

A heater more excellent

than the geothermal heat pump

World's best heating technology

About Us

Since its establishment in 2006, Blue Energy has perfectly solved the temperature deviation between the floor and ceiling in spaces, a problem which remained unsolvable in the field of energy utilization. With our own technology of direct heating, we have realized the world's first 'horizontal-axis circulation convection heating', 5th-generation heating that makes the ascending heat have directivity and circulate by itself.

Blue Energy heats the entire indoor space at the same time without any forcible convector by eliminating the heat storage process and integrating the removal and air-conditioning. Therefore, it has become possible to manage the temperature everywhere in the greenhouse space without variation. In particular, by realizing the no-wind heating without the forcible convector, the indoor humidity is maintained at 80% automatically even at night. Thus, there are no concerns about dew condensation and a dehumidification device is not required. The cost of energy is only half that of conventional products. Compared with the geothermal heat pump, energy-savings are more than 15%.

Our product helps crops grow at the same time so that the height is uniform and the optimal humidity maintained, reducing any concerns about damage by disease and, as a result, having prepared for the foundation of eco-friendly cultivation. As a natural consequence, production increases dramatically and product quality becomes excellent, together with the dramatic reduction in fuel costs.

Blue Energy is also the only company in the world that possesses a total solution required for the heating of greenhouses. We produce all direct heating pipes for space heating, three-lined heating wire for heating the root and stem zones, and submerged water tank heater for watering temperature control.

The direct heating system is the fruit of ceaseless research and technology development aimed at innovation and excellence. Blue Energy will keep on striving to provide the best technology and service without forgetting the quite natural principle that our customers' farming determines the very existence of our company.

Thank you.

Possession of Intellectual Property Rights

Date	Kind	Registration	Name
Nov. 1, 2007	Patent	#10-0774633	Carbon fiber heating cable
Sep. 11, 2009	Patent	#10-0918103	Electric heating pipe
Sep. 20, 2010	Patent	#10-0984312	Winding heater
Feb. 20, 2012	Utility model	#20-0458888	Connection structure of a carbon heating wire and electric cord for preventing electric arc
Dec. 20, 2013	Utility model	#20-0470592	Stopples for heating pipe
Apr. 6, 2016	Patent	#10-1612156	Heating cable with adjustable heating value
Nov. 21, 2017	Patent	#10-1801557	Horizontal-axis whirl convection heating system'
Nov. 18, 2016	PCT	PCT/KR2016/013307	Natural convection heating system
Dec. 21, 2017	Patent (applied)	#10-2017-0176957	Fluid heating device
Jun. 27, 2018	Design	#30-0962900	Fluid heater
Oct. 17, 2018	Trade mark	40-1407462	Sutashimi
Jun. 15, 2018	Chinese patent (applied)	#201680074088.9	Natural convection heating system
Jun. 15, 2018	Japanese patent (applied)	#2018-551732	Natural convection heating system
Jul. 6, 2018	European patent (applied)	#16875927.2	Natural convection heating system

Overview of the Company

2006	7. 1	- Established Blue Energy
2009	9. 11	- Registered the patent of 'Electric Heating Pipe' (#10-0918103)
2010	12	- Heating performance comparison test (diesel fan heater) by National Institute of Horticultural and Herbal Science (Proving effects of cost saving by 64%, humidity by 7%, stem rise by 4%, and overall economy by 46%)
		- Supply project of heating system to carbon-fiber electric heating house (Daegu Metropolitan City Agriculture Technology Center)
2012	12	- Promotion project of small but powerful model farmhouse in facility horticulture field promotion project (Daegu Metropolitan City Agriculture Technology Center of Rural Development Administration)
2013	8	- Urged and realized revision of farming heaters performance testing methods - Newly introducing the systems of measuring the time to reach maximum temperature and the outlet temperature
2015	2	- Selected as the technology task of the creative economy having difficulties in advancing the market (Korea National Industrial Convergence Center)
	7. 1	- Registered the 'direct heating system' as agricultural machinery
2016	1. 6	- Concluded the contract for central settlement of agricultural machinery sale price with National Agricultural Cooperative Federation
	4. 6	- Registered patent of 'the Heating Cable with Adjustable Heating Value' (#10-1612156)
	6. 17	- Selected as the enterprise to be supported as a new exporter by KOTRA
2017	2. 6	- Registered on Korea Online E Procurement System of Public Procurement Service
	2. 14	- Qualified for the performance test of natural-circulation (up-down) convection-type direct heating system and obtained certifications (KOLAS, ILAC.MRA)
		- Safety and uniformity of temperature and humidity, (tested by Korea Testing Laboratory)
	5. 17	- Participated in 'Export Gateway Biz Plaza 2017' (KOTRA)
	6. 27	- Designated as the Export Promising Company of Daegu Metropolitan City (Daegu Techno Park)
	9. 19~22	- Selected an exhibition company in the Daegu Joint Exhibition Hall at Korea Energy Show
	10. 11	- Obtained ISO 9001 Certification
	11. 20	- Registered the heat transfer pipe for heating on Korea Online E Procurement System of Public Procurement Service
	11. 21	- Registered patent of 'Horizontal-axis Whirl Convection Heating System' (#10-1801557)
2018	4. 4 ~ 6	- Selected as a company participating in the Daegu Joint Exhibition Hall at International Green Energy Expo 2018
	6. 15	- Applied for international patent of 'Natural Convection Heating System' (Europe, China and Japan)
	7. 5	- Obtained NET (Net Excellent Technology) Certification (Minister of Agriculture, Food and Rural Affairs. 53-061)
	8. 31	- Registered Tashimi, a submersible water tank heater, on Venture Nara of Public Procurement Office as the innovative procurement product
	11	- Conclusion of MOU with Kashkadarya Province of Uzbekistan for support and cooperation of the direct heating technology

Technology-related Tests and Certifications

Date	Contents	Remarks
May 26, 2011	Heating performance comparison test	National Institute of Horticultural and Herbal Science (Proving effects of cost saving by 64%, humidity by 7%, stem rise by 4%, and overall economy by 46%)
May 14, 2015	Obtaining safety certification of direct heating system (HPS-13200)	Korea Testing Laboratory (15-027053-01-1)
Feb. 10, 2017	Performance test of natural-circulation convection-type direct heating system	Korea Testing Laboratory (17-008368-01-1)
Apr, 2017	Obtained CE Certification (HPS-13200, 15200)	TCF No: MD-170301ST
Sep, 2017	Obtained safety certification of heat transfer pipe for heating (HP-2200AJ, HP-3780BJ)	Korea Testing Certification (T2017-10487 외) (T2017-10487 and others)
Oct. 11, 2017	Obtained ISO 9001 Certification	GIS-0965-QC
Nov. 8, 2017	Obtained KC Certification for Tashimi, a submersible water tank heater	MSIP-REM-BIE-HPC-W2k
Nov. 28, 2017	Obtained CE Certification for Tashimi, a submersible water tank heater	STD-CE-17133
Jul. 5, 2018	Obtained certification of Net Excellent Technology (NET)	Minister of Agriculture, Food and Rural Affairs. 53-061

Participation in the projects of the Government and local governments

Dec. 2010	Supply project of heating system to carbon-fiber electric heating house –Daegu Metropolitan City Agriculture Technology Center
Dec. 2012	Small bur powerful model farmhouse promotion project (facility horticulture field) – Daegu Metropolitan CityAgriculture Technology Center of Rural Development Administration
Nov. 23, 2015	Selected as a participant in 'Intelligent Machine Commercialization Support Project of the Economic Cooperation Zone Promotion Project' – supported by POMIA
Jun. 10, 2016	Selected as a company to be supported for [IP Scale-Up] patent technology simulation production – Daegu Regional Intellectual Property Center
Jun. 17, 2016	Selected as the enterprise to be supported as a new exporter by KOTRA
Aug. 16, 2016	Selected as a company to be supported for reinforcing marketing competitiveness of intelligent machine industry – Daegu Techno Park
Sep. 27, 2016	Selected as a company to be supported for the autonomous business of export enterprise by the Small and Medium Business Administration – recommended by KOTRA
Nov. 2, 2016	Selected as a company to be supported for Korea International Exhibition of Machinery, Equipment, Science & Technology for Agriculture (KIMESTA) – Daegu Techno Park
Nov. 10, 2016	Patents of 2016, selected as the technology to be supported for overseas rights [International stage of PCT (Patent Cooperation Treaty)] – Daegu Regional Intelligent Property Center
Feb. 10, 2017	Selected as a company for grass root enterprise promotion project – (Foundation) Daegu Mechatronics & Materials Institute
May 17, 2017	Selected as a participant in 'Export Gateway Biz Plaza 2017' -KOTRA
May 22, 2017	Selected as a company to be supported for registration of excellent procurement product on Korea Online E Procurement System of Public Procurement Service – Daegu Techno Park
Jun. 27, 2017	Designated as an export promising company of Daegu Metropolitan City – Daegu Techno Park
Aug. 16, 2017	Selected as a business to be supported for test analysis of quality improvement and certification of the decentralized energy industry - Daegu Mechatronics & Materials Institute
Aug. 28, 2017	Selected as a company to be supported for reinforcing marketing competitiveness of intelligent machine industry – Economic Promotion Agency of Gyeongsangbuk-do
Sep. 19-22, 2017	Selected as an exhibition company the Daegu Joint Exhibition Hall at Korea Energy Show 2017 – Daegu Techno Park
Oct. 13, 2017	Selected as a company to be supported for export voucher in the Export Success Package Project – the Small and Medium Business Administration
Apr. 4-6, 2018	Selected as a company participating in the Daegu Joint Exhibition Hall at International Green Energy Expo 2018
Apr. 17, 2018	Selected as a company to be supported for quality improvement of components and materials – Nano Center of Daegu Techno Park
May 2018	Selected as a company to be supported for product registration on Korea Online E Procurement System of Public Procurement Service
Jul. 10, 2018	Selected as a company to be supported for regional innovation growth voucher – Daegu Techno Park
Jul. 24, 2018	Selected as a package support company for promoting technology convergence and commercialization of decentralized energy industry – Nano Center of Daegu Techno Park
Aug. 1, 2018	Selected as a company of patent map support project – Daegu Regional Intellectual Property Center

Blue Energy's Direct Heating System (Whirl Convection Heating Technology)

Conventional heating system

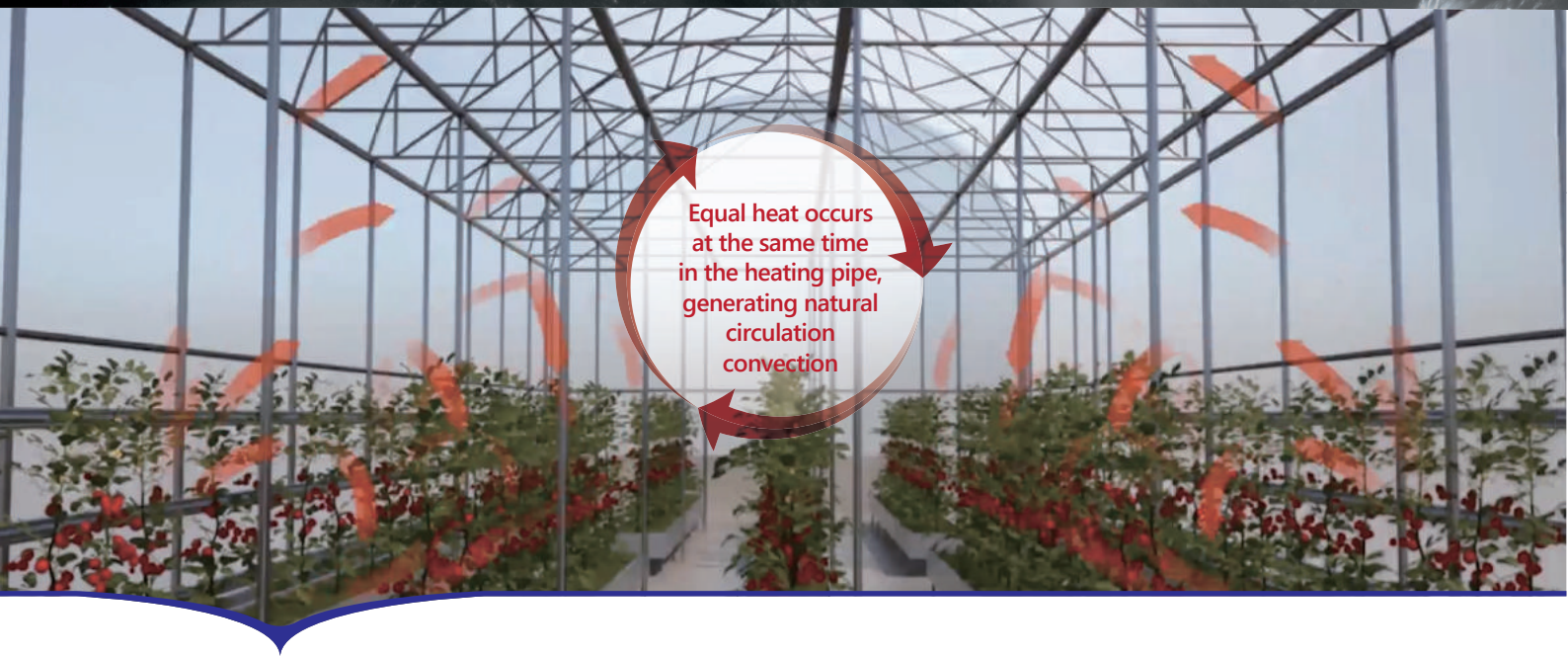
The heating system installed in the vinyl greenhouse:
boiler or fan heater

Problems of Conventional Heating Systems

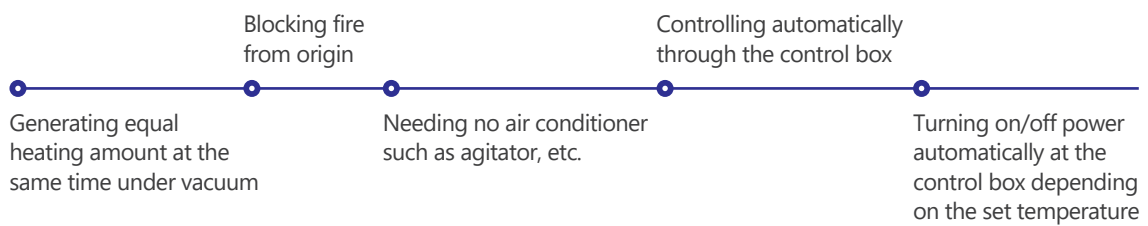
- Large indoor temperature deviation
- Many limitations such as dew condensation, etc.
- Increase of heating cost due to low energy efficiency
- Environmental pollution by using fossil fuels
- Disturbance of healthy crop growth caused by noise, etc.

Comprehensive Comparison with Conventional Heating

Performance factors		horizontal-axis whirl convection	Boiler	Fan heater	Remarks	
Crop growth environment	Growth rate control	Easy	Impossible	Impossible	Possible to control temperature finely	
	Temperature	Reaction rate	Immediately	Heat exchange ~ heat storage ~ dispersion ~ radiation -heat exchange ~ circulation	Heat up - heat exchange - dispersion ~ circulation	Direct heating/horizontal whirl convection
		Change	Maximum ±1.3	About 10~15°C		(ON/OFF basic ±1)
	Humidity	Spatial deviation	Maximum 3°C	About 10~15°C		
		Change	Maximum 80.3% ±6.7%	95% or higher, dew condensation	95% or higher, dew condensation	Crop optimized by itself
	Spatial deviation	Maximum 79.9%±13.5%	Very high (dewcondensation and over drying)	Very high (dew condensation and over drying)		
	Wind	None	Forcible circulating wind	Ventilator, agitator	Natural convection	
Noise	None	Boiler and circulating pump	Fan heater, air-conditioning facilities	No mechanical device		
Energy efficiency	Energy source	Electricity	fossil fuel or electricity	Fossil fuel or electricity		
	Use of energy	Very low	High (kcal)	High (kcal)		
	Heating method	Direct heating	Fuel→water→air	Heater ~ air→air	Saving heat exchange energy	
	Heat storage medium	None	Water (oil)	Water, burner, sheath heater	Saving heat storage energy	
	Removal device	None	Circulation pump	Ventilator	Saving device energy	
	Dispersion means	None	PE and iron pipe	Duct, plastic duct	Saving dispersion energy	
	Radiating performance	Very high ((20 times)	Low	Comparatively high	0.25t vacuum corrugated tube	
	Diffusing method	Horizontal whirl convection	Elevated convection	Elevated convection	Saving ceiling storage heat	
	Agitation device	None	Required	Required	Saving agitating energy	
Maintenance	Mechanical device	Control box, heating pipe	Boiler and pipe, air-conditioning facilities	Fan heater, duct air-conditioning facilities	Not requiring separate space	
	Major defect factors	Almost none	Mechanical corrosion and scale	Mechanical failure fire	Simple structure	
	Construction convenience	Very high	Pipe welding, boiler chamber, etc.	Normal	Corrugated tube, extending snow removal	
	Management convenience	Very high	Low - pipe scale cleaning, etc..	Normal	Module method	
	Durability	Semi-permanent	About 5 years	About 5 years	Stainless steel materials	

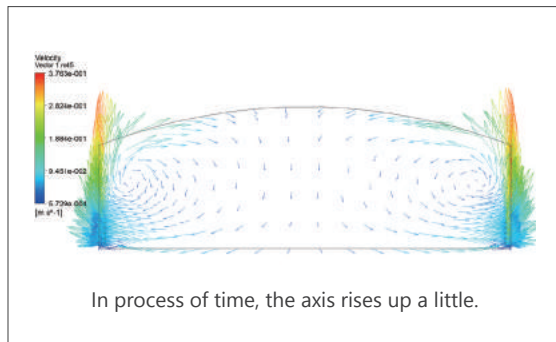


| Blue Energy's Direct Heating System (Whirl Convection Heating Technology)



| Natural Circulation Convection Technology

- Air flow caused by horizontal-axis whirl convection

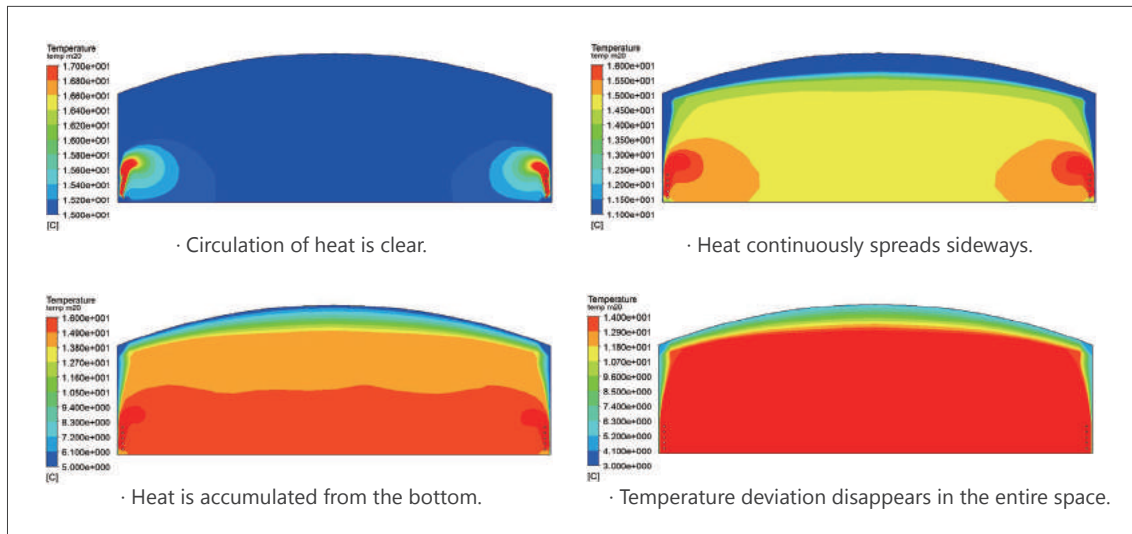


The whirl convection occurs as whirlpool is generated to the direction of horizontal-axis around the direct heating pipes installed on both sides and, in process of time, the axis rises up a little.

- Temperature change due to horizontal-axis whirl convection

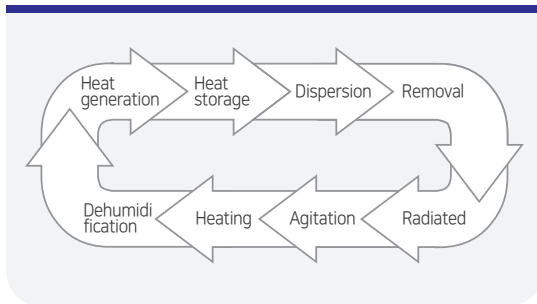
Horizontal-axis whirl convection occurs around the heater, heat is accumulated from the bottom while spreading sideways, and then temperature of the entire space becomes uniform.

Heat flow analysis: Pohang Institute of Metal Industry Advancement Analysis (POMIA)

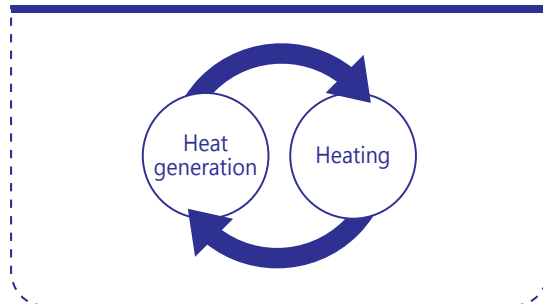


I Advantages of the Technology

We have realized no-wind space heating without any air-conditioning equipment by eliminating the heat storage process and integrating removal and air-conditioning. Even by optimizing the humidity, we have solved due condensation, which is an endemic problem of vinyl greenhouse, from origin.



All heaters including the heat pump



Blue Energy

WHY the Whirl Convection Heating Technology?

1. Temperature is controlled within a deviation of 0°C.
2. Indoor humidity is maintained at about 70%, even at night.
3. Fuel costs are drastically reduced by 50%.
4. As crops' growing speed is constant, the height is uniform.
5. Concerns about damage are significantly reduced.
6. The system is customized depending on the scale or direction of the vinyl greenhouse.
7. Snow can be removed freely as well as the root and stem zones are heated.
8. The product rate, as well as the output, will be increased significantly
9. Shipping date and growth speed can be controlled.
10. Your income will increase due to the reduced fuel cost.
11. Separate installation space is not needed.
12. There is no air-conditioning facility, such as agitator or duct.
13. There is no noise, wind or air pollution.



Performance Comparison with Conventional Technology

I Innovation of the natural circulation convection

· Hardware Configuration

Category	Conventional products		Blue Energy	Remark
	Boiler	Fan heater		
System structure	Central heating and local dispersion combination type		Radiating pipe	Non-powered air-conditioning Simultaneous heating of the entire space
Heat storage medium	Water (oil)	Sheath heater, water	Not required	
Dispersion equipment	Circulating pump	Ventilator	Not required	
Removal means	PE & iron pipe	Duct, plastic duct	Not required	
Agitating equipment	Agitator	Agitator	Not required	
Dehumidifying equipment	Separate dehumidifier	Separate dehumidifier	Not required	

· Heating Mechanism

Category	Conventional products	Blue Energy	Remarks
Air flow method	Forced ventilation	'Air density difference' depending on the temperature difference	Horizontal-axis whirl convection
Temperature maintenance	Indirect (water, wind) heating	'Directly heating' the entire space simultaneously	Direct heating
Humidity maintenance	Dehumidifying equipment	Non-dehumidification and life principle	Temperature control within the dew point
Realization of smart farm	Limits in precise control	Realization of 1℃ unit control	Quick and simultaneous temperature response rate in the entire space

· Convenience of the Management and Operation


Category	Conventional products	Blue Energy	Remarks
Cold-weather damage risk	Concerns about when the central heating equipment fails	Module type	Blocking cold-weather damage from origin
Machine equipment	Mechanical device, air-conditioning equipment	Control box, heating pipe	Installation space not required
Key management elements	Machine failure, corrosion and scale, fire, etc.	Almost none	Simple structure
Durability	About 5 years	Longer than 10 years	Simple structure

I Performance of Whirl Heating

1. Management of Temperature and Humidity

Category		Conventional products	Blue Energy	Remarks
Temperature	Temperature change deviation	±5~10℃	Maximum ±1.3℃	
	Temperature spatial distribution deviation	±10~15℃	Maximum 3℃	
Humidity	Humidity change deviation	Dew condensation, 95% or higher	Maximum 80.3% ±6.7%	
	Humidity spatial distribution deviation	Dew condensation, 95% or higher	Maximum 79.9% 13.5%	
<p><Support of Local Adaptive High-Reliability Slim Farming Machine Manufacturing Base Fostering Project/ (Foundation) Daegu Mechatronics & Materials Institute></p> <ul style="list-style-type: none"> · Test methods: JTM K 09: 2009(testing the constant temperature and humidity chamber)-KOLAS Certification · Test space: 80m×64m×5.5m, vinyl greenhouse for paprika in Changnyeong-gun, Gyeongsangnam-do · Test date: Measuring for 15 hours in minutes from 5:08 pm of February 13 to 8:57 am of February 14, 2017 · Test institution: Korea Testing Laboratory (KTL) 				

2. Energy Efficiency

Heating stage	Energy loss description of conventional products	Blue Energy		
Energy input	Medium materials heated		Heat generation	
Medium	Physical loss following heat exchange	None		
Heat storage	Waste of residual heat energy stored after heating every day	None		
Removal	Waste of energy due to operation of remote heat removal equipment	None		
Dispersion	Waste of residual heat energy stored in the dispersion equipment after heating every day	None		
Radiation	Waste of unnecessary energy due to radiation of residual heat between the system ON and OFF	None		
Heat exchange	Physical loss in the process of heat exchange	None		
Diffusion	Waste of energy due to operation of forced heat diffusion equipment	None		
Ceiling heat storage	Energy waste due to temperature difference with the top of the ground and unnecessary energy use	None		
Agitation	Energy waste due to operation of the upper and lower air flow equipment	None		
Temperature maintenance	Repetition of the above process – occurrence of time difference of the temperature reaction rate	Immediate reaction		Completion of heating
Dehumidification	Dew condensation generated at 95-100% humidity, requiring operation of dehumidifier	None		

Energy efficiency comparison with geothermal heat pump

Contents	Geothermal heat pump	Blue Energy
Full heating wattage	100	92.3%
Amount of power used	100	85.0%
Electric charge	100	86.2%
Installation cost	100	11.1%

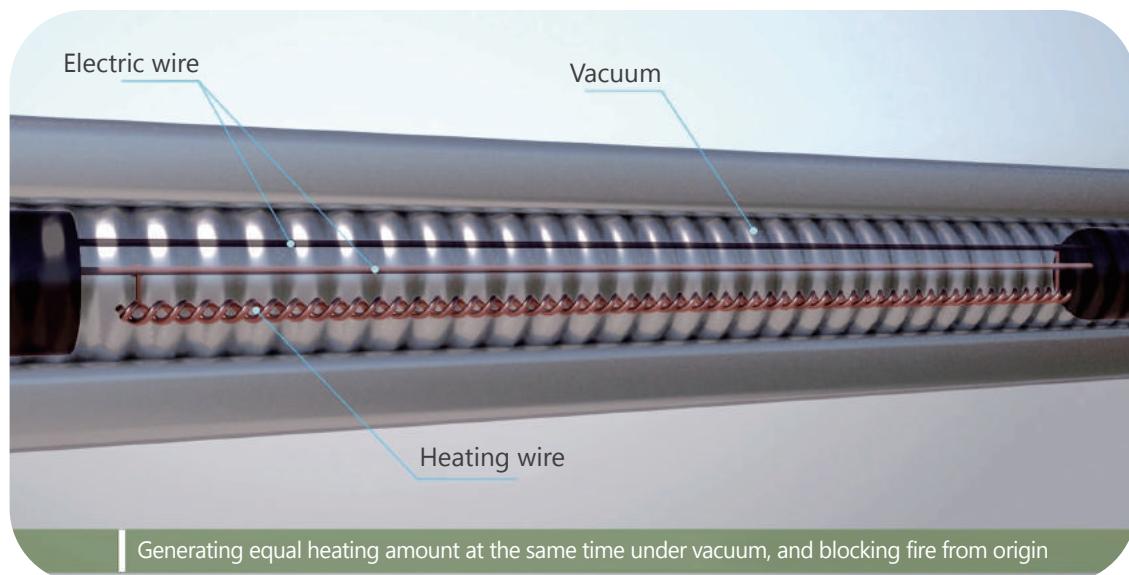
※ Based on KEPCO bill for a same-crop husbandry farmhouse in Changnyeong county, South Gyeongsang province during the period from December 2017 to March 2018

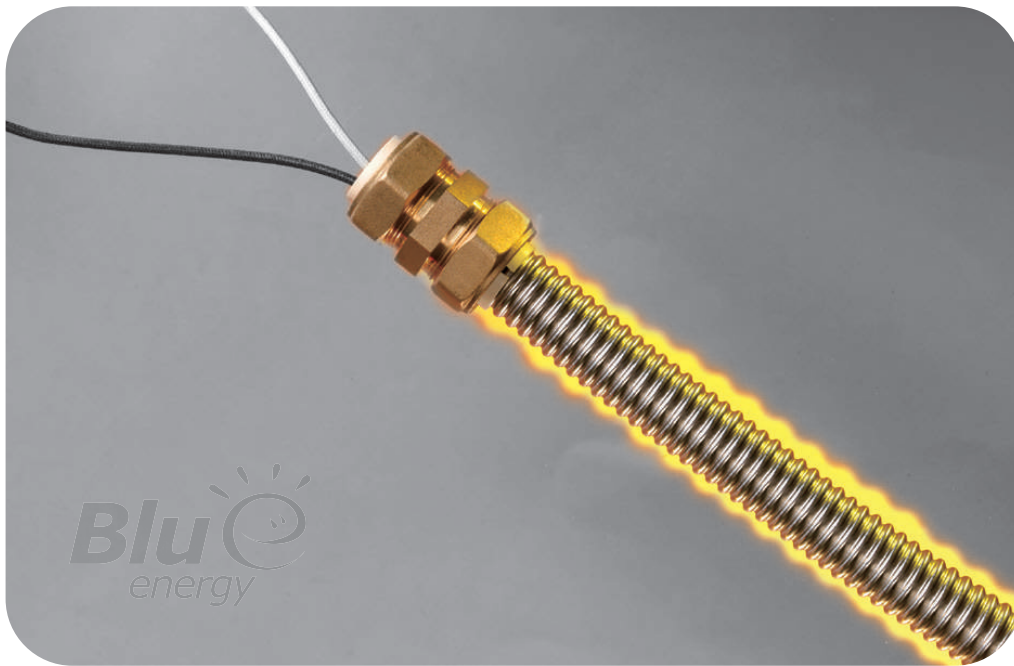
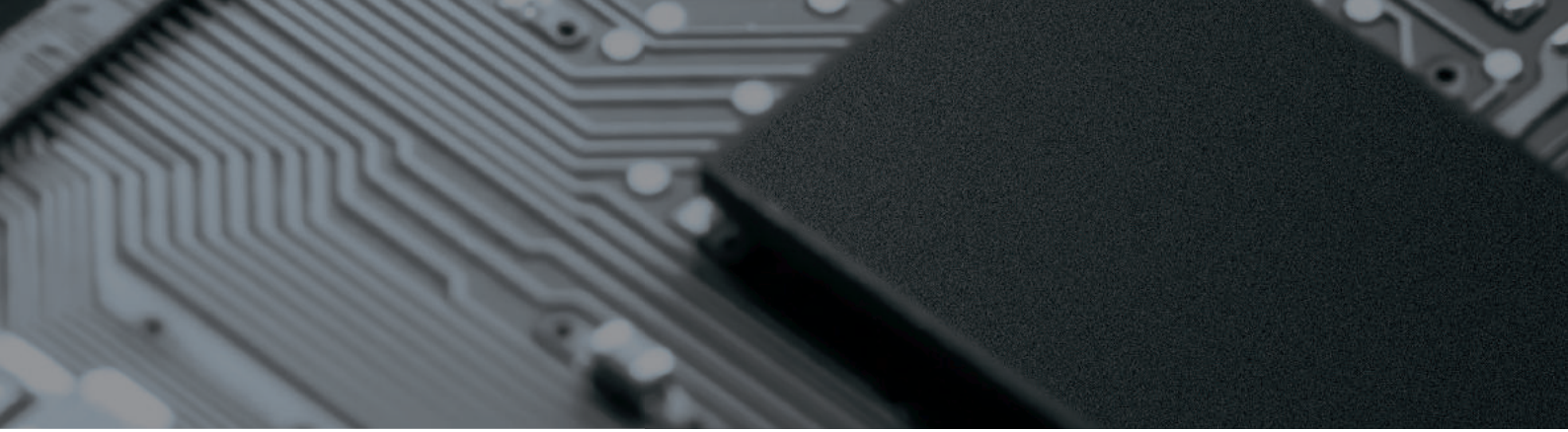
<Reference> Geothermal heat pump is recognized throughout the world as a heating system which is more than twice as efficient as conventional boilers and fan heaters. Therefore, it is no exaggeration to say that the energy efficiency of the Blue Energy system is twice that of a fan or boiler and is even higher than a geothermal heat pump.

About the Product

Heating Tube

- The core of the heating tube is direct heating. Heating Tube is a heater that generates the same heat immediately regardless of the length.





Model No.	Thickness (mm)	Length (m)	Power consumption (W)
HPS-1100A	25Φ/20A/0.25	12m	1100
HPS-2200A	25Φ/20A/0.25	24.5m	2200
HPS-1260B	25Φ/20A/0.25	10m	1260
HPS-2520B	25Φ/20A/0.25	20m	2520
HPS-3780B	25Φ/20A/0.25	30m	3780



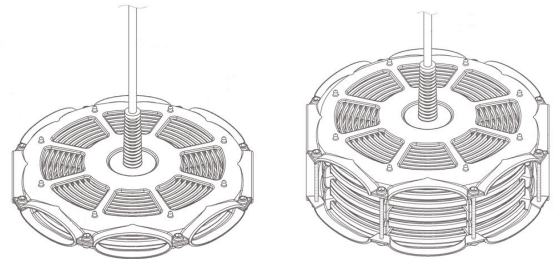


Tashimi that 'warmed severe winter of Pyeongchang'

I Advantages of Tashimi

1. Convenience

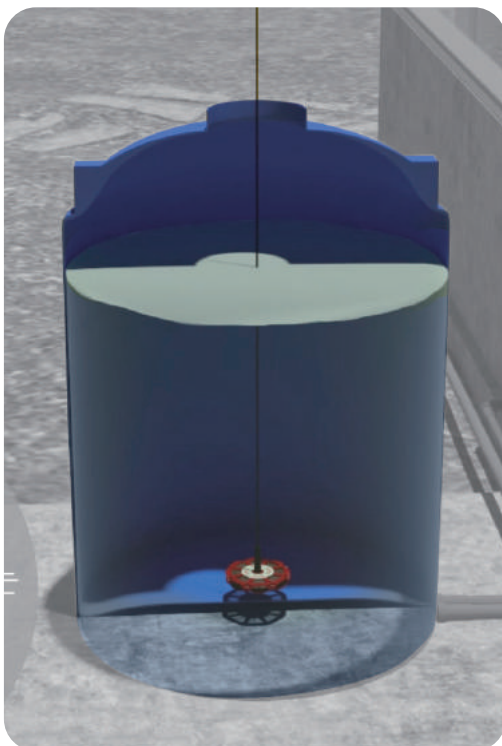
- It will be fine if you just dip it in the water.
- Attached thermostat adjusts water temperature automatically.



2. Safety

- Touching the bottom of the water tank and always being submersible in the remaining water, it blocks fire from origin.
- The height of heat wire is only 4.4mm.
- Made of heat-resistant silicone material, it can be used semi-permanently without worrying about corrosion.

I Usage



① Maintaining temperature of vinyl greenhouse, water tank and land-based aquaculture tank.

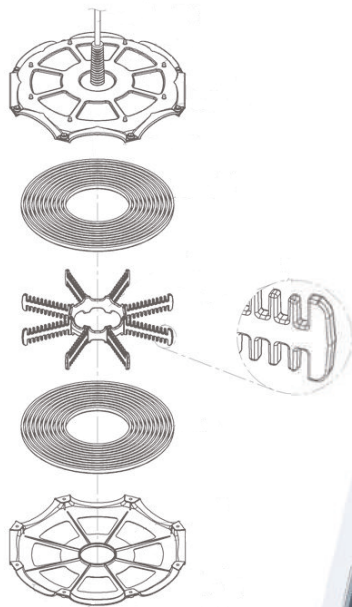
② Especially in a vinyl greenhouse, this product helps crops smoothly absorb nutrients such as phosphorus and potassium as well as promotes growth by supplying water at a temperature suitable for the crops, thereby increasing production volume and merchantability.

1. Tashimi is a product confirmed with NET technology application.
2. It has obtained three kinds of CE Certification, including hazardous compounds safety test, electromagnetic wave safety test, and electrical safety test.

Item	Contents
Standard (mm)	70×310×310
Materials	KP4
Heating wire	12m high heat (heat resistance up to 300℃) silicon sheath
Power consumption	2.2kW
Minimum heating capacity	0.5℃/h (by 3-ton water tank)
Temperature control	Underwater temperature sensor, overheat sensor
Key features	Corrosion resistance (silicon and plastic)



- Installation in the Pyeongchang Olympic Alpine Ski Resort



I Three-lined heating wire

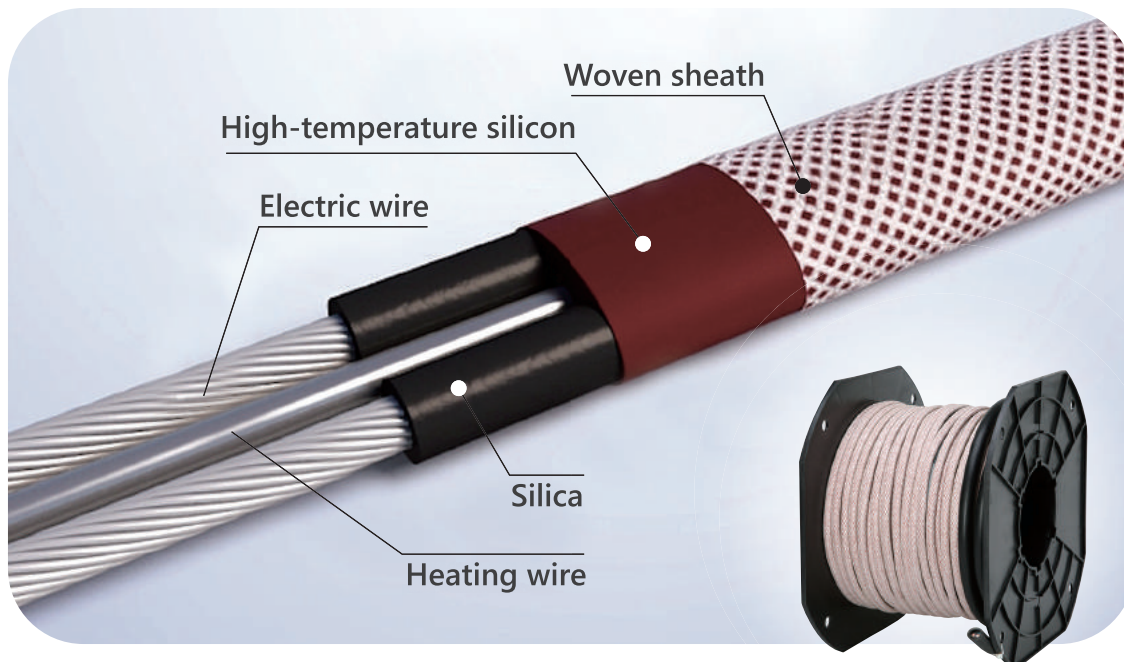
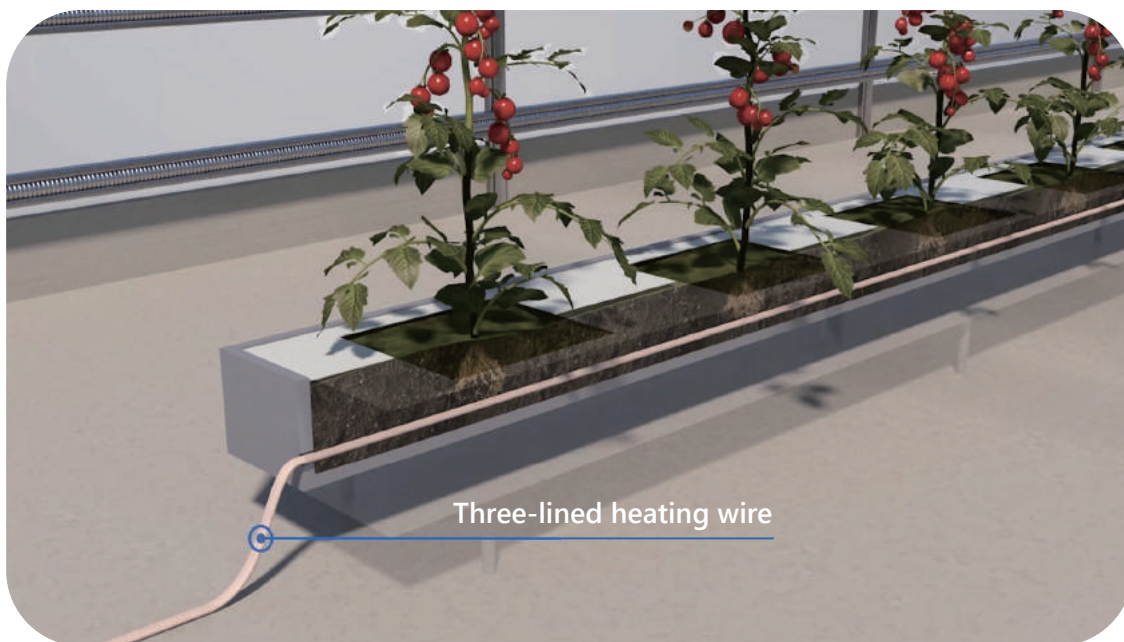
Arbitrarily adjustable heating amount

Various lengths

Making dramatically stable crop growth environment for the winter season

Used for heating the zone under the nutrient bed, that is, the root and stem zones of the nutriculture farm

According to the specification, 400W series used for being laid under the ground like conventional boiler





Kind	Model No.	Thickness (mm)	Length (m)	Power consumption (W)
Heating the root and stem zones	HC-18A	7.7 * 4.6	18	330
	HC-36A		36	660
	HC-54A		54	990
	HC-72A		72	1,320
	HC-90A		90	1,650
	HC-108A		108	1,980
Laid underground	HC-16B		16	400
	HC-32B		32	800
	HC-48B		48	1,200
	HC-64B		64	1,600
	HC-80B		80	2,000
	HC-96B		96	2,400



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