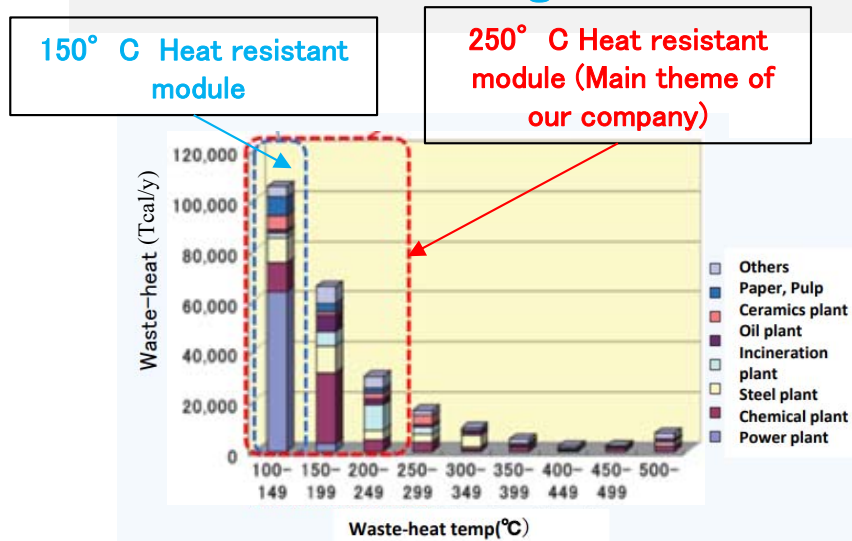


**Introduction of E-ThermoGenTek Co. Ltd.  
and development/practical application of  
stand-alone power supply based on our  
unique thermoelectric generation  
technology.**

**E-ThermoGenTek Co. Ltd.**

# Management Philosophy

Based on our extensive experience in the semiconductor business and our unique technology related to thermoelectric power generation, we are working to popularize thermoelectric power generation, which efficiently converts and recovers the vast amount of **low-temperature waste heat (about 300° C or less)** into electrical energy. **By promoting the efficient use of energy, we will achieve the SDGs(Sustainable Development Goals) and contribute to building a sustainable society.**



Current status of unused low-temp. exhaust heat ( Amount of waste heat by industry and temperature )

**Chemical plant**

**Power plant**

**Incineration plant**

**Data center**

**LNG plant**

**Facility**

**Boiler**

**Kitchen**

**Boiler waste**

**Chemical plant**

**Furnace**

**Heat exchanger**

**Piping**

**Car**

**Motor / Compressor**

**Vessel**

**Fuel battery**

**Solar power generation**

**Infrastructure**

**LED Light**

**Boiler**

**Tools**

**Boiler waste**

**Low power efficiency in summer**

**放熱フィン**

Low-temperature waste heat in different areas of society

# Company Profile

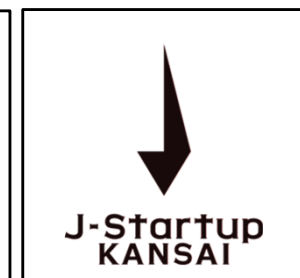


Company name	E-ThermoGentek Co., Ltd.
CEO	Representative Director Michio Okajima
Company Locations	<p>【Head Office】 601-8047 102 Kujo CID Building, 13 Higashikujo Shimotonoda-cho, Minami-ku, Kyoto (c/o Asset Witz Co., Ltd.)</p> <p>【R&amp;D Osaka University base】 565-0871 2-1 Yamadaoka, Suita City D52, Industry-University Co-Creation Building D, Osaka University</p> <p>【R&amp;D Katsura base】 615-8245 Kyoto University Katsura Venture Plaza North Building 202, 1-36 Goryo Ohara, Nishigyo-ku, Kyoto City</p>
Established	February 26, 2013
Capital	376 million yen

© We are planning a third-party allotment of new shares within this fiscal year.



Certified in  
March 2018



Certified in  
October 2022

# Our proprietary technology

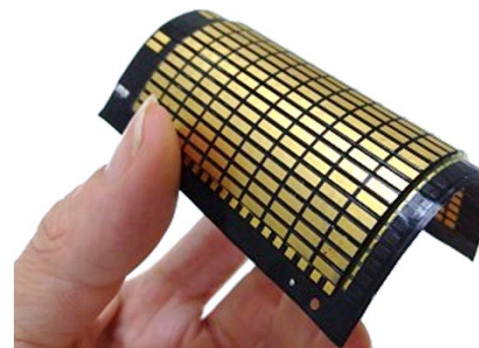
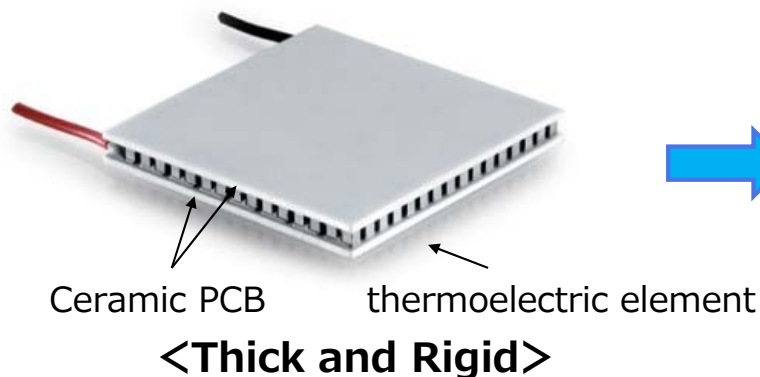
## Practical application of flexible thermoelectric power generation module "Flexiina"! ( **First in the world !** ) **Novelty**

### Module structure (Basic Patent ; Patent no.5228160)

- High-speed, high-density assembly of existing BITE thermoelectric components on ultra-thin flexible substrates using mature semiconductor technology ⇒ **Cost reduction**
  - High energy recovery efficiency is made possible by flexible module structures that may be flexibly curved and attached to cylinder-shaped heat sources ⇒ **Elevated performance**
- ⇒ **Thermoelectric generation with a realistic cost-to-performance ratio has been realized for the first time!! !**

Received inquiries from over 300 companies!!

### Conventional thermoelectric power generation module



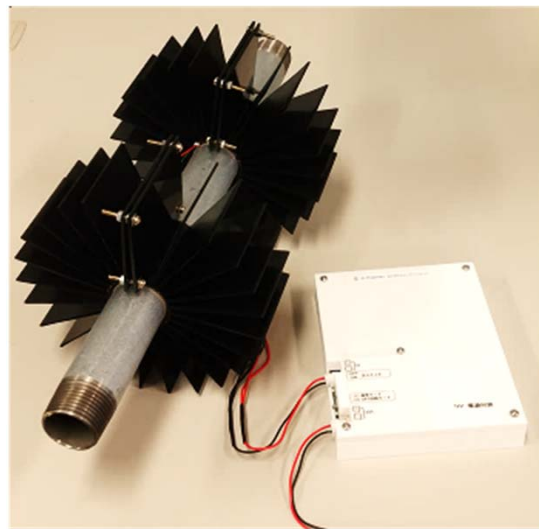
Flexible thermoelectric power generation module "Flexiina" standard sample



## IoT stand-alone power supply-S1 series integrated with 「Flexiina」 :Wrap-around type built for exhaust pipes. (First in the world !)

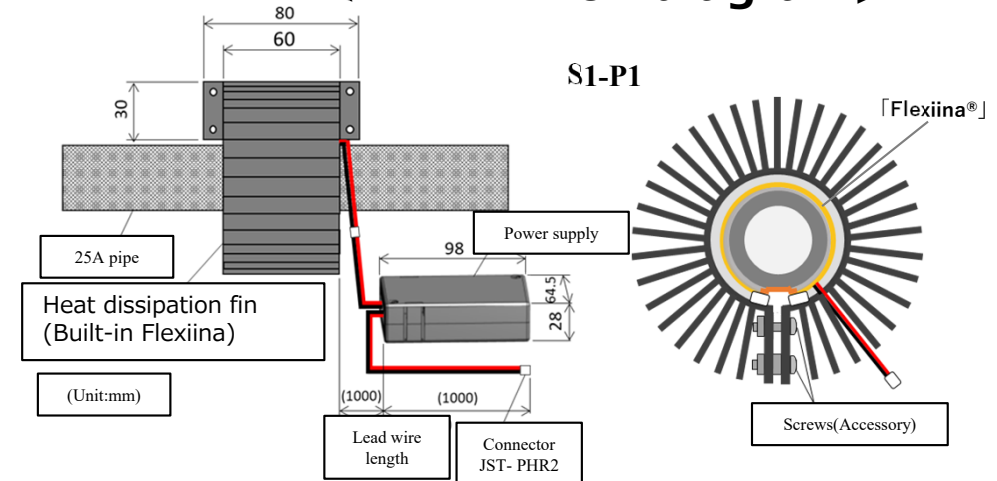
S1-P1B: 10mW(3.3/5V)

S1-P2B: 180mW(9/12V)

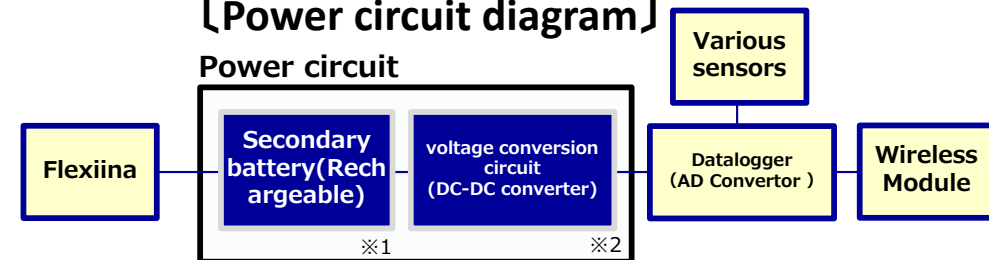


Sample under sale

### 〔Installation diagram〕



### 〔Power circuit diagram〕

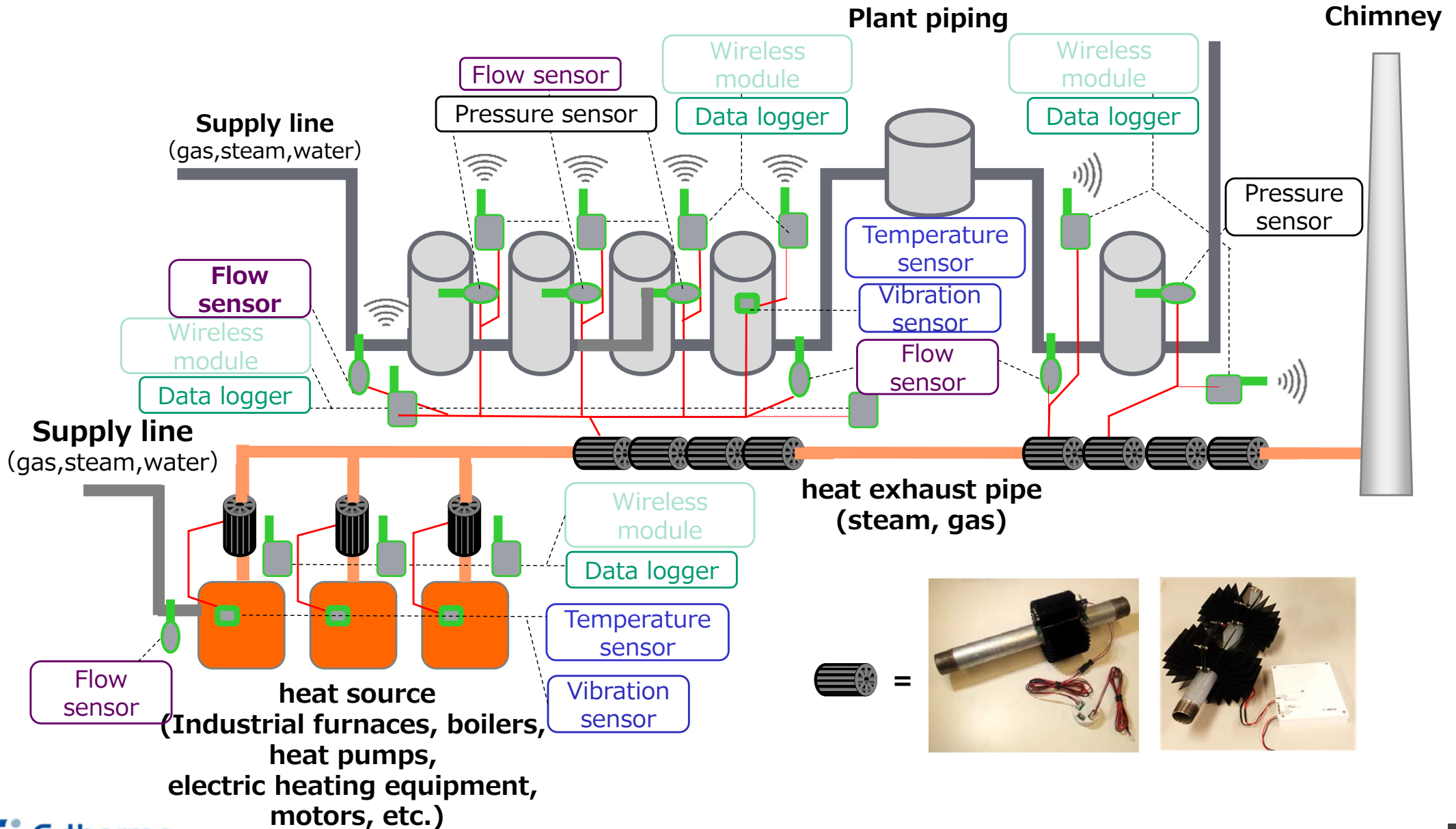


### 〔Features〕

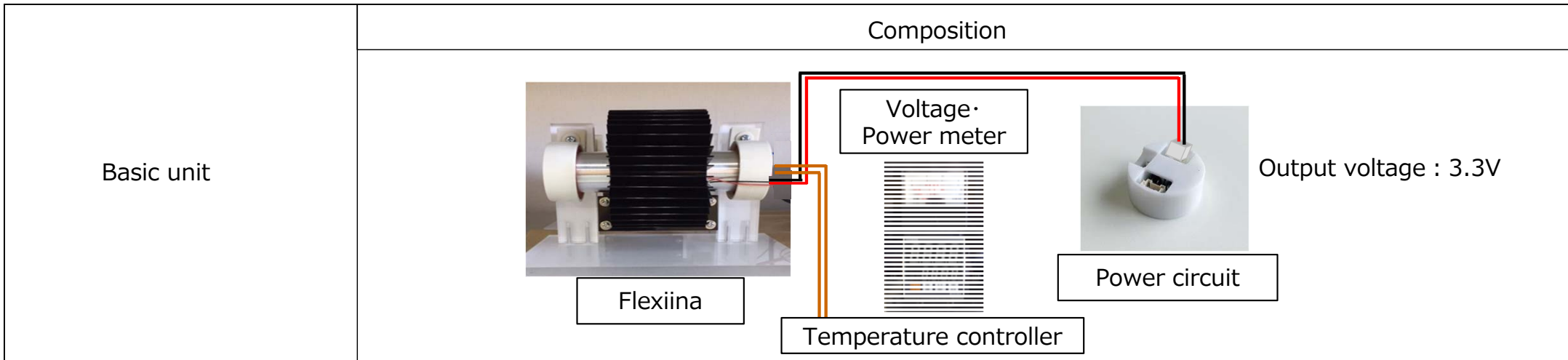
- 1.No need to replace batteries ⇒ Reduced maintenance and management costs
2. High output and cost-effective performance⇒ Enables high-frequency sampling and sensing at high vibration frequencies ⇒ Failure prediction is possible
3. Compact and easy to install ⇒ Easy to consider and implement new IoT systems

# IoT oriented Stand-alone power supply 「S1series」 Powered by 「Flexiina」







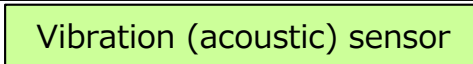

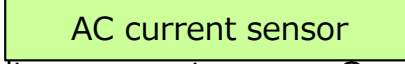
- Installation example of Sensor and stand-alone power supplies for plants



# Flexiina incorporated Stand alone power supply (S1-P1B) Demo kit



## Additional option

(A) Power circuit with communication module	(B) Flexiina o/p measurement Box	(C) Additional sensor
Main Components		
 <p>Power circuit body</p>  <p>Control board</p>  <p>Communication module</p> <p>O/P voltage : 3.3V</p>  <p>USB receiver</p>  <p>Temperature sensor (Attached by default)</p>	 <p>Flexiina O/P measurement box ( with power supply cable )</p>	 <p>Vibration (acoustic) sensor</p>  <p>Temperature sensor</p>  <p>AC current sensor</p> <p>DC voltage current sensor: Coming soon</p> <p><i>* Only one additional sensor can be attached to the power supply circuit connected with communication module (2 sensors can be measured and displayed together with the temperature sensor attached to the power supply circuit connected with communication module).*When measuring with a different sensor, it is necessary to change the settings of the power supply circuit connected with the communication module (will be handled by temporarily returning the device to our company).</i></p>


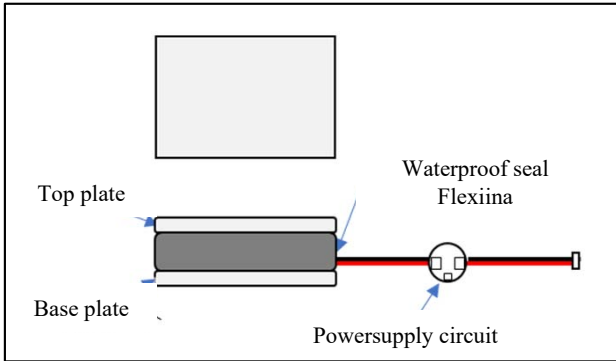
\* The shape of the device may be slightly different from the image.

\* This product is a sample for simple operation check and operation demonstration of Flexiina IoT stand alone power supply. Please do not use it for managing data measurement in the actual manufacturing environment.

## Development of a stand-alone power supply for IoT that uses an exhaust heat-based flat heat source. ( First in the world ! )

S1-F101 ( High output type )

S1-F102 (Low output type)

Exterior appearance		 <p style="text-align: center; background-color: yellow; color: red; border-radius: 15px; padding: 5px;"><b>Sample sales will start soon</b></p>
Output	1.5mW/3.3V (5V) ( $\Delta T=15^{\circ}\text{C}$ ) 4mW/3.3V (5V) ( $\Delta T=25^{\circ}\text{C}$ )	0.06mW/3.3V ( $\Delta T=10^{\circ}\text{C}$ ) 0.12mW/3.3V ( $\Delta T=15^{\circ}\text{C}$ )
Heat source/ ambient environment	Flat heat source ( $\sim 85^{\circ}\text{C}$ ) Heat source/ambient temperature difference of $15^{\circ}\text{C}$ or more	Flat heat source ( $\sim 85^{\circ}\text{C}$ ) Heat source/ambient temperature difference of $10^{\circ}\text{C}$ or more
Size	•Flexiina : 70mm×70mm、t50mm •Power circuit : $\Phi 38\text{mm}$ 、t17mm	•Flexiina : 61mm×44mm、t25mm •Power circuit : $\Phi 38\text{mm}$ 、t17mm (仮)

[Application] For factory IoT (heat, vibration, other)

[Features]

Can be easily attached to flat heat sources ▶ Ideal for predictive diagnosis of motors, compressors, pumps, industrial furnaces, etc.

1. Output is possible with even modest temperature difference ( $\Delta T = 15^{\circ}\text{C}$  or more)
2. No battery replacement required! ▶ It is possible to reduce maintenance and management costs
3. Applicable to various general-purpose wireless sensors ▶ Easy to consider and introduce new IoT systems.

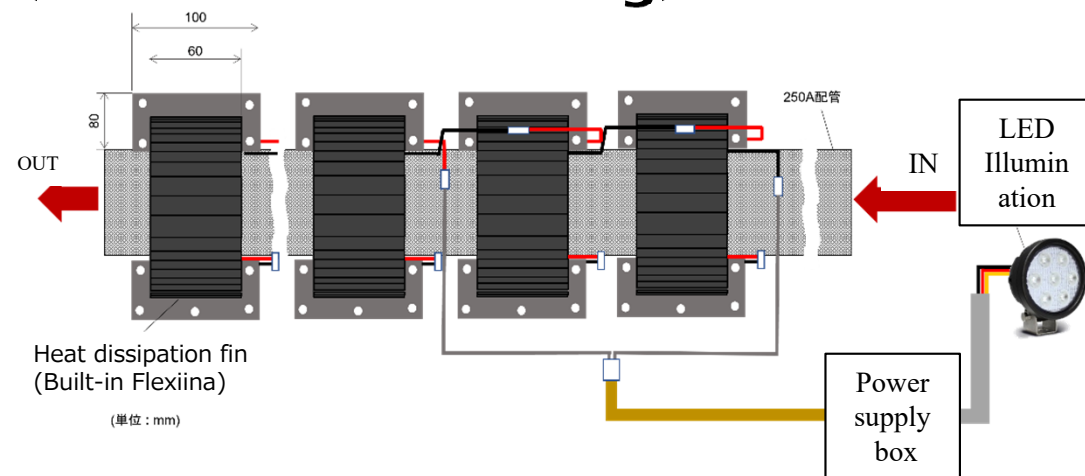


# Development/Practical Application Case:3

## Stand-alone power supply utilizing residual heat from hot water. ( First in the world ! )



### [Installation drawing]



### [Application]

Lighting, surveillance camera, various sensors, communication systems etc.

### [specification]

Output: 24V, 20-40W/m

(Temperature difference between Heat source and ambient:60°C-80°C)

(Pipe diameter  $\phi$ 267.4mm (250A), ground contact)

### [Features]

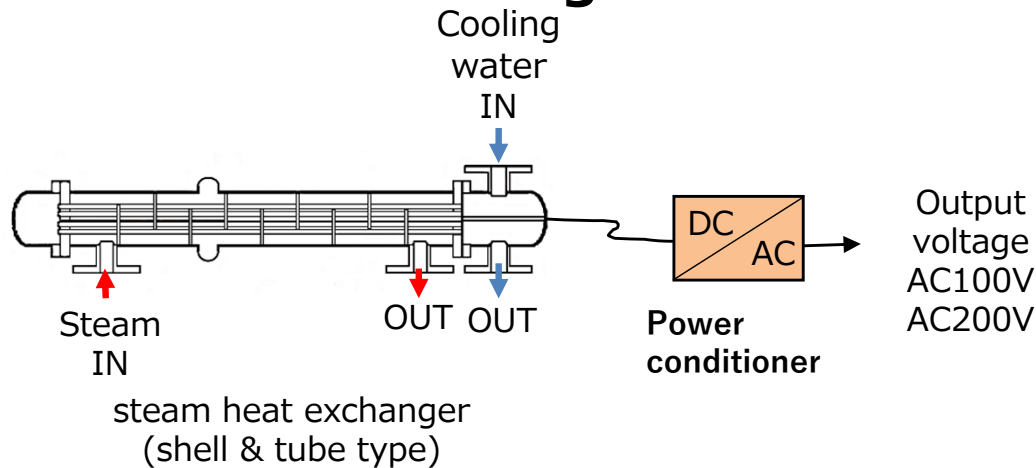
1. Electricity production from effluent that was previously unusable
2. Electricity can be easily harvested even outdoors (no need to install electric wires, which was an issue in the past due to the cost incurred)
3. Works with air cooling (water cooling and thereby pipe laying costs are eliminated)

# Development/Practical Application Case:4

## Energy-saving stand-alone power supply using residual steam ( First in the world ! )

Energy saving

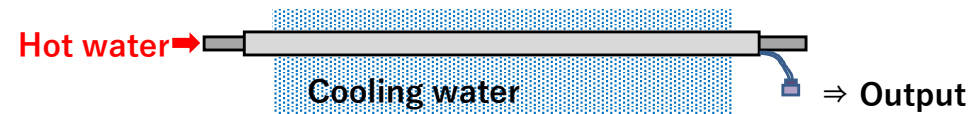
### [Installation drawing]



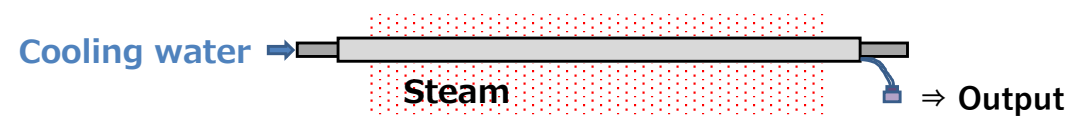
### "Thermoelectric heat exchange tubes" for tube heat exchangers



#### Power generation from hot water



#### Power generation from steam



### [Specification]

Output : 40kW (AC100/200V)

### [Application]

Powerplant (motors, control panels, etc.)

### [Features]

1. Excellent cost performance-

High heat recovery efficiency due to unique structure and manufacturing method

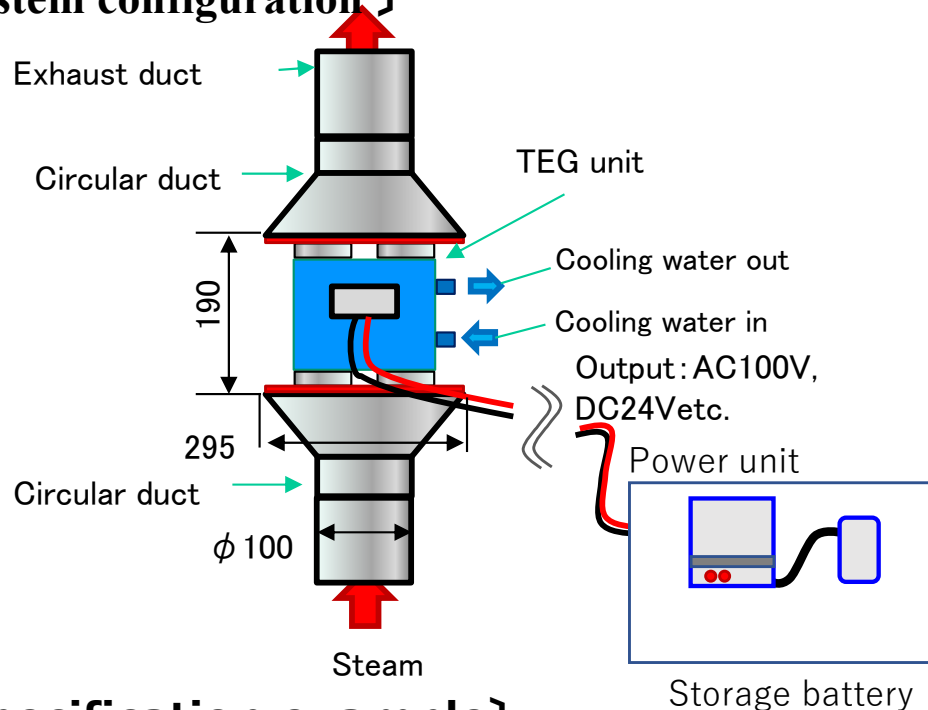
- Significantly reduces maintenance costs as there are no moving parts like generators

2. High reliability due to seamless pipe

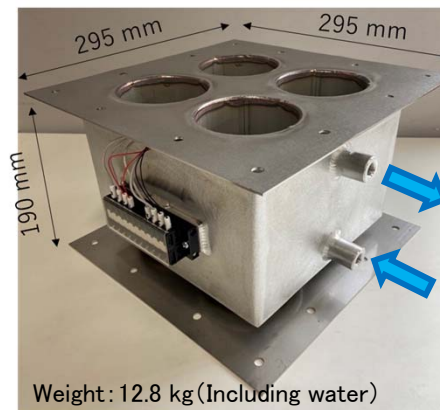
3. High degree of design freedom (supports a wide range of heat source sizes)

## Development of a stand-alone power supply system with a core-type heat collector that uses exhaust gas heat (first in the world!)

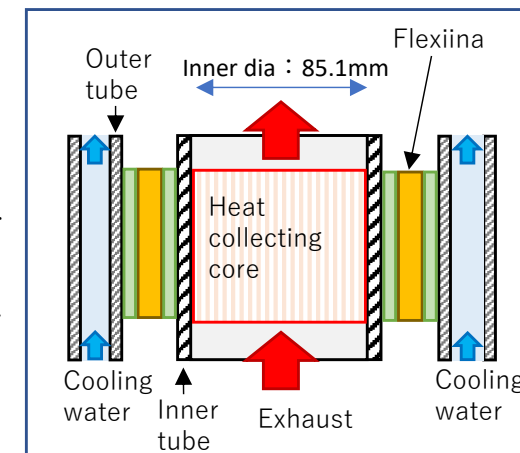
### [System configuration]



### [TEG unit configuration]



▲Exterior image



▲ Cross section of power generation unit

- ※1) Multiple units can be easily configured.  
Example) For 2-unit system ⇒ 400 W  
(Exhaust air volume 600 m<sup>3</sup>/h, cooling water volume 10 L/min)
- ※2) Optimal design is possible according to the allowable pressure drop of the customer's exhaust system.

**[Use]**  
**Factory lighting**  
**Power supply for surveillance cameras**  
**Battery charging, etc.**

### [Specification example]

**Power generation capacity : 200 W (※ 1)**  
**Pressure drop : 200 Pa以下 (※ 2)**  
 (conditions)  
**Exhaust: 350°C 300 m<sup>3</sup>/h, cooling water: 20°C 5 L/min**

### [Features]

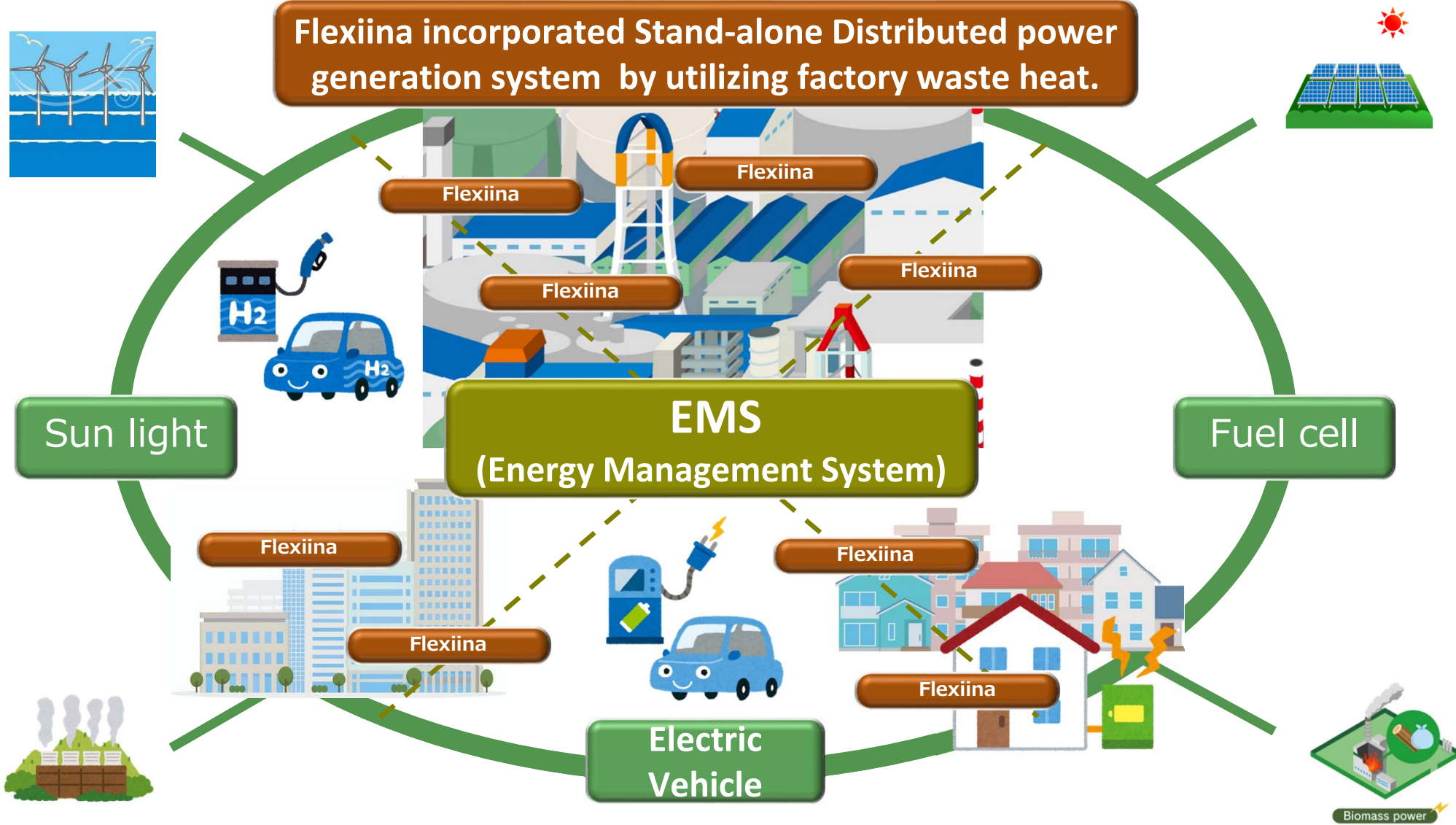
1. High-efficiency heat recovery from exhaust waste heat thanks to the unique structure of the core type heat collector core and the "Flexiina".
2. Water-cooled high-efficiency power generation.

# Future vision

## Energy management system with the concept of 'Local production for local consumption' using residual heat

### VPP (Virtual Power Plant)

Flexiina incorporated Stand-alone Distributed power generation system by utilizing factory waste heat.



Biomass power