

# ADVANCED SOLID BIOFUELS

with ANDRITZ steam explosion, torrefaction, and pelleting solutions

ANDRITZ

# Renewable energy for the future

Solid biofuels offer numerous advantages for decarbonizing energy production, serving as a sustainable substitute for coal. They have higher energy density and durability than conventional wood pellets, superior grindability, and moisture resistance. This allows outdoor storage and reduces fuel logistics costs. Advanced solid biofuels can replace coal without significant investments in existing plants, making them an attractive solution for reducing carbon emissions while maintaining efficient energy production. They facilitate the transition to renewable energy sources.

ANDRITZ's steam explosion and torrefaction technologies, followed by densification solutions ensure that these solid biofuels meet industry requirements while moving toward a more sustainable energy mix in the future.

ANDRITZ provides a comprehensive portfolio of products, solutions, and services. These include engineering, equipment supply, erection, and start-up of complete production lines. We also offer ongoing service support for both new projects (greenfield solutions) and the conversion of existing conventional pellet production facilities to produce advanced solid biofuels.

### TYPICAL APPLICATION

- **Steam explosion:** Drop-in fuel for coal-fired heat and power plants, especially useful because of high grindability and water resistance as well as pre-treatment for gasification.
- **Torrefaction:** Used in the steel and cement industries, where higher fixed carbon content is important.

### BENEFITS

- $CO_2$ reduction as an alternative to coal (fixed carbon content)
- Increased energy density
- Lower logistics costs and easier handling as compared to conventional pellets
- Water resistance and improved grindability
- Upgrade for low-value lignocellulosic residuals
- Retrofitting of existing conventional pellet plants is feasible
- Comprehensive service: engineering, equipment, automation, erection, start-up, and maintenance



## COMPARISON OF WOOD-BASED ADVANCED SOLID BIOFUELS (VALUES MAY VARY FOR DIFFERENT MATERIALS)

| Typical properties at 6% moisture content | Conventional pellets | Steam explosion pellets | Torrefied pellets |
|---|---|---|---|
| Net calorific value in GJ/t | 17.5 | 19 | 21 |
| Fixed carbon content in wt% (db) | 15 | 20 | 35 |
| Pellet bulk density in kg/m³ | 650 | 730 | 680 |
| Volumetric energy density in GJ/m³ | 11.6 | 13.9 | 14.3 |
| Mass yield of thermal treatment | 100 % | 90 % | 65 % |
| Pelleting power consumption | - | lower* | higher* |
| Need for a pellet-binder | no | no | yes |
| Durability | - | higher* | - |
| Hydrophobicity | - | much higher* | higher* |
| Grindability | - | higher* | much higher* |

*compared to conventional pellets

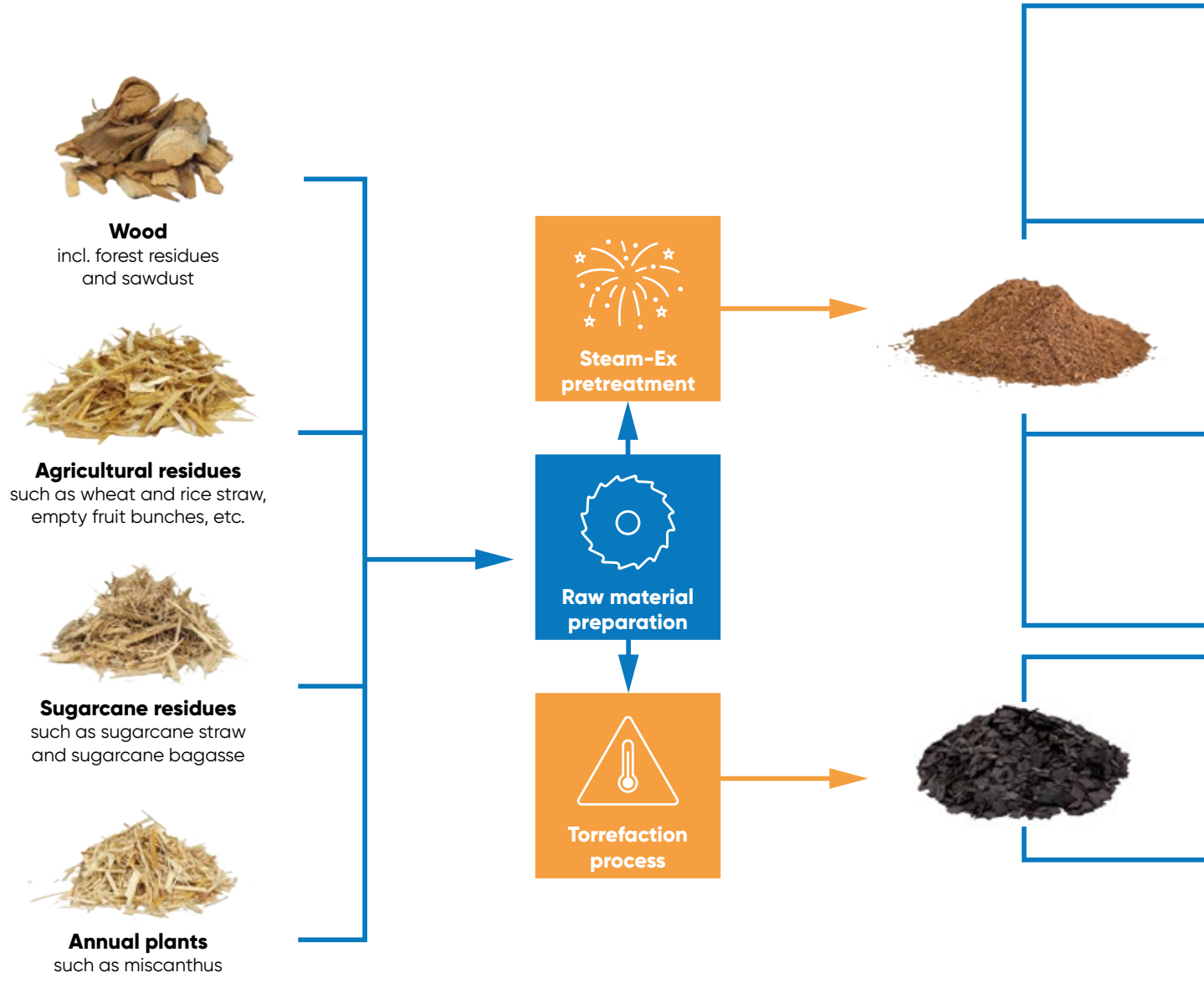


Advanced solid biofuels for various industries



# Various applications for $CO_2$ reduction

ANDRITZ is committed to advancing biofuel development as a leader in the green transition. Biofuels play a crucial role in reducing carbon emissions and providing a renewable energy source. Advances in technology and increased investment in biomass processing are expected to improve efficiency and expand their market in various industries.



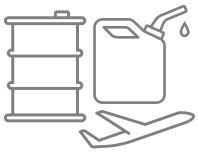


Pelleting



**Steam explosion pellets**
Drop-in fuel for coal-fired heat and power plants

Hydrolysis + fermentation + distillation



**2G bioethanol**
Fuel and platform chemical to produce sustainable aviation fuel (SAF) and various biochemicals

Anaerobic digestion



**Biomethane**
Fuel and platform chemical to produce various biochemicals like biomethanol

Gasification



**Syngas**
Platform for various syntheses to produce biofuel and biochemicals

Pelleting or briquetting



**Coal replacement**
in cement plants

**Pulverized coal injection**
(PCI; Replacement of coal in blast furnaces)

**Carbon sequestration**

# Drop-in fuels for coal fired plants: Steam-Ex process equipment

### RAW MATERIAL PREPARATION

ANDRITZ woodyard operations such as storage, debarking, chipping, and grinding provide raw material at the required particle size.

### DRYING

The ground feedstock is dried in an ANDRITZ belt dryer, which allows the use of low-temperature thermal energy, including waste heat.

### STEAM-EX CORE PROCESS

The ANDRITZ plug screw feeder transports the dried ground feedstock to the pressurized Steam-Ex reactor by creating a pressure seal. ANDRITZ offers several innovative solutions for adapting the plug screw feeder to different conditions and for minimizing maintenance costs. The biomass is pressurized inside the ANDRITZ Steam-Ex reactor with steam to around 15 - 20 bar(g) and continuously treated in this high-temperature steam atmosphere. The subsequent steam explosion in the ANDRITZ Steam-Ex discharger ruptures the lignocellulosic biomass structure, which yields a homogenous powder material. To minimize steam consumption and wear, the special design of the ANDRITZ Steam-Ex discharger has been continuously optimized since the early 2000s. The steam-exploded biomass is separated from the steam using a cyclone.

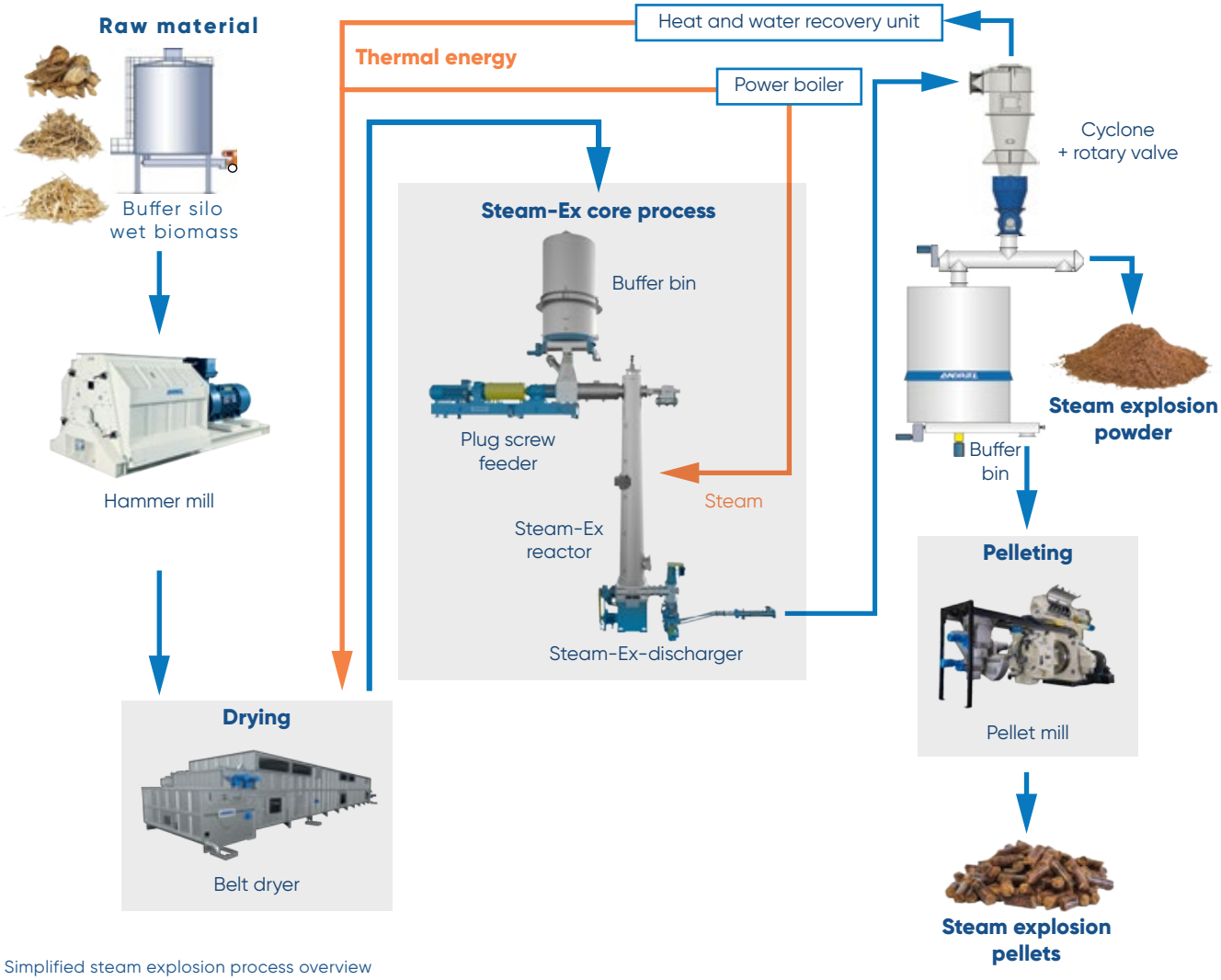
### PELLETING

ANDRITZ pellet mills are then used to efficiently densify the resulting steam explosion powder into steam explosion pellets.




Equipment technology based on many proven solutions worldwide






Simplified steam explosion process overview

## ADDITIONAL BENEFITS

- Simplified retrofitting for existing conventional pellet production lines
- Fine particle sizes after pretreatment for gasification processes
- Enhanced densification of the final product
- Potential use of low-temperature waste heatnance

# Replace coal in cement plants: Torrefaction systems

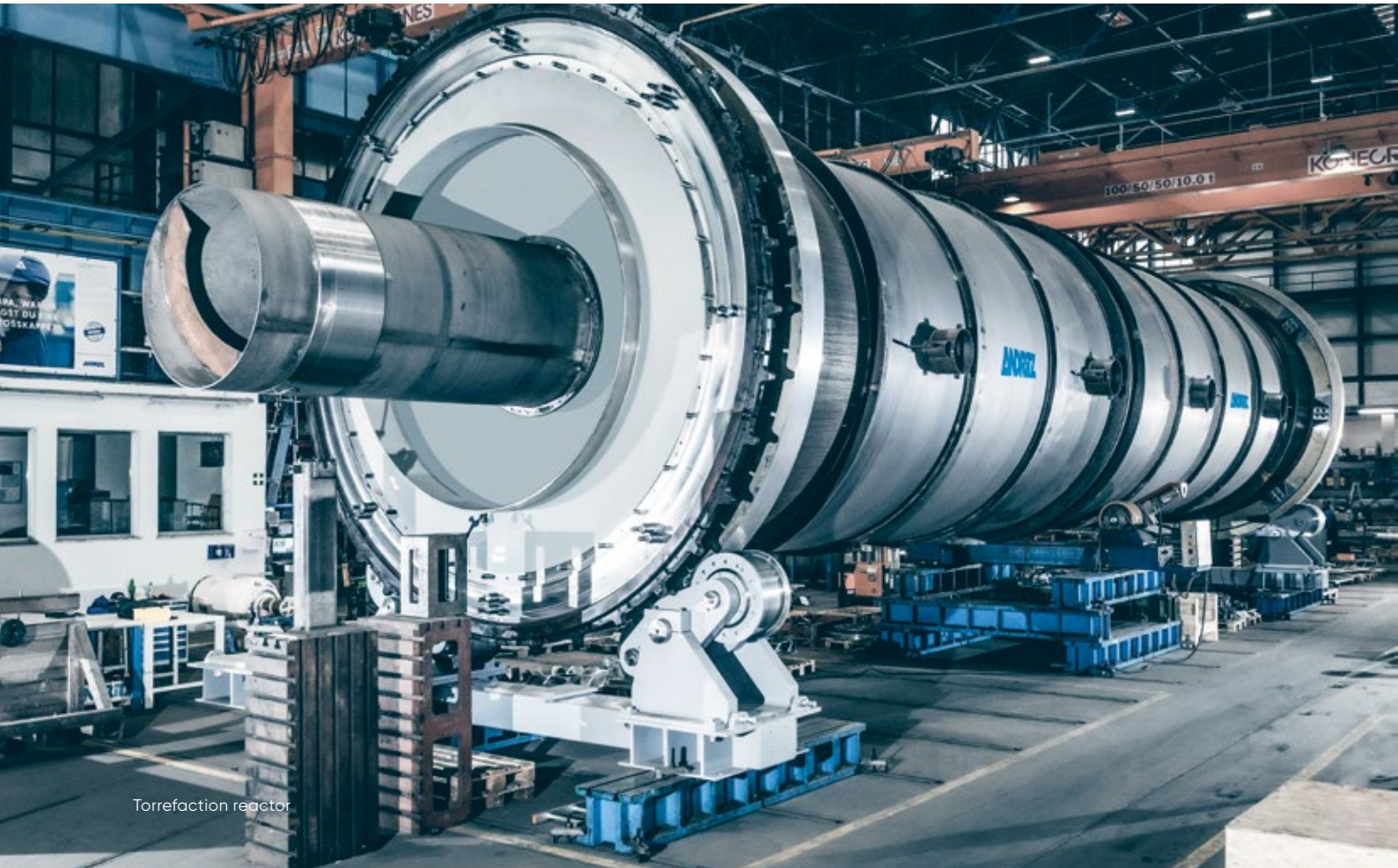
### RAW MATERIAL PREPARATION
ANDRITZ equipment for storage, debarking, chipping, and required grinding, provides raw materials at the specified particle size.

### DRYING
The feedstock is dried in an ANDRITZ belt or drum dryer utilizing available heat from the torrefaction process.

### TORREFACTION
Torrefaction is a controlled carbonization process that heats biomass to temperatures typically ranging from 250-330°C for a defined period and in the absence of oxygen. During this process, the hemicellulose is decomposed, and the low calorific components of the biomass are transformed into gas. This process occurs in a highly sophisticated drum reactor.

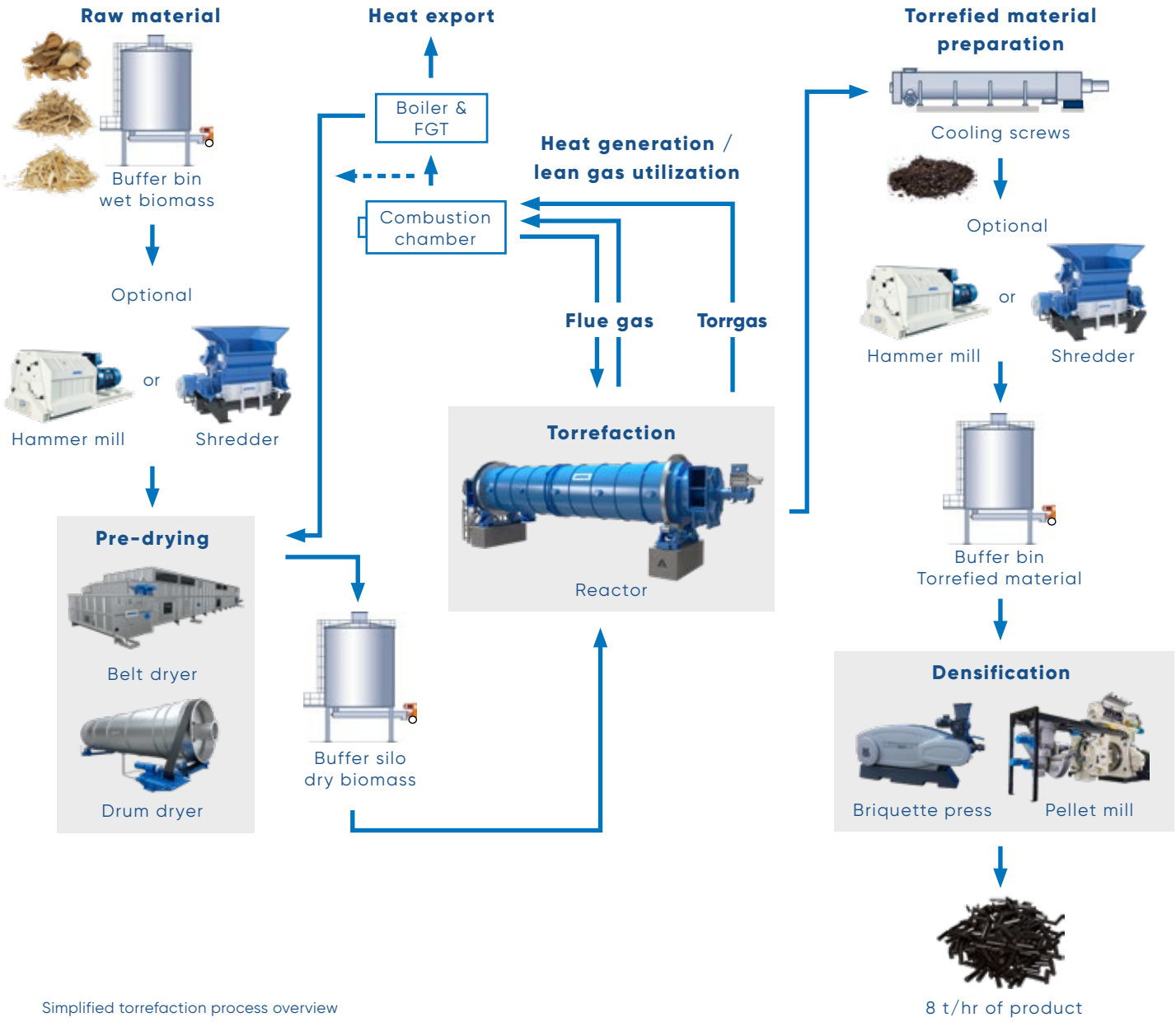
### DENSIFICATION
Depending on the applications, loose torrefied material will be densified through methods such as briquetting or pelleting.

### SCOPE
ANDRITZ can deliver a full process line solution for a torrefaction plant, supplying all the core processes from our existing technology portfolio, covering everything from raw material receipt and preparation, drying to NextFuel torrefaction reception, downsizing, densification processes, plant automation systems, and more.



Torrefaction reactor






Simplified torrefaction process overview

## ADDITIONAL BENEFITS

- Flexible use of feedstock residuals with various particle sizes
- High and adjustable carbon content for optimal replacement of fossil fuels
- Versatile uses for loose torrefied materials
- Energy autarkic process
- Potential use of low-temperature waste heatnance

# Advanced equipment for all biomass applications

All advanced solid biofuels can be downsized and densified using ANDRITZ solution.

ANDRITZ provides complete plant solutions for conventional pellet production, as well as densification technology for producing advanced solid biofuels. We offer a wide range of equipment and process island solutions for biomass processing, including downsizing and densification. These solutions are designed to meet specific needs and maintain high standards of efficiency, reliability, and innovation.

The ANDRITZ fine grinding hammer mill system creates homogeneous material ideally suitable for densification. Variable hammer speeds are available for optimized grinding, before the material is conveyed to the downstream processing.

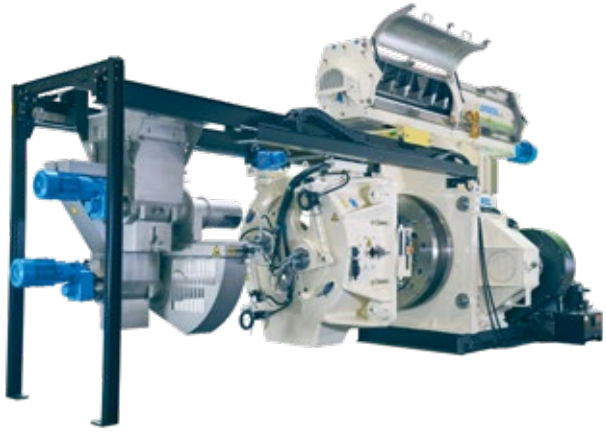
The ANDRITZ pelleting system provides reliable, efficient, and high-quality pellet production. Based on our diverse range of pellet mills, ANDRITZ matches the equipment to the raw material and required capacity for optimal performance.

**BENEFITS**

- Simple and safe handling
- Reduced transport cost
- Better storage capabilities
- Homogeneous fuel
- Potential use of low-temperature waste heatnance



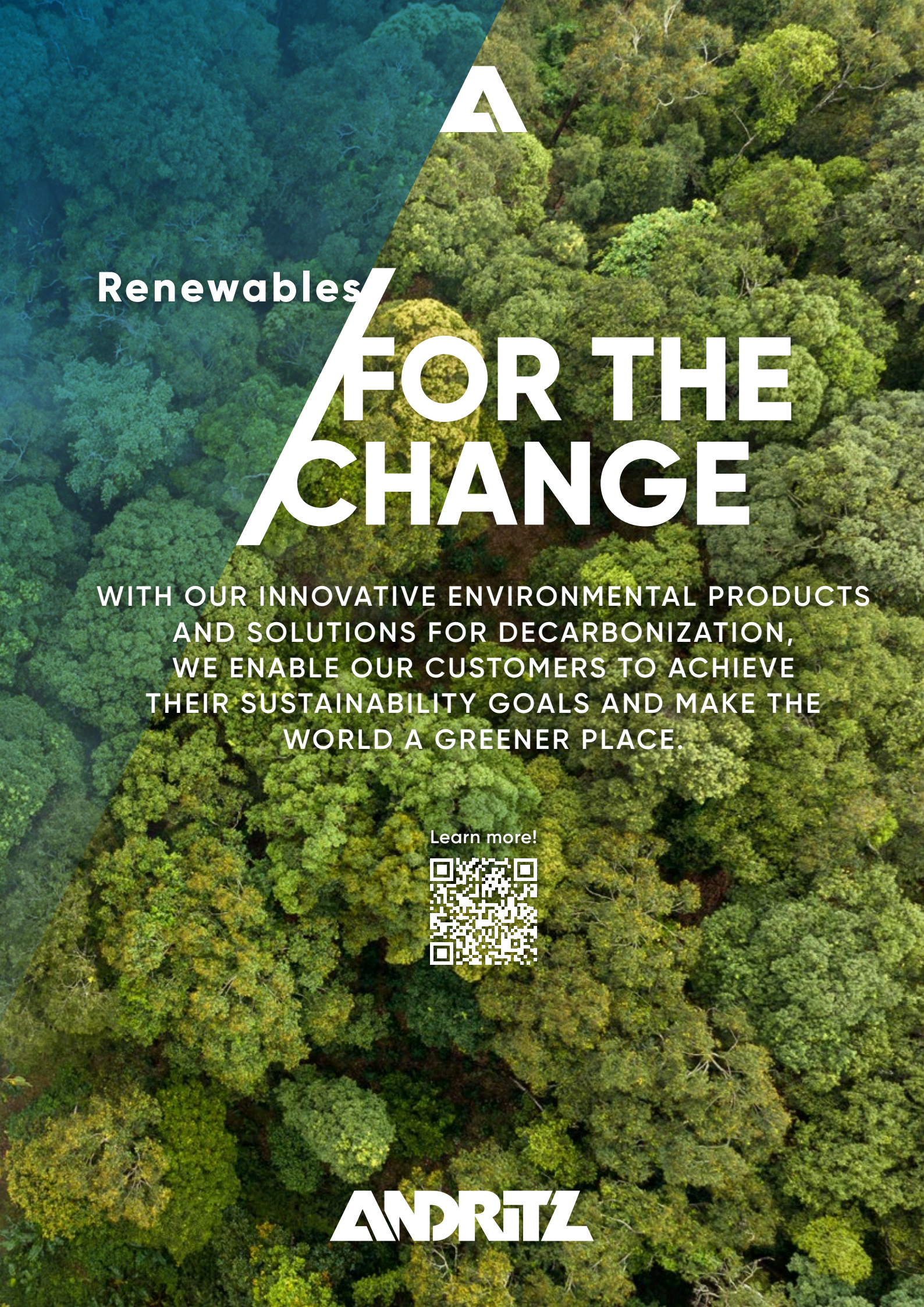

Hammer mill 43 for grinding



PM 30-6 for pelleting



26 LM III for pelleting


Renewables
FOR THE CHANGE
WITH OUR INNOVATIVE ENVIRONMENTAL PRODUCTS AND SOLUTIONS FOR DECARBONIZATION, WE ENABLE OUR CUSTOMERS TO ACHIEVE THEIR SUSTAINABILITY GOALS AND MAKE THE WORLD A GREENER PLACE.
Learn more!
ANDRITZ

## ANDRITZ GROUP

Growth challenges us. It pushes us to reach further and set new goals. We drive technology that transforms industries and shapes a sustainable future. Our innovative solutions make our customers successful and our planet greener.
**ANDRITZ. FOR GROWTH THAT MATTERS.**


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