

— AB FOR THE WASTE SECTOR

COGENERATION
FROM BIOGAS
AND LANDFILL GAS

BIOGAS-TO-BIOMETHANE
UPGRADING AND
LIQUEFACTION

AIR EMISSION
TREATMENT

AB FOR

WASTE



www.gruppoab.com



AB FOR

WASTE





AB SOLUTIONS FOR THE WASTE SECTOR IN A CIRCULAR ECONOMY.

THE FUTURE OF BIOENERGY IS
INCREASINGLY TIED IN WITH
A CIRCULAR ECONOMY THAT
RECOGNIZES AND REWARDS
FLEXIBILITY IN THE USE AND
TRANSFORMATION OF ENERGY.

Reducing atmospheric emissions, increasing the efficiency of energy processing plants and reinforcing the usefulness of the energy carriers produced are fundamental parameters in the design, implementation and maintenance of bioenergy projects.

The organic waste sector is an ideal arena in which the right bioenergy solution can safely manage such waste while gleaning valuable energy from low-cost raw materials.

AB offers a wide range of solutions to the waste sector.

→ **COGENERATION FROM BIOGAS AND LANDFILL GAS**

The ECOMAX® Biogas and ECOMAX® Landfill product line offers companies the superior solution to produce **electricity and thermal energy** via **cogeneration** fueled with biogas.

→ **BIOGAS-TO-BIOMETHANE UPGRADE AND LIQUEFACTION**

AB's **BIOCH4NGE®** **membrane system** produces **utility-grade biomethane** suitable

for direct injection into the natural gas network or to supply the **CH4LNG liquefier** to generate **liquid biomethane**.

→ **AIR EMISSION TREATMENT**

Air emission treatment is managed by applying innovative solutions to eliminate carbon monoxide, nitrogen oxides and volatile organic substances produced by biogas-powered generators.





A SOURCE OF RENEWABLE ENERGY FROM WASTE

Cogeneration produces electricity and heat from controlled waste storage. These energy sources can be used on-site in process plants or sold to the local power utility.

OFFERING THREE PRODUCTS WITHIN THE **ECOMAX® BIOGAS** LINE, AB IS THE IDEAL PARTNER TO DEVELOP HIGH-PERFORMANCE AND RELIABLE **SOLUTIONS** FOR TRANSFORMING ORGANIC URBAN WASTE AND WASTEWATER INTO ENERGY.

THE **ECOMAX® LANDFILL** LINE OFFERS SUPERB SOLUTIONS TO **TRANSFORM LANDFILL BIOGAS**, EXTRACTED UNDER CONTROLLED CONDITIONS AND SPECIFICALLY TREATED, INTO A **RENEWABLE ENERGY SOURCE**.

OVER A LANDFILL'S AVERAGE LIFESPAN, ONE MILLION TONS OF WASTE CAN PRODUCE 1.7 TO 2.5 MILLION M₃ OF METHANE. WITH A CALORIFIC VALUE RANGING ON AVERAGE BETWEEN 3.5 AND 5.0 KWH/NM₃, **LANDFILL GAS CAN READILY POWER COGENERATION SYSTEMS**.

AB'S TECHNOLOGIES TREAT LANDFILL BIOGAS TO ELIMINATE UNDESIRABLE VOLATILE ORGANIC COMPOUNDS, SILOXANES, HYDROGEN SULPHIDE AND AMMONIA THAT CAN SERIOUSLY DAMAGE THE COGENERATION PLANT'S ENGINE.

LANDFILL BIOGAS COGENERATION PRODUCES

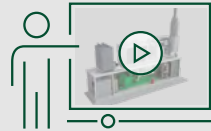
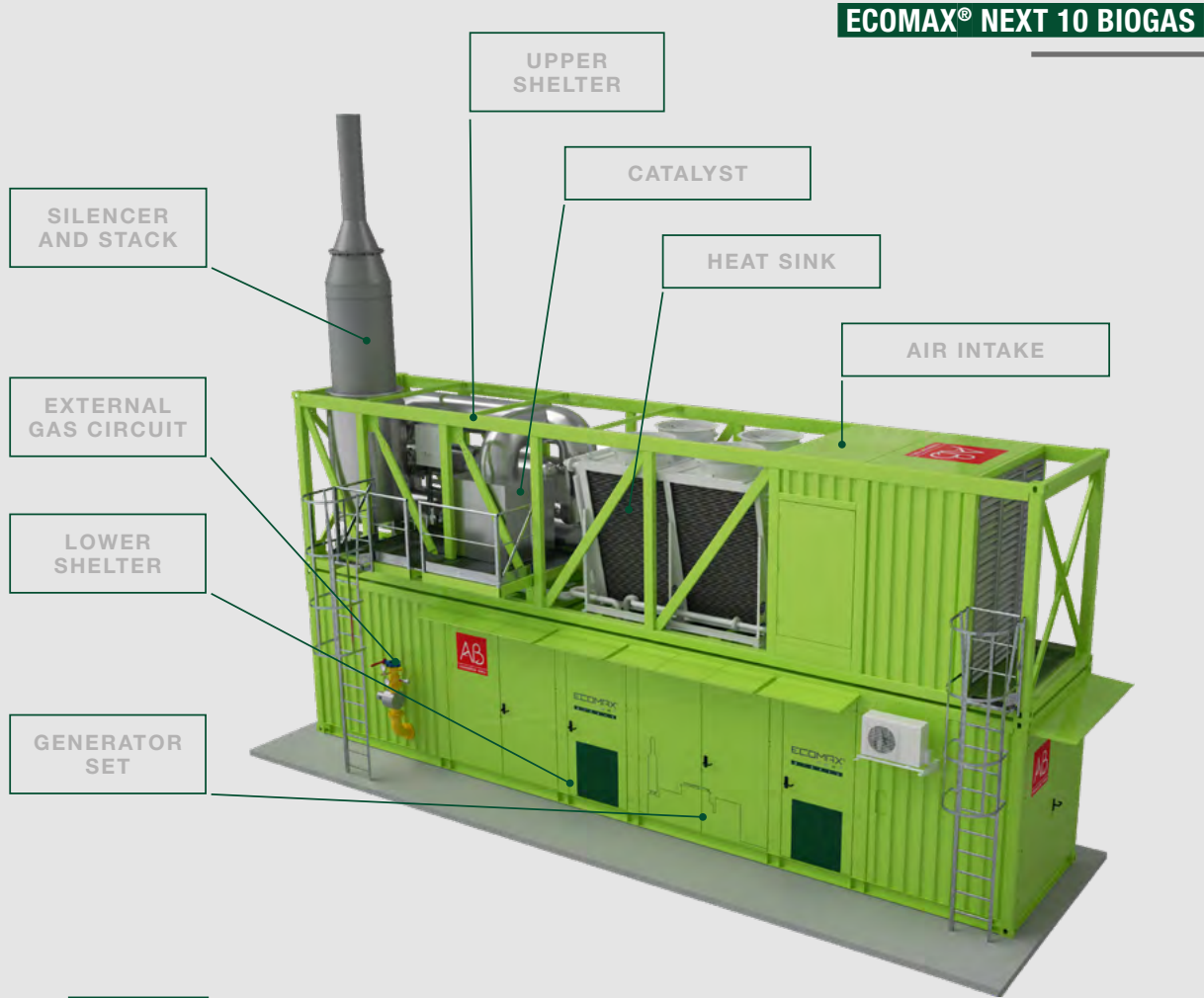


ELECTRICITY
to generate revenue from utility sales



THERMAL ENERGY

- > Steam for production processes
- > Hot water for digester sludge, production processes and building heat



REVIEW PRODUCT DETAILS
IN THE 3D RENDERING VIDEO

The presence and location of various components
are purely indicative and may change depending
on the configuration selected.



ECOMAX®
B I O G A S

ECOMAX®
N E X T
B I O G A S

RANGE



ECOMAX® BIOGAS 3	
Electrical Output [kW]*	336
Total Heat Recovery - as hot water [kW]**	393



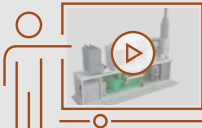
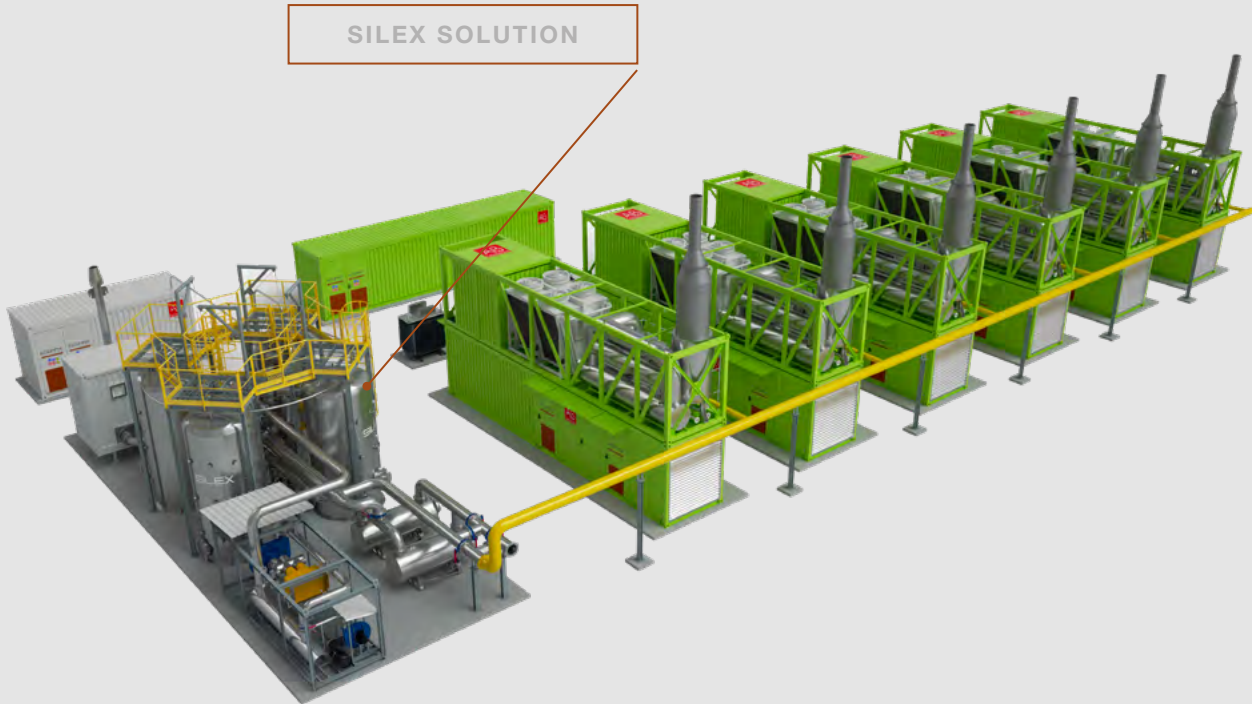
ECOMAX NEXT® BIOGAS	6	8	9	10	12	15
Electrical Output [kW]*	633	847	851	1,062	1,141	1,429
Total Heat Recovery - as hot water [kW]**	723	965	907	1,205	1,209	1,513

Data refers to engines with NOx emissions of 500 mg/Nm3 (5% O2).

* Different electrical configurations are available on request.

** Exhaust gas cooled at 200°C.

ECOMAX® NEXT 10 LANDFILL



REVIEW PRODUCT DETAILS
IN THE 3D RENDERING VIDEO

An example of an ECOMAX® Landfill module installation
coupled with the innovative SILEX system
to remove siloxanes present in landfill biogas.

*The presence and location of various components
are purely indicative and may change depending
on the configuration selected.*



ECOMAX®
LANDFILL GAS

ECOMAX®
NEXT
LANDFILL GAS

RANGE



ECOMAX® NEXT LANDFILL	6	8	9	10	12	15
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ECOMAX® LANDFILL	3
Electrical Output [kW]*	336
Total Heat Recovery - as hot water [kW]**	393

All data are based on engine versions with NOx emissions level at 500 mg/Nm3 (5% O2).
* Customised Electrical Output upon request.
** Exhaust gas cooled at 200°C.



SILEX

THE INNOVATIVE SILOXANE REMOVAL SYSTEM
THAT EXTENDS THE LIFE OF ECOMAX®

Landfill biogas contains siloxanes, volatile organic compounds and other **pollutants** that can **wreak havoc with the engine components of a cogeneration plant**. The combustion of such pollutants contaminates the oil and causes the deterioration of pistons and cylinder heads – maintenance costs can skyrocket.

AB designed the **SILEX solution to remove harmful pollutants before reaching the engine**, significantly reducing maintenance costs and plant downtime.

SILEX

BENEFITS
FOR COGENERATION PLANTS



SUPERIOR PLANT PERFORMANCE
with minimal downtime



REDUCED MAINTENANCE
(cleaning engine heads, changing spark plugs, engine overhauls)



DECREASED and programmable OIL CONSUMPTION



OIL LIFE DOUBLED



MORE POWER
delivered by the engine



FULLY COMPLIANT
with all engine warranties



RANGE

SILEX IS AVAILABLE
IN TWO VERSIONS

SILEX L is designed for large cogeneration plants;

SILEX S is a compact and containerized version for small cogeneration plants.

SILEX S
CONTAINERIZED VERSION

	S 0.8	S 1.6	S 2.4
Total flow (biogas (Nm ³ /h))	800	1,600	2,400
Number of ECOMAX®15	1	2	3

SILEX L
OPEN VERSION

	L 3.0	L 6.0	L 9.0
Total flow (biogas (Nm ³ /h))	3,000	6,000	9,000
Number of ECOMAX®15	4	8	12

SILEX



CHANGE IS AT OUR DOORSTEP.



**BIOMETHANE: SUSTAINABLE,
PROGRAMMABLE, EFFICIENT
AND PROFITABLE.**

BIOCH4NGE® is AB's technology for producing biomethane from biomass, developed to support companies seeking a competitive edge and enhanced sustainability.

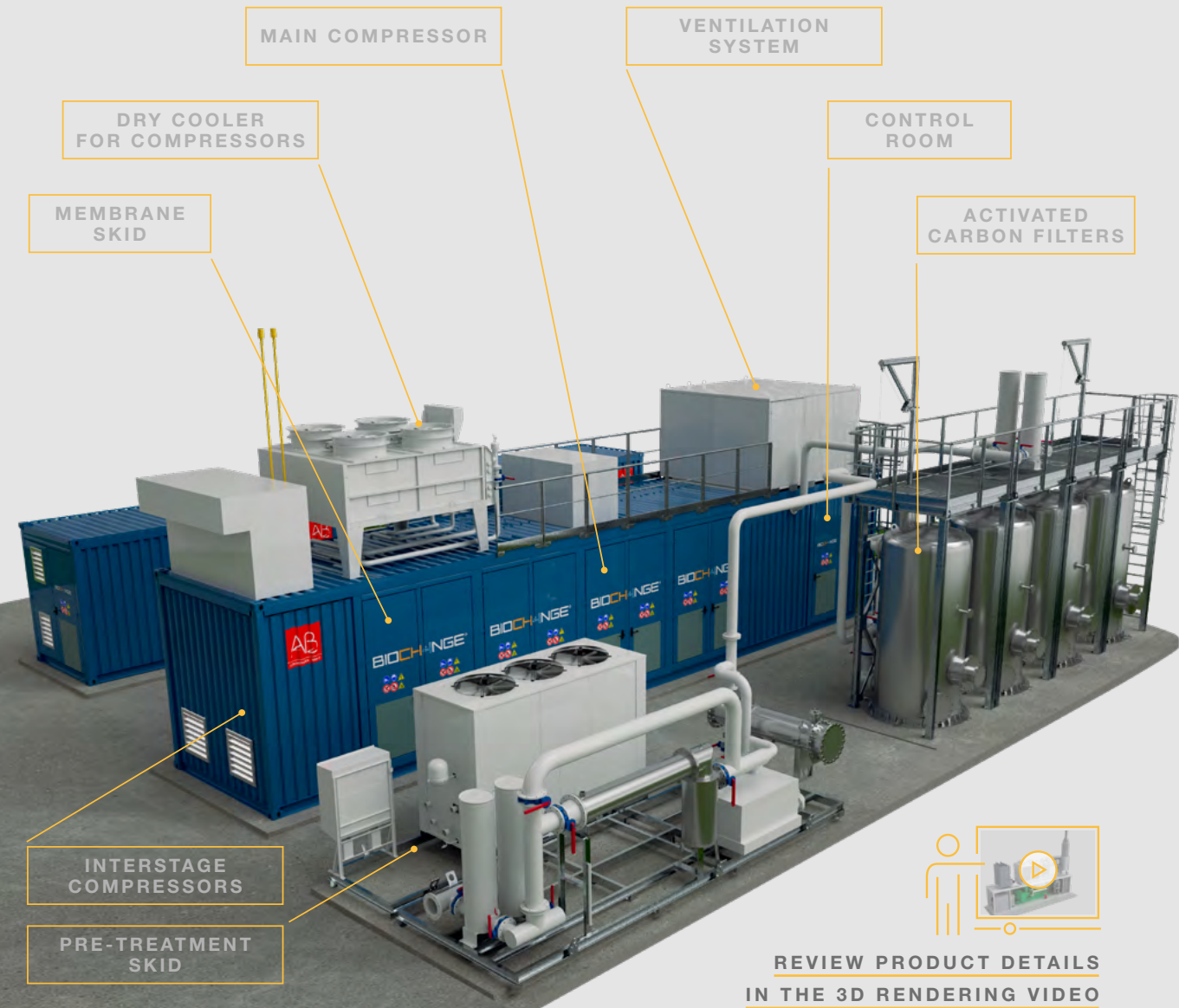
BIOCH4NGE® is a compact, modular, versatile and high-performance system capable of **recovering and converting gases produced by anaerobic digestion into purified biomethane**. This fuel is ideal to power vehicles, supply the utility network or distribute via road transportation.

AB employs **polymeric membranes** that exhibit a selective permeability to separate CH₄ and CO₂ from the waste products found in raw biogas. **Integrating an ECOMAX® cogeneration plant**, fueled by utility gas or excess biogas, with a BIOCH4NGE® system will supply the electrical power and thermal energy required for biomethane upgrading – a truly sustainable plant management solution.

Combining AB's CH4LNG liquefaction system with the fully compatible BIOCH4NGE® plant is an ideal process to yield liquid biomethane. The heart of the CH4LNG process is the cryo-cooler, which is based on the Stirling cryogenics technology and generates cooling capacity by compressing and expanding helium in a closed cycle. CH4LNG is a modular containerized process offering plug-in capabilities, and it consumes no nitrogen during operation. Modules are available in a variety of sizes, with competitive CAPEX and OPEX even for small plants.

**COMPACT, MODULAR
AND VERSATILE, AB'S
HIGH-PERFORMANCE
BIOCH4NGE® SYSTEM
RECOVERS AND
CONVERTS GASES FROM
ANAEROBIC DIGESTION
INTO BIOMETHANE.**

BIOCH4NGE®



REVIEW PRODUCT DETAILS
IN THE 3D RENDERING VIDEO

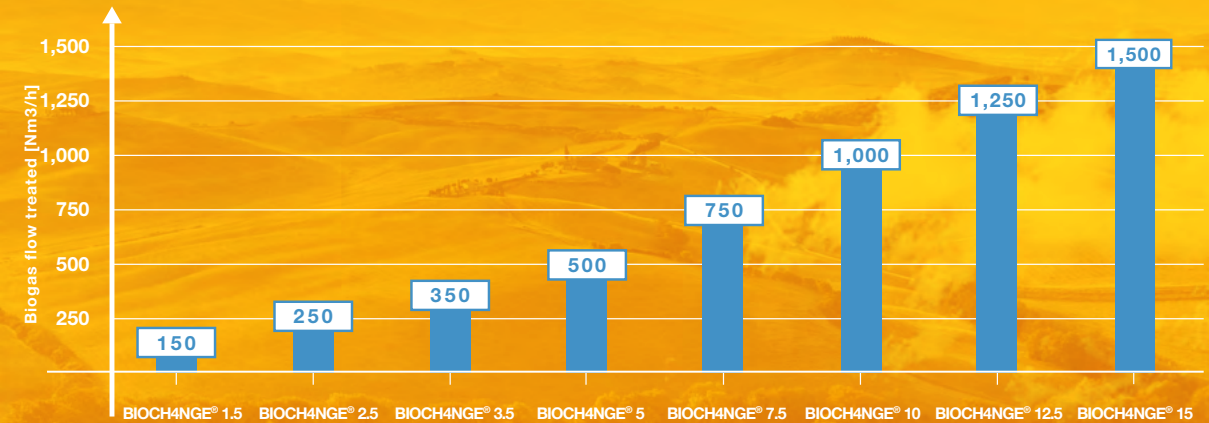


BIOGAS-TO-BIOMETHANE UPGRADING AND LIQUEFACTION

BIOCH4NGE®

BIOCH4NGE® is available in standardized sizes ranging from 150 to 1,500 Nm³/h, complete with pretreatment systems that can be integrated into existing biogas plants and gas liquefaction and CO₂ enhancement processes. AB offers customized solutions for the Italian and international markets.

PRODUCT LINE



Specific consumption: 0.26 kWh/Nm³ – CH₄ recovery > 99%
Typical reference consumption, to be confirmed upon configuration and size selection



AB DELIVERS INNOVATIVE SOLUTIONS TO **CONTROL ATMOSPHERIC EMISSIONS** ARISING FROM BIOFUELS AND BIOGAS PRODUCTION, SUITABLE FOR MOST PROCESSES IN THE **BIOENERGY SECTOR**.



TREATMENT OF
**ODOR
POLLUTION**

AB supplies odor abatement filtering systems to treat emissions arising from various waste management activities.



**SOLVENT
TREATMENT**

REGENERATIVE THERMAL OXIDIZERS
Regenerative thermal oxidizers (RTOs) remove readily combustible volatile organic substances found in most organic waste emissions. The heat recovery efficiency of RTOs can approach 94%, dramatically reducing the consumption of support fuel and decreasing operating costs.



**ENDOTHERMIC ENGINE EXHAUST GAS
TREATMENT**

THE DeNOx SCR REACTOR
SCR selective catalytic reduction is the most effective technology for neutralizing NOx nitrogen oxides in combustion process exhaust gases.

In ECOMAX® modules fueled by natural gas or biogas from anaerobic digestion, AB employs the DeNOx SCR Reactor, processing NOx emissions to achieve increasingly restrictive limits.

As always, AB's quality criteria for plant design,

construction and dimensioning focuses on achieving the maximum NOx abatement efficiency possible.

AB's DeNOx SCR Reactor is available for new ECOMAX® plants and existing cogeneration systems requiring emissions upgrading.



A STRATEGIC CHOICE
TO MAXIMIZE RETURN ON
YOUR INVESTMENT.



SERVICE

AB's staff of specialized technicians operating worldwide guarantees the **ongoing monitoring** and maintenance of each installed plant throughout its life cycle.

The advantages offered by AB Service begin at the installation stage:

- **Single-source partner for every requirement**
- **Remote monitoring and online diagnostics**
- **Availability of original spare parts**
- **Accessible group of highly skilled technical personnel**
- **Network of spare parts warehouses**
- **Guarantee of a quick turnaround on site for repairs, updates and overhauls.**



TERMOVERDE CAIEIRAS LTDA:

21 ECOMAX® 14 BIO

SILOXANE REMOVAL SYSTEM
PURIFIES LANDFILL BIOGAS
16,000 NM³/H

TOTAL ELECTRIC POWER
29.5 MW

DESCRIPTION

21 ECOMAX® modules treat 8,000 tons of waste per day and generate 29.5 MW – enough power to satisfy the electrical demand of a city of 300,000 inhabitants. The plant uses a portion of the energy produced, and the remainder is sold to the local utility grid.



NOVA IGUAÇU (BRAZIL):

12 ECOMAX® 15 BIO

SILOXANE REMOVAL SYSTEM
PURIFIES LANDFILL BIOGAS
9,000 NM³/H

TOTAL ELECTRIC POWER
17 MW

DESCRIPTION

The city of Nova Iguaçu in Rio de Janeiro installed 12 engines powered by landfill biogas to generate clean energy. With a total installed capacity of 17 MW, the plant can satisfy the energy requirements of about 65,000 households, 24/7 all year round.

CASE HISTORIES



SMAT (ITALY):

4 ECOMAX® 14 BIO

BIOGAS FROM WASTEWATER
TREATMENT

TOTAL ELECTRIC POWER
5,600 kW

DESCRIPTION

SMAT is a publicly owned company managing 280 municipalities and about 400 wastewater treatment plants in the province of Turin. In Castiglione Torinese, four cogeneration plants fueled with biogas derived from the anaerobic digestion of sewage sludge produce electricity plus hot water to heat digester sludge and plant buildings.



VOL-V (FRANCE):

1 ECOMAX® 12 BIO

BIOGAS FROM ORGANIC
RESIDUE

TOTAL ELECTRIC POWER
1,200 kW

DESCRIPTION

The plant generates 9,400 MWh of electrical energy annually, powered by the biogas from up to 36,000 tons of organic byproducts supplied by farmers, food industries and local municipalities each year. Electricity is fed into the local network, and nearby greenhouses absorb 6,000 MWh of thermal energy. Agricultural activities accept the fertilizer benefits derived from several tons of digestate.



HITACHI ZOSEN INOVA AG. (US):

1 ECOMAX® 9 BIO

BIOGAS FROM ORGANIC
RESIDUE

TOTAL ELECTRIC POWER
853 kW

DESCRIPTION

Hitachi Zosen Inova, a leading company in energy production from waste, inaugurated its first “Kompogas” plant in San Luis Obispo County, California. The plant processes up to 36,500 tons of organic waste per year, generating roughly 2,900,000 Nm³ of biogas. The biogas fuels cogeneration that develops 6,200 MWh of electricity, supplying the needs of over 600 households.

AB: THE “BETTER WAY”

TO ACHIEVE ENERGY SUSTAINABILITY



Since 1981, AB has tackled the challenges posed by energy sustainability, working alongside our customers to improve their competitiveness while saving energy and reducing emissions.

From our earliest days, we have focused on innovation to develop world-class technologies and processes dedicated to transforming the world of energy.

Our objective? To ensure our customers benefit from the best energy sustainability solutions available anywhere.

How? By dedicating our expertise, production capacity and excellent service capabilities to the problems at hand.

In the cogeneration sector, AB's leadership team has expanded our company's reach to encompass biofuels. We have developed advanced purification and liquefaction processes for biomethane, coupled with highly effective emissions treatment.

We take pride in the “Made in Italy” level of excellence we offer. The AB Group now boasts over 1,000 employees in 20 countries throughout Europe, Russia and North and South America, with primary production and engineering centralized in a state-of-the-art industrial complex located in Orzinuovi, Province of Brescia, Italy.

Our customers rely on us to develop the “Better Way” to support them with the skills, technologies and processes, so they perform at their best. Together, we are helping build a better world.

+1,550



DESIGNED AND INSTALLED SYSTEMS

95%



AVERAGE PLANT AVAILABILITY

+1,300



MONITORED INSTALLATIONS

+1,750



MW INSTALLED



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