

IBTC

**International Biomass
Torrefaction and
Carbonisation Council**

IBTC

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Torrefaction and
Carbonisation Council

IBTC-COUNCIL.ORG

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Biocarbon Terminology Version 3

Shaping the
Future of
Circular
Biocarbon.
Together.

Biocarbon

Both terms refer to a product from thermal treatment of biomass with very low volatile matter remaining in the carbon-rich solid product. The term charcoal is often used for materials that are the result of traditional kiln processes in which the energy of the discharged gases is not used or is only used to a very limited extent. The production of biocarbon, on the other hand, is based on a process with optimized mass and energy balance and the minimization of all emissions. (see Circular Biocarbon)

Biochar

Biochar is a charcoal-like pyrogenic biocarbon produced to become a carbon-rich sequestration material. It is applied in such a way that the contained carbon remains stored as a long-term carbon sink. In some cases, it has additional impacts such as soil quality improvement.

Biocoal

Biomass thermally treated to a mid level of devolatilization. It resembles the typical characteristics of steam coal and hence is a drop-in substitute for thermal coal. Usually it is produced in processes such as torrefaction, hydrothermal carbonization (HTC), steam explosion or pyrolysis. If the term, that has no clear definition on product specifications will prevail is still to be seen.

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Carbonisation

Carbonisation is the process in which the carbon content of the raw biomass is concentrated by thermally treating the biomass in an oxygen-free environment at temperatures typically above 450°C. This process activates multiple chemical reactions achieving the removal of H and O atoms from the biomass, leaving behind almost pure carbon and minerals (ashes).

Circular Biocarbon

An umbrella term proposed by IBTC: Circular biocarbon can be used as a generic term for all biomass-derived carbon products produced and utilized in a circular way from plant biomass. By the term may seem to be redundant at first glance, we propose the word “circular” not only to represent the carbon cycle that is closed in the short term when biomass is used, by absorbing the carbon released into the atmosphere by the next generation of plants through photosynthesis (dark reaction), but also to illustrate the clear focus to follow the principles of the circular economy.

These include sustainable sourcing, sustainable and efficient processing, using all components of the resource, avoiding waste streams, with a focus on optimizing environmental, social, material and economic values achieved through the use of innovative practices and technologies. Therefore the designation of a material as „circular biocarbon“ is a clear extension of the term „pyrogenic biocarbon“ used in the standards and confirms that this meets the compliance criteria of a regenerative circular economy.

Torrefaction

Torrefaction is a thermochemical conversion process which is performed under atmospheric pressure at temperatures between 200° and 350°C mostly in an inert condition (absence of oxygen). During torrefaction, moisture and some volatile organic compounds volatilize from the biomass leading to changes also in physical properties of the solid biomass.

Biochar or
Biocoal? What's
the difference?

Download your free copy of
Biocarbon Terminology now
and stay up to date with the
latest industry terms
and definitions!



Biocoal – the ideal drop-in substitute for steam coal

What is it

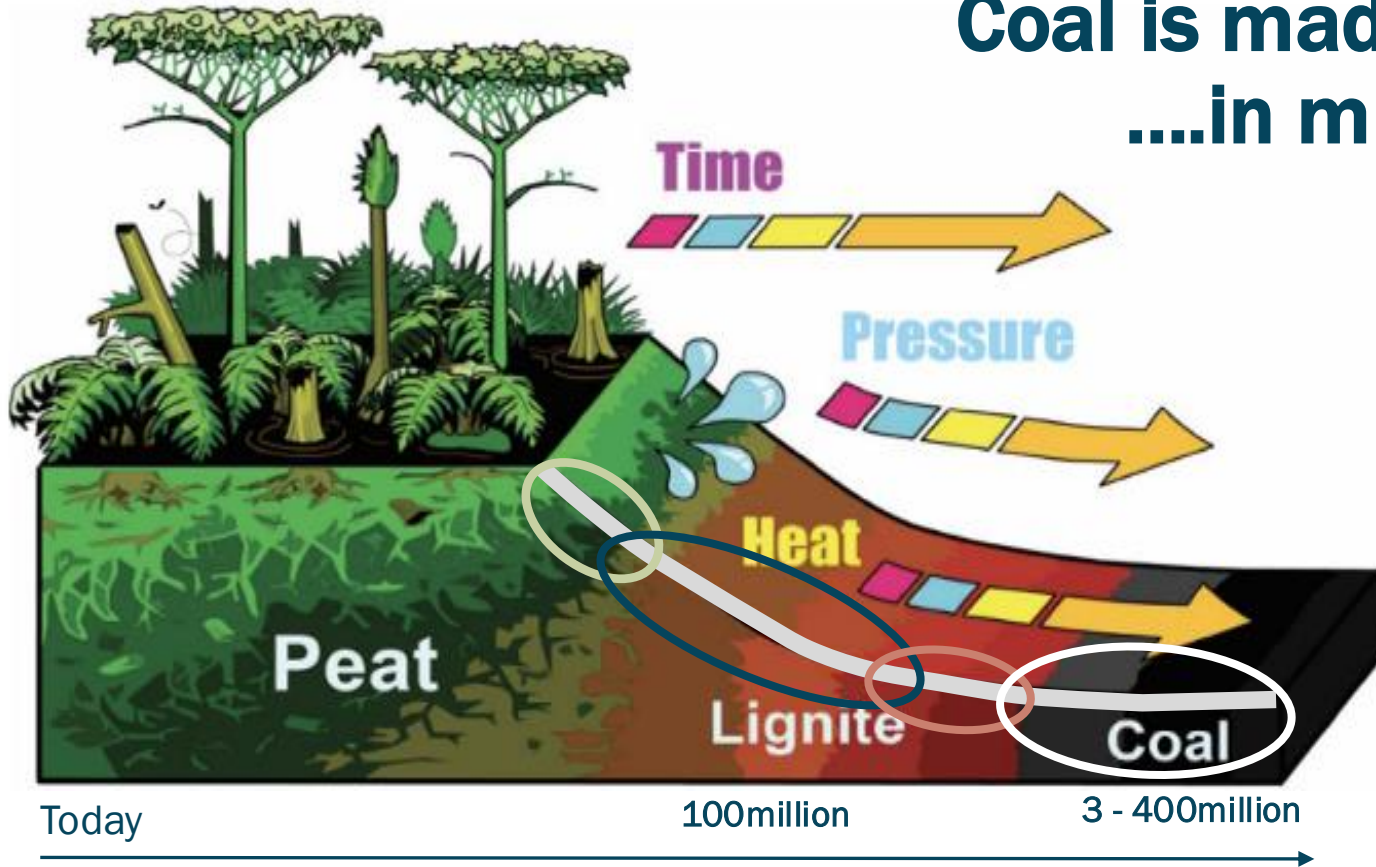
How to produce

Why and what for?

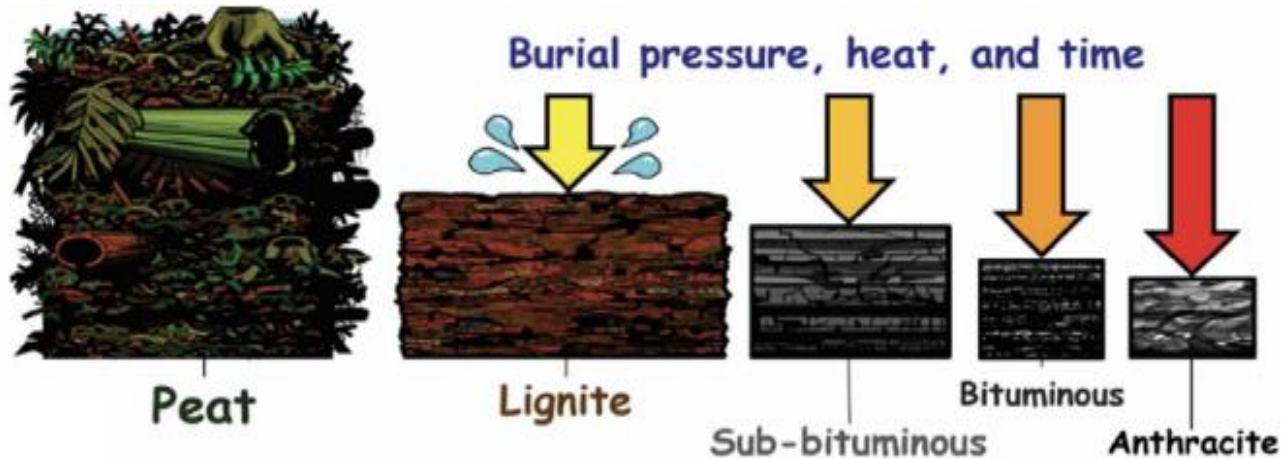
Status quo?

Coal is made of biomassin million of years

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	GCV	
	kJ/kg	kcal/kg
Steam Explosion	17000	4057
Torrefaction	21000	5012
Pyrolyses	25000	5967
Carbonisation = Charring	29000	6921
	33000	7876



...or within minutes
by technology and temperature

Is this a mature Technology?

A 6000 - year success story,
continued...

...but NOT in such traditional
or still unsustainable way

instead....



... by optimized Mass- and Energy Balance

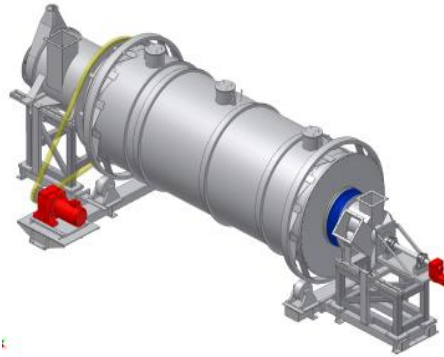
(at minimized material and energy waste)



Several suppliers at level TRL 8,5 to 9



Feedstock to Product



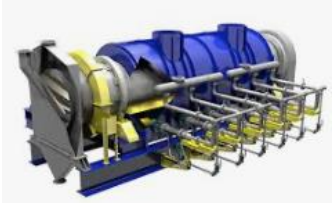
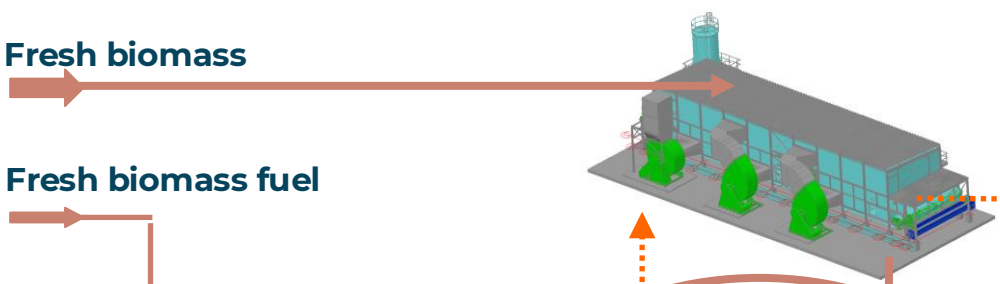
Low Value to High Value

- Every solid biomass can be torrefied, but currently underutilized materials such as forest residues, lowest grade wood chips and hog fuel, agricultural by-products and dedicatedly grown plantation biomass
- Minerals and ashes will only be reduced minimally, hence one of selection criteria

Different Pathways...

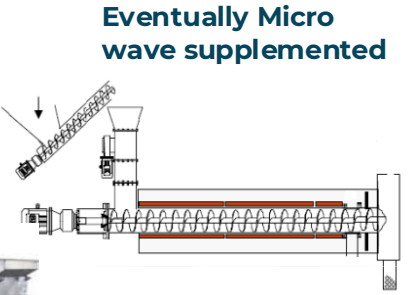
Fresh biomass

Fresh biomass fuel



Drum drier or calciner

Auger-screw type reactor

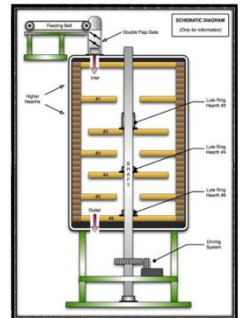


Eventually Micro wave supplemented

Vibrating belt



Multiple Hearth

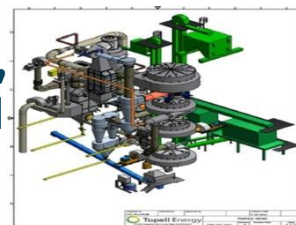


Batch reactor

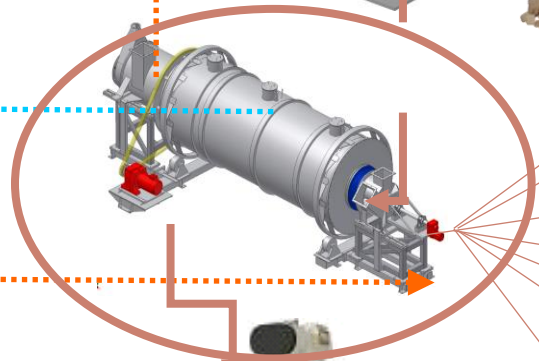
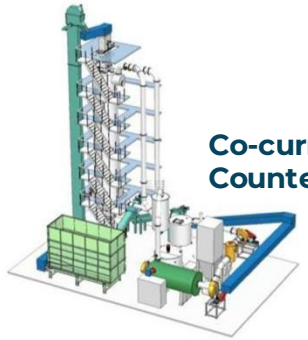


Moving bed reactor

Cyclone, Fluidized bed



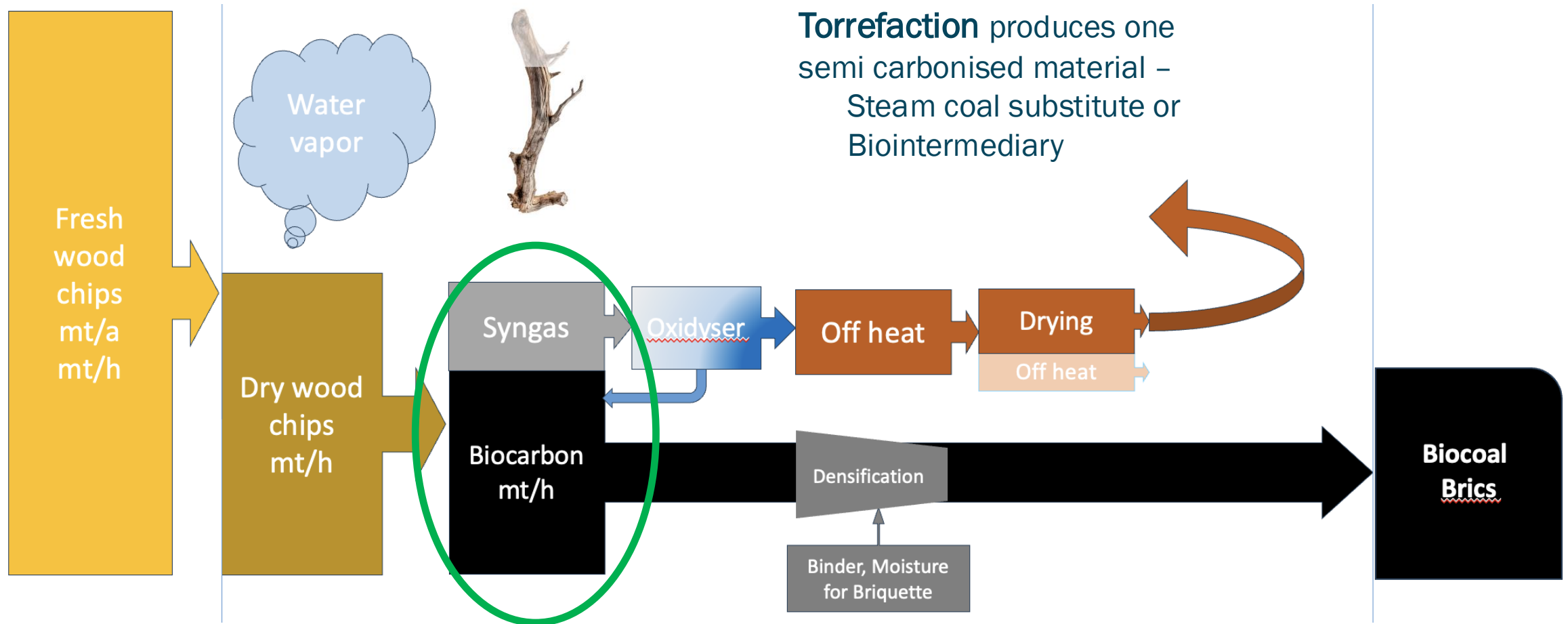
Co-current or Counter current



ENERGY SUPPLY
Biomass +
lean gas incineration



Different processing levels – different products



Torrefaction produces one semi carbonised material – Steam coal substitute or Biointermediary

1 tonne Biocoal requires 2,4 tonnes fresh wood 50% moist

Qualities

and



BIOCOAL

Replacing fossil coal for heat generation and gasification



BIOCHAR

A sustainable solution for carbon sequestration



BIOCARBON

Decarbonizing the metallurgical industry



form factors traded



Pellets
6 - 12 mm



**Piston or
Extrusion Briquetted**
40 - 100mm



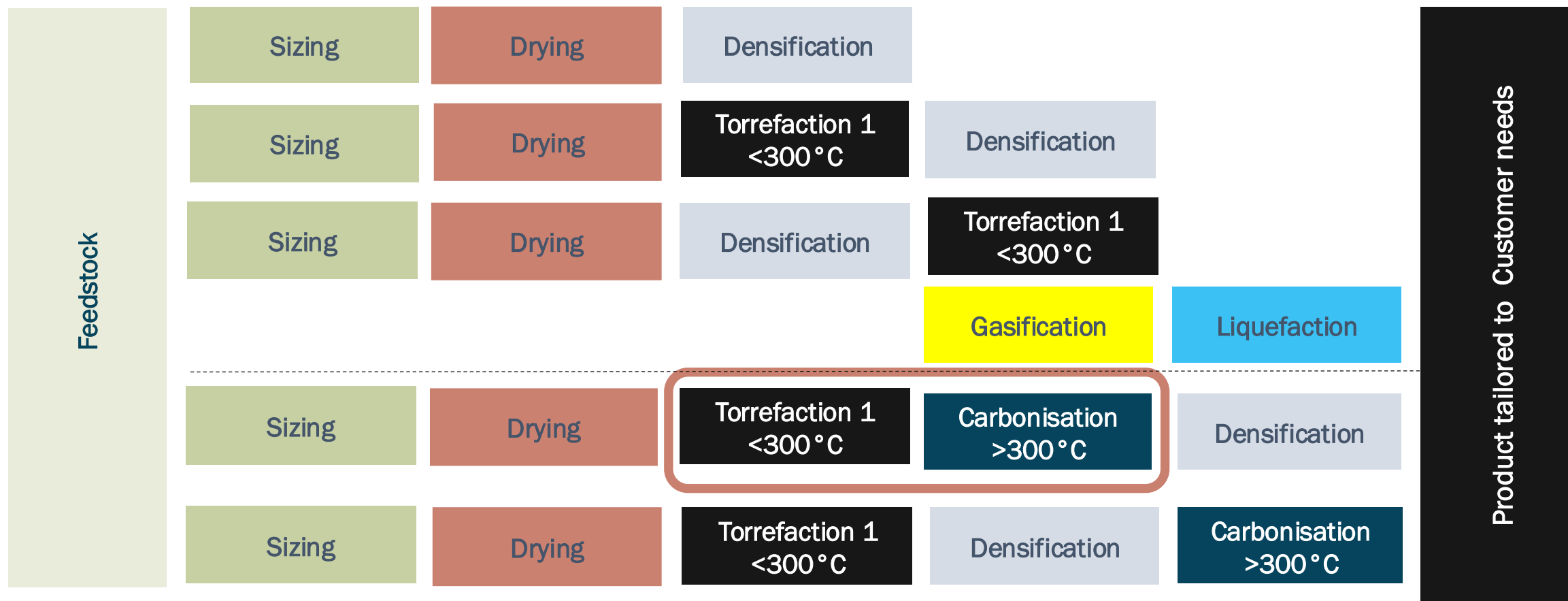
Agglomerated



Roller Briquetted
12 - 50mm

Lining up process steps in a biocarbon value chain

5 steps make the value chain from gate of first processing installation to final delivered product. The first 3 steps are unavoidably located at place of feedstock origin, final steps might as well be established at place of consumption.

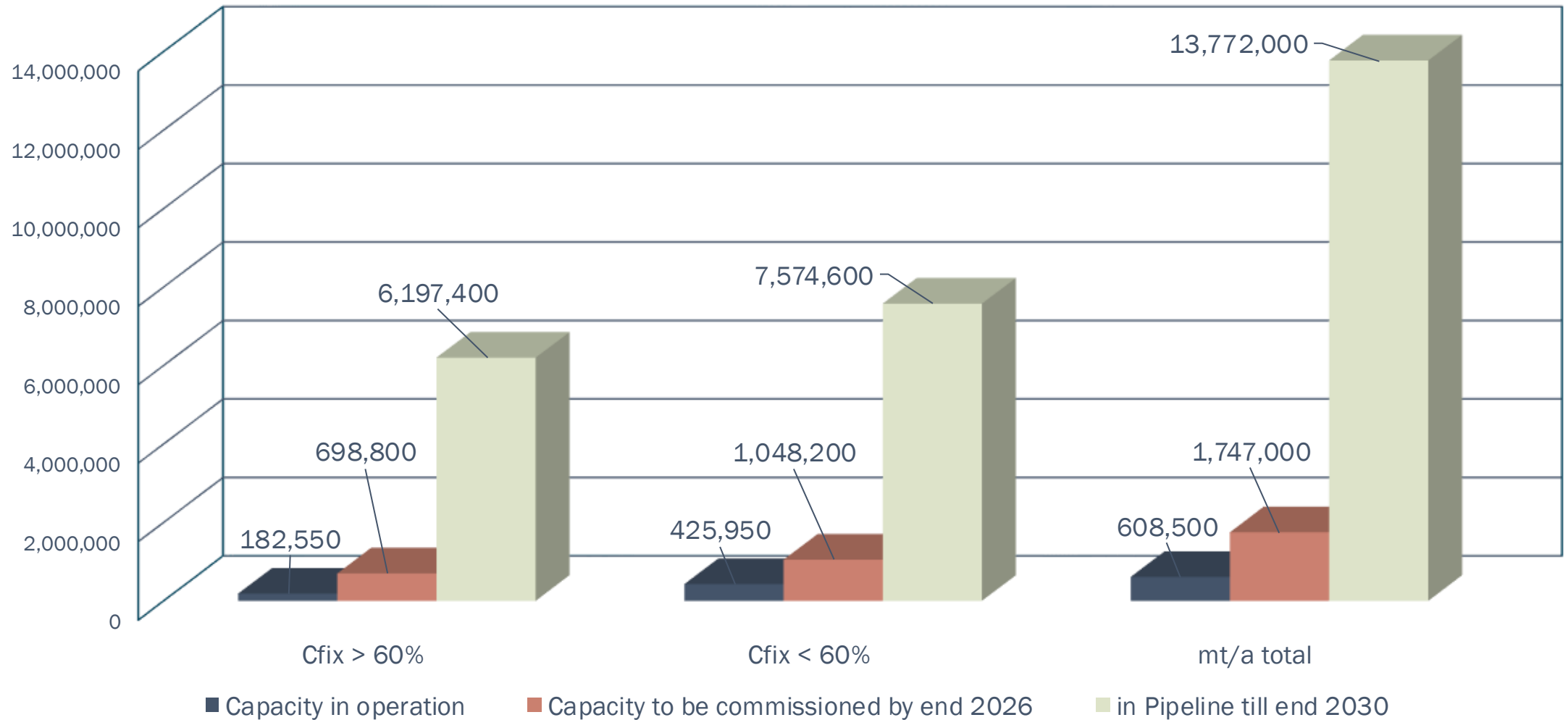


Production Capacity – operating & outlook

Capacity outlook mt/a



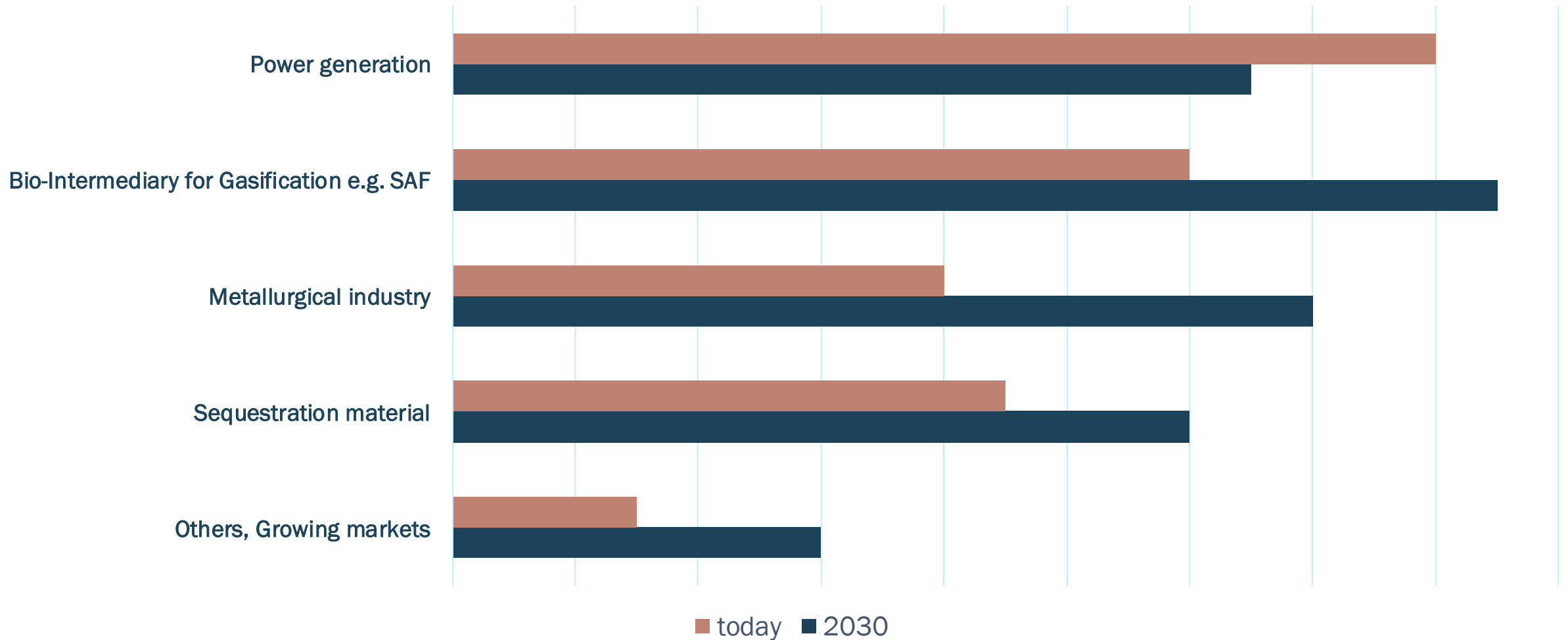
Capacity in operation, commissioned by end Of 2026, in pipeline till 2030



Data from IBTC members survey 2025.

Which applications drive the volumes globally

trends as seen by producers and suppliers



Data from IBTC members survey 2025.

Positive Experience in co-firing

Europe, North America

Confirmation of superior characteristics of torrefied pellets

No adverse effect on milling and combustion detected

Low dust formation

Torrefied biomass can replace coal in power plants

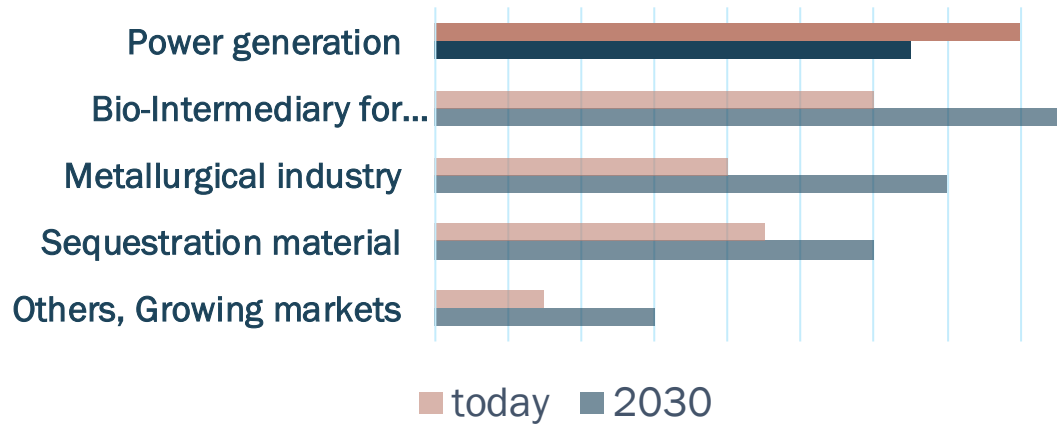


Many positive examples in co-firing 5-100%:

Vattenfall
Essent - RWE
GDF Suez - ENGIE
Dong
Portland General Electric
OPG-Thunder Bay

DONG Studstrup-3 experience

- Two units with total capacity of 714 MW_e and 986 MW_{th}
- Dedicated milling on MPS roller mill adapted for either coal or white pellets
- 200 tons of Andritz/ECN torrefied spruce pellets during 8 hours trial
- Co-firing share: 33 wt%
- Observations:
 - No dust formation during unloading
 - Sufficiently high durability; no issues with dust formation in chain conveyors
 - Normal Minimum Ignition Energy (MIE)
- ECN conducted lab-scale characterisation of pellets Source: ECN



Co-firing Biocoal in coal power plants



selected examples of potential Japanese consumers

Cfix < 60%



JAPAN POWER STATION	Prefecture	Fuel	Present	When Available
Haramachi Thermal Power Station		Coal	biomass	
Hekinan	Aichi	Coal		biomass
Hitachinaka (常陸那珂火力発電所)	Ibaraki	Coal		biomass
Ishikawa	Okinawa	Coal		biomass
Kashima	Ibaraki	Coal		biomass
Kin	Okinawa	Coal		biomass
Maizuru (舞鶴発電所)	Kyoto	Coal	biomass	-
Matsuura	Saga	Coal		biomass
Misumi	Shimane	Coal		biomass
Nagoya Power Plant		Coal	biomass	
Naie (奈井江発電所)	Hokkaido	Coal		biomass
Nakoso	Fukushima	Coal	biomass	
Nanao Ohta Power Station		Coal	biomass	
Nanao-Ohta	Ishikawa	Coal	biomass	-
Niihamanishi (新居浜西火力発電所)	Ehime	Coal		biomass
Oozaki Power Station		Coal	biomass	
Reihoku (苓北発電所)	Kumamoto	Coal		biomass
Sakata	Yamagata	Coal	biomass	-
Sendai	Miyagi	Coal		biomass
Shin-Onoda Power Station		Coal	biomass	
Shinchi Thermal Power Station		Coal	biomass	
Sunagawa (砂川発電所)	Hokkaido	Coal		biomass
Taketoyo Thermal Power Station		Coal	biomass	
Tomato Atsuma	Hokkaido	Coal		biomass

In conclusion



- Our products represent a 6000 years success story, now perfectly efficient produced
- Established processes with an optimized mass and energy balance with minimized material and energy waste
- Circular Biocarbon is the easiest/cheapest pathway to substitute fossil carbon in all coal applications: power, processing, reduction, anode etc and can as well sequester atmospheric Carbon in permanent sinks
- Today mostly energy coal substitute. Growing consumption in processing industry and as intermediary product for carbonization or liquefaction (SAF)
- Very appealing project IRR if sustainable feedstock is secured
- Numerous technology providers on market
- The Number of industrial size plants is rapidly growing (CAGR 67%)



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Please address us

- to learn more about Circular Biocarbon
- to pre-discuss project ideas
- to be brought in touch with project developers and technology suppliers
- to join the Circular Biocarbon community
- and to create value from the just starting Circular Biocarbon revolution in energy & fossil carbon intense industries
- to become part of the global community as a member of IBTC



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Shaping the Future of Circular Biocarbon.

Together.

Join us today

International Biomass
Torrefaction and
Carbonisation Council (IBTC)

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