A LANDMARK COMPANY FOR ENERGY & THE ENVIRONMENT

HALLA Energy & Environment, in succession of Halla's half a century industrial plants business, had entered into the plant industry at its pioneer stage in Korea. Halla Energy & Environment has grown up to a largest specialized company in the environmental industry in Korea and leading company in industrial plants based on its advanced technology developed and plenty of experiences accumulated.

Based on its 40 years experience in the energy and environmental industry, Halla is now concentrating on the new and renewable energy industry such as wind power, solar energy and hydro power industry to substitute the fossil fuels to reduce CO₂ generation, a cause of global warming. Halla will be newly born to a total clean energy & environment industry.

Halla Energy & Environment has the capability to carry out all environmental and industrial plants, and civil & construction works on a turnkey basis ranging from feasibility studies to design, manufacturing, construction and operation & maintenance as well.

Halla Energy & Environment will be your trustworthy partner for your growth and success to offer you the most economical investment & operational costs and technical solutions as well in such fields of industrial & environmental plants, new & renewable energy facilities.

Company Introduction / Award & Acquisition

Company Introduction

Present	The Completion of the Korean`s first Refused Derived Fuel (RDF) Power plant (Iksan 2nd Industrial Complex Community Energy Supply System)
	Established VINA-HALLA HEAVY INDUSTRIES, Vietnam
2000 [,] s	First comany in Korea to acquire certification for an integrated management system (quality, the environment & health) in the areas of construction and the environemt Completed construction of an industrial facility manufacturing plant in Eumseng, Korea First company in korea to be awarded a contract for flue gas denitrification facilities (Seoul Thermal power plant)
	Environmetnal division separated and became an independent comany Halla Energy & Environment
90 's	First Korean company to operate a municipal solid waste incineration plant (Changwon incineration plant)
	Halla Heavy industries entered the enviornmental industry field First company in korea to be awarded an overseas contract to build a fabric collector facility (Saudi Arabia)
6 0~70 's	Established Hyundai International Inc, The predecessor of Halla Engineering & Heavy Industries Co. Ltd

Award & Acquisition

Present	2019	Citation from Commander of Capital Defense Command, Republic of Korea Citation from Changwon city for contribution to resource recovery facility's operation Received an award for the best facility for evaluation of waste disposal facility's installation and operation (Gangnam resource recovery facility/ the Ministry of Environment) Citation from Mayor of Chuncheon city for contribution to municipal administration Received an appreciation plaque from Korea East-West power Co, Ltd.
	2016	Citation from Seoul metropolitan government for improving operational
	2012	Certificated for leading Environmental Company by Minister of Environment
	2011	Excellence of Green Technology Awarded, Seoul Enviornmental Awards
	2010	The National Green Technology Award, Commendation of the Minister of Environment (Municipal Waste Recycling Plant, Pyrolysis & Melting Type)
	2007	Certified by the Korean Ministry of the Environment for new technoloy regarding RBF Acquired patent for industrial waste recycling system
	2006	Declared the '2010 Vision (HIT! 5010)' Acquired patent for manufacturing method of the sludge Acquired patent for integrated incineration system for organic sludge and combustible waste Acquired patent for soil remediation technology Acquired 2 patent for RBF
	2005	Received the \$3 million Export Tower Award Acquired new technology certificate (automated disinfection process in water treatment) Acquired patent for the pyrolysis & melting waste method
	2004	Acquired patent for gas sensor Acquired patnet for RBF (Riverbed filtration) Acquired patent for automated water treatment system Certified by the Korea Ministry of the Environment for new technology regarding water treatment method
	2003	Acquired equipment patent for the integrated digestive treatment of food waste & animal excrement Acquired patent for RID (Rotation Immersion Disks) System Acquired patent for HASS (Hall Advanced Sewage System) Acquired patent for soil remediation method (permeable reactive barrier)
	2002	Received presidential Award at the New Technology Promotion Competition
	2001	Received quality certifications for environmental equipment (fabric collector) Received quality certificates for environmental quipment (incineration facilities)
2000's	2000	Received quality certifications for enviornmental facilities
00	1999	Acquired patent for our anaerobic digestion facility used for organic waste treatment
90's	1997	Received the Jang Yeong Shil award for facility development in the filed of anaerobic digestion utilizing organic waste to create compost

BUSINESS **A**REAS

TURN-KEY BASIS ENGINEERING SOLUTION

⁶⁶ Based on our wide experiences, Halla Energy & Environment offers the total solution from feasibility studies to design, construction, operation and after sales service. ⁹⁹



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Environmental Plants

True coexistence between human beings and nature to create a better tomorrow... Halla Energy & Environment, Korea's largest environmental company is making it possible.



- Waste Treatment Facilities
- Water Treatment Facilities
- Air Pollution Control Facilities



•Waste Treatment Facilities

"Resource Recovery - Halla is at the Center of it!"

Halla Energy & Environment, the company concentrating its efforts on human beings and the future value of the environment





Municipal Solid Waste Incineration Plant

Stoker / Stoker+Rotary Kiln

The waste incinerator of Halla Energy & Environment is the up-to-date technology with higher heat recovery from higher combustion efficiency and minimized generation of harmful substances such as dioxin, etc. Halla's incineration technology has been proven for its durability and safety through many plants that Halla has built and been operating as well. Halla's waste incinerator contributes to renewable power generating, too. Steam generated utilizing the waste heat from the incinerator is being sold for district heating and/or utilized to generate electric power by operating the steam turbine generator. The residual incineration ash generated from Halla's stocker and rotary kiln incinerator is being used to produce the bricks.





Stoker+Rotary Kiln







Pyrolysis, Gasification & Melting Incinerator (fluidized bed type)

The fluidized bed type pyrolysis, gasification & melting incinerator is an environment friendly and very stable technology in which the waste is partly burned by fluidized material and partly dissolved by the combustion heat, and the carbide generated is melted in the swirling - flow melting furnace by the gas combustion heat and discharged as slag.



Pangyo Clean Tower Incinerator (45tons per day x 2)





Pyrolysis & Melting Stoker Incinerator

Halla's pyrolysis & melting stoker incinerator developed and commercialized by a domestic technology and patent allowed is the energy-saving system. It melts down the wastes utilizing high combustion heat of homogenized carbon material and pyrolyzes the residues utilizing combustible gas heat in the pyrolysis furnace of the incinerator. It is also an advanced technology that enables the recycling of solid residues through melting and vitrification and minimizes the dioxin emission.



Sludge Incineration Facility (fluidized bed type)

Sludge generated at sewage water or wastewater treatment plants has different properties depending on the area, season and accordingly requires an optimally designed incineration system.

Halla Energy & Environment on the basis of our experience of having designed and installed one of the largest capacity pulp sludge incinerators in Korea (380 tons per day) is supplying optimal facilities suited for characteristics of the sludge itself.



Masan sludge incinerator (90 tons per day)





Organic Waste Recycling Facility

Two-phase anaerobic digestion process for organic wastes recycling technology developed by Halla Energy & Environment can be used for biogas production not only through the anaerobic digestion of food waste with high sodium and water content, but also through various biodegradable organic waste like livestock manure, sewage sludge, etc. Sewage sludge, generated from the anaerobic digestion of organic waste is used as high quality compost or liquefied fertilizer and produces biogas as an alternative energy source for boilers and power generation facilities.





Landfills

We construct sanitary and safe landfills for municipal solid waste and fly ash utilizing the anaerobic cell method, an advanced technology to minimize environmental pollution from secondary pollution substances.





Pneumatic Refuse Collection System

Waste is thrown into a hopper and transported through pipes using air vacuum and pressure to collection areas. Then the waste is separated and crushed or pressed so it can be easily transported to the 2^{nd} stage or final stage treatment facility. This is an environment friendly technology that is excellent for use in downtown areas.





Mechanical Biological Treatment

With MBT (Mechanical Biological Treatment) technology, the waste is separated mechanically before simple incineration or being taken to a landfill to collect the recyclable materials and to produce the RDF. This maximizes the amount of waste that can be turned into energy and minimizes the amount of waste that must incinerated or taken to a landfill. The produced RDF can be used as an alternative fuel in cement production and power generation plants, and also the produced biogas can be used for power generation.



• Water Treatment Facilities

"Clean Water - Halla Energy & Environment can make it." Halla Energy & Environment is insuring the stable supply of clean water for people.





Sewage Treatment

Water polluting is getting worse because of destruction of the natural environment and water ecosystems caused by rapid economic development and industrialization. Particularly, nitrogen and phosphorous are substances that destroy water ecosystems. Halla Energy & Environment has developed an advanced wastewater treatment process that can remove nitrogen and phosphorous and it can reduce eutrophication. We have built wastewater treatment plants near new urban areas and also environment friendly underground wastewater treatment plants for the reuse of recycled water.



Wastewater Treatment Plant

The characteristics of industrial wastewater can vary according to the substances contained and the production process. Therefore, it is important to perform a field study for an analysis of the pollution source and selection of the most efficient treatment process. Halla Energy & Environment has extensive references for designing, constructing and operating wastewater treatment plants in the areas of pulp materials for paper, livestock manure, waste water from incineration, leachate from landfills and industrial waste water.





Improvement of water advanced treatment

By developing the combined maintenance system for purification and maximizing efficiency of advanced water treatment process, we aim at securing treated water quality and establishing simple, economical maintenance. In order to commercialize the integrated operating management system for water advanced treatment and produce & supply qualified tap water, we acquired Certification (NO.605) from the korean Government. Halla Energy & Environment is concetrating on the existing and the new water purification plants for improvement as well as modernization.



Improvement of water purification using smart sensing and operation technology of unit process is the combined maintenance system of which the automatic control system and real time automatic water analysis systems are included.

- Water-monitoring of Taste /Odor using smartsensing
 Operating of advanced oxidation process using real time
- peroxide measuring device • Decision making of recycling time using TRRI
- Real time monitoring of disinfection by product in Chlorine disinfection process and Automatic control of Chlorine dosing
- Water-monitoring of water purification by Web-based and the analysis of process effciency (Smart-EnviDB)







Benefits of Riverbed Filtration

- Utilizes the natural filtration of the riverbed aquifer
- Removes nutrient salts & pollution substances (Cryptosporidium, DBP_s, Endocrine Disruptors)
- Reduced facility site area
- Reduced maintenance cost
- No use of chemicals
- No sludge generated





Patent

Title : Water gathering screen having cleaning and reverse cleaning device
No. :10-2011-0014343

• Date : 2011.2.18





Riverbed Filtration & Seawater Desalination Intake System

The Riverbed Filtration process extracts water from the river shoreline. The vertical well connected with horizontal (lateral) screen pipes the intakes filtrated river water through the rivered aquifer layer. This process secures an indirect water intake source and helps improve river water quality as well as to maintain river water infiltration.

Furthermore, desalinated seawater, naturally filtrated through the sand beneath the sea water, is gained indirectly by utilizing naturally formed seashore sand. Halla Energy & Environment has modified a beach-well method with high efficiency in operation and management to achieve simple pre-treatment process and reduction of construction and maintenance cost.



• Air Pollution Control Facilities

"Clean Air – Halla Energy & Environment can make it."

Clean air for a better life, the air pollution control systems of Halla Energy & Environment are making it possible.





Precipitators

Electrostatic Precipitator

The electrostatic precipitator removes dust from emission sources utilizing the principal of corona discharge. Halla's E.P. technology is strictly fulfilling the global dust emission standards as proven by that we supplied the highest efficient Electrostatic Precipitators for Yeongheung thermal power plant 1~4 units in Korea and the Mundra thermal power plant (800MW x 5 lines), the world largest power plant in India.



Fabric Collectors

As environmental standards and regulations for dust emission are getting stricter and stricter, Halla Energy & Environment developed the high efficient fabric collectors by improving the large scale electrostatic precipitators which were mainly used in cement kilns and proven the better performance and results.

Also, our air coolers and fabric collectors of high efficiency that is the pre-treatment facility at the steel mill where the large volume of high-temperature is emitted maintains reputations at all installation sites for its superior performances.







Flue Gas Desulfurization System

The flue gas desulfurization (FGD) system removes sulfur oxides present in flue gas produced in boilers and power generation plants utilizing coal or heavy oil as fuel. Halla's FGD system having well-arranged nozzles to spray overlapping in several layers according to the gas flow, has outstanding efficiency in removal of sulfur oxides. Also, Halla FGD offers the advantages of economical initial investment and low operation & maintenance costs as well. High purity gypsum, a by-product, can be used in making gypsum board, an adhesive mixture for cement, an improving agent for soil and as a road paving material.







Flue Gas Denitrification System

Halla Energy & Environment is equipped with its own design and supply capacity for selective catalytic reduction (SCR) flue gas denitrification systems. Halla has successfully executed construction of a denitrification system for unit #4 & #5 of the Seoul thermal power plant, the first denitrification facility installed in a thermal power plant in Korea. The selective catalytic reduction (SCR) is the system to decompose nitrogen oxide generated from combustion into harmless nitrogen and vapor before emission to atmosphere by passing the exhaust nitrogen through the catalytic layer along with reductants (ammonia or urea).



Samcheonpo thermal power plant #3 & #4 flue gas denitnifrication system (560MW X2)





Industrial Plants & Equipment

Halla Energy & Environment is proud of being pioneer and successor of industrial plants in Korea.



- Cement Plants
- Material handling, Loading & Unloading Equipment
 Ash Handling Systems



Cement Plants

Halla had successfully completed and supplied many large-scale cement plants and production facilities such as Lafarge-Halla Cement and Hyundai Cement project in Korea, SPCC in Saudi Arabia, and NSCC in Malaysia, etc. We have been also engaged in maintenance, renovation and rehabilitation of major cement plants at home and abroad to improve the plants productivity and efficiency.



Material handling, Loading & Unloading Equipment

<section-header><image>

Based on our advanced technology and abundant production experience of varies environmental, industrial and power generation plants and facilities, Halla is also manufacturing the material handling, loading and unloading equipment such as stackers, reclaimers, cranes, conveyors, level-luffing cranes (LLC), unloaders, and advanced automated facilities, etc.



Ash Handling Systems

An ash handling system collects and transports the bottom ash and the fly ash generated in coal fired thermal power plants to an ash pond or ash storage silo.

There are two types of bottom ash handling system; wet handling system cooling by water and dry handling system cooling by air.

The fly ash is used as a raw material for cement and an additive mixture for concrete while the bottom ash is recycled into bricks and aggregates as construction materials. Halla's ash handling systems minimize environmental pollution and maximize the economical benefits from the extended recycling.





Ash hadling system for the Yeongheung Thermal Power plant (800,MW,X 2)



Energy Plants

The company to create a clean future - Halla Energy & Environment! At Halla Energy & Environment, we develop clean energy as we advance the vision of future energy.



Renewable Energy Facilities Power Generation Facilities



Renewable Energy Facilities



RDF (Refuse Derived Fuel) is a solid fuel that is produced by processing combustible components extracted through dehydrating, shredding, and sorting to remove its incombustible matters such as moisture, metal, and glass which are contained in the waste. It utilizes the fluidized bed boiler technology that is designed for combustion of the RDF. Based on the characteristics of fluidized bed boiler which molds well in the layer, it is able to have complete combustion in relatively the low temperature and excess air rate. In addition, fluidized bed boiler adapts to fuels that contain a lot of moisture. The fluidized bed method also has advantage that it is able to reduce pollutant emmission without additional process. It produces electric power by using a steam turbine generator with the steam that is produced by combustion of RDF, and the steam with high pressure and high temperature from the steam turbine generator is provided to industrial complex to increase its generation efficiency. Generation by utilizing RDF is an environment friendly energy recovery method that collects the energy from the disposal of waste.





Waste Heat Recovery Cogeneration for Cement Plant

Cement Waste Heat Recovery Power Generation is a technology for the purpose of effective energy use In recovery of waste heat that is generated during the cement production stage. It produces high pressure steam through the waste heat recovery boiler that uses the high temperature waste heat generated at the cement kiln. The high pressure steam produces the electric power by powering steam turbine and generator. Part of the produced power returns to its generator as the generator's electric power. It provides efficient and economical energy use by making profit through selling back the surplus electric power.









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Biogas Upgrading and Purification Technology

Biogas purification and upgrading technology produces high purity bio-methane through the refinement of biogas that is produced in anaerobic digestion system such as landfills, sewage disposal facilities and organic waste recovery facilities. The high purity bio-methane can be substituted for fossil fuel to be used as automotive fuel. In addition, the technology provides alternative energy, and it leads people to confront climate change more actively. Through the installation and operation of the biogas automotive fuel facility in the Sudokwon landfills site, Halla is producing bio-methane approximately 14,400Nm3 per day and providing biogas fuel for more than two hundred vehicles per day. Based upon the technology, we are coping with the technological change to recover organic waste such as organic sludge, food waste and waste water. We are striving to provide more CNG fueled vehicles and new & renewable energy by utilizing the technology of biogas automotive fuel.



Landfill Gas (LFG) Recycling Facilities

Converting Landfill Gas (LFG) into industrial fuels such as LNG is accomplished by collecting and purifying methane gas generated from waste landfills. This process not only creates a valuable energy resource but also reduces global warming factors as well as the pungent odors around landfills.

Halla Energy & Environment, for the first time in Korea, secured technology for LFG heavy gas conversion. It has successfully designed and installed conversion units at the Seongam landfill in Ulsan City, where the converted methane is used to increase the SCR temperature at the Ulsan incineration plant and for the boiler at the Keumho Petroleum Chemistry Company. With this project, annual energy savings have amounted to more than 2 Billion Korean Won.

<image>





Concentrated Solar Power Plant (CSP)

Solar power is a clean energy resource for the future that can satisfy all the world's power demand with just 1% of solar radiation from desert regions around the world. Halla Energy & Environment (Halla E&E) has been participating in the Korea-China Collaborative Project, installing 1MW tower type CSP plant developments worthing 15million USD sponsored by the Ministry of Knowledge Economy and the Korea Energy Management Corporation of Korea from Jan. 2006 to Dec. 2011. During the project, Halla E&E and the Korea Institute of Energy Research together was in charge of the key CSP technologies ; the receiver and thermal storage device.

Halla E&E also have participated in Parabolic Dish Stirling System Development Project and studied on the convergence between the CSP and other environmental technologies such as seawater desalination, water detoxification, water disinfection and other methods for waste treatment.

By the effort to successfully commercializing the converged system of CSP and other environmental technologies, Halla E&E now seeks position as an eco-friendly technology company, leading to conserve our global environment.



Wind Power Plants

Halla Energy & Environment is accelerating R&D for renewable energy resource technologies to cope with environmental changes domestically as well as overseas regarding regulating the discharge of green house gases according to the United Nations Convention on Climate Change.

In meeting with the growing demand of renewable energy in the global market and based on the abundant experience in steel fabrication, Halla expanded its manufacturing plant as its 2nd factory in Baria-Vungtau, Vietnam with the latest state of the art facility, the most qualified, experienced man-powers and labors.



Photo Voltaic Power Plant

During this age of high oil prices and global warming, the world is concentrating efforts to secure a stable supply of energy resources as well as reducing green house gases agreed to in the Kyoto Protocol in Feb. 2005. This is why Halla Energy & Environment is focusing on constructing highly efficient photo voltaic power generation facilities and complexes from site selection to design and construction.



Yeongheung Thermal Power Facilities

Power Generation Facilities

Small Hydropower Plants

Halla Energy & Environment has constructed a small hydropower plant using cooling water discharged from main power generation plants and the difference in the ebb and flow of the tides for the first time in Samchonpo, Korea. With this achievement, we will continue to develop technology and facilities regarding tidal power generation and tidal stream power generation.



Meeting with the world's rapidly increasing power generation demands, Halla Energy & Environment is providing power generation facilities in a suitable time based on our extensive accumulated experiences and technologies. Our technology capability and project management in all EPC aspects include design, procurement, construction and commissioning.



Iksan 2nd Industrial Complex Group Energy Supply Facilities



Hydropower Plants

The emphasis on clean power generation facilities has raised the importance of hydropower generation facilities due to the rapid depletion of fossil fuels and the negative impact on the earth's environment. Halla Energy & Environment's experience in hydropower generation facilities includes providing major equipment for the Yongdahm Dam and the integrated monitoring/control system for the Chooncheon hydropower generation facility renovation project.

Community Energy Supply System (CES)

CES offers energy savings as well as a pleasant environment by simultaneously supplying both heat and steam produced from power generating facilities to apartments, business offices, hotels and department stores located in highly congested areas and to industrial complexes.

Civil Works and Building Engineering & Construction

Wellbeing Human City – Halla! Creating environment friendly cities for a clean future – Halla Energy & Environment



Roads \cdot Harbors \cdot Apartment renovations & Residential construction



• Civil Works

Based on our broad construction experiences and technologies, Halla Energy & Environment has made major inroads in the civil works area which is the base for the country's economy including major roads and highways, tunnels, bridges and harbors. From design to construction and after sales service, we have become a company highly respected by our customers.





- 2. Gamil-Choi Road
- 3. Deokrye-Yonggang Road

1

3

Cheongmyeong Tunnel
 Seocheon Bridge (suspension)

• Building Engineering & Construction

The building engineering and construction area of Halla Energy & Environment is creating pleasant residential and business environments from apartments and business buildings to large-scale area development projects that bring people and nature together in harmony.



Operation & Maintenance of Facilities

Wealth knowledge & Knowhow– Halla! Only an abundance of experience in operating facilities can guarantee low cost operations and stable maintenance.



• Operation & Maintenance of Facilities

With an abundant experience in designing and constructing environmental plants, Halla Energy & Environment can maintain the stable maintenance of a facility's unique characteristics and maximize advantages thereby. Our know-how obtained from operation of various facilities including incineration plants, sewage water and wastewater treatment plants and food waste treatment plants is resulting in the development of new technologies, improvement of processes and reductions in maintenance costs.



Soil Remediation

As a result of increases in population and industrial development such as leachate from landfills, acid drainage from abandoned mines, oil stored underground and substances released from industrial complexes, the Influx of harmful substances is contaminating soil and groundwater sources.

Halla Energy & Environment, on the basis of the environmental technology, accumulated, has acquired patents on groundwater and soil remediation processes developed together with a research team from Seoul National University in order to revive contaminated soil and groundwater sources, a major environmental concern in the 21st Century.

The Permeable Reactive Barrier (PRB) is an on-site remediation process that can remove harmful substances such as organic chloride compounds, nutritional salts and heavy metals from the groundwater. We are also making contributions in the development of domestic environmental technologies by participating in the PRB-net, which is an R&D network organized by leading global PRB groups such as the U.S. Environmental Protection Agency, Waterloo University (Canada) and Queen's University (U.K).

Geoworks - a specialized soil remediation company (Joint venture company between Halla Energy & Environment and Seoul National University)

• Exhaust Gas CO₂ Recovery and Liquefaction Technology

The recovery of exhaust gas CO_2 decreases the emission of gases causing global warming and creates economic added value through storing and selling the liquefied carbonic acid. It satisfies the "Low Carbon Green Growth" industrialization strategy promoted by the government, and the collected CO_2 can be utilized not only in agricultural field as a plant growth catalyst but also in industrial field. Halla will respond to the nations' policy such as the energy target scheme through technology development which recovers the exhaust gas CO_2 from its sources such as incineration facilities, environmental plants, chemical plants, power plants, and landfills. The recovered CO_2 will be utilized as agricultural and industrial provision for the acquirement of economic resources.

