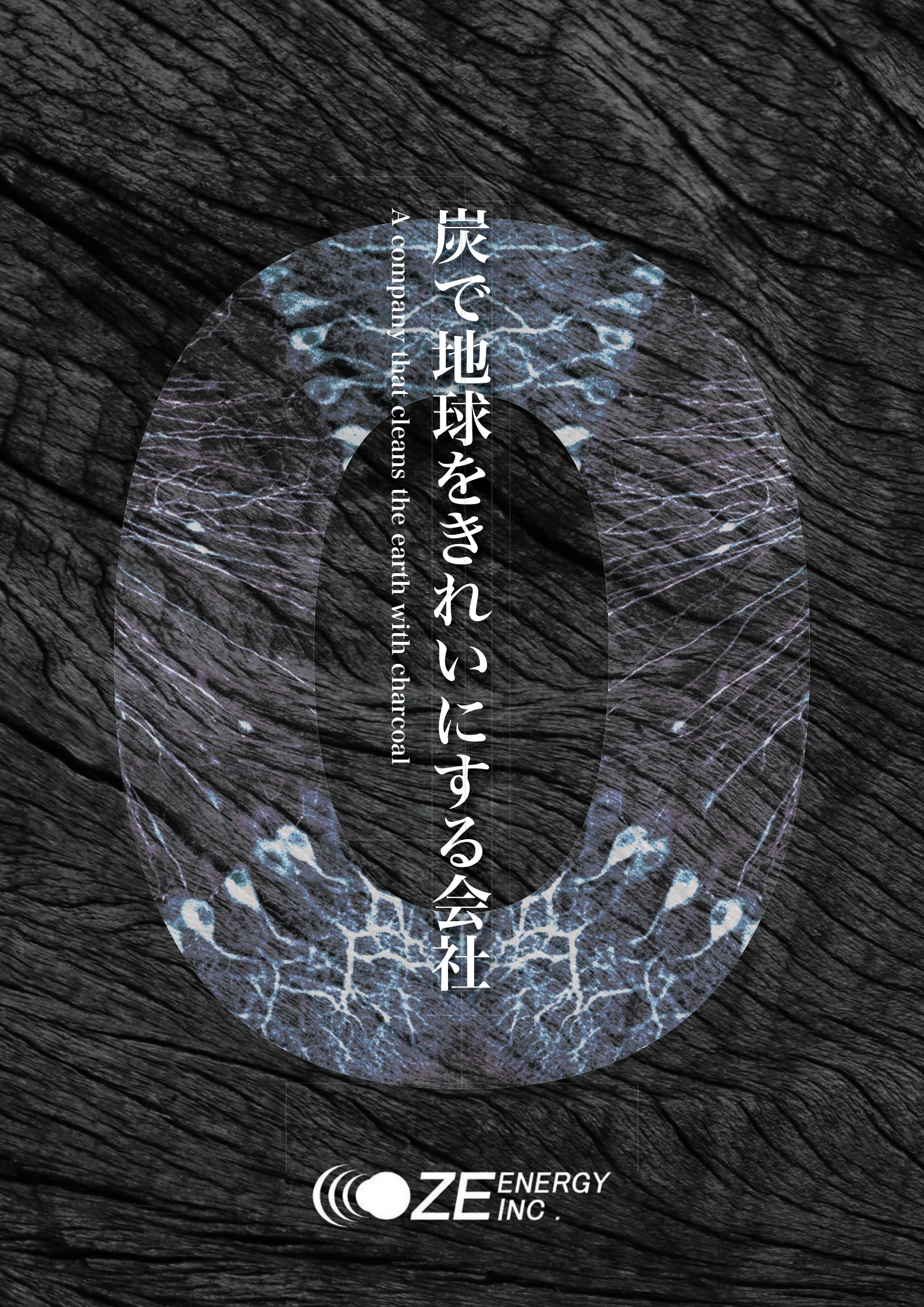
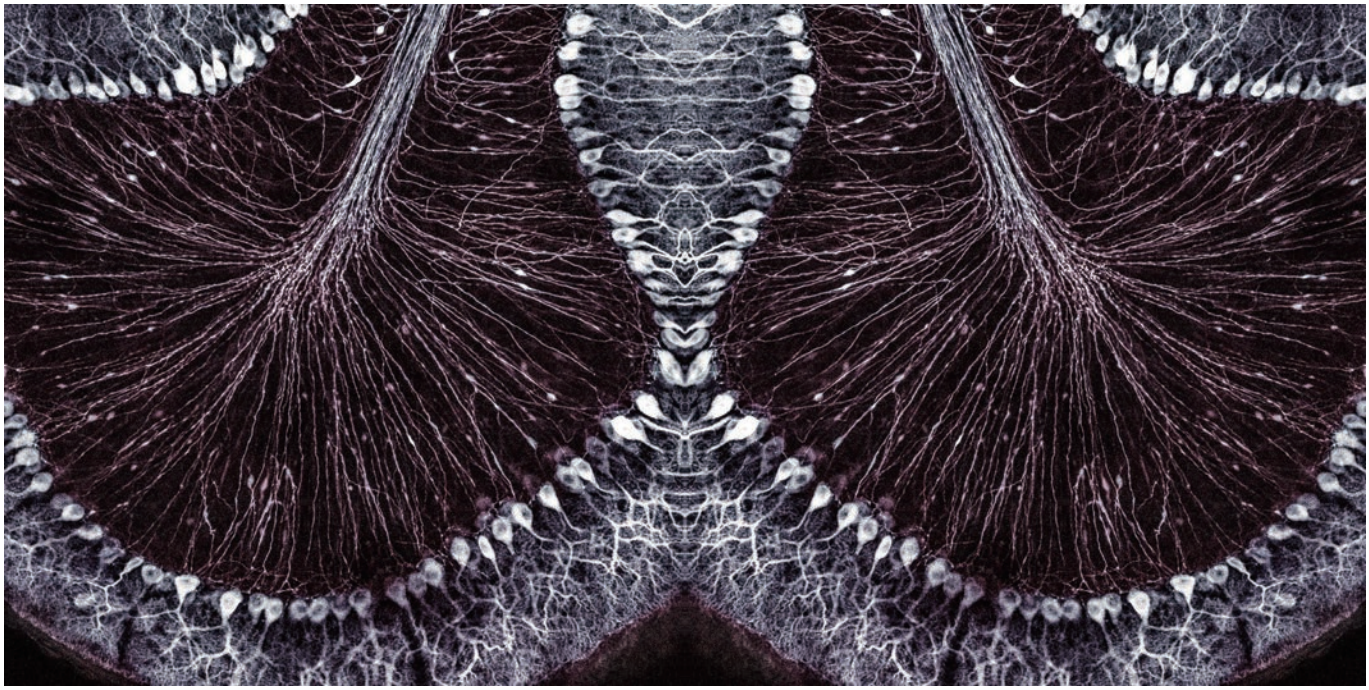


# 炭で地球をきれいにする会社

A company that cleans the earth with charcoal

ZE ENERGY INC.

# Corporate philosophy



「Apex」 Archival Pigment Print 100×97.3cm
Satoru Yoshioka

**With a global perspective, we aim to contribute to the realization of a decarbonized and SDGs-achieving society by providing unique environmental technologies and services. Specializing in environmental issues, renewable energy, and water/food/agriculture, we strive to become a global-scale, wide-area "*synaptic enterprise" that achieves regional development, resource sustainability, and customer prosperity.**

## Toward becoming the brain cells of the Earth as a "synaptic enterprise"

Nowadays, the world is linked in real time both economically and in resources—making not only Japan as a nation but even individuals anywhere extremely connected to the global community. This is an era in which growth can no longer be expected by considering only one's own country or what is immediately visible.

Looking at the world, issues over environment, energy, food, and water undeniably exist, and there are calls for a shift from mass production and mass consumption to an era of high-value-added appropriate-quantity production and consumption. ZE Energy, guided by its corporate philosophy, must broaden its perspective to the entire planet and take action on these issues as members of Spaceship Earth.

We possess proud technologies cultivated over more than 30 years, including carbonization and gasification, as well as wood biomass power generation that has been further developed from those technologies. By incorporating superior technologies from other companies and promoting applied services, we believe that we can contribute to resolving the issues at hand. Domestically in Japan and internationally, through collaboration with local governments and local businesses, we promote the "local production for local consumption" model from the perspectives of resources, the environment, the economy, and culture.

By organically linking our technologies and those of other companies with regional characteristics, we also achieve effective resource utilization and waste resource regeneration. At the same time, by generating small-scale energy and effectively utilizing waste heat and CO2, we create added value in traditional primary industries such as forestry and agriculture. This generates new employment, revitalizes local communities, and enables the achievement of a sustainable society. We are not merely one company. Like the brain cells of the Earth, we must connect with other companies and regions, collaborate to contribute to customer prosperity, and act as members of Spaceship Earth for the sake of the children of the future.

* Synaptic enterprise:
An original term referring to an organizational body in which, like synaptic cells in the brain, companies transmit and receive information while linking with one another, with this corporate collaboration functioning like brain cells to propel economic activities (i.e., Matsushita theory); the artistic photograph seen here depicting brilliantly colored nerve cells as viewed through an electron microscope is a collaborative work by photographer Satoru YOSHIOKA and neuroscientist Hermina NEDELESCU, PhD, in cooperation with the Neurobiology Research Unit at the Okinawa Institute of Science and Technology (OIST).

## ZE Energy: Registered the trademark “Zero Emission” and upholding it as corporate philosophy

ZE Energy's predecessor was a carbonization equipment manufacturer. Since founding in 1987, the company has pursued research into “soil improvement using charcoal” and has addressed environmental challenges such as resource recycling. At that time, almost no companies in Japan were confronting environmental issues head-on. The vision was to effectively utilize waste that had been discarded as garbage, reduce waste to near zero, recycle it as a resource, and create an ideal circular model that benefits both the Earth and industry. The mission envisioned in those days remains unchanged even after nearly 30 years. From carbonization equipment to biomass resource regeneration and biomass power generation, ZE Energy's initiatives have expanded and undergone new evolution with the changing era. As a pioneer in environmental technology, to remain true to its founding spirit, the company registered the term “Zero Emission” (i.e., reducing the burden on the Earth to as close to zero as possible) as a trademark and has upheld it as its corporate philosophy.

# Mission

## Turning all biomass waste into carbon resources toward a “zero-waste society”

As a sustainable resource supplier positioned to become the 2050 standard, we discover value in discarded items and work to realize a circular society for biomass resources using carbonization technology in Japan and worldwide.

# Vision

## Constructing carbonization centers nationwide in Japan to establish regional resource circulation systems

Biomass waste generated within each region is carbonized for effective utilization as biochar and conversion to carbon credits. By further forming it into solid fuel, it serves as an alternative energy source to coal and coke, contributing to $CO_2$ emissions reduction.

# Value

### Sustainability

By utilizing local resources in a circular manner, we generate renewable energy such as biomass power generation, and through the resource regeneration of waste, we fulfill the responsibility to help solve environmental problems and keep the Earth clean for the future.

### A community-based approach

We provide new infrastructure and energy solutions tailored to regional characteristics, advancing sustainable regional and urban development together with each region.

### Innovation and technological capabilities

We leverage cutting-edge technologies to realize efficient and innovative energy generation, creating new value from what has hitherto been discarded as waste.

# Social problems to be solved

- **Global warming caused by carbon dioxide and methane**
- **Air pollution by open burning and other sources**
- **Economic destabilization by climate change**
- **Strain on waste disposal facilities and illegal dumping**

Mass consumption of fossil fuels is accelerating global warming and climate change is causing natural disasters. This results in an economic loss and instability of the global economy. In developing countries, open burning of waste is releasing

## Solving problems by carbonizing waste

- **Drastically reduce fossil fuel use by spreading carbonization centers that utilize biomass.**
- **Reduce greenhouse gases in the atmosphere by carbonizing waste for carbon fixation.**
- **Build a system for reducing $CO_2$ emission by using renewable energy.**

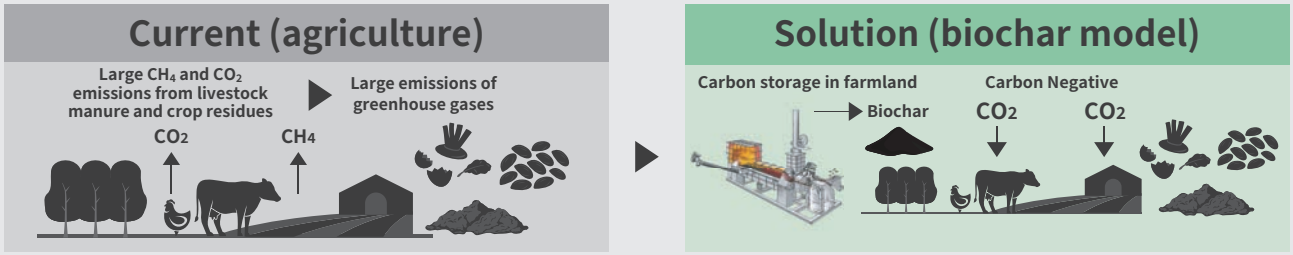
Greenhouse gases are reduced by carbonizing biomass resources at the carbonization centers and using them as biochar or alternatives to fossil fuels. Moreover, carbonizing waste enables harmless safe disposal and CO2 reduction.

### Growth-oriented carbon pricing

**In addition to the existing global warming tax, Japan's carbon tax system is scheduled to be expanded in stages in the framework of GX (green transformation); it will become mandatory for large businesses above a certain size to participate in the emissions trading scheme (GX-ETS) from April 2026 and the fossil fuel levy will be introduced in FY2028.**

| Launched from | Program | Summary |
|---|---|---|
| FY2026 | Emissions trading (GX-ETS) | A full-fledged implementation of a system in which large businesses trade emission allowances in excess or shortage from a set limit. |
| FY2028 | Carbon levy | Charges are levied on fossil fuel importers and related entities according to their emissions. This is practically a new carbon tax. |
| FY2033 | Paid auction | Power generation companies buy emission allowances from the government. |

# Biochar (applied to farmland) carbon credit model

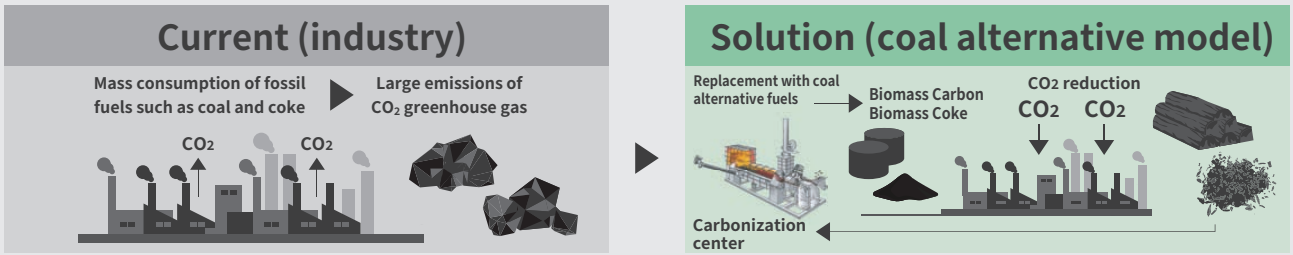



**A model in which $CO_2$ absorbed by plants is carbonized and buried in the ground to prevent its release into the atmosphere for hundreds of years.**

❶ **Tokyo Stock Exchange's carbon credit market: J-credits, mainly traded bilaterally (one-on-one negotiations) before, are traded just like stocks.**

❷ **Bilateral trading (direct deal): A business makes an off-market deal with a credit originator (e.g., farmer and municipality). Even now, this type of deal is often chosen for credits with compelling narratives like biochar or bulk purchases.**

# Biomass Coke (coal alternative) model




## Coal alternative models and relationship with credits by industry

❶ **Electric power companies: Biomass co-firing for coal-fired power plant: A model in which wood pellets or other biomass is fired with coal at power plants.**
**Mechanism: Burning plant-derived fuels is not counted as $CO_2$ emission (carbon neutral) and thus a cut in coal use equals reduction in emissions.**
**Credit: The company has the reduced emissions certified by J-credit or any similar program and uses or sells such amount as an emission allowance.**

❷ **Steel manufacturers: Using biochar instead of coke: A large amount of coke (coal baked in the absence of air) is used as a reducing agent in steel production. Research is underway for replacing the coke by biochar.**
**Mechanism: Using plant-based charcoal (biochar) instead of coal as a carbon source reduces $CO_2$ in the whole production process.**
**Credit: Major steel companies are aiming at establishing this technology and, in the long run, enhancing their product value as low-carbon steel (green steel) as well as creating credits.**

❸ **Foundries: Alternative to carbon in cupolas and furnaces: In the casting process for melting metal, coal-derived products are used as fuels and additives.**
**Mechanism: Carbon materials used for casting are replaced by charcoal derived from woody biomass.**
**Credit: The whole industry is promoting registration with J-credit. Small foundries are considering putting their reduced emissions together to create a credit.**

# Biochar (applied to farmland) carbon credit model

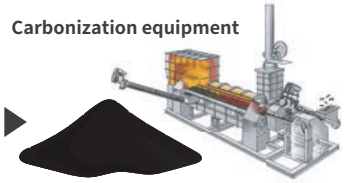
**Unused biomass waste, such as crop residues, food residues, and livestock manure, is carbonized at carbonization centers to be installed across the country and recycled as biochar. Carbon fixation by burying in farmland will reduce both waste and greenhouse gas emissions. In the agricultural sector, decarbonization is accelerated for resource and land utilization, government request, and new business opportunities. This sector is playing an important role in achieving carbon neutrality by 2050.**

## Crop residues, food residues, and livestock manure

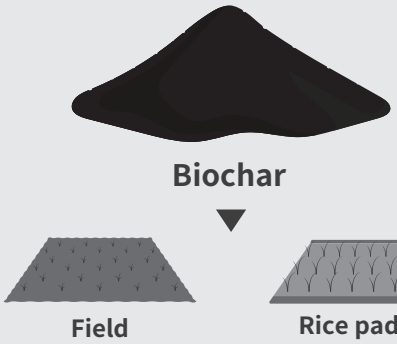
Bird feces 13M t/year | Cattle manure 83M t/year | Food residues 17M t/year | Rice husks 14M t/year

## Large $CO_2$ & $NH_4$ emissions

Livestock manure



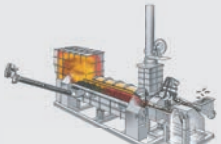

Biochar




Decarbonization by burying biochar in farmland

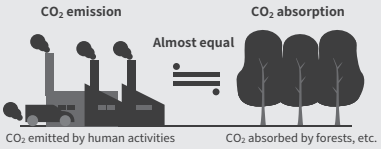
**Carbon fixation using biochar**

Crop residues, food residues, rice husks, livestock manure, etc.



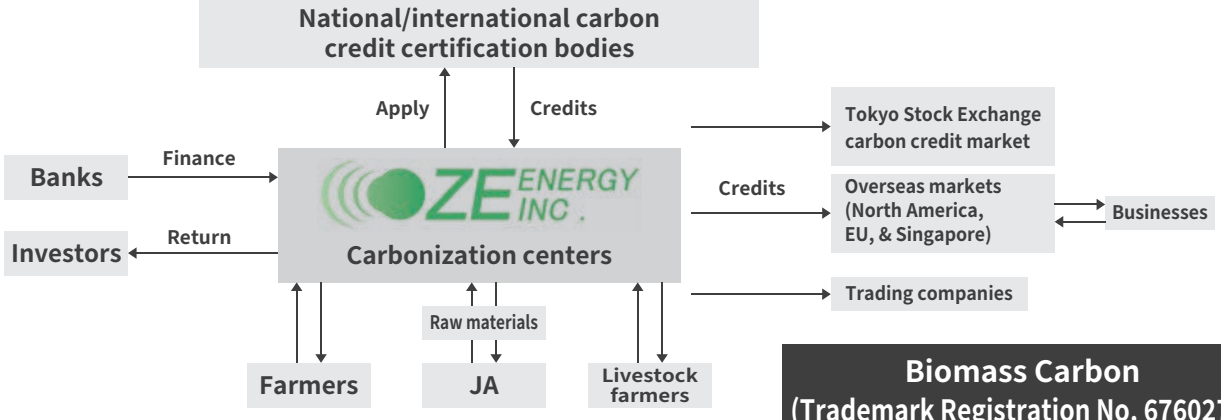
Nationwide carbonization centers

Pellets and biochar




Carbon neutral

## Biomass Carbon carbon credit model



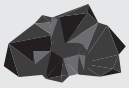

**Biomass Carbon (Trademark Registration No. 6760272)**

# Biomass Coke (coal alternative) model

**Woody biomass waste, unused wood, and scraps can be turned into Biomass Coke and used as alternatives to fossil fuels. Using Biomass Coke in the fields of steelmaking, casting, cement, and power generation leads to reduction in both waste and greenhouse gas emissions. Biomass Coke helps cut $CO_2$ emissions while holding down capital investment. It is a practical means of decarbonization that works promptly, just like electric furnaces, hydrogen reduction, CCUS and other advanced technologies.**

Global coal consumption
**8.7B t**

Coal/coke

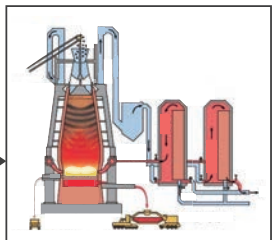


Japan's annual imports
**210M t**

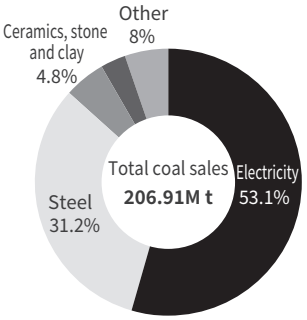
## Reasons for acceleration in steel industry

① Industry image
② Request from the government
③ Carbon tax burden
④ International competition

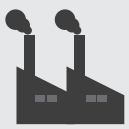
**Coal must be phased out by 2050.**



20M t/year
**Blast furnace**




Source: "Changes in Japan's coal sales by industry" by JCOAL



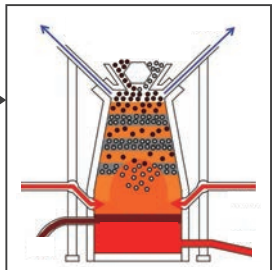
Factory: 30M t

Coal power plant: 110M t

Steel company: 70M t

**Large $CO_2$ emissions**

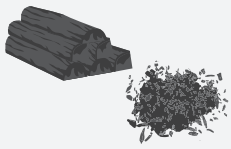
**Decarbonization by replacement**



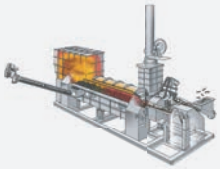
1M t/year (Japan)
**Cupola**

**Decarbonization by replacing fossil fuels**

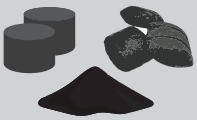
- Automakers
- Foundries



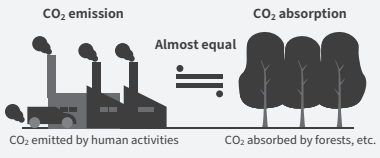
Logs, wood chips, etc.



Nationwide carbonization centers



Biomass Carbon
Biomass Coke
Briquette




Carbon neutral

## Biochar Coke carbon credit model


Coke

National/international carbon credit certification bodies

Apply
Credits

Banks
Finance
Return

Investors
Finance
Return

Sponsors/ JV partners
Finance
Return

ZE ENERGY INC.
Carbonization centers

Supply materials
Buy/provide

Biomass Carbon
Biomass Coke
Buy

Credits

Government agencies

Electric power companies
Steel companies
Foundries

Trading companies

Credits

Carbon credit market

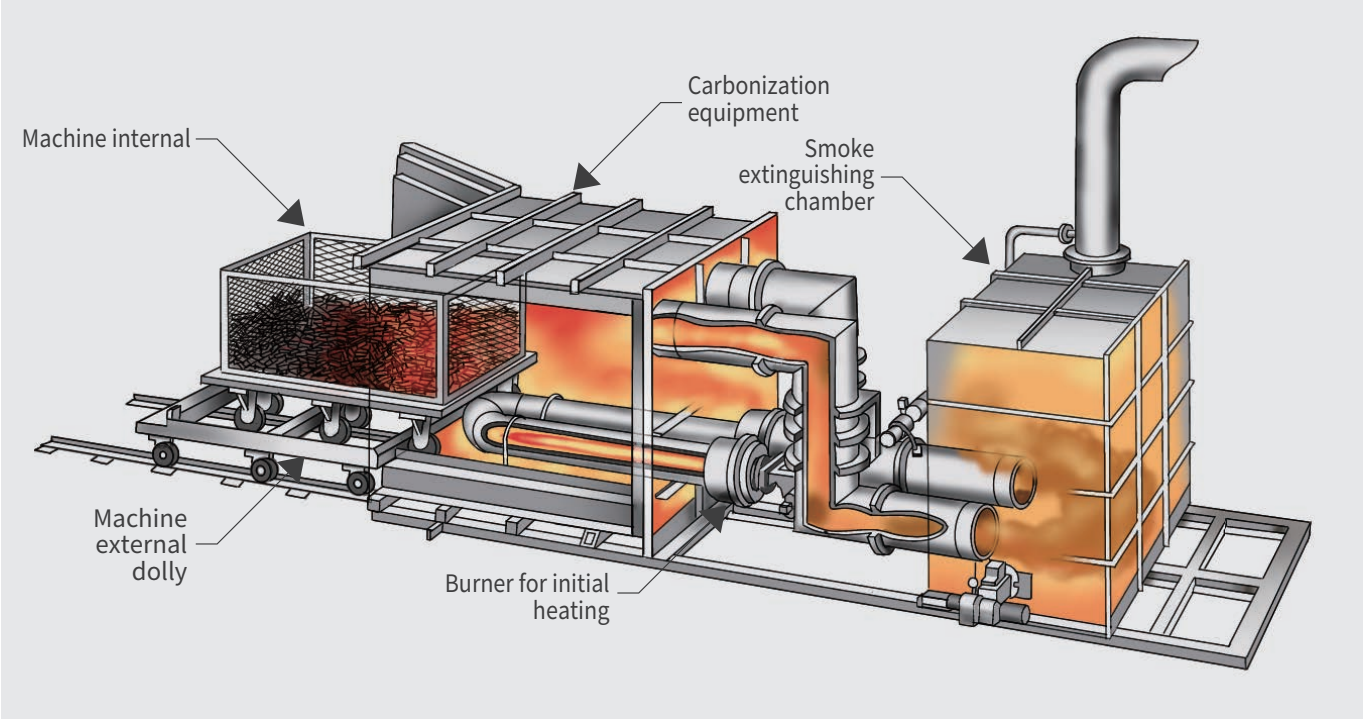
Forestry cooperatives
Sawmills

Intermediate treatment companies
Construction industrial waste disposal companies

Government and municipalities
Food companies

**Biomass Coke**
**(Trademark Registration No. 6799439)**

# Batch carbonization equipment (ZEBIO-B series)




## Excellent convenience that reduces labor for pre-processing such as when crushing

The ZEBIO-B series is batch-type carbonization equipment with ceramic insulation in the main body, capable of directly accepting large waste items. It achieves high thermal efficiency, enabling direct production of charcoal or carbonized materials simply by feeding in waste without need for processing such as crushing. It also supports the removal of organic components adhering to discarded boards or waste aluminum. We gladly accept consultations for customization or made-to-order products according to material properties, installation area, capacity, etc.

By introducing the optional drying chamber, exhaust heat from the carbonization equipment can be supplied to the dryer, realizing further cost reductions.

## ZEBIO-B Series Specifications Table

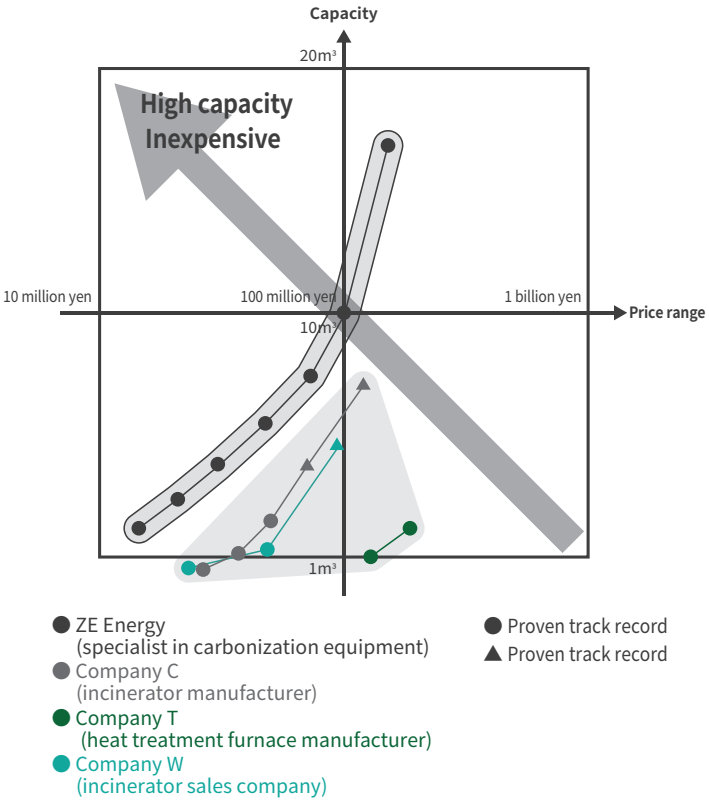
We gladly accept consultations for customization or made-to-order designs based on material properties, installation area, capacity, etc.

| Batch type (ZEBIO-B series) | CCH-SB-900 | ZEBIO-B-3000 | ZEBIO-B-4000 | ZEBIO-B-6000 | ZEBIO-B-10000 |
|---|---|---|---|---|---|
| Input amount (wood logs, 50% moisture content) | 0.9 $m^3$ (approx. 0.4 t) | 1.8 $m^3$ (approx. 0.9 t) | 2.4 $m^3$ (approx. 1.2 t) | 3.6 $m^3$ (approx. 1.8 t) | 5.4 $m^3$ (approx. 2.7 t) |
| Unit dimensions (mm) | L2,500×W2,000×H2,000 | L6,000×W2,000×H2,500 | L6,800×W2,000×H2,500 | L5,800×W2,400×H2,500 | L7,000×W2,400×H3,900 |
| Installation area (mm × mm) | 5,000×3,200 | 12,000×3,200 | 13,500×3,200 | 13,000×4,000 | 16,000×4,000 |
| Materials | SS, SUS, ceramics | | | | |
| Power source | AC100V/200V 50/60Hz | | | | |
| Electricity consumption | 0.55kWh | 1.5kWh | 1.7kWh | 2.2kWh | 3.0kWh |
| Fuel | Kerosene / heavy oil A (also compatible with gas fuel and BDF) | | | | |
| Fuel consumption | max 8L/h | max 10L/h | max 15L/h | max 20L/h | max 20L/h |
| Heating temperature range | 300–750°C (Higher temperatures can be accommodated with design modifications.) | | | | |
| Optional equipment: | Drying chamber, secondary smoke extinguishing chamber, vinegar solution recovery unit, heat exchanger, automatic control unit (The basic specification is semi-automatic.), forced cooling unit, $N_2$/$CO_2$ purge mechanism, dust remover, biomass fuel hot air generator, Kalina cycle power generator (binary power generation) | | | | |

Notes:

1. Fuel consumption varies significantly depending on the calorific value, moisture content, shape, and condition of the processed material, as well as on the desired properties of the carbonized product.
2. The above input amount varies depending on the input material and its moisture content.
3. Heating time varies significantly depending on the carbonization method, conditions of the input material, etc. Please contact us for details.
4. The above specifications and dimensions are subject to change without prior notice. Please contact us for details.
5. Designs can also be customized to accommodate processing volumes other than those listed above.

# Technology




**1. Secondary combustion utilization of gases generated during the carbonization process of biomass resources**

By reusing the energy from the generated dry distillation gases, dependence on external fuels is reduced, achieving substantial reductions in running costs. This also contributes to minimizing $CO_2$ emissions during biomass carbon production.

**2. High safety achieved through pressure control within the carbonization equipment**

By properly controlling negative pressure inside the system, the leakage of flammable and harmful gases such as CO to the exterior is prevented, making highly safe automatic operation possible. A stable operating environment is ensured, enabling support for long-duration and continuous operation.

**3. Durability and a simple structure backed by experience**

Through a track record of the development and manufacturing of diverse models, we have a thorough understanding of material properties and operating conditions, and we adopt a simple structure with only the essential functions carefully selected. This suppresses the risk of equipment failure, realizing long-term stable operation and reduced maintenance burden.

## Features of the ZEBIO-B series

**1. High thermal efficiency achieved by adopting ceramics**

The adoption of ceramic heat insulation in the main body ensures excellent thermal efficiency within the unit. This extremely high thermal efficiency enables a substantial reduction of running costs.

**2. Produces high-quality carbonized products in a short time**

High-temperature carbonization is possible, enabling the production of superior high-temperature charcoal that other companies cannot replicate. The extremely high carbon fixation rate allows the carbonized product to be completed much faster than with traditional earthen kilns.

**3. Superior convenience with almost no pre-processing required**

Pre-processing such as crushing is almost unnecessary, and the large door enables the direct input of large waste materials.

**4. Ensuring safety through automatic control**

Our control system, backed by extensive experience, enables highly safe automatic operation. We also support operational management with a reliable maintenance system through the introduction of automatic reporting and similar features. Operation can be tailored to local needs by adjusting the gasification temperature setting. The system supports easy switching between power generation, carbonization, and hydrogen fuel production.

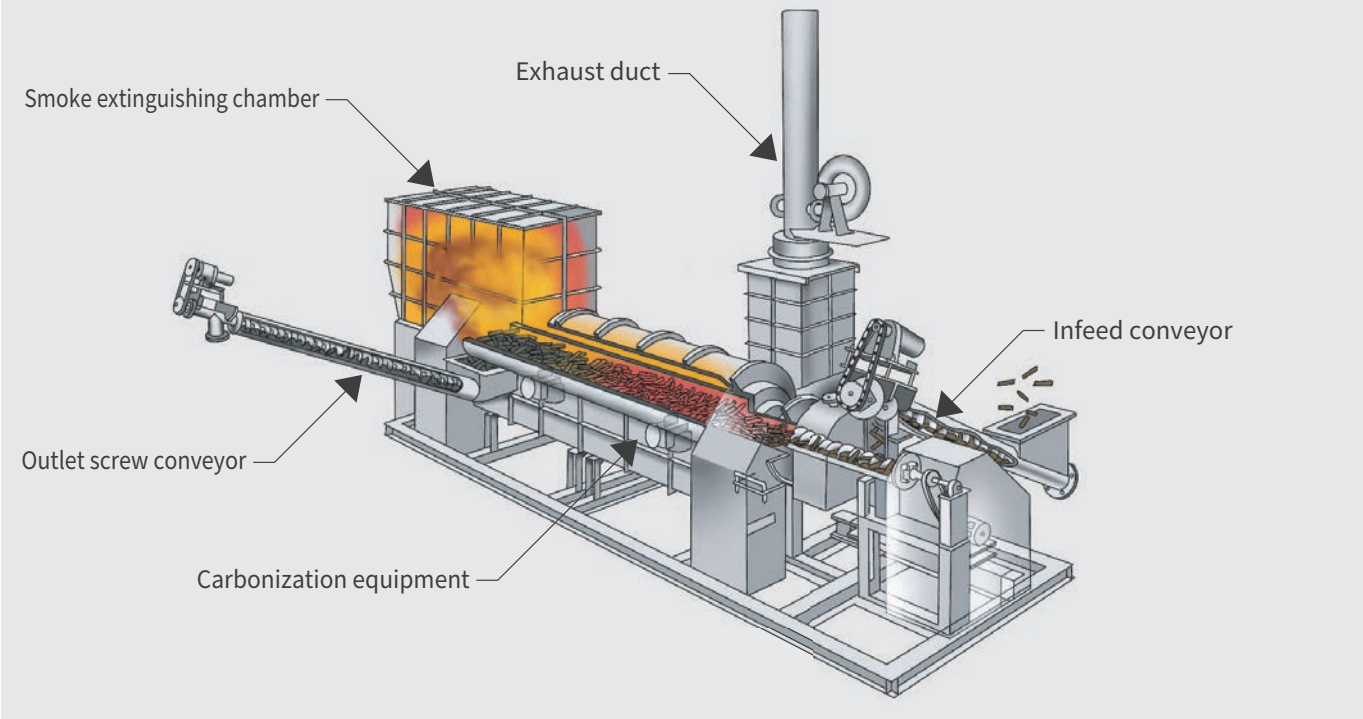
**5. Alternative energy use possible (optional specification)**

By introducing a biomass fuel burner as an option, other energy sources such as charcoal, wood biomass, and waste cooking oil can be used as alternative energy sources to fossil fuels. This greatly contributes to reducing running costs.

**6. Maximizing the utilization of exhaust and waste heat (optional specification)**

We offer optional equipment such as waste heat boilers and water softeners, enabling steam and hot water generation for use within a factory. We also support the installation of exhaust heat exchangers, Stirling engines, Kalina cycle generators (binary power generation), and boilers.

# Continuous carbonization equipment (ZEBIO-C series)




## The ultimate circular system that reuses exhaust gas and waste heat

The ZEBIO-C series pursues maximum energy efficiency across the entire lifecycle by recovering gases produced during carbonization and reusing them as a heat source. With optional equipment add-ons, we enable the construction of anticipated advanced power generation systems and the utilization of alternative energy sources in place of fossil fuels. The system also excels at processing high-moisture waste such as sludge and paper sludge.

By adopting a drying-carbonization system, the exhaust heat from the carbonization equipment can be supplied directly to the drying system. This realizes further cost reductions.

## ZEBIO-C Series Specifications Table

We gladly accept consultations for customization or made-to-order designs based on material properties, installation area, capacity, etc.

| Continuous type (ZEBIO-C series) | ZEBIO-C-350 | ZEBIO-C-750 | ZEBIO-C-1200 | ZEBIO-C-1400 | ZEBIO-C-1800 |
|---|---|---|---|---|---|
| Input amount (wood logs, 50% moisture content) | 120kg/h | 500kg/h | 1,500kg/h | 2,500kg/h | 6,000kg/h |
| Unit dimensions (mm) | L8,000×W2,000×H2,600 | L11,000×W2,600×H3,900 | L14,000×W3,600×H4,600 | L16,000×W4,000×H5,000 | L20,000×W4,500×H6,000 |
| Installation area (mm × mm) | 10,000×4,000 | 13,000×4,700 | 16,000×5,000 | 18,000×5,200 | 22,000×5,500 |
| Materials | SS, SUS, ceramics | | | | |
| Power source | AC200V 50/60Hz | | | | |
| Electricity consumption | 15kWh | 20kWh | 40kWh | 50kWh | 60kWh |
| Fuel | Kerosene / heavy oil A (also compatible with gas fuel and BDF) | | | | |
| Fuel consumption | max 10L/h | max 30L/h | max 60L/h | max 100L/h | max 120L/h |
| Heating temperature range | 300–600°C (Higher temperatures can be accommodated with material changes.) | | | | |
| Optional equipment: | Hopper, inlet/outlet conveyor, CDS, vinegar solution recovery unit, heat exchanger, water softener, chiller / cooling tower, waste heat boiler, dust remover, grease vaporizer, touch panel control panel, scrubber, denitrification unit, biomass fuel hot air generator, Kalina cycle power generation unit (binary power generation) | | | | |

Notes:

1. Fuel consumption varies significantly depending on the calorific value, moisture content, shape, and condition of the processed material, as well as on the desired properties of the carbonized product.
2. The above input amount varies depending on the input material and its moisture content.
3. Heating time varies significantly depending on the carbonization method, conditions of the input material, etc. Please contact us for details.
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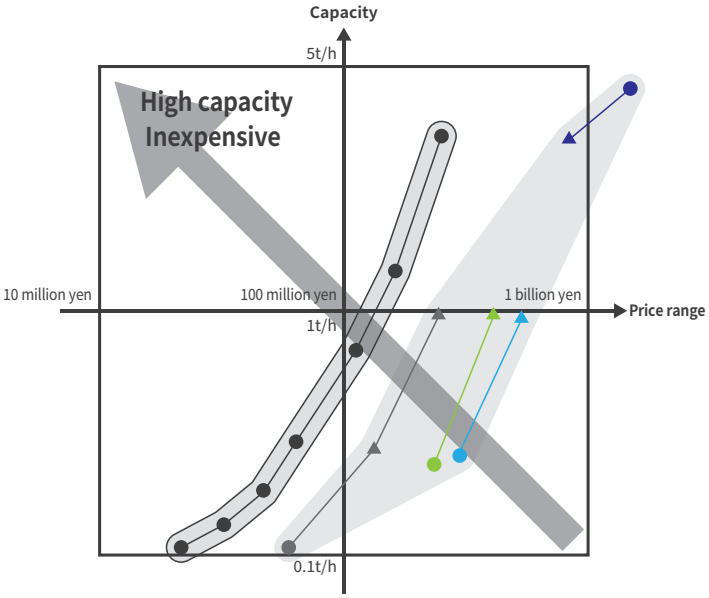
5. Designs can also be customized to accommodate processing volumes other than those listed above.

# Superiority（Technology）




- ZE Energy (specialist in carbonization equipment)
- Company M (general engineering company)
- Company Y (dryer manufacturer)
- Company TO (sewage treatment manufacturer)
- Company W (incinerator sales company)

- Proven track record
- Proven track record

## Continuous carbonization equipment for sludge treatment

### 1. Over 30 years of development and manufacturing experience and one of Japan's largest domestic delivery track records

We have been developing and manufacturing carbonization equipment for more than 30 years, with delivery records exceeding 200 locations and a lineup of over 20 equipment types. This accumulated technical expertise enables us to design and manufacture large-scale continuous carbonization equipment.

### 2. World's first carbonization equipment specialist manufacturer to obtain CE mark certification

In 2017, we conducted design improvements in preparation for European operations and, after passing rigorous safety and environmental examinations, became the world's first carbonization equipment specialist manufacturer to obtain CE mark certification.

### 3. Unique business model protected by patent and trademark registration

We secured a patent for our Carbonization Center Model and **a registered trademark for “Carbonization Equipment."** We establish distinctive positions that extend beyond equipment supply to include full commercialization and operational management.

CE ® ©

## Features of the ZEBIO-C series

### 1. Recycling of dry distillation gas as a heat source

This is the “circulating indirect heating method” that utilizes dry distillation gas generated in the carbonization process as a heating source. This allows for high thermal efficiency with little fuel, greatly contributing to reducing running costs.

### 2. Processes waste with over 80% moisture content

The system carbonizes not only dry materials but also high-moisture waste (sludge, paper sludge, food waste, etc.). We incorporate the waste heat drying system to dry the material before feeding it into the carbonization equipment. This dramatically improves carbonization efficiency for high-moisture waste.

### 3. Compact design that achieves space savings

We leverage our long track record of manufacturing and numerous design experiences to realize compact design. We tailor design to the site of installation, enabling setup even in narrow or space-limited locations.

### 4. Supports power generation systems (optional specification)

You can add a power generation system as an option—this feeds dry distillation gas into the engine or can convert waste heat into steam. We adjust the gasification temperature setting to match regional needs, enabling tailored operation. The system also supports switching between carbonization and hydrogen fuel production.

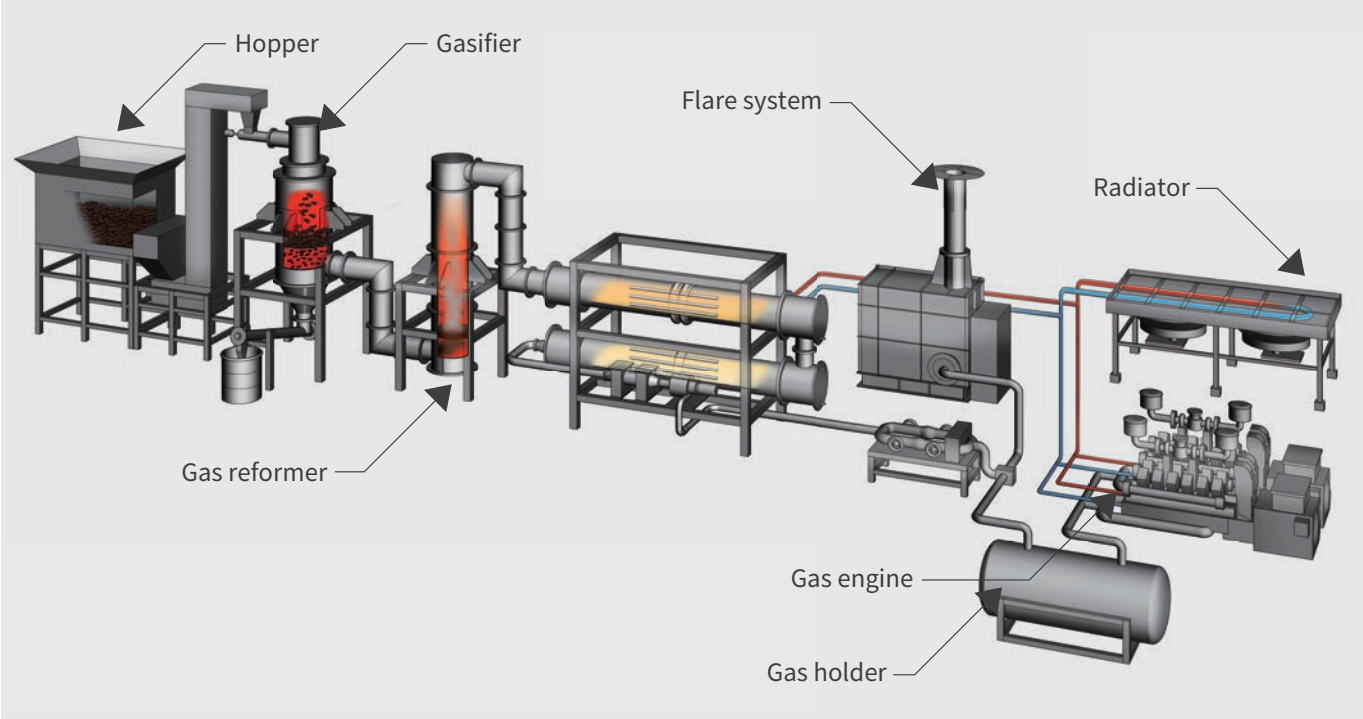
### 5. Ensuring safety through automatic control (optional specification)

Our control system, backed by extensive experience, enables highly safe automatic operation. We also support operational management with a reliable maintenance system by introducing automatic reporting and similar features.

### 6. ZEBIO-C series: Supporting an ideal circular system with a single unit (optional specification)

With options such as a waste heat boiler and water softener, this series can be used to generate steam and hot water within a factory. Installation of exhaust heat exchangers, Stirling engines, Kalina cycle generators (binary power generation), or boilers is also possible.

# Biomass power generation system




**Biomass power that leverages the resources currently available on the earth is a clean and safe alternative energy to fossil fuels.**

This system is designed to separate chips made of thinned or unused wood into gas and charcoal with the gasifier and run the gas engine to generate power. Unlike steam turbine biomass power generation systems, which need to collect wood from a wide area, this system uses locally available fuel for local generation and consumption in a mountainous area. Moreover, waste heat from the engine can be also utilized. This is a power system essential for the utilization of unused wood in mountainous areas. Distributed installations of this system will enhance national disaster resilience and help build new infrastructure.

**Highly operational design with tar formation minimized**

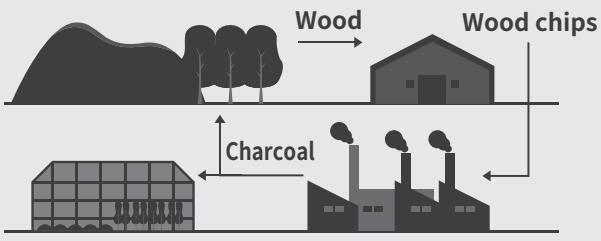
**(Gasifier outlet: 80 mg/Nm³, engine inlet: 5 mg/Nm³)**

**Patented**

**Patent No. 6762715 (P6762715)**

*** The patent is also granted in Europe, North America, and Asia.**

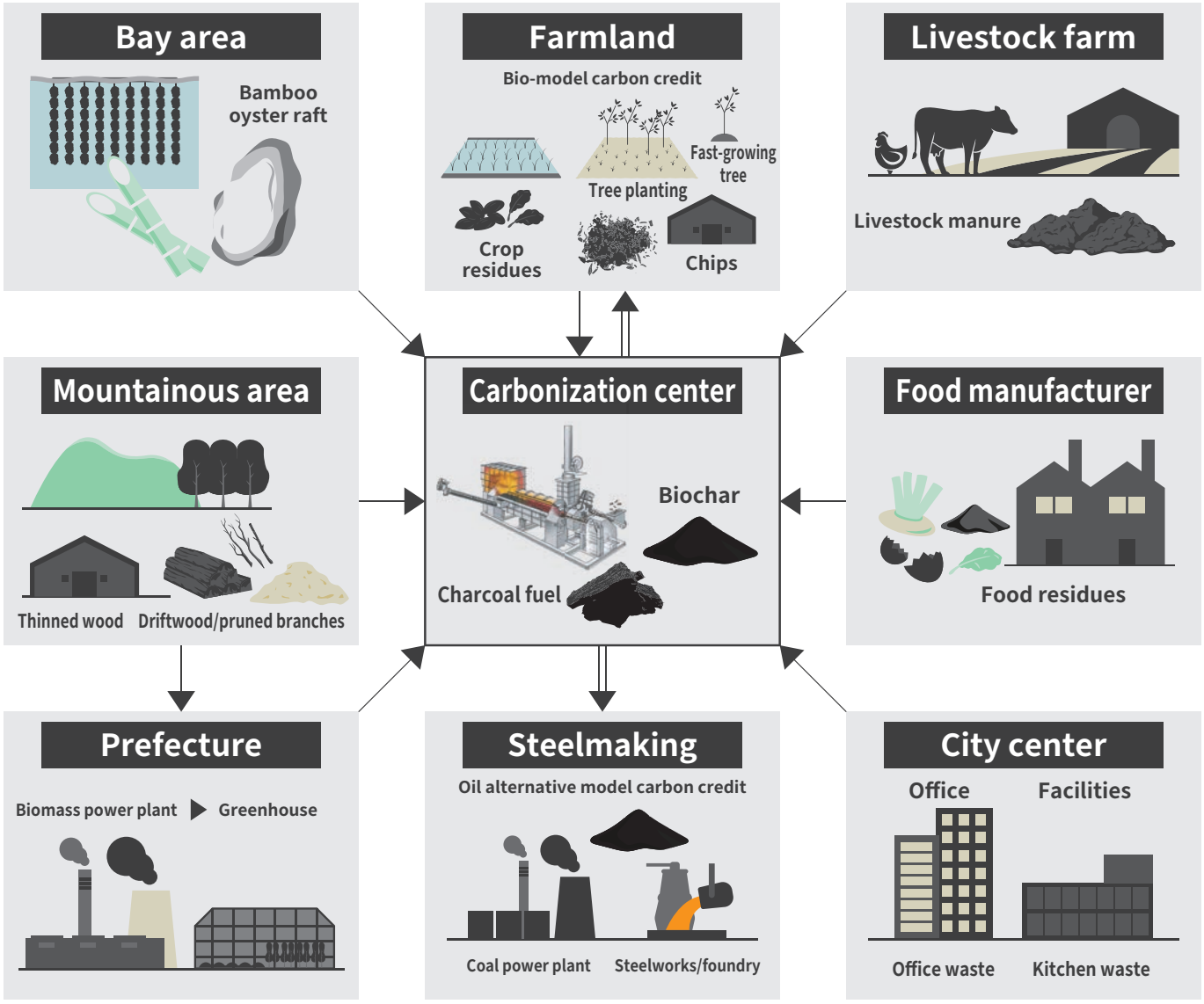
**Regional circulation model**




**Power generation ▶ Local consumption**

# We will expand the carbonization center business across the country and overseas.

Business method patent: “Carbonization center”




* J-Credit is a national program to certify as credits the CO2 and other greenhouse gas emissions reduced or absorbed by energy-saving equipment or forest management. These credits are traded or utilized by businesses, for example, to offset their emissions, adjust emission reports required by law (Act on Promotion of Global Warming Countermeasures), or publicize their environmental efforts. The program is run by three ministries of Japan, i.e., Ministry of the Environment , Ministry of Economy, Trade and Industry, and Ministry of Agriculture, Forestry and Fisheries, and aimed at balancing global warming countermeasures and economic activities.

| Type of credit | Example | Approximate price (per ton) |
|---|---|---|
| Renewable energy (power generation) | Solar and wind power generation | 6,000 yen or over |
| Energy saving | Use of high-efficiency boilers | 4,500 yen or over |
| Forest/absorption system | Proper forest management | 10,000 to tens of thousands of yen (rare) |
| Biochar | Burying in farmland | Tens of thousands of yen or over (very high price) |

As of January 2026

* The trading situation is tense in Japan because full-fledged implementation of the GX-ETS (Emissions Trading Scheme) will commence in FY2026.
* The GX-ETS (Emissions Trading Scheme) is part of the GX League promoted by the Japanese government. It is a framework for CO2 allowance (permit) trading between businesses. Businesses sell excess allowances if their emissions are below the limit or buy if they exceed the limit. In this way, the scheme is designed to reduce greenhouse gas emissions cost-effectively as a whole, aiming at achieving both decarbonization and economic growth. From FY2026 onwards, businesses above a certain size are required to participate in the scheme.

# Service

## Step.1

### Secure raw materials.
Securing crop residues, wood and other locally available raw materials for charcoal production and distribution channels.

### Provide facilities.
Providing the carbonization center with necessary equipment for charcoal production, such as carbonization

### Find customers.
Finding the nearest customers for produced charcoal in cooperation with shareholders and business partners.

**Carbonization center project**

## Step.2

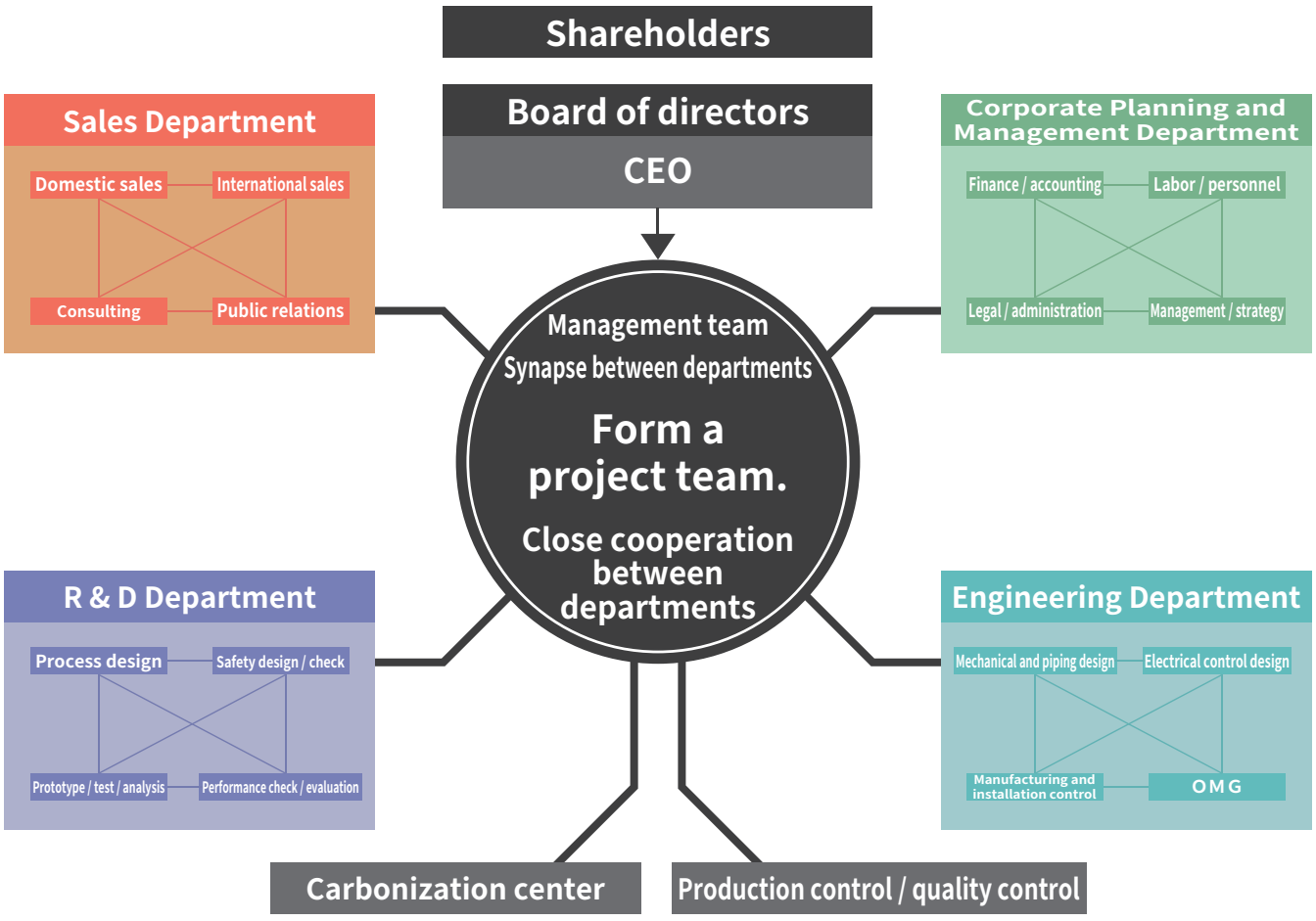
### Operations
We will undertake operations including machine operation at the carbonization

### Maintenance
We will undertake the maintenance of the overall facilities of the carbonization center and perform periodic inspections.

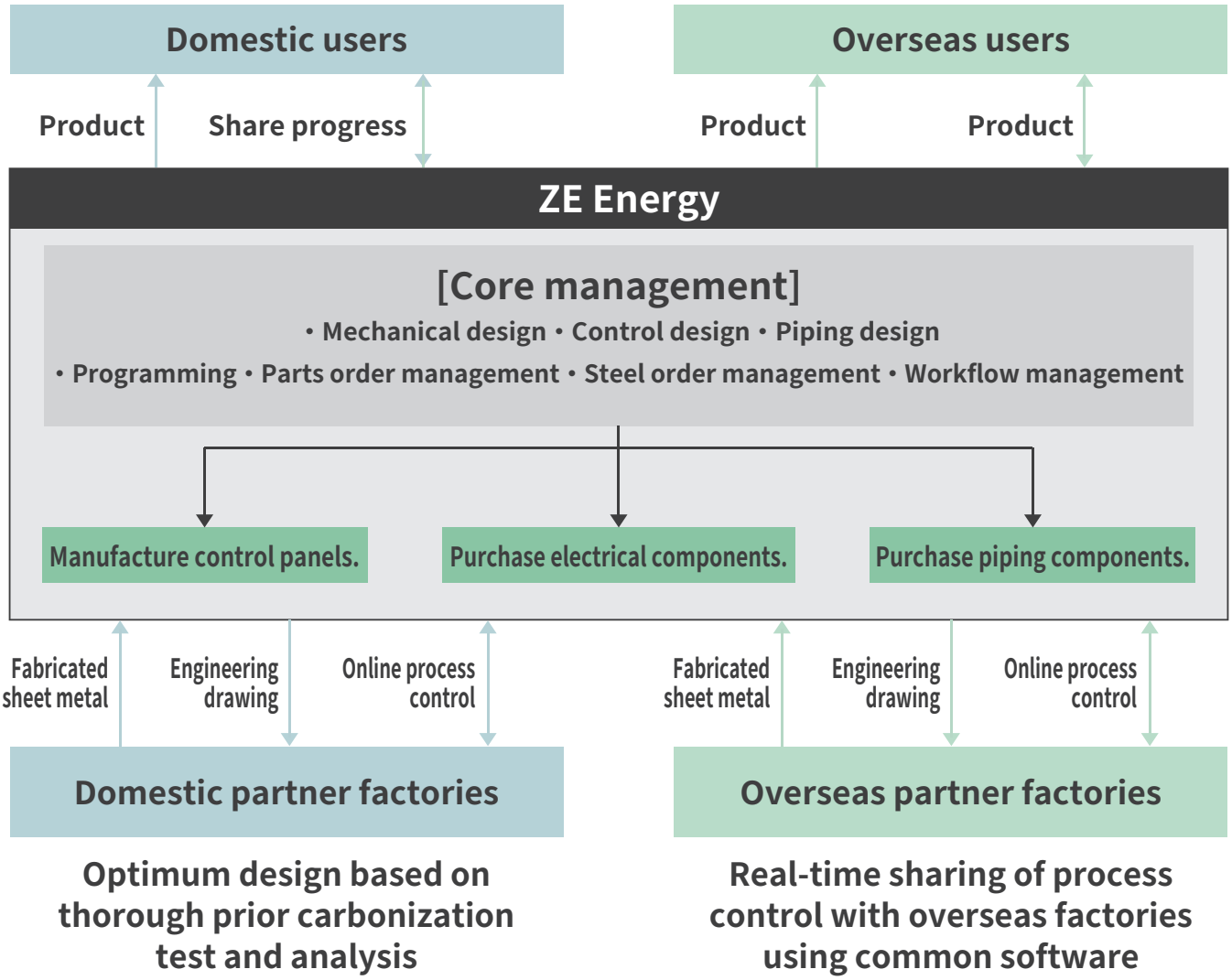
### Provide insurance.
Our partner company will provide necessary insurance for the carbonization center.

**Operation of carbonization center**


# Organization in ZE Energy



# Domestic and overseas manufacturing control systems




**Optimum design based on thorough prior carbonization test and analysis**

**Real-time sharing of process control with overseas factories using common software**

## Overseas Affiliates

ZE ENERGY Vietnam

Nextcarbon

Carbon Credit Holdings

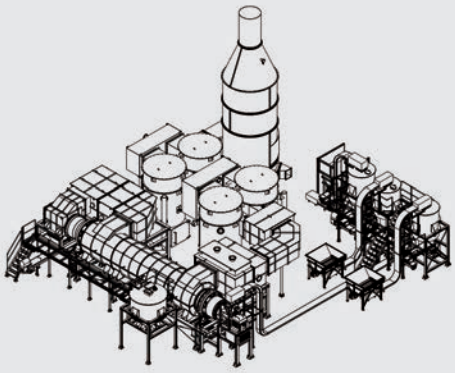
## Overseas Partners

DYNAMIC TECHNOLOGIES (PVT) LTD DT

GRILL IMPEX
BARBECUE IN GOOD COMPANY

Yeong Ming

# Transport methods (installation/assembly and overseas delivery)

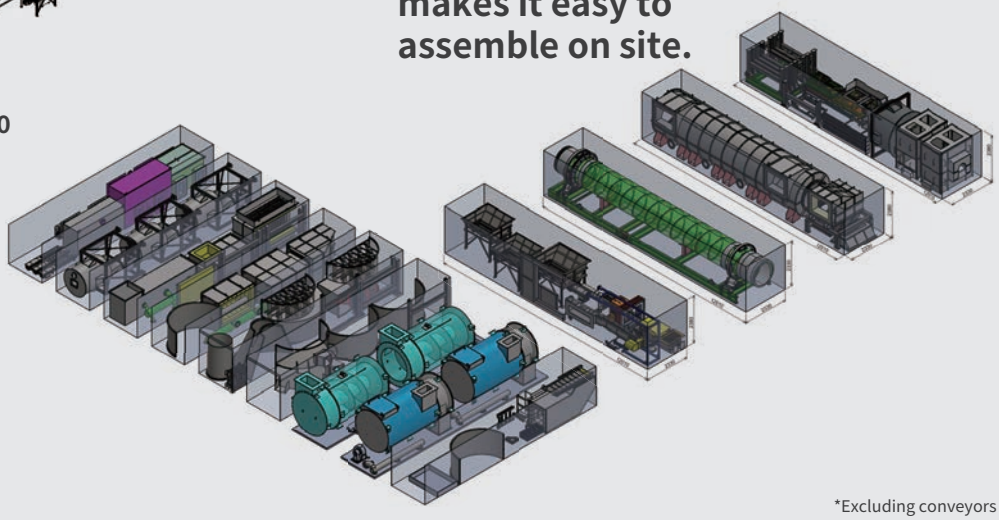


E.g.: ZEBIO-C1200

## Disassembly, packing, and sea transport (containerized shipping)

**40-ft container x 13**

**Flanged connection makes it easy to assemble on site.**



*Excluding conveyors

**Business alliances** **Guidance/training**

CCH & ZE = Local companies

- Assembly manual ▶ Assembly
- Operation manual ▶ Operation
- Maintenance manual ▶ Maintenance

## Quick compact assembly

Overseas sheet metal fabrication factory

**Japan**

- Containerized sea transport
- Land transport in Japan
- Temporary assembly
- Test run and adjustment
- Transport
- Assembly at customer's site
- Commissioning / acceptance inspection

**Overseas**

- Temporary assembly at overseas factory
- Test run and adjustment
- Disassembly, packing and customs clearance
- Containerized sea transport
- Customs clearance / land transport
- Assembly at customer's site
- Commissioning / acceptance inspection
- Guidance on maintenance

# Test service prior to carbonization equipment introduction

## Suggestions for charcoal analysis, processing and utilization

### Advantages of introducing the ecological technology “carbonization equipment”

✓ Reduces $CO_2$ emissions more than incineration does.

✓ Generates little dioxins.

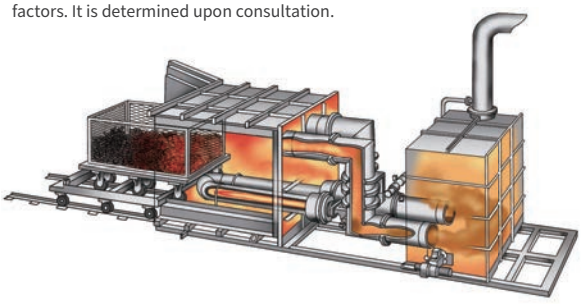
✓ Enables in-house power generation using waste heat.

**Compatible with organic waste from any industry.**

### B Batch carbonization equipment

Price of carbonization test: 195,000 yen (tax excluded) or over
Approximate input amount: 0.6 $m^3$ (approx. 180 kg) / batch (wood chips with a 30% moisture content)

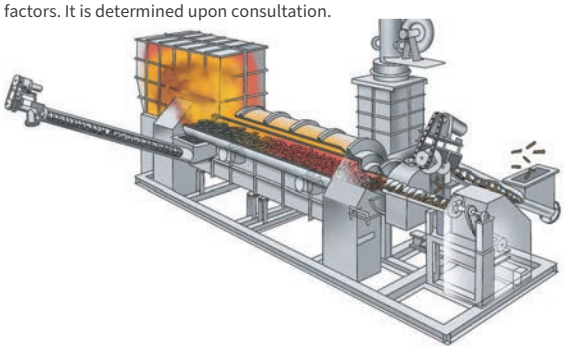
* The input amount varies with material type, condition, moisture content, and other factors. It is determined upon consultation.




### C Continuous carbonization equipment

Price of carbonization test: 295,000 yen (tax excluded) or over
Approximate input amount: 60 kg/h x 6, (approx. 360 kg/day) (wood chips with a 30% moisture content)

* The input amount varies with material type, condition, moisture content, and other factors. It is determined upon consultation.




## Toyama Office

**(Test is conducted in this office.)**

**2, Frontier Park, Oyabe City, Toyama, 932-0856, Japan**

## Toyama Lab carbonization center to open in 2026

# Models produced and sold in the past

| Machine photo | Model | Purpose of carbonization equipment | Delivered to: |
|---|---|---|---|
|  | **Continuous**<br>**CCC series**<br>**ZE original** | Developed for intermediate sludge treatment companies.<br><br>As this equipment has spread, carbonization was newly added to the list of intermediate treatment processes. Unlike the conventional methods of drying and incineration, the equipment was an innovative system that enabled recycling by carbonization.。 | Intermediate treatment companies<br>Other |
|  | **Batch and continuous discharge**<br>**ZEBIO-G series**<br>**ZE original** | Developed as a municipal waste treatment system.<br><br>A system combining batch and continuous features. Bags of household waste are fed from the top and carbonization by automatic control begins when the door is closed. After carbonized, charcoal is discharged continuously from the bottom. The equipment first targeted small municipalities but it later began to be adopted by businesses, too. | Prefectures and municipalities<br>Intermediate treatment companies<br>Other |
|  | **Batch**<br>**ZEBIO-B series**<br>**ZE original** | Carbonization of riverside weed as an entrusted project by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).<br><br>Developed upon a request for on-site treatment of riverside weed. Using a mobile RDF system, weed is turned to RDF at the river and the equipment carbonizes the RDF. Produced charcoal is used as a purifier for river water. Several units were delivered to the ministry. | MLIT<br>Cast iron pipe manufacturers |
|  | **Continuous carbonization firing equipment**<br>**CCC-M series** | Recycling paper sludge after carbonization firing<br>→ Three-company project with a plant construction company<br><br>Carbonization firing makes it possible to recover soft calcium carbonate from paper sludge as it is not oxidized. This enables reuse as raw materials for papermaking. | Paper manufacturers<br>Other |
|  | **Batch**<br>**ZEBIO-B series**<br>**ZE original** | Sold as a disposal system of five specified risk materials (SRMs) from cattle after the BSE outbreak.<br><br>Developed to be sold to meat centers across the country when BSE spread. Five SRMs are carbonized and then fired at low temperature to enable reuse. Cattle offal can be used as fuel, which helps lower the running cost drastically, compared with incinerators. | Meat centers<br>Tokyo Quarantine Station<br>Other |
|  | **Batch**<br>**Charcoal kiln series**<br>**ZE original** | Developed for charcoal making users.<br><br>Developed at the request of a forestry cooperative requiring disposal of thinned wood and bamboos. Designed to produce charcoal (bamboo charcoal) and wood vinegar (bamboo vinegar) without using electricity. The equipment is used in a mountainous area, carbonizing felled trees on site. They are used as a soil conditioner. Popular model sold in a large numbers to forestry cooperatives and forestry workers. | Forestry cooperatives<br>Individual forestry workers<br>Individual charcoal makers<br>Other |

**Over the past 30 years, we have designed and manufactured products tailored to customers' requirements.**
**The experience and achievements have led to the present product lineup and they are continuing to evolve with our daily R&D efforts.**

# Charcoal product examples

Powder

Pellets

Briquettes

Compression molding (large)


Compression molding (small)

## ■ Improve the environment with the power of nature. Highly functional, sustainable Biomass Carbon

Applications: Soil improvement, water treatment, odor elimination, and industrial raw materials
Features and purposes: Good quality charcoal, porous, environmental cleanup, and carbon storage

Biomass Carbon is a plant-derived resource appropriately carbonized and a highly functional material with an excellent porous structure. The small holes adsorb harmful materials and odor. If the charcoal is mixed into soil, the holes serve as a home for microorganisms and help healthy growth of crops.

In addition, attention is drawn to the carbon sequestration effect to store carbon for several hundred years by trapping atmospheric CO2 in soil as charcoal. This is a new standard material that demonstrates high functionality, from water purification to agricultural and industrial uses, while protecting Earth's natural cycle. Our product is high-quality mass-manufacturable charcoal.

## ■ Replace coal by plants. Next-generation high-efficiency energy, Biomass Coke

Applications: Alternative fuels and fuel additives for casting/ steelmaking, boilers, large facilities, and electric power companies
Features and purposes: Coal alternative, high density, and carbon-neutral heat source

Biomass Coke is an innovative solid fuel comparable to coal-based coke in hardness and heating value, which are achieved by ultra-high compression and carbonization of unused wood or other wood resources using our original technology.

The biggest difference from the conventional wood pellets and chips is the high energy density. As it maintains steady thermal power for long hours, Biomass Coke can be used as an alternative to coal in steelmaking or casting or for co-firing in a large boiler, which are otherwise difficult. No drastic changes to the existing facilities are needed to introduce it. This product, which will give an advantage in the GX (Green Transformation) by accelerating the reduction of Scope 1 (direct) emissions, is a high quality briquette with a carbon content of 90% or more.

| Item | Main applications | Strengths | Form |
|---|---|---|---|
| Biomass Carbon | Soil improvement, water purification, adsorbent | Porous (adsorption), carbon fixation | Granules or powder |
| Biomass Coke | Industrial fuel, reducing agent, heat source | High heating value, high hardness, alternative to coal | Solid (cylindrical or other forms) |

# Suggestions for charcoal utilization and secondary processing

We will make suggestions for uses of produced charcoal, such as soil improvement, water quality improvement, odor elimination, and fuel, as well as secondary processing according to the materials' characteristics based on analysis results. In the case of a garment manufacturer, who had discarded a large amount of fabric scraps, we carbonized those scraps (fibers) and developed a pencil with a lead made from the charcoal jointly with Earth Plus. We won the Excellence Award in the Sustainable category of the Stationery of the Year 2023.

### Charcoal x pencil: "Pencil of clothes"

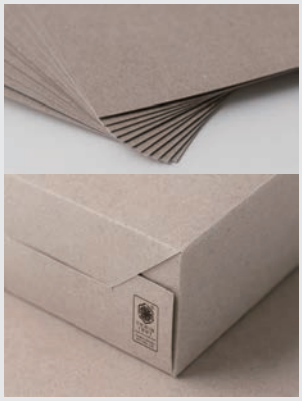
We have carbonized fabric scraps discarded at a garment factory and developed a pencil with a lead made from the charcoal. The "pencil of clothes" was awarded in the Sustainable category of the Stationery of the Year 2023.

It was jointly developed by three companies: Miyamori Co., Ltd., ZE Energy Inc., and Earth Plus Inc.

### Charcoal x paper: "Light charcoal kraft paper"

We made charcoal powder from rice husks, coffee grounds, used tea leaves, and fibers and mixed with waste paper to develop recycled paper.

It is a joint project between Papal Co., Ltd., a long-established paper manufacturer founded in 1890, and ZE Energy Inc.



# Carbon Resource Regeneration from Biomass Waste Toward a New Era of Biomass Carbon

## Worldwide network to promote recycling

Decarbonization and resource recycling are issues to be tackled on a global scale.
ZE Energy is scaling out carbonization technology and business models developed in Japan to North America, Europe, and Asia and promoting sustainable carbon recycling, working closely with the local partners.


| | |
|---|---|
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| Toyama Office | 2, Frontier Park, Oyabe City, Toyama, 932-0856, Japan |
| Fukushima Office | Inside the Okuma Incubation Center, 230 Shimonogamishimizu, Okuma Town, Futaba District, Fukushima, 979-1308, Japan |
| Singapore Office | 30 PETAIN ROAD SINGAPORE (208099) |
| Sri Lanka Office | 650A7, IDB Industrial Estate, Ratmalana, 10390 Srilanka |
| Vietnam Office | 13 Đường số 53, An Phú, Thủ Đức, Thành phố Hồ Chí Minh, Vietnam |
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Japanese