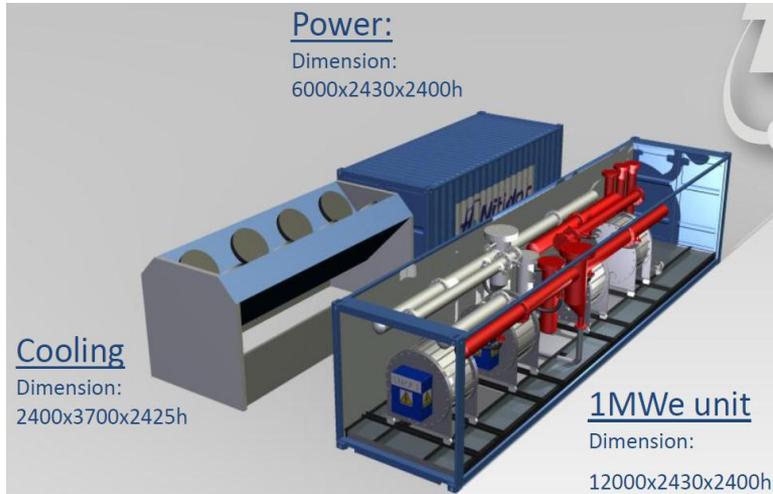
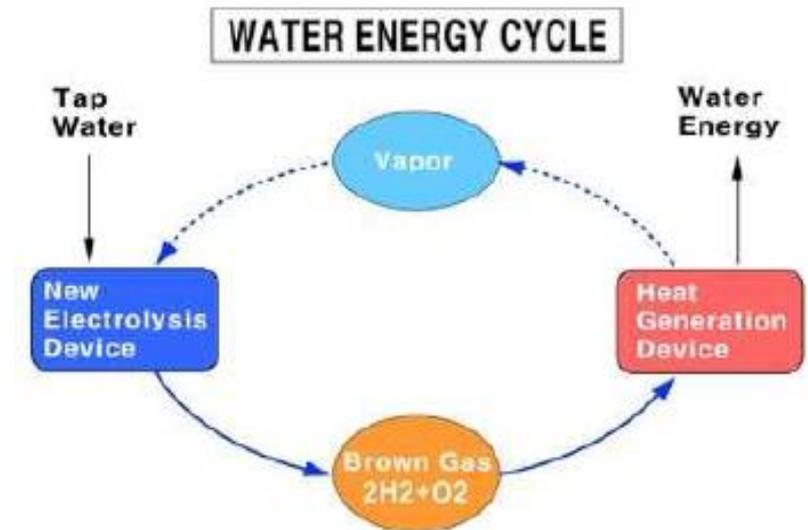


Hydroxy Water Electrolyser

Hydro-Oxygen Gas for Combustion and Metal Cutting



Water is Energy !



BBN Partners
BioClean & BlueEnergy Network

#22-203, 12 Gil, Sapyung-Daero, Seocho-Gu, Seoul, Korea
T : +82-2-6000-3979 M : +82-10-2979-6201 E : bbn@bbnworld.com

Water Treatment, Waste to Energy, Recycling, Renewable Energy
Global Market Expansion, Strategic Sourcing, Cross-border Financing,

HHO WATER GAS GENERATION SYSTEM

HHO Water Gas is used in the field of :

1. Gas Welding
2. Gas Cutting of Metal
3. Brazing, Soldering
4. Glass Process
5. Gold Silver Jewelry Works
6. Water Fuel for Industrial Boiler,
7. Heating Furnace, Incinerator
8. Melting Furnace, Drying Plant
9. BTU increase of fossil power plant
10. Fuel for Engine and prime mover

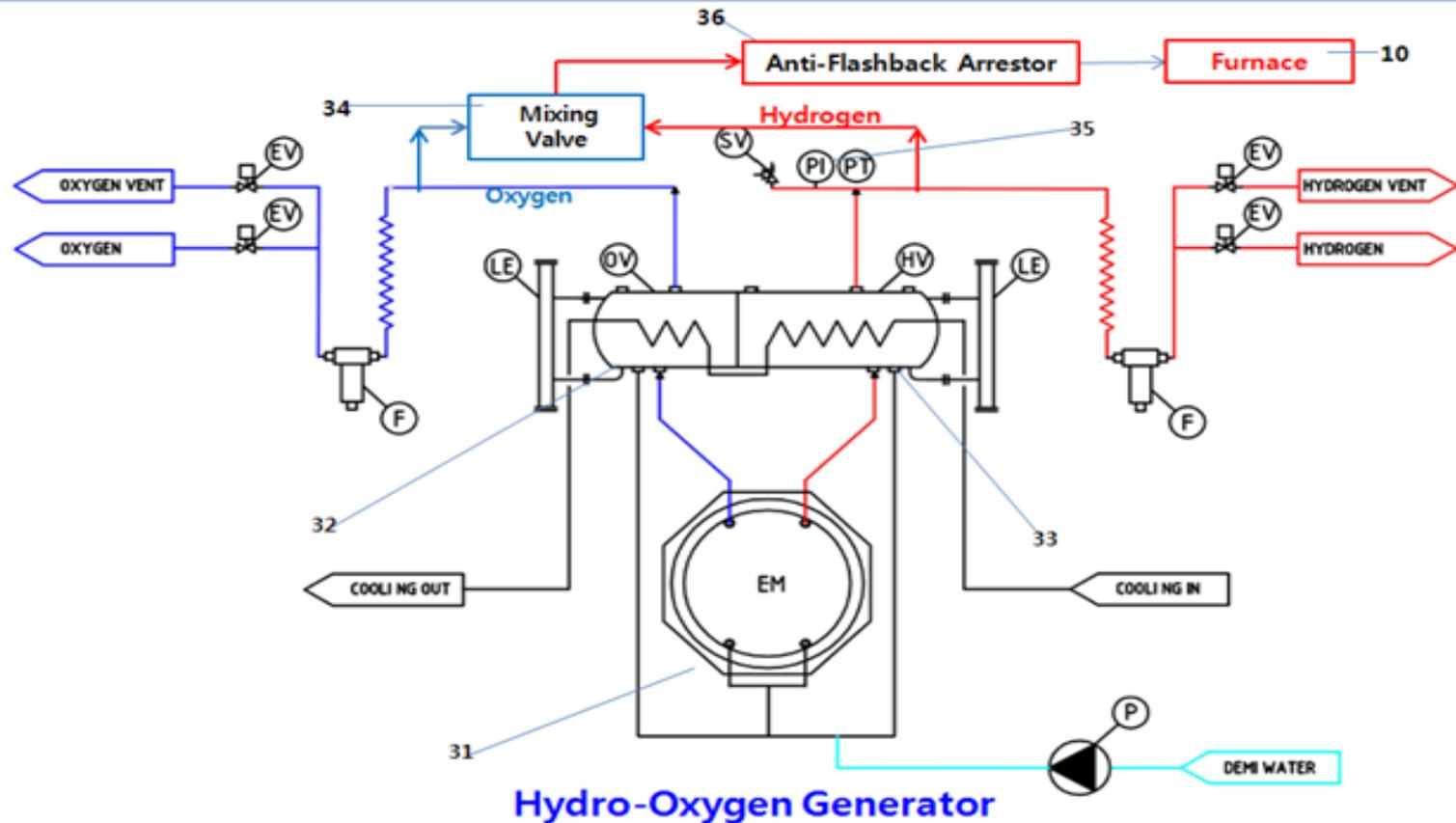
BBN has Two types of HHO Gas Generator .. Air cooling type of small Capacity of HHO Generator and 1,000,000 liters per hour of water cooling HHO Generator



[VIDEO HHO Water Gas | Brown Gas](#)

What is HYDROXY Brown Gas?

- Produced by electrolyzing the water
 - Anode (-) : Oxygen, - Cathode (+) : Hydrogen
 - Mixture gases of O & H : between the two electrodes
- All gases produced in this process is called "Brown Gas".

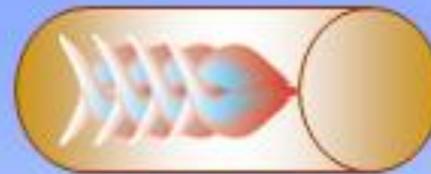


Mass Balance of HHO Brown Gas

Water : 150 ℓ /hr
Electricity : 690kWh



Brown Gas Generator



Combustion equipment



H₂O (ℓ) : 150 ℓ /hr

Brown Gas : 300m³/hr

H + H₂ : 200m³/hr

O + O₂ : 100m³/hr

H₂O(g)

Heat generation : Emitted as flame

Main Features of HHO Water Brown Gas

① Safety

- Can be used at **low pressures** (0.1 ~ 2.0 kgf/cm²) **without storage**

② Clean energy

- Composed of H₂ and O₂
- When burned, BG turns back into water again.

③ Ultra High temperature and fast rate of combustion

Temperature of any objects can reach above 1,900°C within 3 sec.

•High Efficiency of Energy

When producing HHO Gas by using our system, 2.3kW/m³ of electric power is consumed, while other companies consume 3.5~4.2kW/m³ of electric power .

Hydro-Oxygen Generator

BBN-1500



Input Voltage	380 ±10%,50/60Hz,three phase
Rated Capacity (KVA)	6
Operation Current (A)	150
Working Gas Pressure (Mpa)	≤0.2
Relative Humidity (%)	90
Rated Gas Production (L/h)	1500 ±10%
Water Consumption (L/h)	1.1
Maximum Cutting Thickness (mm)	50
Effective Punching Thickness (mm)	15
Water Feed	auto
Cooling Mode	Air Coll
The Insulation Level	F
Power Supply Protection Grade	IP21S
Flame Temperature (°C)	Adjustable 800~3200
Working Medium	Filtered water or deionized water or soft water
Working Method	Continuous
Environment Temperature (°C)	0~40
Outline Dimensions - L*W*H (mm)	1100*760*1200
Gross Weight (kg)	160
Ventilation Space Requirement (mm)	400 in each direction

BBN-2500



Input Voltage	380 ±10%,50/60Hz,three phase
Rated Capacity (KVA)	9
Operation Current (A)	200
Working Gas Pressure (Mpa)	≤0.2
Relative Humidity (%)	90
Rated Gas Production (L/h)	2500 ±10%
Water Consumption (L/h)	1.6
Maximum Cutting Thickness (mm)	80
Effective Punching Thickness (mm)	40
Water Feed	auto
Cooling Mode	Air Coll
The Insulation Level	F
Power Supply Protection Grade	IP21S
Flame Temperature (°C)	Adjustable 800~3200
Working Medium	Filtered water or deionized water or soft water
Working Method	Continuous
Environment Temperature (°C)	0~40
Outline Dimensions - L*W*H (mm)	1260*780*1280
Gross Weight (kg)	324
Ventilation Space Requirement (mm)	400 in each direction

BBN-4500

Input Voltage	380 ±10%,50/60Hz,three phase
Rated Capacity (KVA)	15
Operation Current (A)	300
Working Gas Pressure (Mpa)	≤0.2
Relative Humidity (%)	90
Rated Gas Production (L/h)	4500 ±10%
Water Consumption (L/h)	2.7
Maximum Cutting Thickness (mm)	160
Effective Punching Thickness (mm)	60
Water Feed	auto
Cooling Mode	Air Coll
The Insulation Level	F
Power Supply Protection Grade	IP21S
Flame Temperature (°C)	Adjustable 800~3200
Working Medium	Filtered water or deionized water or soft water
Working Method	Continuous
Environment Temperature (°C)	0~40
Outline Dimensions - L*W*H (mm)	1200*780*1470
Gross Weight (kg)	450
Ventilation Space Requirement (mm)	400 in each direction

BBN-6500

Input Voltage	380 ±10%,50/60Hz,three phase
Rated Capacity (KVA)	22
Operation Current (A)	300
Working Gas Pressure (Mpa)	≤0.2
Relative Humidity (%)	90
Rated Gas Production (L/h)	6500 ±10%
Water Consumption (L/h)	3.8
Maximum Cutting Thickness (mm)	200
Effective Punching Thickness (mm)	70
Water Feed	auto
Cooling Mode	Air Coll
The Insulation Level	F
Power Supply Protection Grade	IP21S
Flame Temperature (°C)	Adjustable 800~3200
Working Medium	Filtered water or deionized water or soft water
Working Method	Continuous
Environment Temperature (°C)	0~40
Outline Dimensions - L*W*H (mm)	1460*900*1470
Gross Weight (kg)	520
Ventilation Space Requirement (mm)	400 in each direction

Hydro-Oxygen Generator

BBN-9500



Input Voltage	380 ±10%,50/60Hz,three phase
Rated Capacity (KVA)	31
Operation Current (A)	350
Working Gas Pressure (Mpa)	≤0.2
Relative Humidity (%)	90
Rated Gas Production (L/h)	9500 ±10%
Water Consumption (L/h)	5.8
Maximum Cutting Thickness (mm)	300
Effective Punching Thickness (mm)	90
Water Feed	auto
Cooling Mode	Air Coll
The Insulation Level	F
Power Supply Protection Grade	IP21S
Flame Temperature (°C)	Adjustable 800~3200
Working Medium	Filtered water or deionized water or soft water
Working Method	Continuous
Environment Temperature (°C)	0~40
Outline Dimensions - L*W*H (mm)	1520*900*1490
Gross Weight (kg)	610
Ventilation Space Requirement (mm)	400 in each direction



Model Number: BBN-18000
 AC Voltage Requirement (V): 380
 Phase: three phase four wire
 The largest cutting thickness: 350-450mm
 Operation Mode: continuous working
 Power Consumption (kW/h): 45, adjustable
 Max Gas Output (L/h): 18000 +/-10%
 Raw Material: pure water/filtered tap water
 Max Water Consumption (L/h) : <9.5
 Water Feed: auto
 Dimensions-L*W*H(mm):1570*1240*1750
 Gross Weight(kg):2000



Model Number: BBN-25000
 AC Voltage Requirement (V): 380
 Phase: three phase four wire
 The largest cutting thickness: 350-450mm
 Operation Mode: continuous working
 Power Consumption (kW/h):62.5, adjustable
 Max Gas Output (L/h): 25000 +/-10%
 Raw Material: pure water/filtered tap water
 Max Water Consumption (L/h) : <12.5
 Water Feed: auto
 Dimensions-L*W*H(mm):1570*1240*1750

BBN Hydro-Oxygen Generator



Model Number: BBN-35000
AC Voltage Requirement (V): 380
Phase: three phase four wire
The largest cutting thickness: 350-450mm
Operation Mode: continuous working
Power Consumption (kW/h):95, adjustable
Max Gas Output (L/h): 35000 +/-10%
Raw Material: pure water/filtered tap water
Max Water Consumption (L/h) : <18
Water Feed: auto
Dimensions-L*W*H(mm):1570*1240*1750
Gross Weight(kg):2500



Model Number: BBN-50000
AC Voltage Requirement (V): 380
Phase: three phase four wire
The largest cutting thickness: 350-450mm
Operation Mode: continuous working
Power Consumption (kW/h):120, adjustable
Max Gas Output (L/h): 50000 +/- 10%
Raw Material: pure water/filtered tap water
Max Water Consumption (L/h) : <31
Water Feed: auto
Dimensions-L*W*H(mm): 1570*1240*1750
Gross Weight(kg):2500



1MWe 300NM3 HYDROXY Generator

Power:

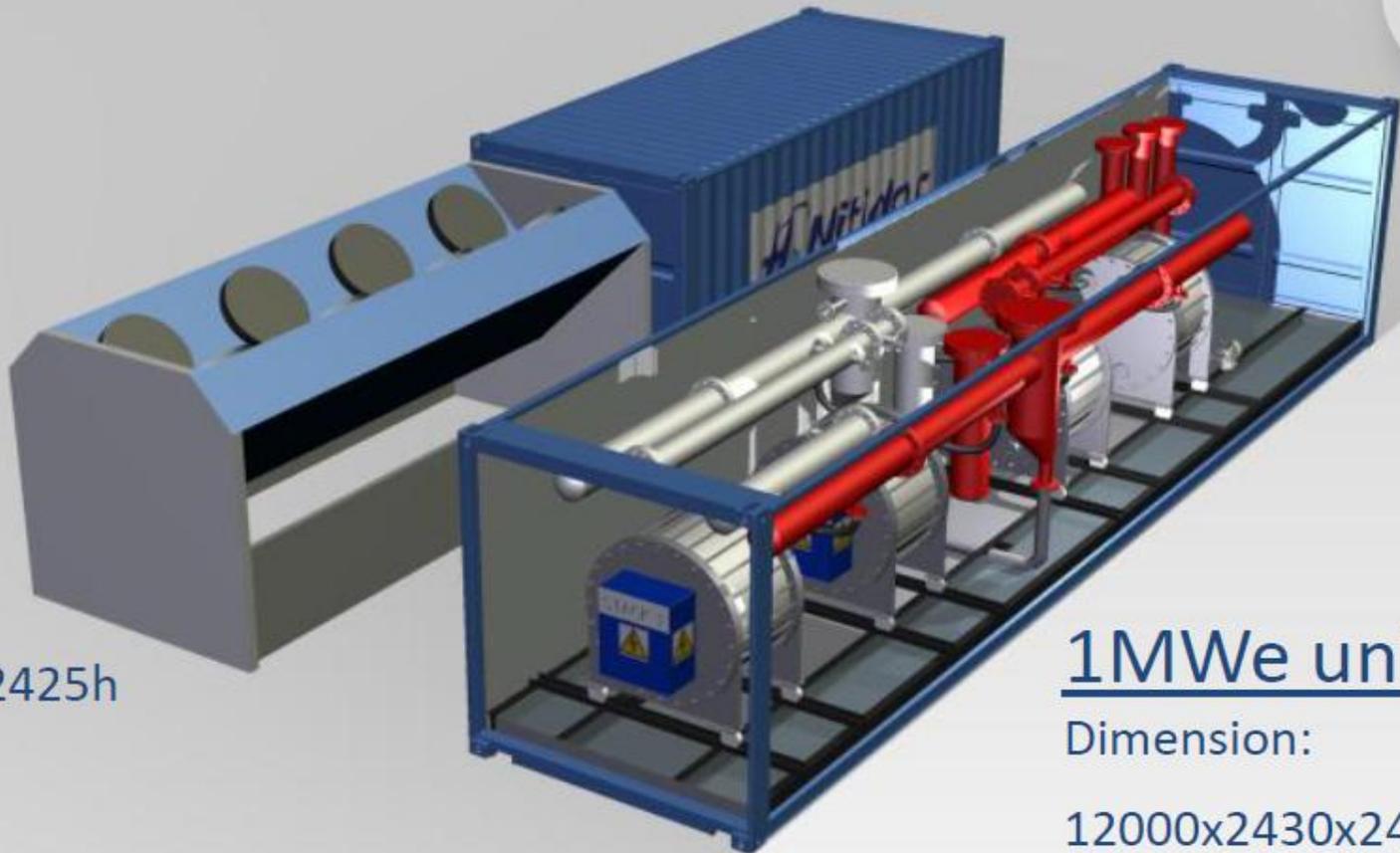
Dimension:

6000x2430x2400h

Cooling

Dimension:

2400x3700x2425h



1MWe unit

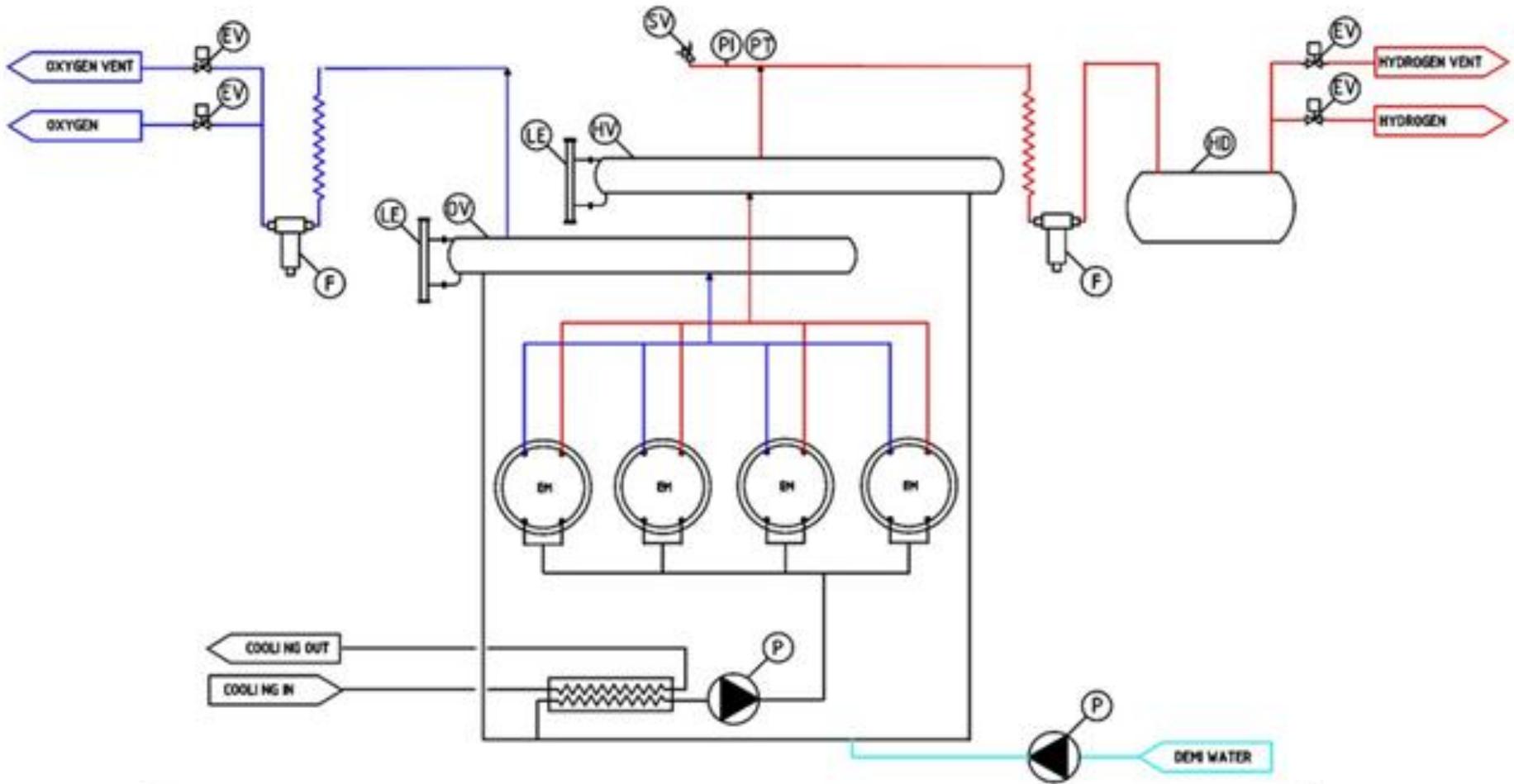
Dimension:

12000x2430x2400h

1MWe 300NM3 HYDROXY Generator

Rated stack capacity, hydrogen	[Nm ³ /h]	200,0
Rated stack capacity, oxygen	[Nm ³ /h]	100,0
Maximum operating pressure	[barg]	30
Minimum and Maximum operating temperatures	[°C]	5 - 80
Ambient temperature	[°C]	-25 / +40
Room temperature	[°C]	+2 / +40
Electrolyte (KOH solution) concentration	[% w]	25 - 30
O2 in H2 directly from stack	[vol. %]	< 0,1
H2 in O2 directly from stack	[vol. %]	< 0,2
KOH in H2	[mg/Nm ³]	< 1
Cell active area	[cm ²]	5000
Cell current density	[A/m ²]	4000
Demineralized water consumption	[l/h]	180,00
Demineralized water conductivity	[μS/cm]	< 5
Nitrogen consumption (each shutdown)	[Nm ³]	2
Stack Power consumption	[kW]	940
AUX Power consumption, max	[kW]	1,5
Cooling capacity	[kWth]	285,0
Dimensions		
Dimensions of electrolyser module (L x W x H)	[mm]	container 40 ft
Dimensions of power system (L x W x H)	[mm]	container 20 ft

1MWe 300NM3 HYDROXY Generator

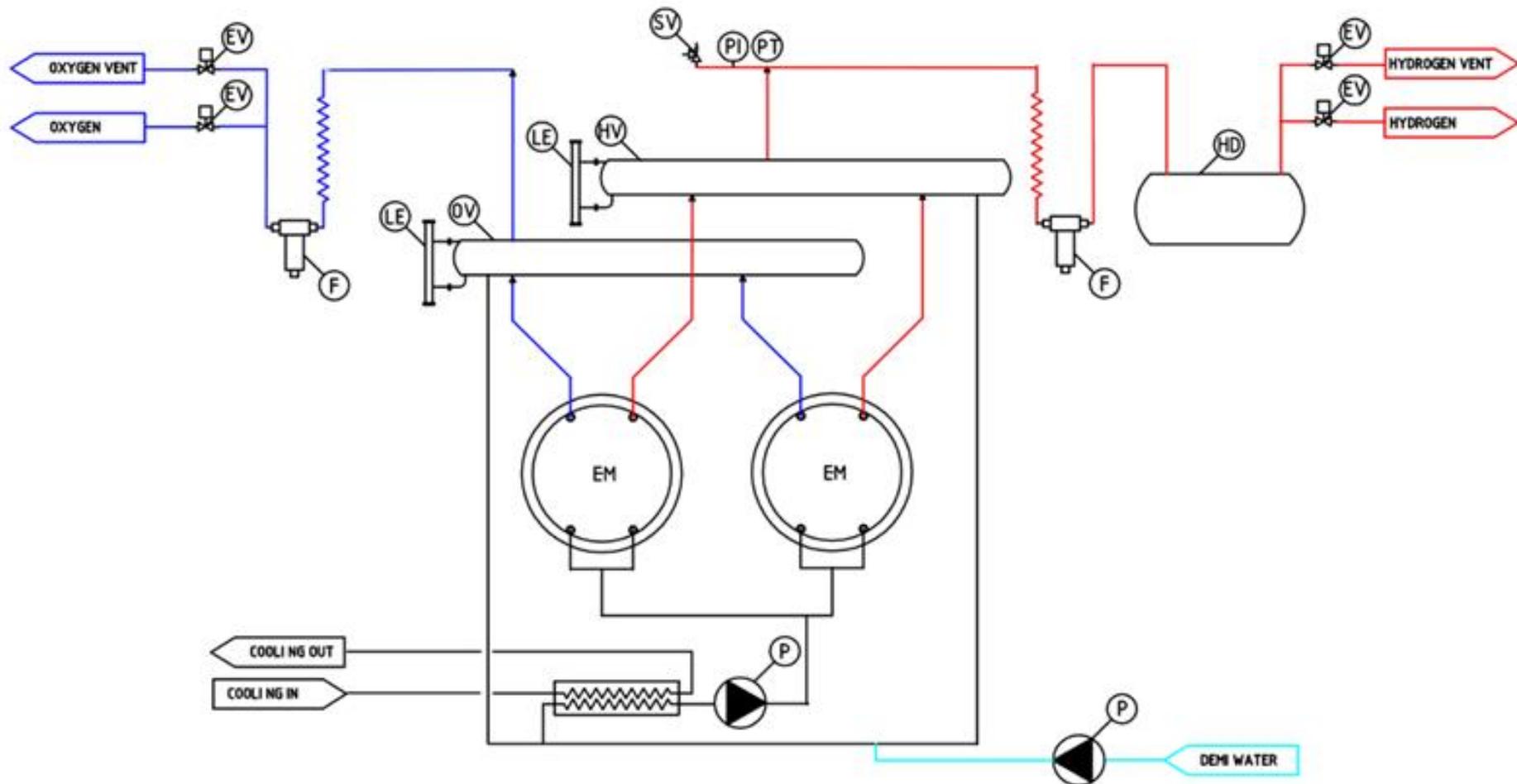


EM: Electrolysis Module (stack)	EV: Electrovalve
OV: Oxygen vassel	LE: Level Element
HV: Hydrogen vassel	P: Pump
HD: Hydrogen Drum	PI: Pressure Indicator (Gauge)
F: Filter	PT: Pressure Transmitter

500KWe150NM3 HYDROXY Generator

Rated stack capacity, hydrogen	[Nm ³ /h]	100,0
Rated stack capacity, oxygen	[Nm ³ /h]	50,0
Maximum operating pressure	[barg]	30
Minimum and Maximum operating temperatures	[°C]	5 - 80
Ambient temperature	[°C]	-25 / +40
Room temperature	[°C]	+2 / +40
Electrolyte (KOH solution) concentration	[% w]	25 - 30
O2 in H2 directly from stack	[vol. %]	< 0,1
H2 in O2 directly from stack	[vol. %]	< 0,2
KOH in H2	[mg/Nm ³]	< 1
Cell active area	[cm ²]	5000
Cell current density	[A/m ²]	4000
Demineralized water consumption	[l/h]	90,00
Demineralized water conductivity	[µS/cm]	< 5
Nitrogen consumption (each shutdown)	[Nm ³]	1
Stack Power consumption	[kW]	470
AUX Power consumption, max	[kW]	1,5
Cooling capacity	[kWth]	145,0

500KWe150NM3 HYDROXY Generator



EM: Electrolysis Module (stack)
 OV: Oxygen vassel
 HV: Hydrogen vassel
 HD: Hydrogen Drum
 F: Filter

EV: Electrovalve
 LE: Level Element
 P: Pump
 PI: Pressure Indicator (Gauge)
 PT: Pressure Transmitter

What is HHO Gas Generator / Brown Gas Generator

Brown Gas Generator / HHO Gas Generator consumes water and electricity, electrolyze water into hydrogen gas and oxygen gas, we can use H₂ and O₂ as source of flame replacing LPG, Propane, Acetylene fuel or natural gas or other fuel.

Brown Gas Generator / HHO Gas Generator can be used for welding work of many industries.

Application Industries of Brown Gas Generator / HHO Gas Generator :

1. Welding

(1) Jewelry Industry:

For welding kinds of chain and string which are made of platinum, gold, silver, copper, stainless steel, etc.

For mending tiny sand holes on jewelry casting.

For jewelry repairing (reforming, casting, welding).

(2) Electronic Industry:

For welding enameled wire, computer wire peeling, LED wafer, flame-treating circuit board, thermocouple and platinum resistor leading wires.

What is HHO Gas Generator / Brown Gas Generator

(3) Medical Industry:

For denture welding.

For welding metal fittings and mending sand holes in dentistry.

No-carbon flame disinfection and glass seal.

(4) Laboratory:

For Welding of laboratory teaching, providing convenient, safe and clean oxy-hydrogen flame.

(5) Others:

Instrument welding, Air-condition copper pipe welding, Automobile exhaust pipe welding, Fishhook welding, Storage battery tinsplate welding, lighting hardware welding and etc.

2. Cutting

Large HHO Gas generator/ Brown Generator:

can be widely used in Carbon Steel Cutting and continuous casting slab cutting of Steel Plant.

It can cooperate with manual cutting torch, semiautomatic cutting machine, shape cutting machine, CNC cutting machine instead of traditional fuel gas.

What is HHO Gas Generator / Brown Gas Generator

3. Heating and sealing

- (1) metal and nonmetal heating
- (2) glass tube sealing, quartz glass tube sealing
- (3) ampoule bottles sealing
- (4) water injection drawing sealing
- (5) mould repair, quenching, crucible heating melting metal
- (6) solar wafer processing, IC packaging.



4. Polishing: Organic glass / Acrylic Polishing



5. Others: For Welding or Heat treating small metal parts, Iron Cutting, Catalytic combustion of other fuels, Engine carbon cleaning for automobiles.

Advantages of HHO Gas Generator for Welding work:

1. Operation is convenient:

The Brown Gas Generator / HHO Gas Generator produce oxy-hydrogen gas by automatic way, gas cylinder is not required any more. Turn on to produce gas and shut down to stop producing. Machine will shut down automatically when the gas pressure is too high (if gas output can not be used up). Machine will turn on auto when the gas pressure is not enough. The gas output is adjustable.

2. Welding is fast:

The Hydro Oxygen flame temperature is high up to 2800 degree, it can heat the welding spot to melting point fast in about 1 second to finish welding.

3. Welding precision is high:

The flame is concentrated, it can achieves welding of precise devices.

4. Welding spot is smooth and beautiful:

Oxy-hydrogen flame combustion doesn't form carbide, so there is no black spot, avoid the second treatment of cleaning and polishing.

5. Environment friendly:

Brown Gas Generator / HHO Gas Generator 's fuel comes from water, there is water vapor after combustion, no any harm done to environment.

6. Energy saving:

Brown Gas Generator / HHO Gas Generator saves energy cost over 30% compared with other gas welding way. Adding the oxygen cost, it will save cost over 40%.

Features of Brown Gas Generator / HHO Gas Generator

1. Maximum Safety

--Steady, reliable fuel delivery. Fuel is available immediately after machine is switched on. No gas cylinder which can rupture or explode.

--Multiple safety devices, including overheating and in-sufficient water cut-off switches, will automatically turn off power to ensure the safety of both equipment and user.

2. Environmentally Friendly

--The HHO Gas fuel generated by our Brown Gas Generator / HHO Gas Generator burns completely without creating pollutants, toxic fumes, or public nuisance.

--Does not generate hydrocarbons, carbon monoxide, or carbon dioxide.

3. High Mobility

-- Brown Gas Generator / HHO Gas Generator come equipped with wheels to facilitate moving the generators to the job, not the other way around.

--Our Brown Gas Generator / HHO Gas Generator immediately generates fuel as needed, no need for dangerous gas cylinders.

--Fuel can be used for long periods of time without overheating peripheral equipment.

Features of Brown Gas Generator / HHO Gas Generator

4. High Temperature & high-energy

--Calorific value is 34000Kcal/kg.

--The Hydro Oxygen flame temperature is over 2800c, it is straight, less heat loss and high-efficient.It could melt refractory metals and none-metals.

5. Low Cost & Maximum Economy

--Hydro Oxygen gas is generated only using electricity and pure water. The cost of electricity and water reduces more than 40% compared with LPG, Propane, and Acetylene fuel.

--Both economical and practical.Energy Saving more than 30% compared with traditional LPG, Propane, and Acetylene fuel.

6. Low Heat Loss

--Use of Hydro Oxygen fuel provide a more focused heat source with less heat loss, maintaining a more comfortable, safer, lower fatigue working environment.

Features of HHO Brown Gas Generator

7. Catalysis characteristic

Hydrogen is an active catalyst which can be mixed with air to feed in to catalyze and combust all solid, liquid, gas fuel. It also can speed up the reaction process, promote combustion to be completely.

8. Using by producing

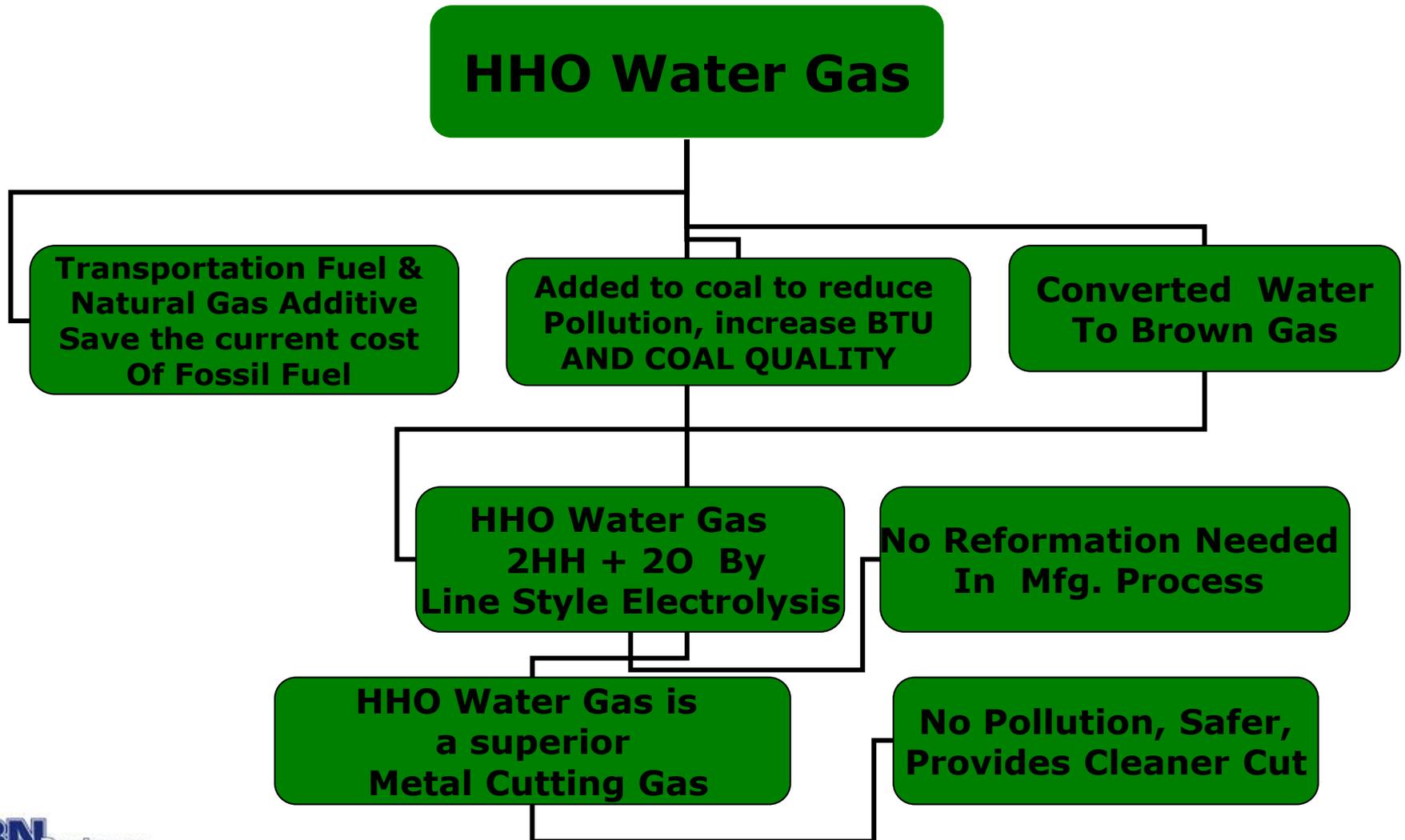
Brown Gas Generator / HHO Gas Generator can supply gas as user demand by adopting the advanced automatically control technology, no gas storage.

9. Wide application range

Brown Gas Generator / HHO Gas Generator is suitable for all industries which needs fuel gas to do flame processing, especially flame cutting, flame welding, heating.

HHO Water Gas Technology:

Value Added Applications



HHO Water Gas Technology

Offers the Fossil Fuel & Coal Steam Industry
For New Profit Centers

- HHO Water Gas:
 - Increases the BTU output at the burn site
 - Allows a purchase of less expensive coal while receiving a better cleaner burn.
 - Greatly lessens your smoke stack emissions by up to 80 to 90% without major infrastructure costs and high maintenance as with other currently available technologies

◆ The comparison test of flame temperature

1) Method of the test

- sample size : 500mm x 500mm x 9T Slab
- distance of flame and sample : 450mm



2) The result

Amount	State of combustion	Flame Color	Length of flame (mm)	Change of temperature	
				Starting point	5 minute after
Heavy Oil 40L/h	Much black dirt	Yellow + Red Flame	900	13°C	308°C
Heavy Oil 40L/h + BG 7m ³ /h	Without black dirt	Red + Blue Flame	1,600	13°C	618°C

◆ Comparison of CO² volume [H.O vs. (H.O + H.B)]

1) July 2007 CO₂ volume of heavy oil : 347ton/month

- heavy oil 257L/h x 2.81 kg /L x 16h/d x 30d/month = 347ton/month

2) July 2008 CO₂ volume of heavy oil : 107ton/month

- heavy oil 52L/h x 2.81 kg /L x 16h/d x 30d/month = 70ton/month

- BG 80N m³/h x 2.3 kW /N m³ x 0.42 kg /kW x 16h/d x 30d/mont = 37ton/month

∴ Reduce about 2,880ton (69%) of CO₂ volume annually

* H.O : Heavy Oil * H.B : Hot Blast

Using HYDROXY Gas In the Coal Power Generation Application

Benefits and Estimate of Costs & Savings

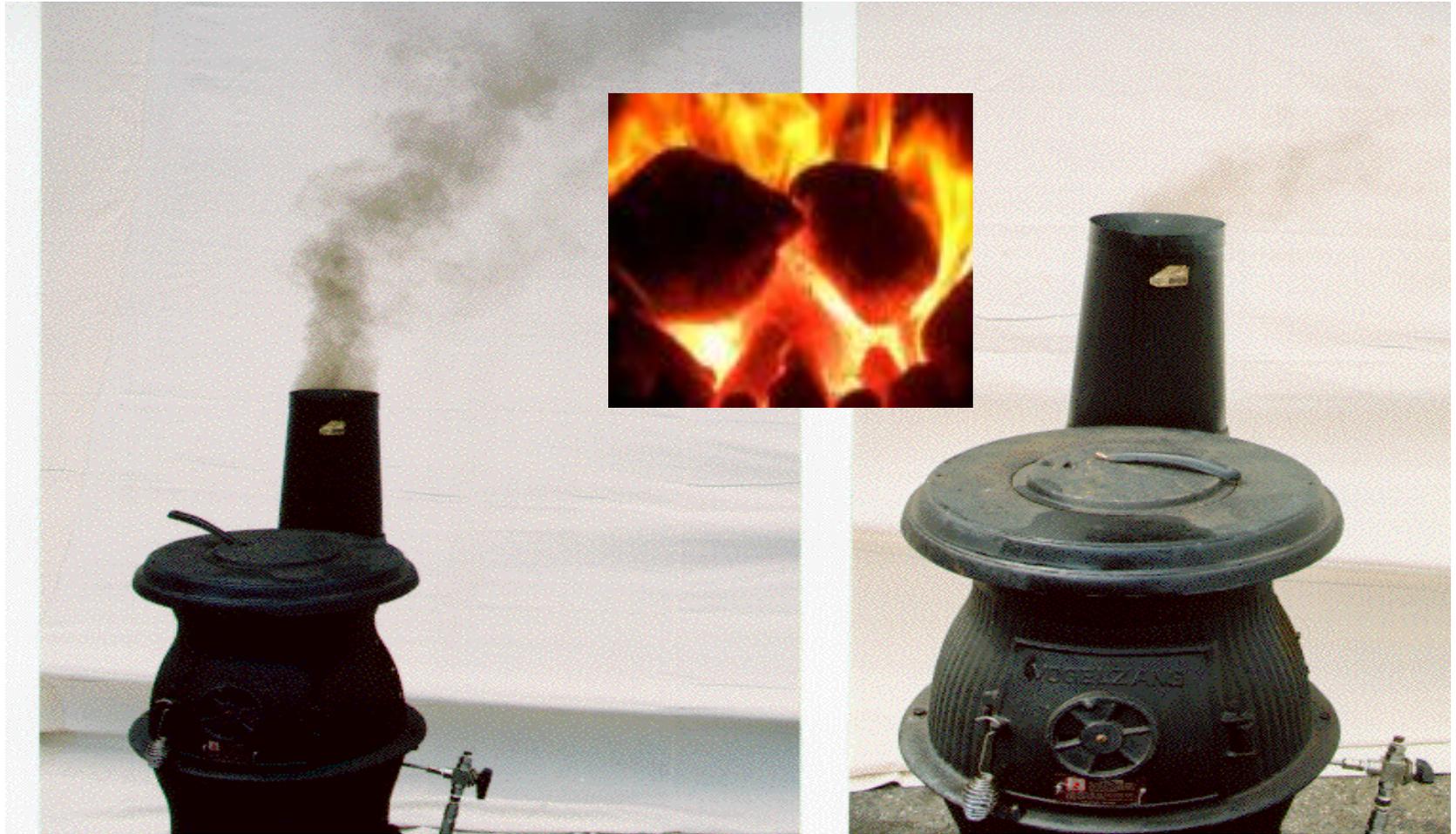
“The average coal-fired power plant is only 1 / 3 efficient, meaning 2 / 3 of the energy in the fuel is wasted.”

D.O.E .

Key Statistics

- **Fossil fuel-fired electric power plants constitute the largest source of air pollution in the U.S. Based on real data from DOE sources, here are some striking facts about power plant pollution.**
- **The U.S. uses fossil fuels to generate more than 2/3 of its electricity. 51% is generated with coal, 15% is generated with natural gas, and 3% is generated with petroleum.**
- **In 1999, electric power plants produced approximately 2.2 billion tons of carbon dioxide, 12 million tons of sulfur dioxide, and 7 million tons of nitrogen oxides.**
- **The average coal-fired power plant is only 1/3 efficient, meaning 2/3 of the energy in the fuel is wasted.**
- **The average fossil fuel-fired power plant was built in 1964, long before the Clean Air Act began requiring pollution controls.**
- **Of the largest 1000 fossil fuel-fired power plants in the U.S., 77% are not subject to pollution controls under the Clean Air Act's New Source Review requirements.**
- **On average, power plants that are subject to New Source Review requirements emit much less sulfur dioxide per megawatt-hour of energy produced.**

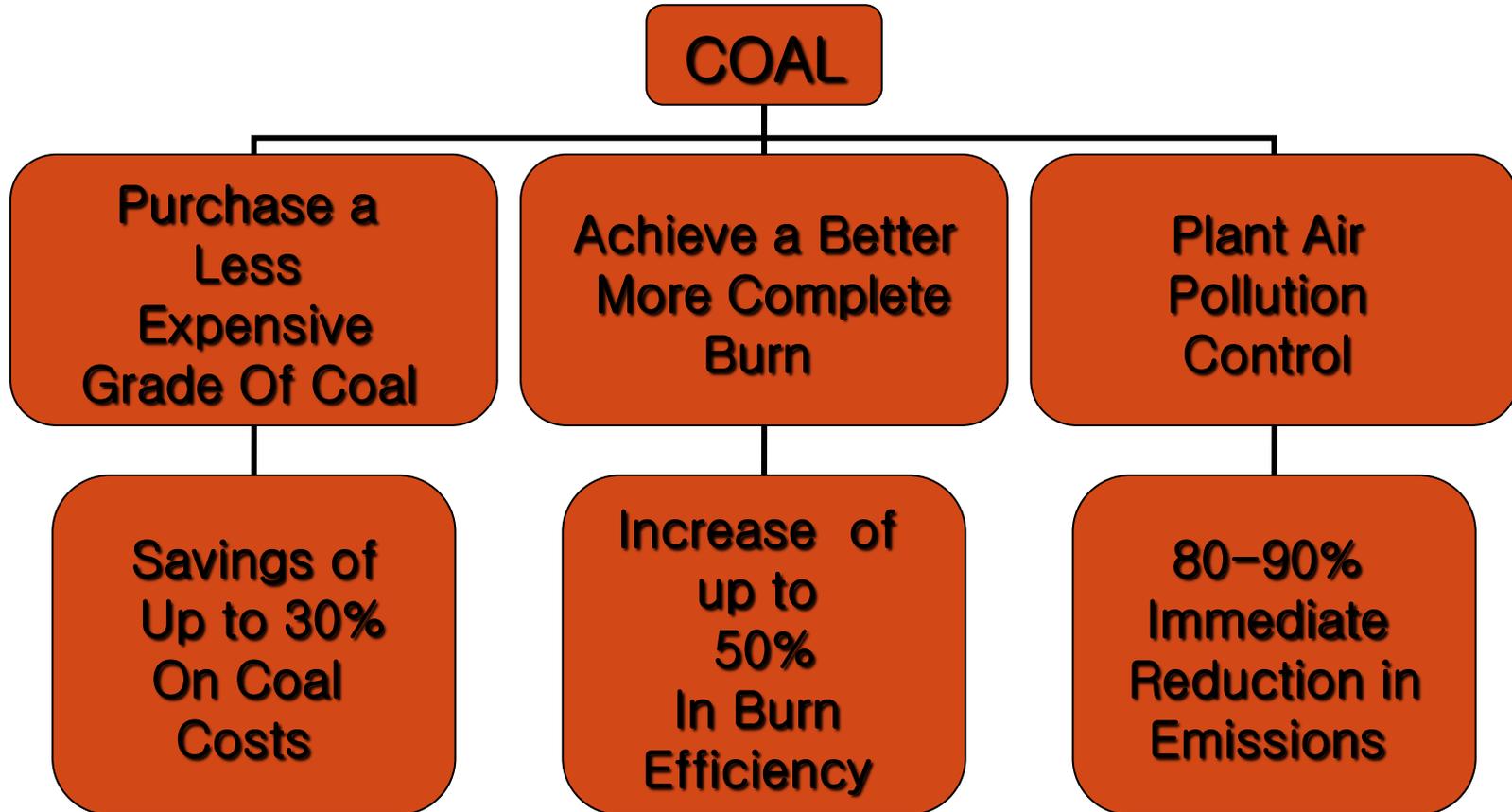
HHO Gas Added to Coal Will Reduce Air Pollutants (Emissions) by 80-90%



Without HHO Water Gas

With HHO Water Gas

HHO Water Gas Advantages



NOTE:

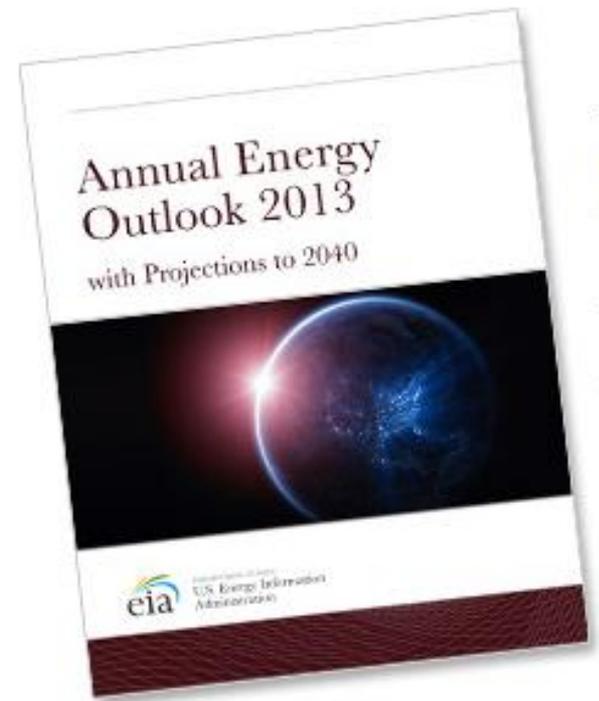
If a Power Plant is operating at a 35% efficiency rating, HHO Water Gas technology would increase that plants energy production by 50% of the deficiency i.e. 30-35% without any major capital investments for infrastructure .

According to the EPA forecasts of new and future power plant technologies

The best that these technologies can and do offer for coal powered efficiency is only a 50-55% energy efficiency rating.

This relates to a 45% to 50% loss of efficiency and subsequently a loss of efficiency and money for the Power Plants

Divide the last column numbers by 3,412, the number of BTUs per One Kw of Power Generation)



Divide the last column of numbers by 3,412, the number of BTUs per One Kw of Power Generation *You will then find the operating efficiency percentage*

Table 38. Cost and Performance Characteristics of New Central Station Electricity Generating Technologies

Technology	Online Year ¹	Size (mW)	Leadtimes (Years)	Base Overnight Costs in 2004 (\$2003/kW)	Contingency Factors		Total Overnight Cost in 2004 ³ (2003 \$/kW)	Variable O&M ⁵ (\$2003 mills/kWh)	Fixed O&M ⁵ (\$2003/kW)	Heatrate in 2004 (Btu/kWhr)	Heatrate nth-of-a-kind (Btu/kWhr)
					Project Contingency Factor	Technological Optimism Factor ²					
Scrubbed Coal New	2008	600	4	1,134	1.07	1.00	1,213	4.05	24.38	8,844	8,600
Integrated Coal-Gasification Combined Cycle (IGCC)	2008	550	4	1,310	1.07	1.00	1,402	2.58	34.21	8,309	7,200
IGCC with Carbon Sequestration	2010	380	4	1,820	1.07	1.03	2,006	3.93	40.28	9,713	7,920
Conv Gas/Oil Comb Cycle	2007	250	3	540	1.05	1.00	567	1.83	11.04	7,196	6,800
Adv Gas/Oil Comb Cycle (CC)	2007	400	3	517	1.08	1.00	558	1.77	10.35	6,752	6,333
ADV CC with Carbon Sequestration	2010	400	3	992	1.08	1.04	1,114	2.60	17.60	8,613	7,493
Conv Combustion Turbine ⁵	2008	160	2	376	1.05	1.00	395	3.16	10.72	10,817	10,450
Adv Combustion Turbine	2008	230	2	356	1.05	1.00	374	2.80	9.31	9,183	8,550
Fuel Cells	2007	10	3	3,679	1.05	1.10	4,250	42.40	5.00	7,930	6,980
Advanced Nuclear	2013	1000	6	1,694	1.10	1.05	1,957	0.44	60.08	10,400	10,400
Distributed Generation -Base	2007	2	3	769	1.05	1.00	807	6.30	14.18	9,950	8,900
Distributed Generation -Peak	2008	1	2	924	1.05	1.00	970	6.30	14.18	11,200	9,880
Biomass	2008	80	4	1,612	1.07	1.02	1,757	2.96	47.18	8,911	8,911
MSW - Landfill Gas	2007	30	3	1,402	1.07	1.00	1,500	0.01	101.07	13,648	13,648
Geothermal ^{6,7}	2008	50	4	2,960	1.05	1.00	3,108	0.00	104.98	45,335	36,468
Conventional Hydropower ⁶	2008	500	4	1,319	1.10	1.00	1,451	4.60	12.35	10,338	10,338
Wind	2007	50	3	1,060	1.07	1.00	1,134	0.00	26.81	10,280	10,280
Solar Thermal ⁷	2007	100	3	2,515	1.07	1.10	2,960	0.00	50.23	10,280	10,280
Photovoltaic ⁷	2008	5	2	3,888	1.05	1.10	4,467	0.00	10.34	10,280	10,280

¹Online year represents the first year that a new unit could be completed, given an order date of 2004.

²The technological optimism factor is applied to the first four units of a new, unproven design, it reflects the demonstrated tendency to underestimate actual costs for a first-of-a-kind unit.

Benefits for Coal Power Generation

- Production
 - Increased BTU content
 - You may now utilize a cheaper grade of coal yet achieve a better burn utilization
 - Approx. 30% increase in energy efficiency from the same amount of coal.
 - HHO Water Gas should be a cost plus savings when incorporated at your plant location.
 - HHO Water Gas technology does not require a major cash investment and operates at a far lesser cost than other production enhancement technologies.
- Clean Air Benefits
 - Eliminates up to 80% to 90% of smoke stack emissions without a major retrofit expense as with other clean air technologies.
 - Can save millions in costs and potential clean air fines.
 - Builds good relations with the community where you are located.
 - Utilizes liquid wastes produced by the facility for feedstock.



The Operational Benefits

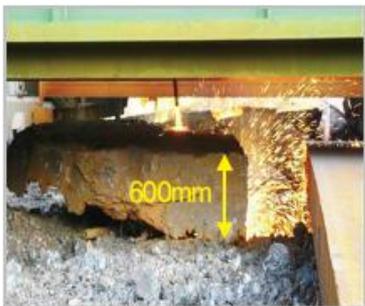


- **CONCLUSIONS AND SUMMARY:**

- 1) Despite large public and private investments over several decades, the use of conventional technologies (essentially those initiated by the Germans during WWII) has failed to process coal into both an economically and ecologically acceptable fuel. While the persistence of funding these old-line technologies is certainly not opposed it is evident that the survival, let alone the expansion of the coal industry under increasing environmental restrictions requires NEW expanded outlook and the adaptation of new available technologies.
- 2) Hydrogen is, by far, the best possible additive to improve coal combustion and the resulting cleaner burning environmentally friendly exhaust due to its highest available flame temperature and speed that permit the combustion of the unburned hydrocarbons in coal exhaust.
- 3) In its present form of manufacturing hydrogen has not, cannot, and will not be used as coal additive because of its prohibitive cost according to current production methods (electrolysis of water or reformations of fossil fuels). In fact, industrial grade hydrogen currently has a cost of the order of 50 times the cost of natural gas.
- 4) The HHO Water Gas Technology is the ONLY industrially ready and proven technology for the production of a clean burning fuel that is cost competitive with respect to existing fossil fuels. HHO Water Gas technology has been verified and can now be supplied to any qualified potential end users.

**The above data was prepared by D.O.E. on the basis of Hydrogen Gas
HHO Gas is 99% same as Hydrogen Gas**

Replacing cutting equipment's fuel (LNG + preheat oxygen) to Brown Gas is to increase cutting speed, to narrow cutting loss, to decrease dust, to accomplish environment improvement and to reduce production cost.



[600mm Tundish Slug / 250mm Slab cut 2006. 12]



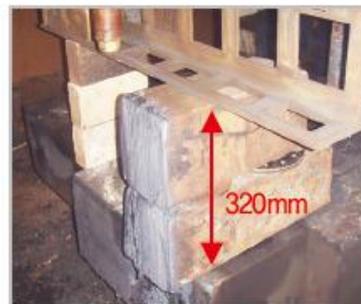
[SC-950mm / SCM-810mm cut 2010. 10]



[250mm Hot Slab 2007. 12]



[Cylinder cover cut]



[SMC billet 2 column cut]



[Round bar bundle cut]

■ Supply records

Customer	Use	Thickness of material	Model name	Year
POSCO	Slab cutter	250mm	ER-7K	2004. 12
POSCO	Tundish / Slab cutter	600mm	ER-200K	2006. 12
POSCO	Hot slab cutter (performance line)	250mm	ER-240K	2007. 12
POSCO Special Steel	Stainless / special steel cutter	800mm	NER-172K	2010. 10
Nisshin steel (japan)	Slab cutter	250mm	NER-23K	2012. 03
SeAH Besteel	Round bar bundle / Bloom cutter	250~800mm	NER-172K	2012. 11

Feature of Brown Gas cut : Environment friendly

Reducing cutting width to decrease fume emission by 50~80% improves working environment and decreases dust collector facility.



Cr10%鋼 LPG溶断

[LPG cutting field]



Cr10%鋼 BG溶断

[Brown Gas cutting field]

Comparison of plate cut [LPG vs BG]

Thickness of steel plate	CUTTING SPEED(MM / MIN)		Feature
	LPG	Brown Gas	
20mm	Max 400	513~720	※ If cut with Brown Gas (compared with LNG) - Clean cut surface and no need of grinding - Less loss - Less burr - Easy elimination of burr
40mm	Max 300	480~600	
80mm	Max 230	280~460	



[cut surface]



[40mm Slab cut]

※ Applications: Cutting and processing of steelmaking, shipbuilding, heavy industry

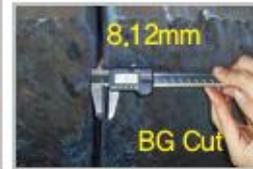
▪ Reduce loss [LPG vs BG]



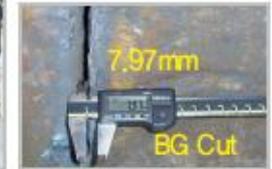
[Comparison of 250mm slab cut]



[650mm carbon compound steel loss is reduced by 67%]



[140~200mm stainless tundish slug loss is reduced by 54%]



▪ Table of tundish cut comparison (T600mm×L1,055mm) [LNG vs BG]

Items	LNG + Preheat oxygen	Brown Gas	Note
Cutting time per one cut	About 23.05min	About 13.92min	About 1.8 times increase of productivity
Amount of using high pressure oxygen	35.35Nm ³ (11.5 Bar)	17.50Nm ³ (10 Bar)	Decrease of oxygen by 60% if non-use of preheat oxygen and cutting speed
Loss	20mm	11mm	- 45% reduction of loss - 50% or more reduction of fume emission

[Measured by Gwangyang POSCO Steelmaking Department, Dec. 2007]

▪ Table of 250mm hot slab cut comparison [LNG vs BG]

Items	LNG	Brown Gas	Note
Cutting speed	250mm/min	460mm/min	1.8 times faster
Loss	9~10mm	6~7mm	30% reduction
Gap in cut	Gap occurs using two torches	No gap occurs using one torch	-
Fume emission amount	Multiple number of occurrence	Small amount occurrence	70% slash
Environment friendly	Carbon dioxide emission	No carbon dioxide emission	-
Safety	Risk of suffocation and explosion	No risk of suffocation and explosion	-

Harmful incinerating(Bottom ash, Fly ash) dioxin in the incineration plant is completely destroyed, if melted under 1,350 ~ 1,450°C by using clean fuel Brown Gas. Harmful heavy metal is stabilized and recycled as aggregate that can extend the life of reclaimed land.

■ The next generation core environment technology development business by Ministry of Environment



[Inside of E&E affiliated lab – 5ton / day x 2 units]

■ Supply records

Customer	Use	Model name	Year
MCLE Co., Ltd. JAPAN	1ton / day incinerator melting system	ER-60K	2001. 06
ZET Co., Ltd. JAPAN	5ton / day incinerator melting system	ES-300K	2002. 03
Kifushima incineration JAPAN	5ton / day incinerator melting system	ES-300K	2002. 10



[Kifushima incineration plant]

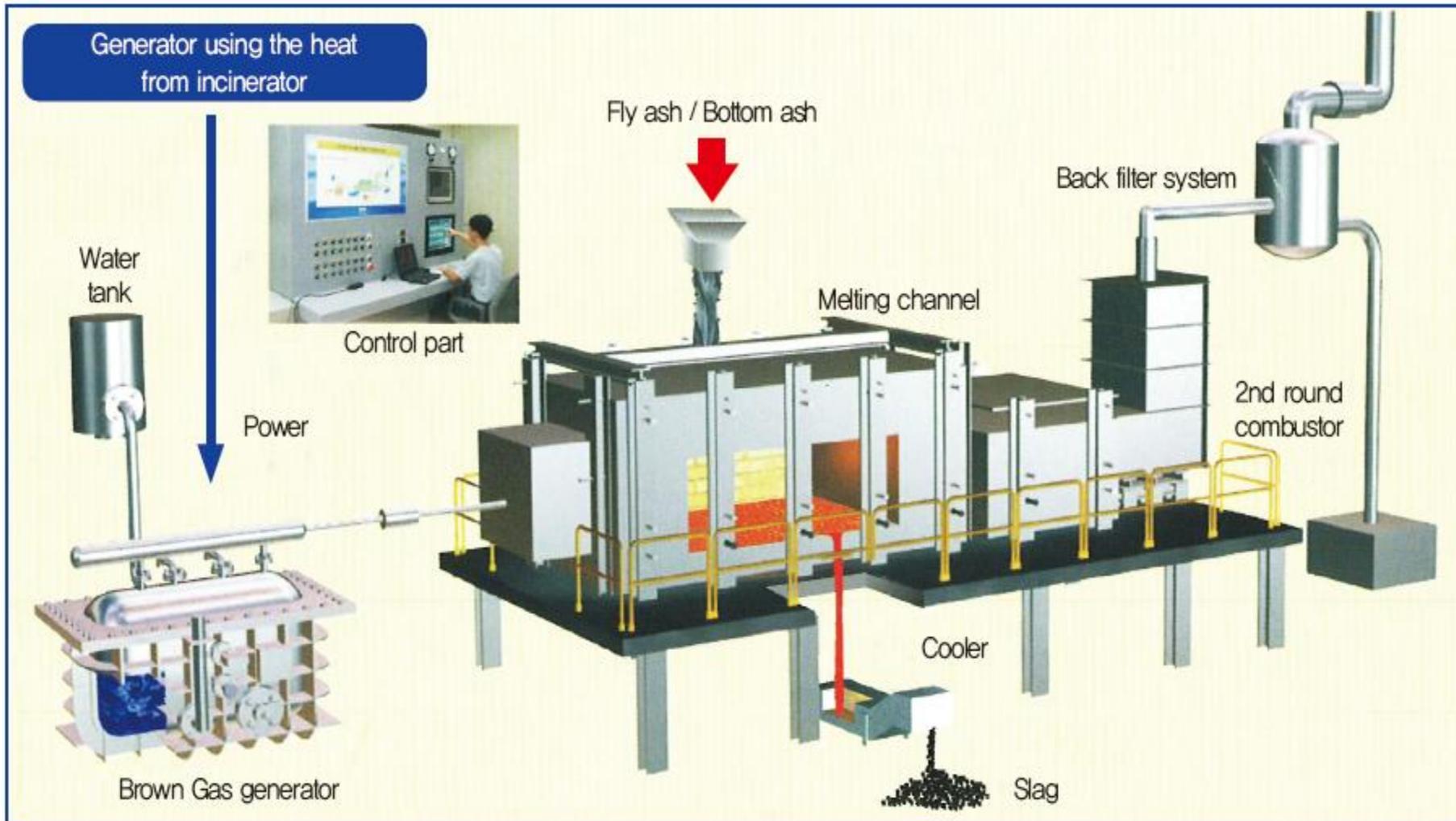


[Process of melting line installation]



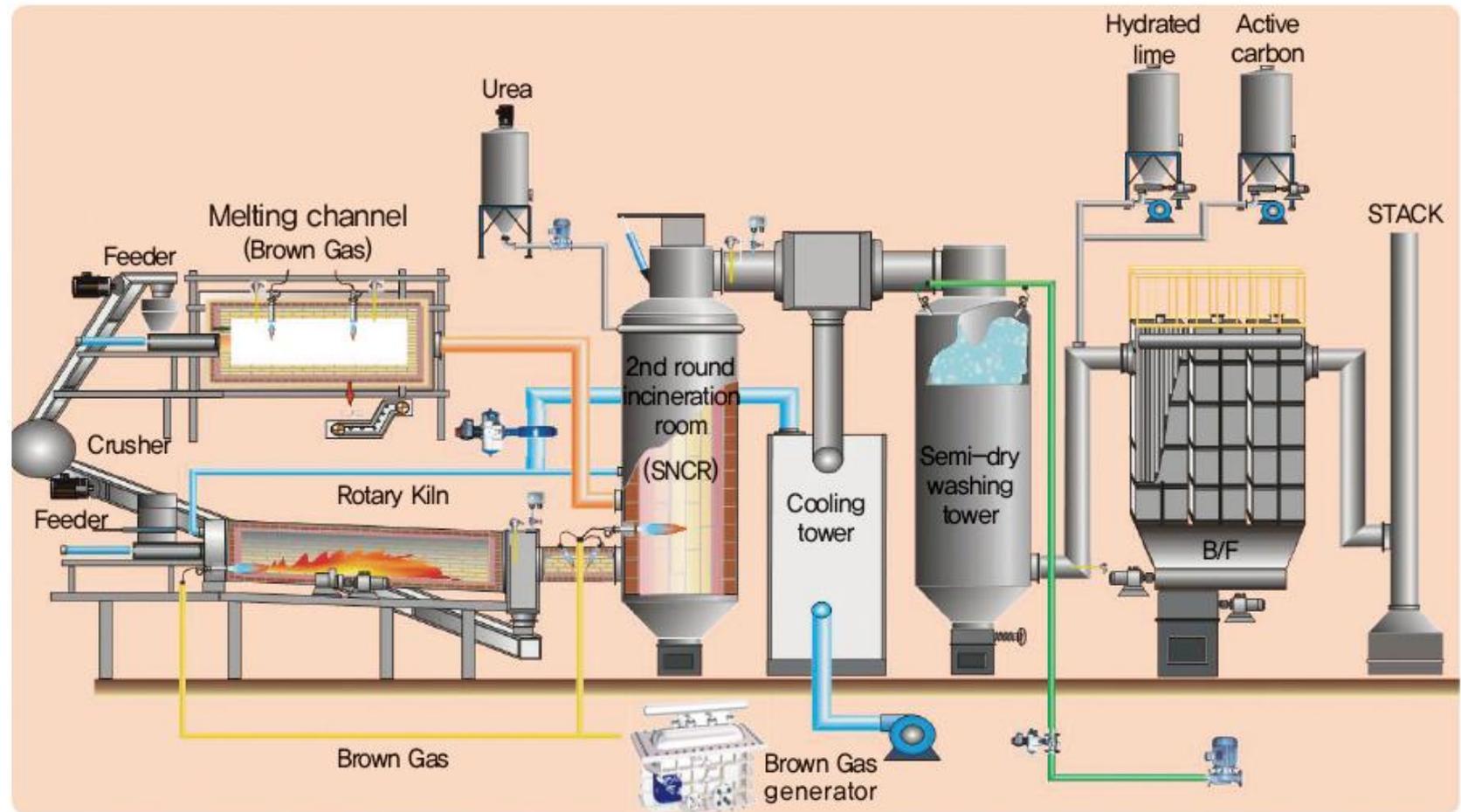
[First ignition]

Structure of side surface melting system



Melting asbestos fabric over 1,500°C using Brown Gas to prevent the scattering of harmful asbestos fabric for lung

- The next generation core environment technology development business by Ministry of Environment



Waste asbestos melting process cost and purchase amount

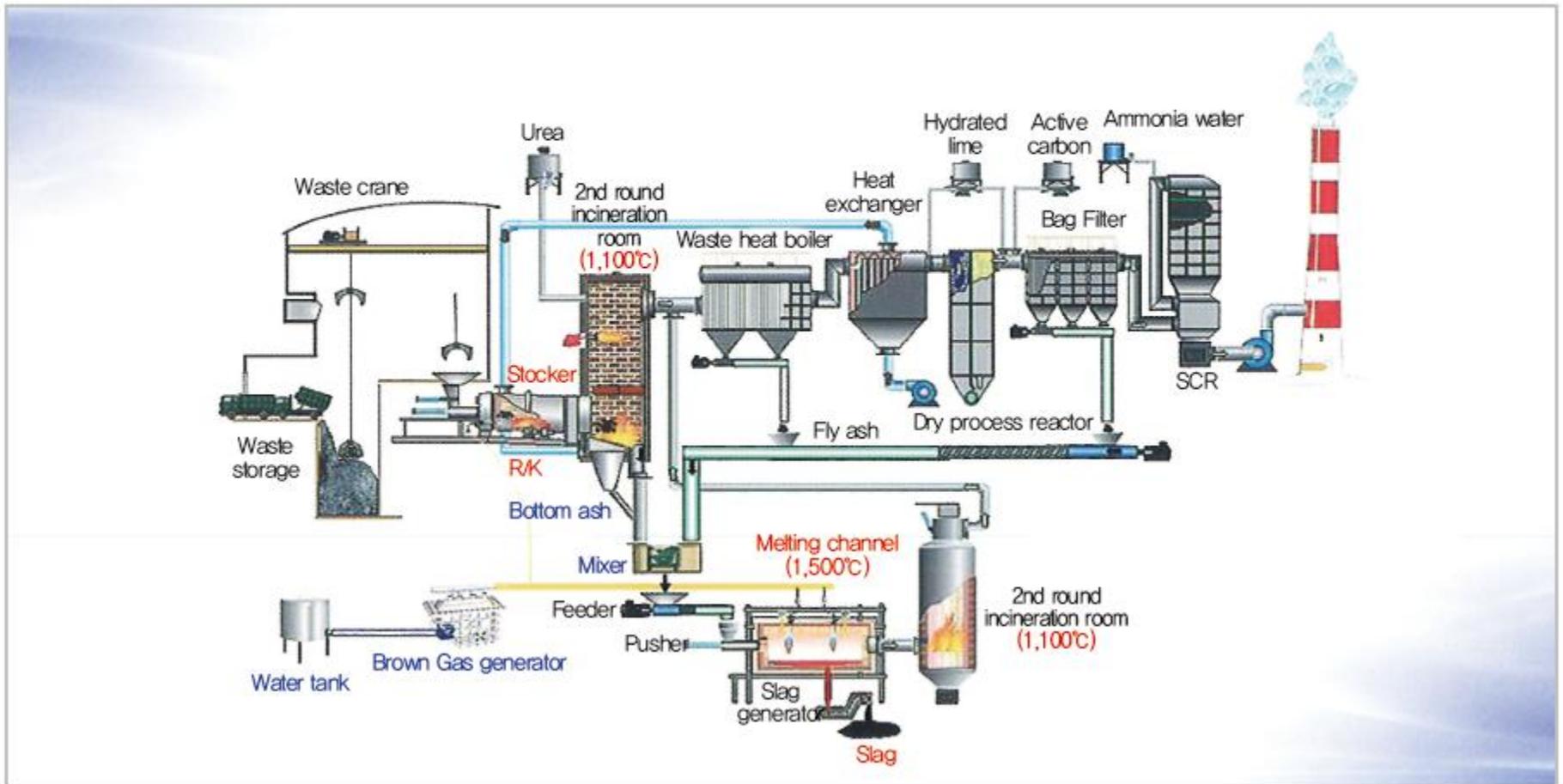
Model name	Process method	Process cost per ton
Japan Y company	Plasma melting	Around 200,000yen
Japan H company	Surface melting	50,000yen ~ 150,000yen
E&E Co., Ltd.	Surface melting	40,000yen
Management type reclamation cost (non-oxygen)		100,000yen ~ 250,000yen

Economical efficiency analysis of melting facility operation for 5ton / day of waste asbestos

- 1) Income / day = ¥2,000,000 / day
 - 5 ton / day process cost = ¥400,000 / ton x 5 ton / day = ¥2,000,000 / day
 - 1 m³ process cost = ¥40,000 ~ ¥60,000
 - 5 ton = About 50m³ (1 m³ = 40 ~ 200kg = Average 100kg)
- 2) Spending / day = ¥500,000 / day
 - Electricity / day = ¥295,700 / day
 - Labor / day = ¥100,000 / day
 - 10 workers x ¥300,000 / person, month = ¥3,000,000 / person, month
 - ∴ (¥295,700 + ¥100,000 + depreciation) / day = ¥500,000 / day
- 3) Profit before tax / year = ¥450,000,000
 - (¥2,000,000 - ¥500,000) / day x 300 day / year = ¥450,000,000 / year

Infectious / industrial waste incineration and melting system using Brown Gas

Infectious waste is incinerated under higher temperature of 850~950°C and Bottom ash is melted with Fly ash in high temperature condition inside the melting channel (1,450~1,500°C). Emission gas generated during incineration and melting process is burned in the 2nd round incineration room (1,100°C). It is the comprehensive incineration and melting system without emission of the second pollution such as smoke and ill-smell.



Infectious / industrial waste incineration and melting system using Brown Gas

- The next generation core environment technology development business by Ministry of Environment



[Rotary kiln incinerator]



[Melting channel]



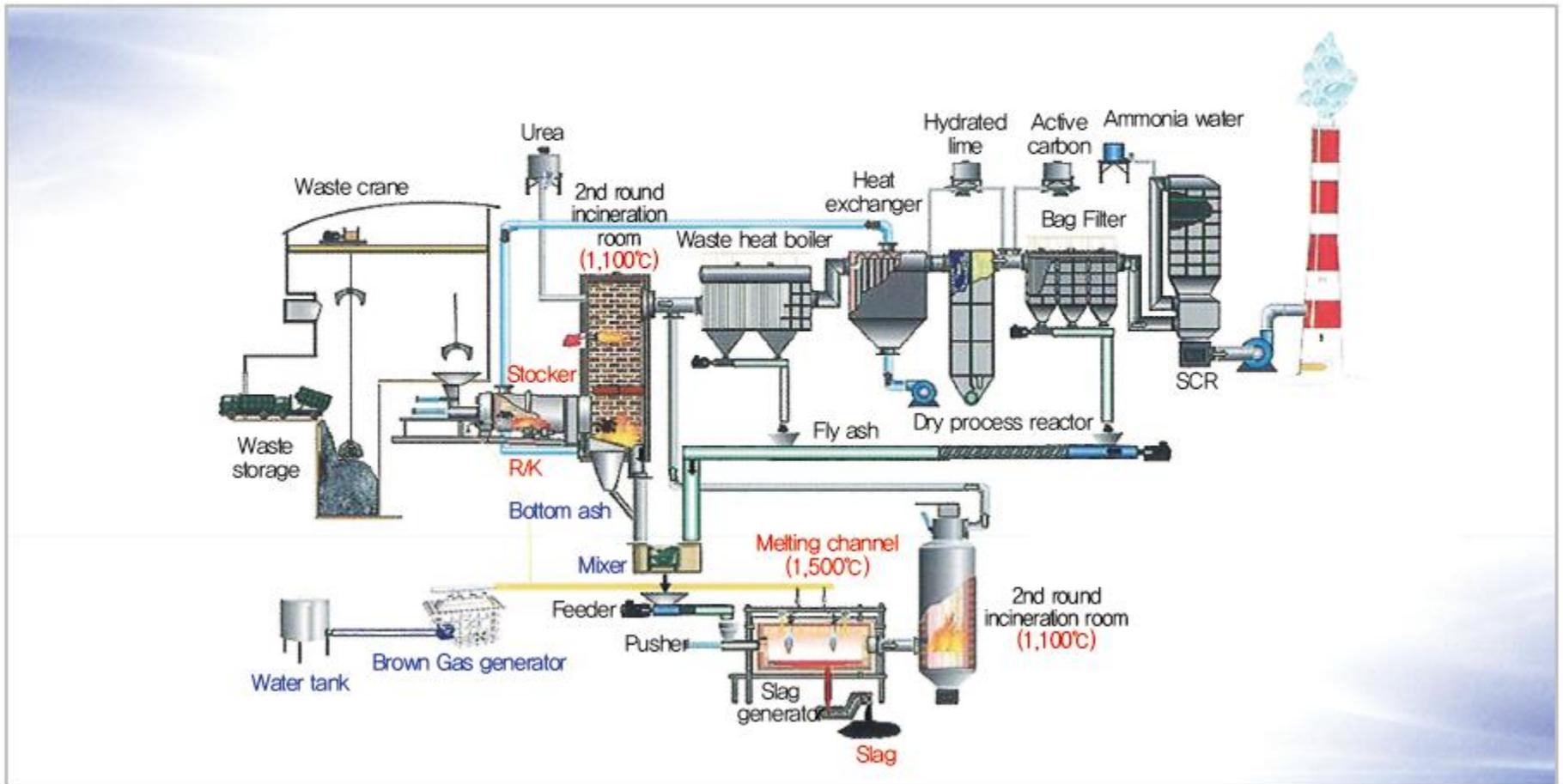
[2nd round combustion room / air preheater / rapid cooling tower]



[Back filter / Chimney]

Infectious / industrial waste incineration and melting system using Brown Gas

Infectious waste is incinerated under higher temperature of 850~950°C and Bottom ash is melted with Fly ash in high temperature condition inside the melting channel (1,450~1,500°C). Emission gas generated during incineration and melting process is burned in the 2nd round incineration room (1,100°C). It is the comprehensive incineration and melting system without emission of the second pollution such as smoke and ill-smell.



Industrial waste / VOCs / ill-smell incineration process facility using Brown Gas

Fossil fuel and Brown Gas are mixed as fuel to incinerate the firing retardant industrial waste, volatile organic compound (VOCs), and ill-smell in temperature of 800°C or higher to reduce fuel and emission of greenhouse gas (CO₂,NO_x, etc.)



[ER-100K Brown Gas Generator]



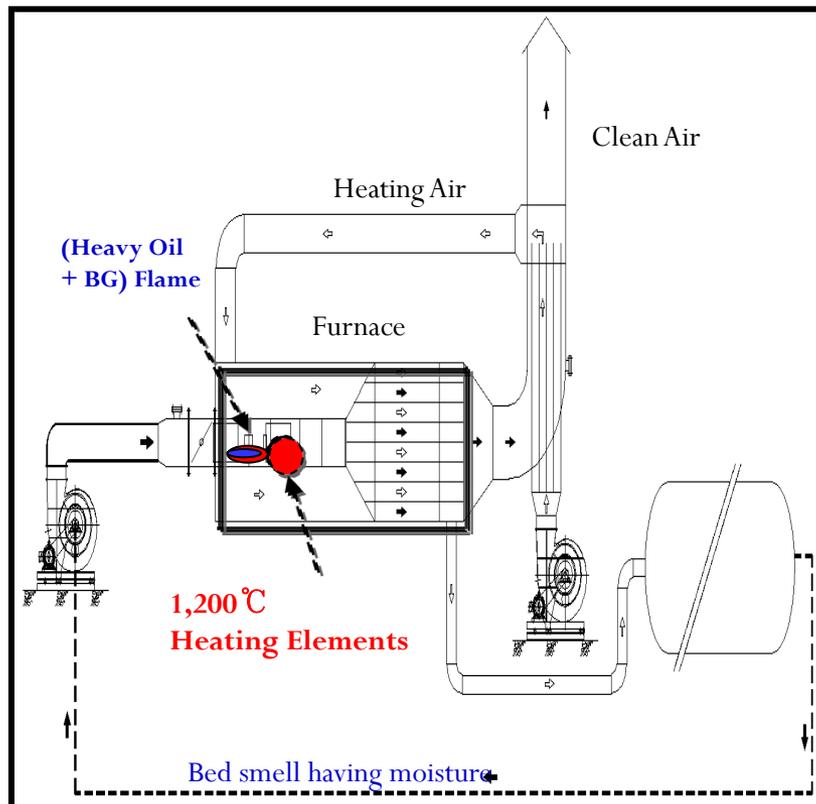
[Industrial waste incineration process facility in Koshin Service, Japan]

■ Supply records

Customer	Use	Model name	Year
Koshin Service Co., Ltd. JAPAN	For industrial waste incineration	ER-100K	2008
MJT Co., Ltd. KOREA	For VOCs / ill-smell incineration	ER-20K	2009
Ishihyoki Co., Ltd. JAPAN	For 240ton / day waste water non-drainage facility by incineration	NER-80K	2010
Ishihyoki Co., Ltd. JAPAN	For 240ton / day sludge drying and ill-smell removing facility	NER-120K	2010
DAE HEA Crematory Co., Ltd. THAILAND	Cremation facilities	NER-4.6K	2012

Industrial waste / VOCs / ill-smell incineration process facility using Brown Gas

When burning heating elements by heavy oil and Brown Gas mixture, temperature increases over 1,200 °C, which passes the VOCs and ill-smell having moisture within heating element; thus, **saving fuel consumption** and **reducing CO₂ emission**.



Industrial waste / VOCs / ill-smell incineration process facility using Brown Gas



[VOCs/ ill-smell incineration process facility MJT]

Water Energy Mix Combustion System

Fossil fuel and HHO Brown Gas are mixed as fuel to incinerate the firing retardant industrial waste, volatile organic compound (VOCs), and ill-smell in temperature of 800°C or higher to reduce fuel and emission of greenhouse gas, CO₂, NO_x, etc.

Customer	Use	Model name	Year
Koshin Service Co., Ltd. JAPAN	For industrial waste incineration	BBN-100K	2008
MJT Co., Ltd. KOREA	For VOCs / ill-smell incineration	BBN-20K	2009
Ishihyoki Co., Ltd. JAPAN	For 240ton/day waste water non-drainage facility by incineration	BBN-80K	2010
Ishihyoki Co., Ltd. JAPAN	For 30ton/day sludge drying and ill-smell removing facility	BBN-120K	2010
HEAVEN Funeral Home (Indonesia) DAE HEA Crematory Co., Ltd.	Cremation facilities	BBN-4.6K	2012



100K Brown Gas generator



waste incineration process
in Koshin Service, Japan]

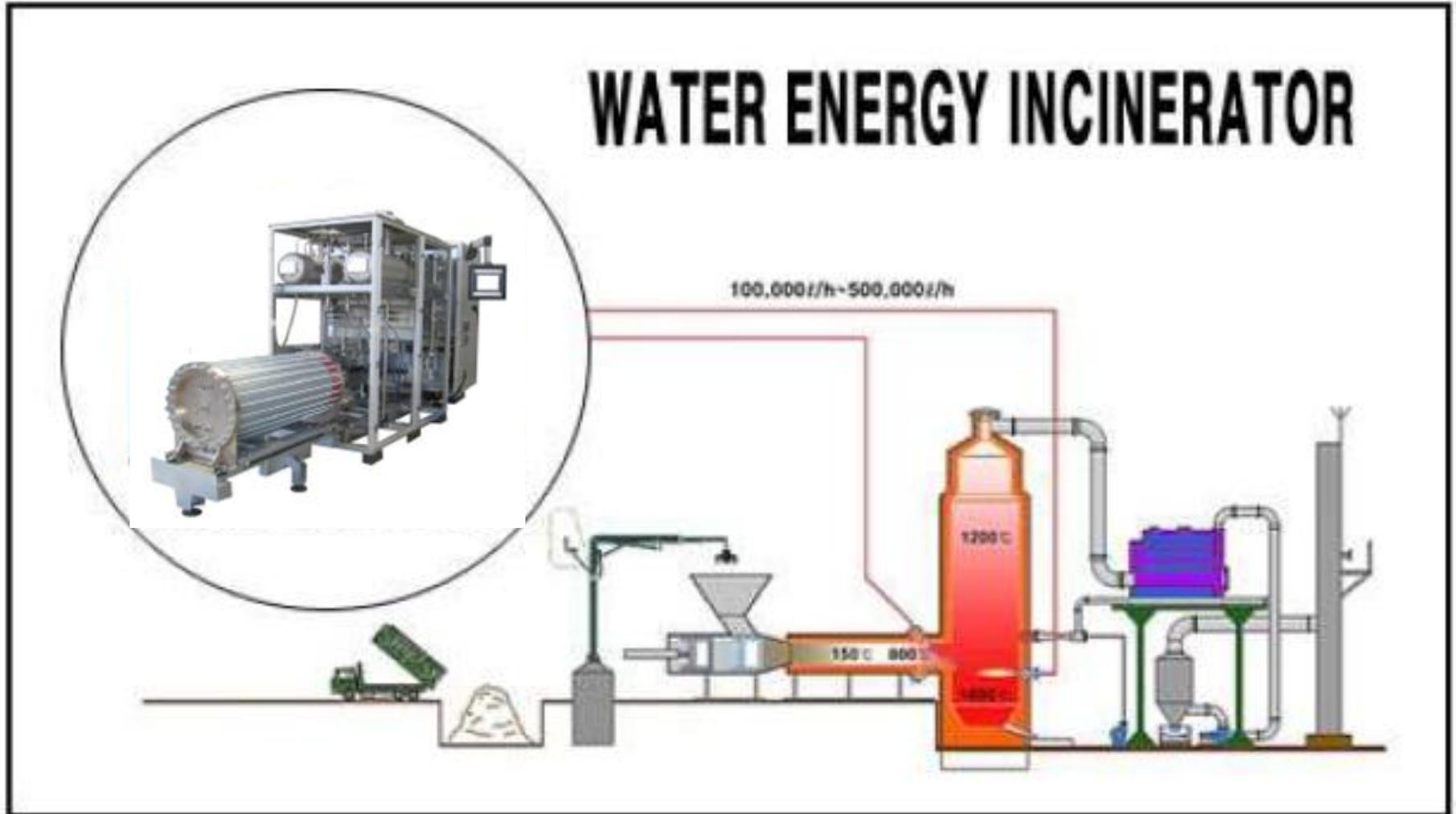


Waste silicon sludge drying
facility in Ishihyoki Co., Japan



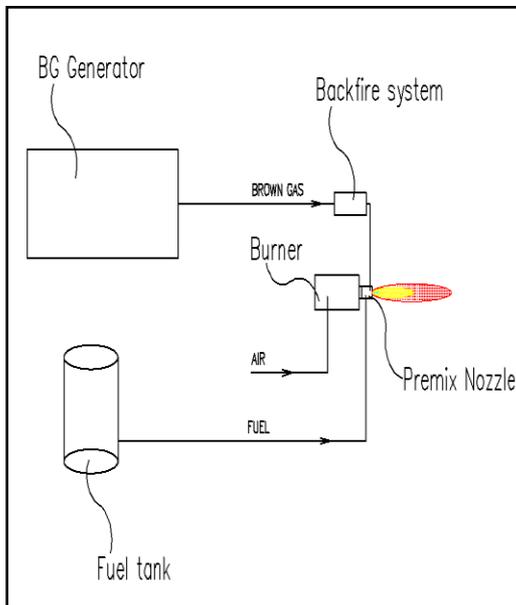
Waste water non-drainage
facility by incineration in
Ishihyoki Co., Japan

HHO Water Gas Is Made Directly On-Site From Water Directly to Application

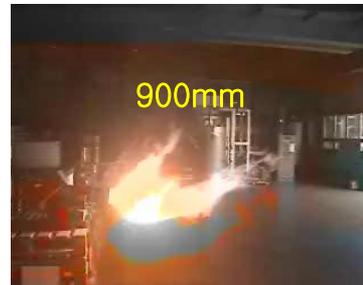


Premixed combustion system with BG and Oil

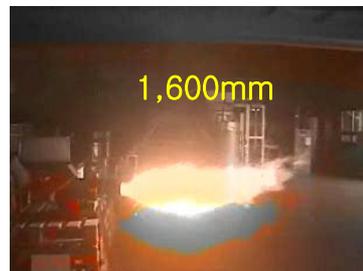
The system runs as Brown Gas and heavy oil mixture burn to dry off the sludgy and the by-product gases and their odor are combusted in secondary chamber at 800°C to make the resultant harmless. Operation **cost** and the production of **CO₂** can be reduced as much as **33.9%** and **48.2%**, respectively.



Mixed Fuel Principle



[Heavy Oil]



[Heavy oil + BG]



[Japan 30 Ton/day Waste Silicon Sludge Drying Facility 2011.03]

◆ Comparison of fuel before using Brown Gas system and after at sloar factory of ISHIHYOKI corporation in Japan

石井表記(株) ソーラー工場ブラウンガス設備燃料消費試験比較

Table1 280°Cの時の燃料消費量の比較

280°C	重油使用量(L)	電力使用量(kW)	コスト(円)	燃料削減(%)	コスト削減(%)
重油のみ(差圧-0.6kPa)	49.7	0	3591.9	-	-
ブラウンガス(差圧-0.3kPa)	26.6	48.3	2602.5	46.4	27.5

Table2 350°Cの時の燃料消費量の比較

350°C	重油使用量(L)	電力使用量(kW)	コスト(円)	燃料削減(%)	コスト削減(%)
重油のみ(差圧-0.6kPa)	73.8	0	5335.7	-	-
ブラウンガス(差圧-0.3kPa)	36	68.7	3564.4	51.2	33.2

Table3 450°Cの時の燃料消費量の比較

450°C	重油使用量(L)	電力使用量(kW)	コスト(円)	燃料削減(%)	コスト削減(%)
重油のみ(差圧-0.6kPa)	92.5	0	6689.2	-	-
ブラウンガス(差圧-0.3kPa)	47.9	68.7	4423.3	48.2	33.9

Table4 恒温温度と条件

	ブラウンガス混焼	A重油のみ
280°C	(ブラウンガス9m ³ /h+6ガロンノズル)×2本 差圧 0.3kPa 外気温度:20°C 湿度:18%	9ガロンノズル×2本 差圧 0.6kPa 外気温度:29°C程度 湿度:18%
350°C	(ブラウンガス9m ³ /h+6ガロンノズル)×2本 差圧 0.3kPa 外気温度:28°C 湿度:16%	9ガロンノズル×3本 差圧 0.6kPa 外気温度:29°C程度 湿度:17%
450°C	(ブラウンガス9m ³ /h+6ガロンノズル)×2本 差圧 0.3kPa 外気温度:27°C 湿度:18%	9ガロンノズル×3本 差圧 0.6kPa 外気温度:25°C程度 湿度:10%

[CALCULATION]

[Table 280°C 경우 연료 절감량 비교]

- 49.7L x 72.27엔/L = 3,591.9엔
- (26.6 L x 72.27엔/L) + (21m³ x 2.3kW x 14.12엔/kW) = 2,602.5엔
- 연료 삭감 : [(49.7L - 26.6L) / 49.7L] x 100 = 46.4%
- Cost 삭감 : [(3,591.9엔 - 2,602.5엔) / 3,591.9엔] x 100 = 27.5%

[Table 350°C 경우 연료 절감량 비교]

- 73.8L x 72.27엔/L = 5,335.7엔
- (36L x 72.27엔/L) + (29.87m³ x 2.3kW x 14.12엔/kW) = 3,564.4엔
- 연료 삭감 : [(73.8L - 36L) / 73.8L] x 100 = 51.2%
- Cost 삭감 : [(5,335.7엔 - 3,564.4엔) / 5,335.7엔] x 100 = 33.2%

[Table 450°C 경우 연료 절감량 비교]

- 92.5L x 72.27엔/L = 6,689.2엔
- (47.9L x 72.27엔/L) + (29.87m³ x 2.3kW x 14.12엔/kW) = 4,423.3엔
- 연료 삭감 : [(92.5L - 47.9L) / 92.5L] x 100 = 48.2%
- Cost 삭감 : [(6,689.2엔 - 4,423.3엔) / 6,689.2엔] x 100 = 33.9%

◆ Non Flammable Waste Incineration of Koshin Service Crematory



[Brown Gas Generator]



[Koshin Service crematory in Japan]

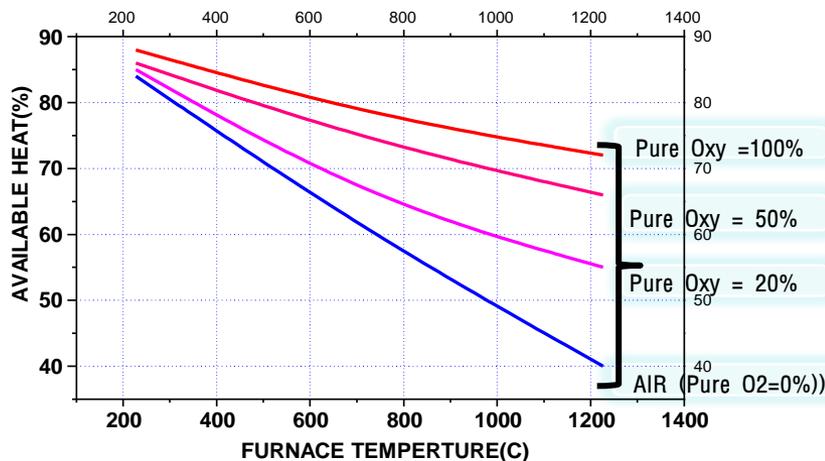
◆ Comparison of energy cost of Koshin Service crematory

Fuel	Items	Mar	Apr	May	Jun	Jul
Heave Oil + H. blast (BG) 2008	Consuming of H.oil/ℓ	48,705	20,141	36,521	20,543	22,142
	Price of H.oil(¥)	85	85	92	92	92
	Amount of H.oil/m	4,139,925	1,711,985	3,359,932	1,889,956	2,037,064
	Electricity(kWh/m)	74,288	120,268	116,121	124,410	127,968
	Electricity(¥/m)	1,158,893	1,876,181	1,811,488	1,940,796	1,996,301
	Fuel cost(¥/m)	5,298,818	3,588,166	5,171,420	3,830,752	4,033,385
	Saving Amount/m(¥)	-3,381,620 (38.9%)	-3,312,842 (48%)	-2,566,066 (33.2%)	-6,728,508 (63.7%)	-6,536,581 (61.8%)
Heave Oil 2007	Consuming of H.oil/ℓ	98,225	77,419	80,967	111,290	111,290
	Amount of H.oil/m	8,349,125	6,580,615	7,448,964	10,238,680	10,238,680
	Electricity(kWh/m)	21,238	20,538	18,495	20,550	21,235
	Electricity(¥/m)	331,313	320,393	288,522	320,580	331,266
	Fuel cost(¥/m)	8,680,438	6,901,008	7,737,486	10,559,260	10,569,946

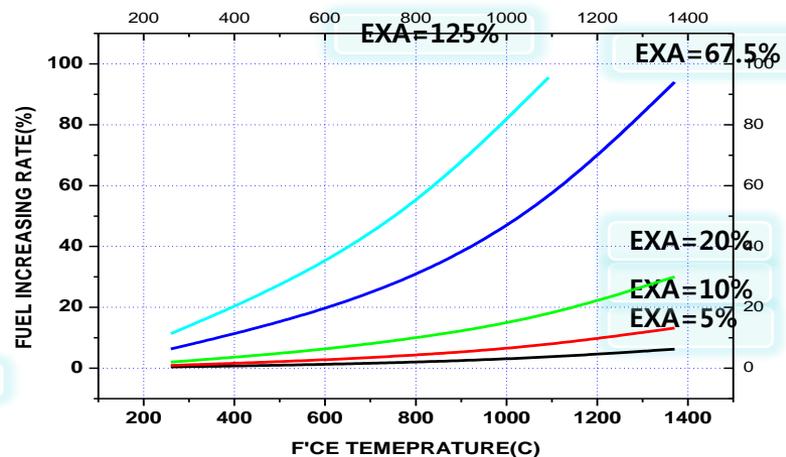
☞ electricity of 2007 : ¥14.6/kWh electricity of 2008 : ¥15.6/kWh

Cause to be saved fuel consumption

- 1) Oxygen(O_2) in the Brown gas helps the combustion of bunker fuel oil C, so decreases air volume for combustion and reduces the consumption of bunker fuel oil C.
 - There are 79% of nitrogen(N_2) in the air not helpful for the combustion and most of its energy is being wasted by heating up these nitrogen
- 2) Reduce bunker fuel oil C with high temperature combustion by the help of oxygen(O_2) and hydrogen(H_2) in the Brown Gas.



- Low Temp. : Low fuel saving effect according to oxygen ratio.
- High Temp. : High fuel saving effect according to oxygen ration.



- Low Temp. : Low fuel consumption rate difference according to excess air ratio.
- High Temp. : High fuel consumption rate difference according to excess air ratio.



#22-203, 12 Gil, Sapyung-Daero, Seocho-Gu, Seoul, Korea
T : +82-2-6000-3979 M: +82-10-2979-6201 E: bbn@bbnworld.com

Water Treatment, Waste to Energy, Recycling, Renewable Energy
Global Market Expansion, Strategic Sourcing, Cross-border Financing,