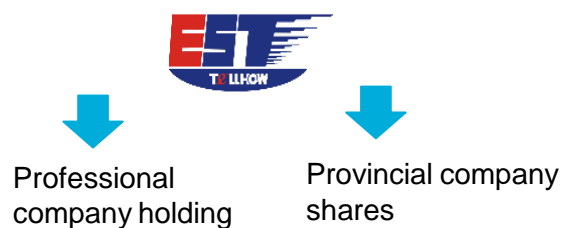
- ❑ Customer of an aluminum melting furnace:
- ❑ 21.9147 million Nm<sup>3</sup> natural gas is used annually, with a calorific value of 7950 kcal / Nm<sup>3</sup>, converted into 41.549 million Nm<sup>3</sup> of biothermalgas.
- ❑ In November, the largest energy consumption was 2.546 million Nm<sup>3</sup>, converted into 4.827 million Nm<sup>3</sup> of bio pyrolysis gas.
- ❑ Supporting 100000 ton biomass pyrolysis gas project:
- ❑ The capacity of pyrolysis gas is 8091.02 m<sup>3</sup> / h, the maximum monthly output is 5.826 million Nm<sup>3</sup>, and the annual output is 56.637 million Nm<sup>3</sup>.
- ❑ The supporting capacity of the project can meet the maximum energy demand of users, with an annual surplus of 15.088 million Nm<sup>3</sup> of pyrolysis gas.

## Technical parameters of high temperature pyrolysis of 100000 tons to produce biogas

No	Item	scale		Description		Calorific value	Remarks
		t/h	10 <sup>4</sup> t/a		Proportion(%)	Kcal/kg	
1	Main raw materials						
1.1	Corn stalk	19.39	13.57	To contain water30%		2650	
1.1	Corn stalk	14.29	10	To contain water5%		3862	
2	Main products						
2.1	Biomass charcoal	1560.00	1.092	Produce	10.92	1800	Output of biochar after cyclic combustion
2.2	Biogas	9142.86	6.40	Product	47.16	3710.80	8091.02 m <sup>3</sup> /h
2.3	Wood vinegar	1714.29	1.2	Product	12.00		
2.4	Smoke	22222.00					After heating the carrier, the flue gas volume is 30000 Nm <sup>3</sup> / h, and the temperature is 800 °C
2.5	Circulating water volume (direct cooling pipe)	450000					Outlet water temperature 80 °C

Biogas composition	Volume ratio%
CO	52.88
CH <sub>4</sub>	14.68
CO <sub>2</sub>	13.46
H <sub>2</sub>	8.61
N <sub>2</sub>	2.13
O <sub>2</sub>	0.18
CH <sub>3</sub> CH <sub>3</sub>	1.7
CH <sub>2</sub> =CH <sub>2</sub>	2.71
C <sub>3</sub> H <sub>8</sub>	0.18
Cyclopropane	0
Propylene	1.32
Isobutane	0.01
N-butane	0
Acetylene	0.04
Trans Butene	0.13
1-butene	0.09
Isobutene	0.07
CnHm	0.21
<b>Calorific value Kcal/Nm<sup>3</sup></b>	<b>4193.2</b>
<b>Average density kg/Nm<sup>3</sup></b>	<b>1.13</b>



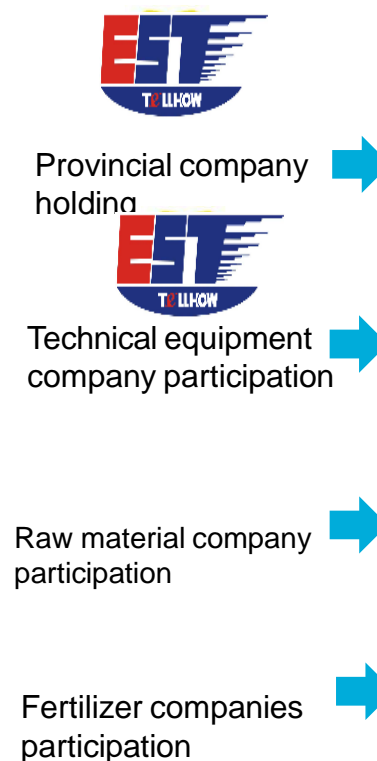


Straw collection, storage and transportation platform company

Biomass harvesting cooperation



Biomass project cooperation

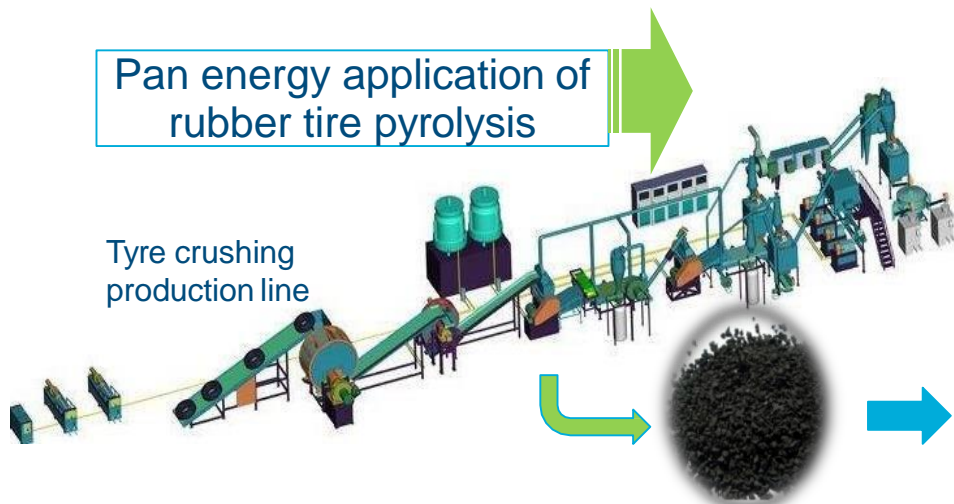


Biomass pyrolysis co-production of fertilizer

Biomass project co-production of fertilizer cooperation

## Pan energy application of rubber tire pyrolysis

Tyre crushing production line



Pyrolysis gas



Bio-oil



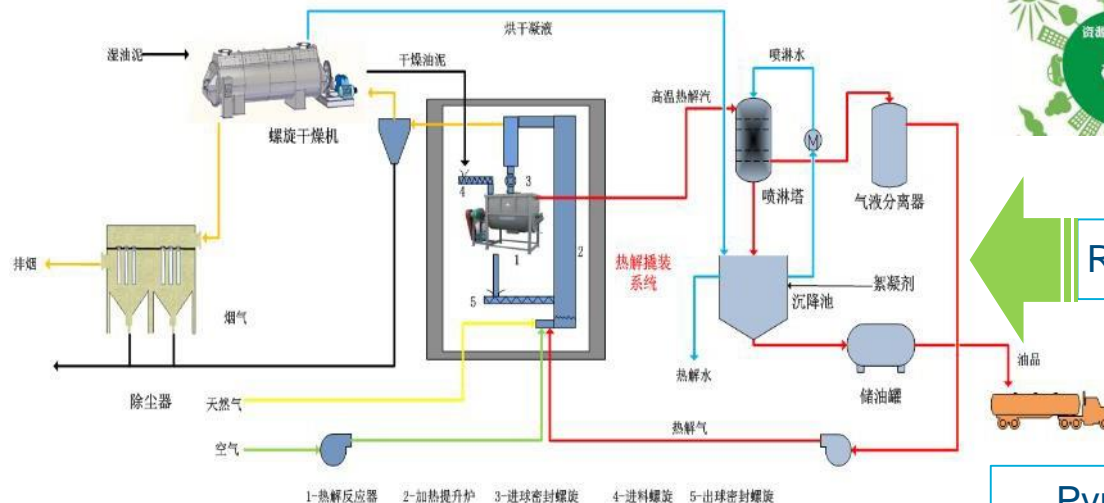
Carbon black



Carbon black granulation



## Rotary pyrolysis of oily sludge



Pyrolysis technology of reciprocating chain plate

Skid-mounted







## Company vision

We hope and work hard to make our products contribute to China's goal of "carbon neutral, carbon peak" as soon as possible. In order to show that we are a responsible company, we must shoulder a mission: "give priority to the use of advanced technology, products and services, so as to improve the customer experience.". We hope that our small power gas generator sets can provide customers with more competitive procurement costs under the same excellent quality.





# Biomass Waste Gasifier



# THANK YOU!

Energy solutions experts around you, Tellhow EST

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