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Wuxi Teneng Power Machinery Co., Ltd.

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www.powermaxgasifiers.com



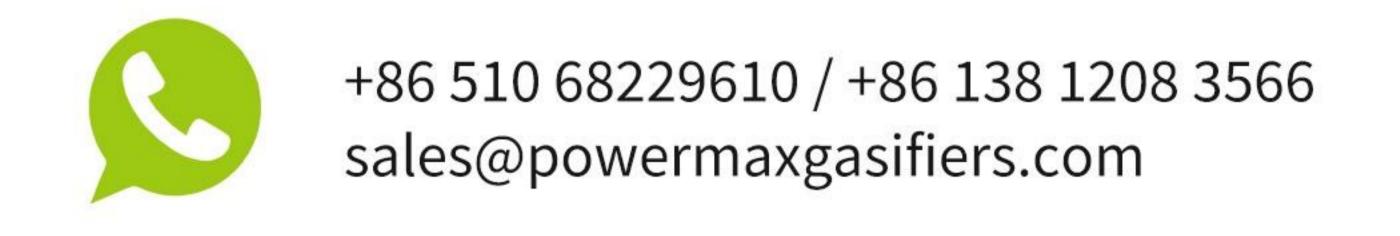
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#### POWERMAX DUAL-FUEL BURNER

Patended by Powermax, the low pollutants dual fuel burner is an equipment installed on a boiler. The design of the burer allows to burn high temperature synthesis gas (up to 800°C) or a conventional fuel or a mixture of both (natural gas, propane, fuel oil). The burer is available from 1MW to 25MW Range.

#### POWERMAX, A UNIQUE FLEXIBILITY

Powermax supply a unique burner that offers a complete flexibility in the choice of fuels uder the current fuel prices and availability. The burner ensures reliable operation and allows operation at nominal power being fed only by biomass syngas, only by the conventional fuel or by any propotion of these fuels(0-100%).





# The impact of diesel combustion on environmental pollution

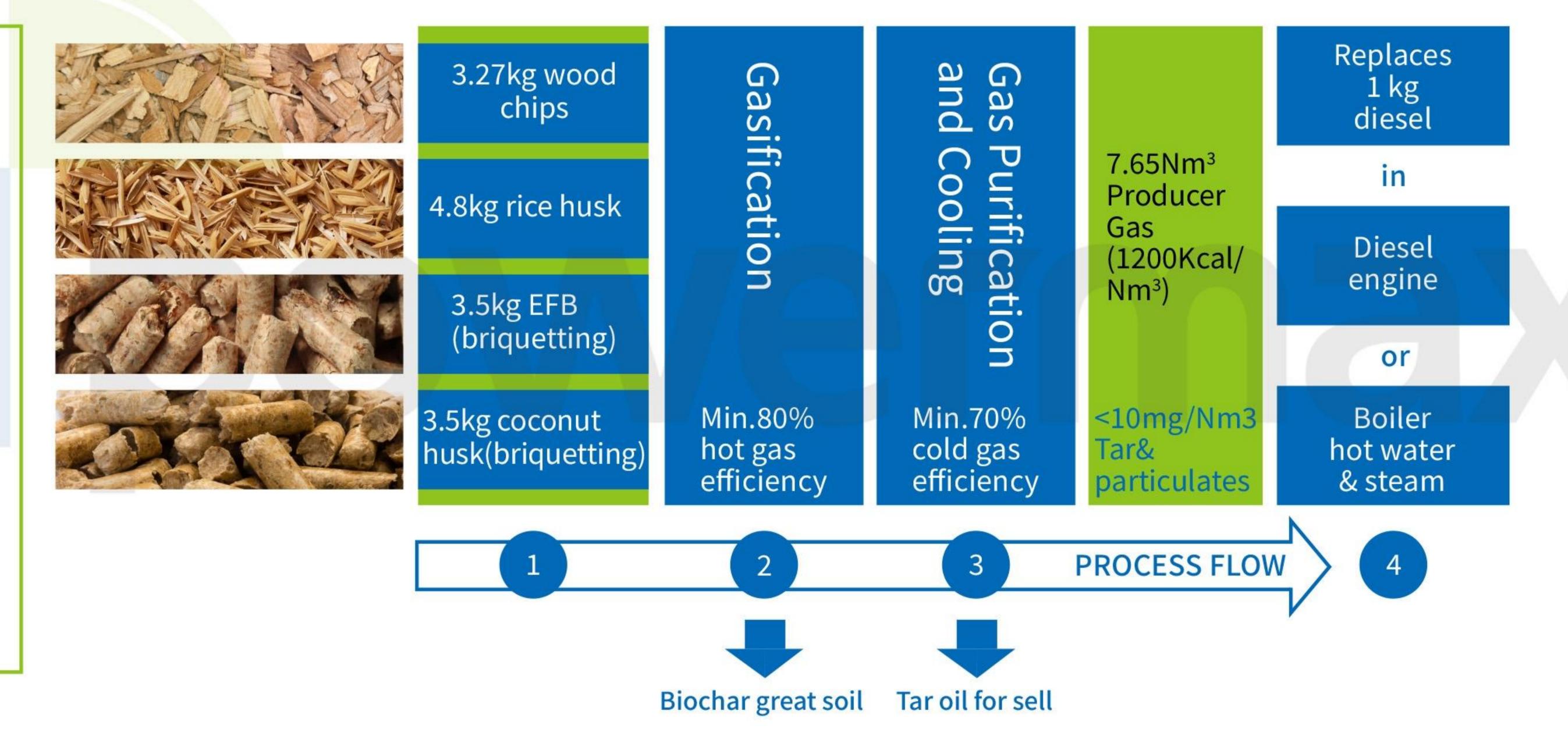


Diesel combustion releases large amounts of harmful substances, including nitrogen oxides, sulfur oxides and particulate matter. These pollutants not only have a serious impact on air quality, but may also cause health problems. In addition, greenhouse gases (such as carbon dioxide) produced by diesel combustion lead to global warming.

With the rising awareness of environmental protection and adjustments in energy structures, traditional diesel boilers have caused greater impact on the environment, while also bringing increasing operantional costs. Biomass gas, as a renewable and low-carbon clean energy source, holds vast potential for application.

Converting diesel fired boilers to biomass gas boilers not only helps reduce carbon emissions and environmental pollution but also lowers energy consumption and enhances economic benefits.

How much biomass replaces 1 kilo of diesel...



# CARBON DIOXIDE (CO2) IS CONSIDERED A TERRIBLE GAS FOR SEVERAL REASONS:

Greenhouse Effect: Carbon dioxide is one of the major greenhouse gases that can absorb and re-radiate heat from the earth's surface, causing global warming. This rise in temperature will trigger a series of climate changes such as extreme weather and rising sea levels.

**Ecosystem damage:** Climate change puts pressure on ecosystems, leading to species extinction, habitat loss and biodiversity decline, affecting ecological balance.

Public health risk: Increased carbon dioxide concentration is related to reduced air quality, which may lead to respiratory diseases, cardiovascular diseases and other health problems, especially affecting vulnerable groups.

**Economic losses:** Natural disasters (such as floods, droughts, hurricanes, etc.) caused by climate change will cause infrastructure damage, reduce agricultural production, and interrupt economic activities, bringing huge economic burdens to society.

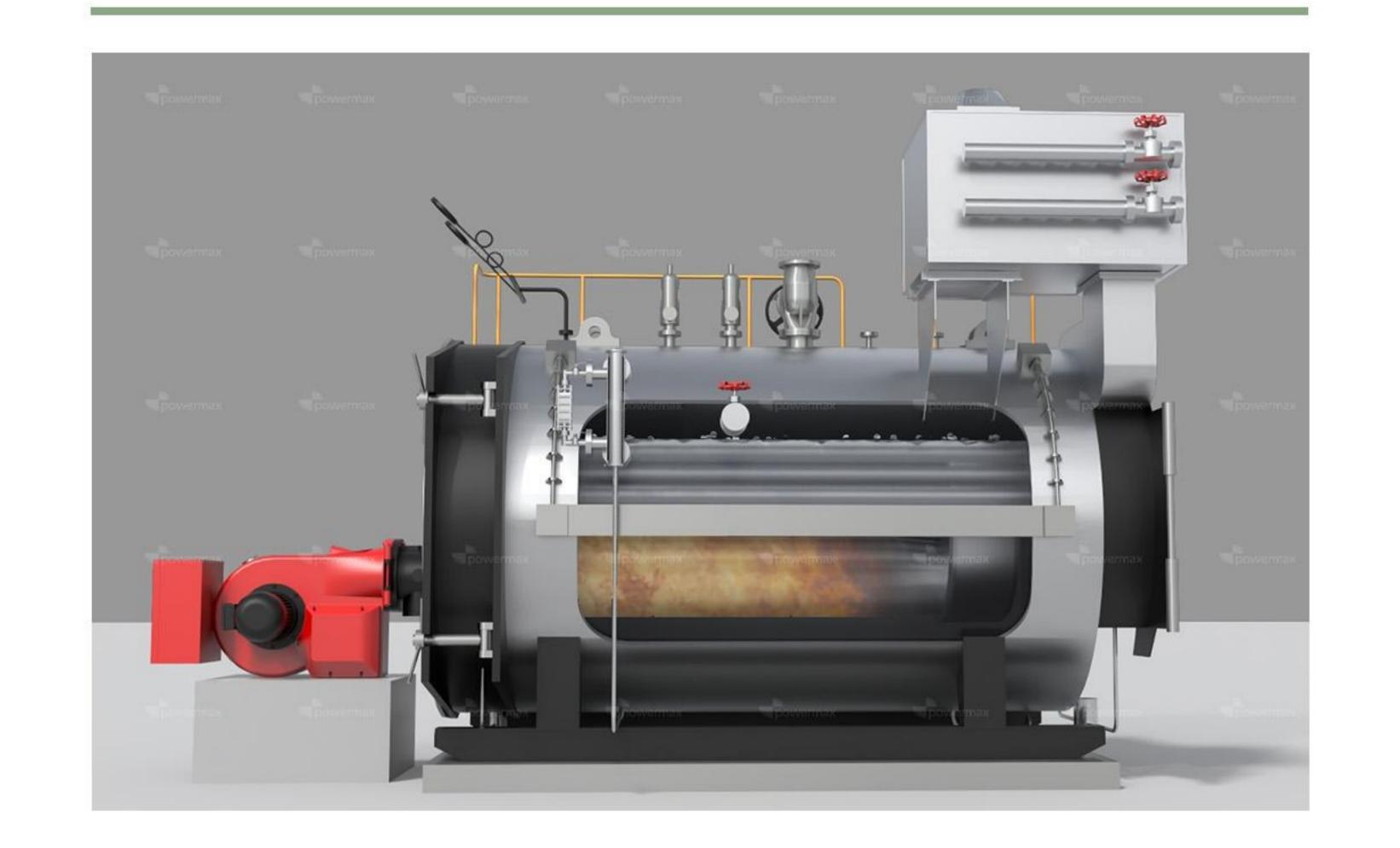
**Social inequality:** The impacts of climate change tend to be uneven, with developing countries and disadvantaged groups more susceptible, leading to increased social inequality.

Mental Health Impact: Uncertainty and natural disasters caused by climate change may lead to mental health issues such as anxiety and depression.

Therefore, the increase in carbon dioxide is not only an environmental problem, but also a social, economic and health challenge that requires a global response.



# Comparative Analysis of Diesel Fired Boilers and Biomass Gas Boilers:

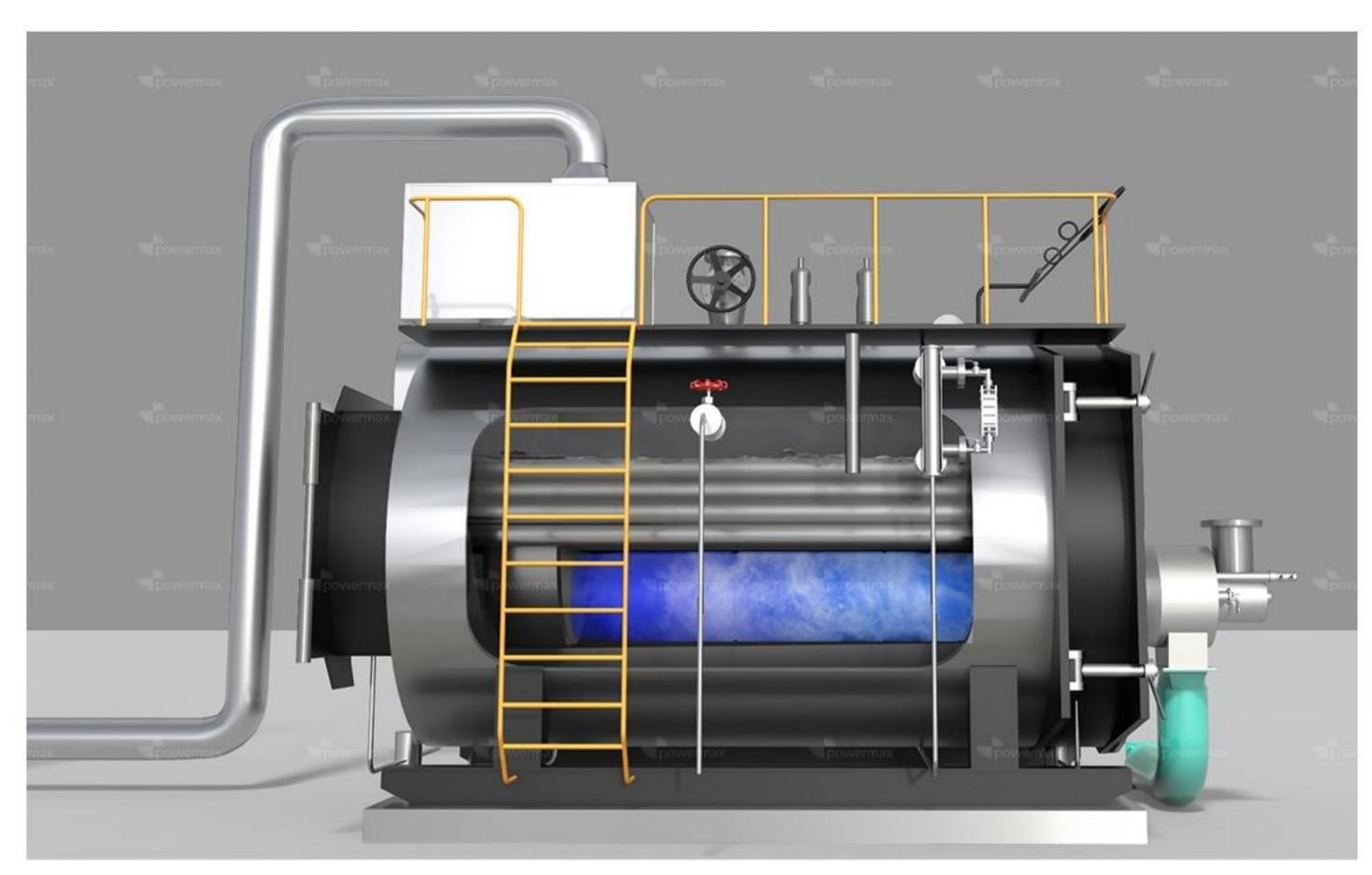


Diesel fired boiler is a thermal energy production equipment that uses diesel as fuel and is widely used in industry and power generation. Its main features include:

**Mature Technology:** Diesel fired boiler technology is relatively mature, starts quickly, and has high thermal efficiency.

**Fuel Dependence:** Dependent on fossil fuels, prices are greatly affected by market fluctuations.

**Environmental Challenge:** Nitrogen oxides, sulfur oxides and particulate matter will be released during the combustion process, causing air pollution.



Biomass gas boiler is a device that uses renewable biomass fuels such as wood chips, crop residues and other organic wastes for heat energy production. Its main features include:

**Environmental Protection:** The combustion of biomass fuel produces lower emissions of greenhouse gases and pollutants, helping to reduce environmental pollution.

Sustainability: Utilize agricultural and forestry waste to promote resource recycling and support sustainable development.

**Economical:** Biomass fuel is generally cheaper and has lower long-term operating costs.



#### WHY BIOMASS GAS BOILER HAS ADVANTAGES

Biomass gas boilers are superior to diesel boilers in terms of environmental protection, sustainability, economy and applicability, and are an ideal choice for modern industry and energy transformation. Choosing biomass gas boiler will not only help reduce environmental impact, but also achieve long-term economic benefits.



#### ENVIRONMENTAL PERFORMANCE

Biomass Gas boiler: Using renewable biomass fuel, the greenhouse gas and pollutant emissions produced during combustion are significantly lower than diesel boilers, complying with more stringent environmental standards.

Diesel Fired Boiler: Burning diesel releases large amounts of harmful substances such as nitrogen oxides, sulfur oxides and particulate matter, causing air pollution and health risks.



#### SUSTAINABILITY

Biomass Gas boiler: Utilize agricultural and forestry waste to promote resource recycling and support sustainable development.

Diesel Fired Boiler: Relying on limited fossil fuels and facing risks of resource depletion and price fluctuations.



#### ECONOMY

Biomass Gas Boiler: Although the initial investment may be higher, biomass fuel is generally cheaper, with lower long-term operating costs and significant economic benefits.

Diesel Fired Boiler: Fuel costs are greatly affected by market fluctuations, and long-term use may result in high operating expenses.



#### APPLICABILITY

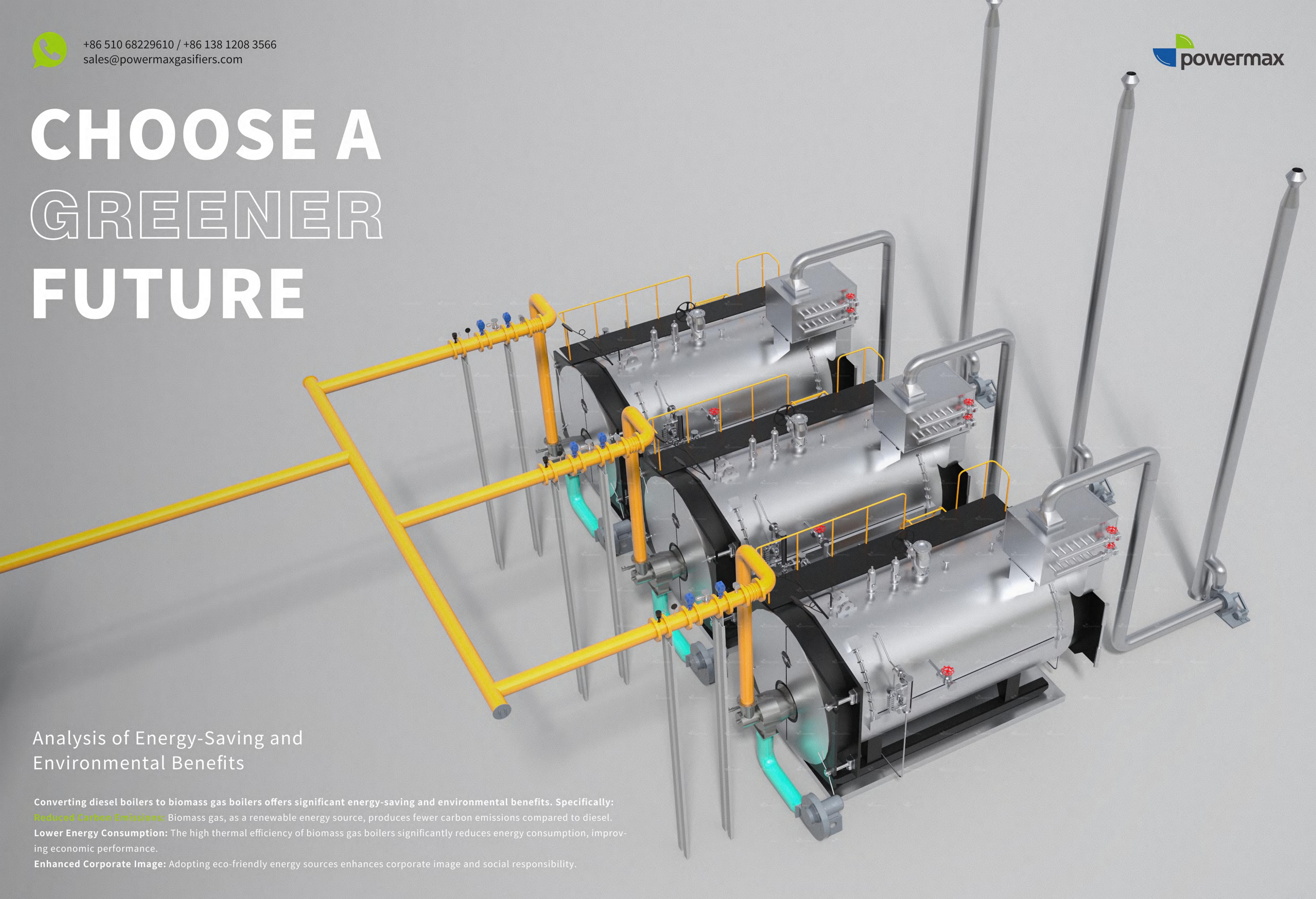
Biomass Gas boiler: suitable for enterprises that pursue environmental protection and sustainable development, especially in agriculture, forestry and related industries.

Diesel Fired Boilers: Suitable for short-term and traditional needs, but facing increasing pressure in the context of increasingly stringent environmental regulations.

3 sets 4T/H Diesel Fired Boilers consume 863 liters diesel per hour, 6,904,000 liters per year (assume 8000hours per year, diesel 9181 Kcal/Liter, boiler efficiency 90%)

In Malaysia Diesel 0.63USD per liter, it costs 4,349,520USD per year.
In Indonesia Diesel 0.96USD per liter, it costs 6,627,840USD per year.

Diesel is very expensive, burning diesel produces many harmful emissions, and it makes our earth warming very quickly, since burning 1 liter diesel creates 2.54kg of CO2, so 3 sets 4T/H diesel fired boiler created 17,536ton CO2 per year.





Converting diesel fired boilers to biomass gas boilers offers significant energy-saving and environmental benefits.

#### Conversion Plan

Powermax Renewables can offer you Compact Biomass Gasification Systems to produce clean biomass syngas to replace your exiting fossil fuel boiler such as diesel, HFO, natural gas boiler to 100% biomass syngas boiler.

No need to change your exiting boiler, just change the burner and add ID Blower after Boiler.

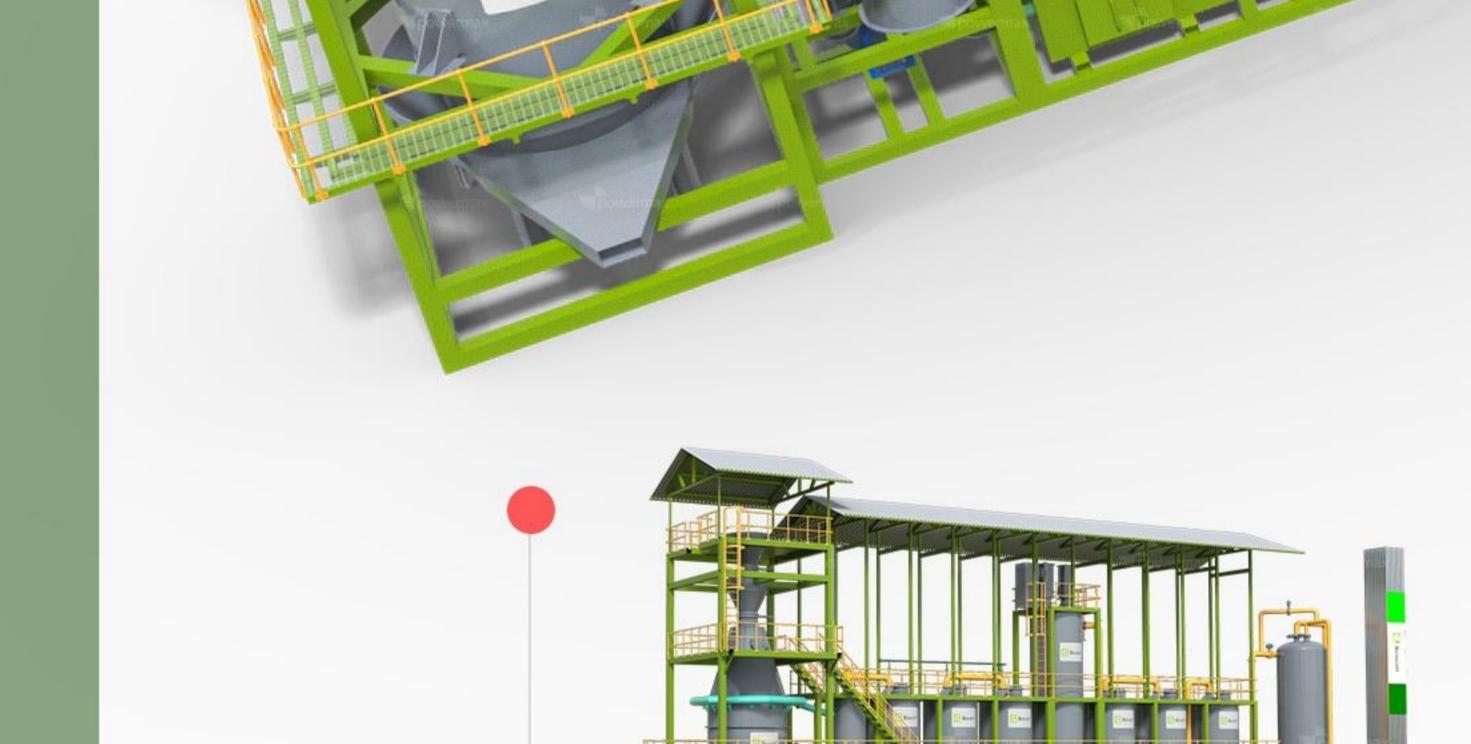
#### Technical Advantages

Efficient Combustion: Biomass gas burns fully, providing high thermal efficiency and significantly improving the boiler's performance.

#### Environmentally Friendly Emissions:

The converted boiler meets national environmental standards, reducing harmful emissions and minimizing environmental impact.

Stable Operation: The advanced control system monitors the boiler's operational status in real-time, ensures stable operation and reduces the failure rate.



#### Biowatt Compact Biomass Gasification System

All components are pre-installed, investors can achieve fast returns. This not only simplifies installation, but also allows for very quick start-up, so you can benefit from it immediately. The system offers great flexibility because it provides a modular design and has the ability to trigger biomass gasification system for maximum performance. Containerized biomass gasification systems can be optimally tailored to unique situations.



#### Dual-fuel burner

#### Thermal power up to 25MW

Powermax is an unique patended dual-fuel burner that offers complete flexibility in fuel selection based on current fuel prices and availability. The burner ensures reliable operation and allows operation with biomass syngas, conventional fuel such as diesel, HFO, natural gas,LPG,CNG or any proportion of these fuels. The burner also can work with mixure burning.



#### Biomass gas boiler

Biomass gas boilers are efficient and eco-friendly boilers that use biomass gas as fuel. They employ advanced combustion technology and control systems to achieve efficient and stable combustion while reducing harmful emissions. Biomass gas boilers are compact, easy to operate, and convenient to maintain, making them an ideal alternative to traditional diesel boilers.

- 1 Set Biowatt1000 Cold Gas Energy Output 3.49MWh, it can connect with 6T/H Steam Boiler.
- 2 Set Biowatt1000 Cold Gas Energy Output 6.98MWh, it can connect with 12T/H Steam Boiler.
- 4 Set Biowatt1000 Cold Gas Energy Output 13.96MWh, it can connect with 24T/H Steam Boiler.

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# Comparison between Diesel Fired Boiler and Biomass Gasification Boiler (3 sets 4T/H Boiler)

MALAYSIA	BEFORE	PRICE	AFTER CHANGING TO BIOMASS	PRICE
3 sets 4T/H fired boiler per hour cost	863 liters diesel per hour	543.69 USD per hour	2,640KG wood chips per hour	132 USD per hour
3 sets 4T/H fired boiler per year cost	6,904,000 liters per year	4,349,520USD per year	21,120Ton Wood chips per year	1,056,000USD Per year
	Stack: SMOKE, produces many harmful emissions Create 17,536ton CO2 per year.		Stack: NO SMOKE, 100% GREEN AND Clean.  By product: 1700ton per year Biochar  C02 negative.	
	SAVE ALMOST 75%. (Ass	ume 4000kcal/KG wood chi	ips 50USD per ton)	

INDONESIA	BEFORE	PRICE	AFTER CHANGING TO BIOMASS	PRICE
3 sets 4T/H fired boiler per hour cost	863 liters diesel per hour	543.69 USD per hour	2,640KG wood chips per hour	132 USD per hour
3 sets 4T/H fired boiler per year cost	6,904,000 liters per year	6,627,840USD per year	21,120Ton Wood chips per year	1,056,000USD Per year
	Stack: SMOKE, produces many harmful emissions Create 17,536ton CO2 per year.		Stack: NO SMOKE, 100% GREEN AND Clean.  By product: 1700ton per year Biochar  C02 negative.	
	SAVE ALMOST 85%. (Ass	ume 4000kcal/KG wood chi	ips 50USD per ton)	

#### The Actual Cases



This client has purchased our briquetting machine to produce EFB briquettes in Gua Mugsang area of Malaysia using raw EFB, with production capacity of 3T/H. Meanwhile, they installed our gasification system at their factory in Kota Bharu to produce 5000-6000Nm3/H cleaning biomass syngas, which was supplied to three sets of 4Ton diesel boilers to replace diesel fuel, reducing carbon dioxide emissions and fuel costs greatly.



This client has purchased our gasification system at their factory in Portugal to produce 4500Nm3/H cleaning biomass syngas, which was supplied to one set 18ton diesel boiler and three sets of 3Ton diesel hot air generators to reduce diesel consumption, meanwhile we also supply them with one set 12MW dual fuel burner and 3 sets 1.8MW dual fuel burners, these burners can not only run dual fuel mode, but also mix burning mode. It reduces carbon dioxide emissions and fuel costs greatly.

## Powermax Renewables

Services and Support

We have successfully implemented numerous diesel boilers to biomass gas boiler conversion projects for various businesses and institutions. These projects have achieved remarkable energy-saving and environmental benefits, earning praise from our clients.

We provide comprehensive services and support, including project consultation, design, installation, commissioning, and after-sales maintenance.

Our professional team offers one-stop services to ensure the smooth implementation and stable operation of conversion projects.



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Cogeneration

Heat and Power

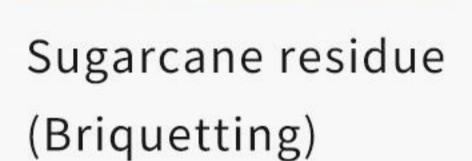
(with ORC unit)

# Biomass Gasification Heating Solution (For Boiler, Furnace, Dryer, Kiln and etc)

Powermax -DFBG(Downdraft Fixed Bed Gasifier)

Design to use dry biomass(Moisture content less than 20%)







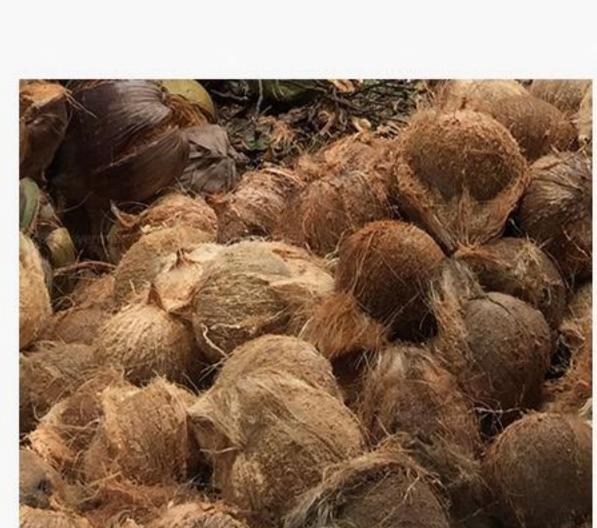
Empty fruit bunch (Briquetting)



Wood chip



Rice husk (Briquetting)



Coconut husk (Briquetting)

# Applications within industries and municipalities

The Powermax process is for industries and communities that wish to reduce their consumption of fossil fuels by replacing them with biomass while reducing their energy bills.

The typical application is the replacement of an existing burner by our dual-fuel burner for the total or partial substitution of fossil fuel.

#### Specifications of Powermax process

Power range	1 to 25 MW(biomass) 1 to 100 MW(total)	
Fuel	wood chips; other solid biomass	
Wood consumption	100 kg/h to 2400 kg/h per module	
Syngas LHY	1200Kcal/Nm³	

#### Benefits of Powermax solution

- Easy installation (small surface area)
- No modification of the existing equipment
- Flexible use (quick start and stop)
- Fully automated operation
- Easy tracking of power demands
  Operational safety
- Reliability and stability
- Cost-effective
- Reduction of environmental footprint
- Choice of the fuels depending on price development

### POLLUTANT EMISSIONS AT 6% O<sub>2</sub>, AND BIOCHAR

Particulates	<50 mg/Nm³	
NO <sub>x</sub>	<200 mg/Nm³	
Biochar	5-10% of inlet biomass weight according to biomass	

#### Integrated Biomass Solution

- The Powermax process allows total or partial substitution of fossil fuels (natural gas:propane, fuel oil) by solid biomass for industrial heat production. The gasifier produces syngas at a competitive price, compared to fossil fuels, and draws value from all types of solid biomass (clean wood chips, recycled wood, agricultural residues).
- The Powermax process innovation consists in combining biomass gasifier and specific dual-fuel burner without any syngas treatment. It is available in 1 to 25 MW range and allows fossil fuel combustion or any mixture of both.
- The innovating design of Powermax process brings a great flexibility with a 30%-100% power modulation allowing for an easy tracking of power demands.

  Fossil fuel
  Fuel oil, natural gas, propane

  Biomass gasifer

  Dual-fuel burner

  Boiler

The reactor is based on the principle of downdraft fixed bed gasification, where the solid is converted through drying, pyrolysis, oxidation, and reduction.

Heat

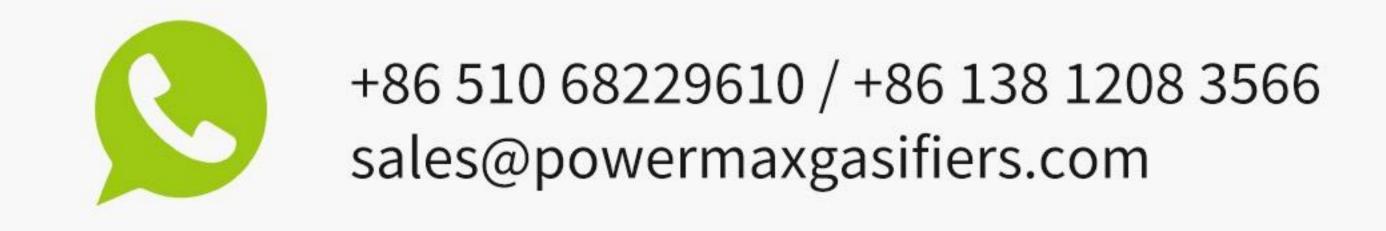
Steam, thermal oil,

hot water

- The patented dual-fuel burner is designed to burn the syngas coming directly from the gasifier at 400-500 °C with no need for any cleanup.
  - It is able to use either syngas or fossil fuels (natural gas, propane, fuel oil), alone or simultaneously.
- The smoke does not require any treatment after being generated from clean wood.
- Powermax technology can be installed with all kinds of boilers, ovens, or dryers, replacing fossil fuels burners without changes of the existing equipment.

1 - 1

Biochar





#### Biomass Gasification Boiler Solution Convert Your Coal Fired Boiler to Biomass Syngas Boiler

#### POWERMAX-UFBG(Updraft Fixed Bed Gasifier)

Design to use wet biomass(Moisture content max 55%) such as waste wood, bark, EFB and etc.



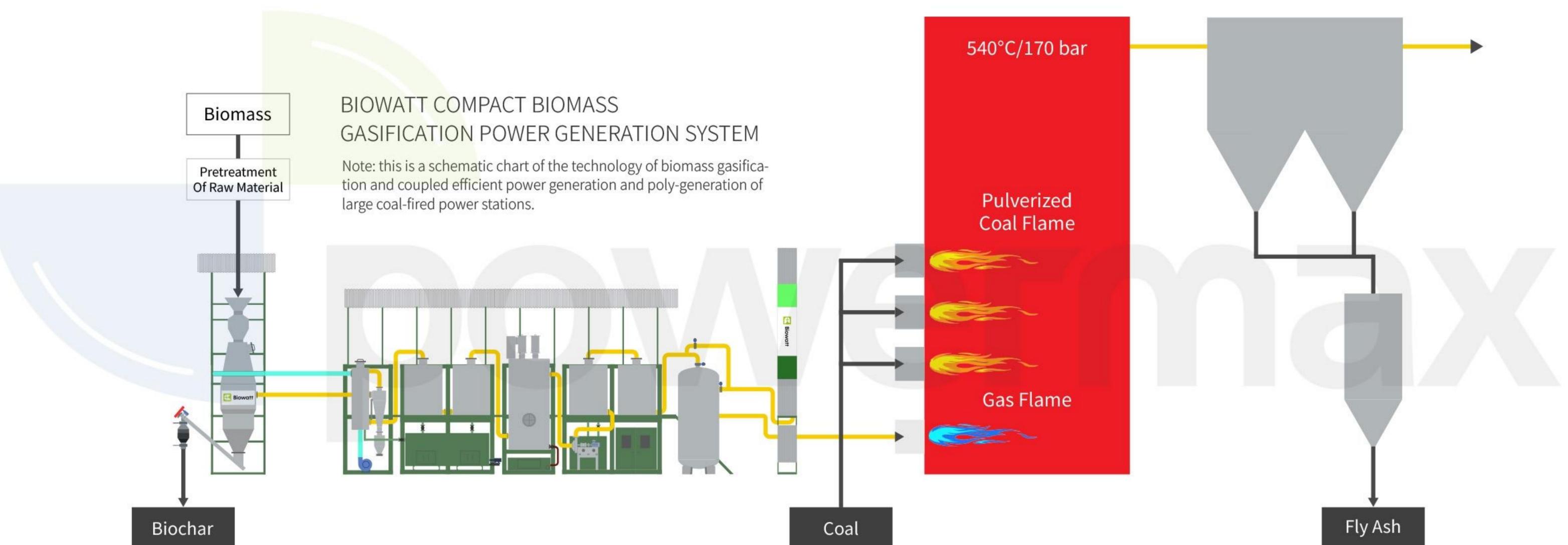
# Raw Material Raw Material Cooling Tower Water Pump Feed Bin Looding Position Feed Auger Water Pool Adh Motor Temporary Feed Bin Booster Fan Decomposition Furnace

# Biomass Gasification Coupled Efficient Power Generation And Poly-Generation Technology

#### Technical Principle

After gasification reaction of the biomass raw materials completing in furnace, the syngas is directly sent to the boiler of large coal-fired power station in the way of thermal gas after dedusted by the purification system, which is mixed with coal powder and utilized the original power generation system to achieve the purpose of efficient power generation.

This technology makes use of the large coal-fired power station units to convert biomass energy into electricity more efficiently, and the biochar generated from gasification can also gain considerable additional benefits, realizing the effective utilization of biomass, so as to alleviate the problems of energy crisis and greenhouse gas pollution.



#### Process Flow Chart

- Technical performance: raw material pretreatment process is simple and raw material is widely available; The tar will not condense when the gas enters the coal-fired boiler at a higher temperature, and the sensible heat of the gas is fully utilized.
- Environmental benefits: Due to biomass gas replacement of coal, it reduces CO2、SO2 emissions, while combustion of low calorific value gas in boilers reduces NOx emissions.
- Economy: After the biomass gas is added into the boiler system, the efficient combustion of gas forms a high temperature zone, which is conducive to the complete combustion of coal powder. While the coal power system remains efficient, the efficiency of biomass conversion into electric energy can reach 37%, higher than the existing biomass direct combustion power generation (22-30%). The biochar obtained from gasification can be used as high quality energy, soil conditioner, reducing agent, fertilizer slow-release carrier and carbon dioxide sequestration agent, which have higher economic benefits.
- Flexibility: This technical route is suitable for coal-fired power generating units of different capacities. Biomass gasification and reburning to generate power make full use of the original high-efficiency power generation equipment of the power station to ensure higher power generation efficiency in any scale.
- National policy: Biomass gasification power generation can monitored by gas flow rate, temperature and gas composition parameters to calculate independently and electricity and power grid enterprises shall settle separately. At present the way has been officially confirmed by the national development and reform commission (Implementation of Biomass Power Generation Coal Coupling of the Pilot), and it can obtain biomass electricity price subsidies.