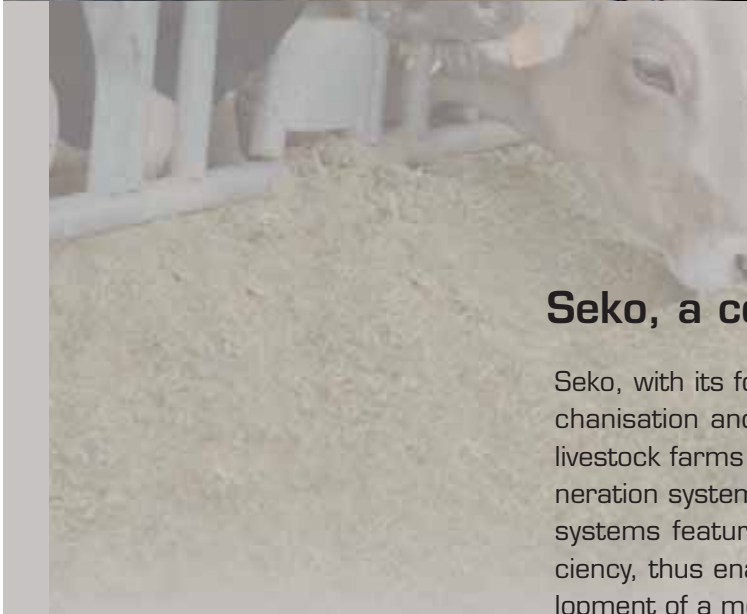


PROFESSIONAL HIGH EFFICIENCY  
BIOGAS PLANTS AND COGENERATION SYSTEMS





## Seko, a company dedicated to agriculture

Seko, with its forty years of international experience in the field of agricultural mechanisation and a distribution network covering 67 countries, offers arable and livestock farms cutting-edge solutions in the production of biogas plants and cogeneration systems with power from 50 to 2000 kWel. The company's plants and systems feature exclusive all-Italian technology, maximum dependability and efficiency, thus enabling it to make an ongoing and effective contribution to the development of a modern profitable agricultural sector in perfect harmony with nature.

Thanks to our team of professional experts with many years of experience in the field of environmental and energy technologies, we can develop the simplest and most sustainable solutions in terms of performance and budget, dealing with all stages of the project: from the feasibility and profitability study right through to plant start-up and management.

An in-depth knowledge of the agricultural world at both national and international level, acquired during the company's many years of experience and via a close relationship with its customers, makes Seko Agripower a competent dependable partner and a highly professional consultant who can always be relied on to provide the simplest and most realistic solutions.

The SEKO Agripower technology represents Italian excellence in the whole biogas sector in terms of efficiency, dependability and running costs.

Our exclusive plants ensure perfect operation and extraordinary versatility, maximising biogas production by full exploitation of the biomass used.



Located in Veneto, one of the most industrialised regions of Northern Italy, the company's operating facilities, where the entire product range is designed and developed, occupy an area of 60,000 m<sup>2</sup>.

Over 1000 machine units featuring "Made in Italy" technology and design are produced every year at the new Seko plant and 90% of its products are exported all over the world, concrete proof of their extraordinary quality and performance.

Seko is a company based on solid foundations of tradition and quality, with a strong international bias; its constantly increasing turnover and growing production capacity are reflected in its positive performance trend.

### Quality

Seko has obtained the ISO 9001:2008 Quality Management System certification which guarantees the technological excellence achieved in its new modern production departments, enabling it to offer its customers the most efficient and reliable solutions in the sector.



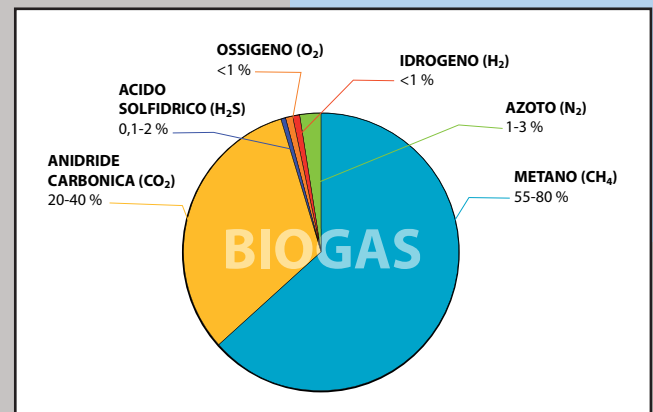


# Biogas technology

## WHAT IS BIOGAS?

The biochemical decomposition of organic substances produces a mixture of gases which have different names depending on where they are produced:

- in agriculture: biogas
- in water purification plants: wastewater gas
- in landfills: landfill gas
- from wood: wood gas



Biogas consists essentially of methane ( $\text{CH}_4$ ), carbon dioxide ( $\text{CO}_2$ ), hydrogen sulphide ( $\text{H}_2\text{S}$ ), oxygen ( $\text{O}_2$ ), hydrogen ( $\text{H}_2$ ) and nitrogen ( $\text{N}_2$ ).

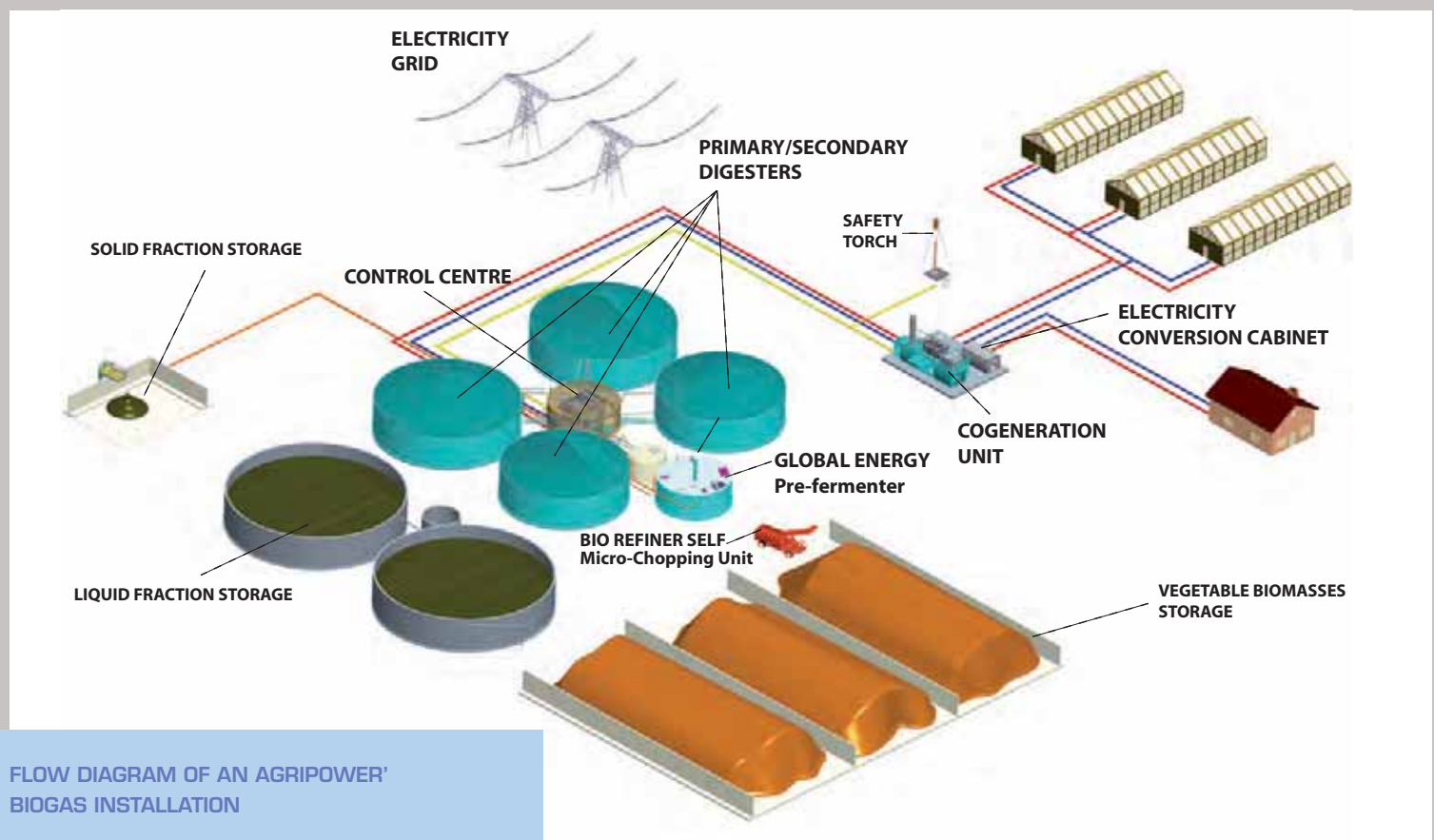
The gas is colourless, relatively odourless (in relation to the  $\text{H}_2\text{S}$  content) and non-toxic.

The explosion limit mixed with oxygen varies, according to the pressure and temperature, between 6% and 12% (in volume) of methane.

## How BIOGAS IS PRODUCED

Biogas is obtained from the biological fermentation of vegetable substrates from the agricultural or agro-industrial sector and organic substrates such as dung when the right environmental conditions are present in the digester (no air; appropriate temperature, continuous mixing), allowing the bacteria to transform the organic substance contained in the biomass.

Biogas is produced from energy crops such as maize and sweet sorghum, from crop residues, organic vegetable waste and animal by-products, manure and slurry.



FLOW DIAGRAM OF AN AGRIPOWER' BIOGAS INSTALLATION



## USE OF BIOGAS

Biogas is used as a fuel to generate electricity and heat.

- **The electricity** is channelled into the grid, guaranteeing a high investment return and self-sufficiency for the farmer.
- **The heat** can be used on the farm or used or sold for domestic, business and industrial heating.
- **The digestate** (the process residue) is an organic fertiliser which is re-used in agriculture, without any additional cost, thus completing a natural environment-friendly cycle without any contaminating waste.

## ADVANTAGES FOR THE FARM

- Energy channelled into the grid with pre-established guaranteed prices and duration.
- High economic return due to the feed-in tariffs.
- Improved management of nitrates from animal wastes.
- A continuous heat resource at a constant price for use in various applications: domestic, business and industrial heating.
- Enhanced energy value of the animal wastes digested.
- Re-use of the digested product in agriculture.

## ENVIRONMENTAL ADVANTAGES

- Reduction of methane emissions within the farm.
- Reduction of ammonia emissions.
- Reduction of indirect emissions of other greenhouse gases.
- Safeguarding of natural resources and greater independence from fossil fuels.
- Clean energy produced by nature without any pollution.



**SEKO, VIA ITS DIVISION AGRIPOWER, IS NOW MARKETING A SECOND GENERATION OF BIOGAS PLANTS, DESIGNED AND BUILT FOR TOP PERFORMANCE IN THE VARIED WORLD OF INTERNATIONAL AGRICULTURE.**

**THE GREAT ADVANTAGES OF OUR TECHNOLOGY, CONFIRMED ALSO BY THE NUMEROUS PATENTS REGISTERED, ARE ALL TARGETED AT DEVELOPMENT OF THE HIGHEST ENERGY EFFICIENCY WITH MAXIMUM SAVING IN BIOMASS AND OPTIMISED PLANT OPERATION.**

- In mechanical and biological terms, we have made important innovations in the preliminary phase of loading and pre-treatment of the solid biomass, a decisive factor for increasing biogas production.

Thanks to a patented mechanical pre-treatment system, using a special machine called Bio-Refiner, all the biomass fed to the plant is crushed and finely chopped, thus increasing the surface area for bacterial attack with consequent improvement in breakdown.

- The material is fed into the "Global Energy" pre-fermenter by pumping the biomass and not by means of loading modules or loading augers, thus minimising both servicing costs and replacements of mechanical parts.

- The heating and mixing technology applied to our pre-fermenter operating system produces, via bacterial inoculum from the storage tanks or the digesters, enzymatic hydrolysis of the fresh biomass, triggering biogasification in only 2–4 hours compared to the 24–36 hours required by traditional plants.

- The entire process is controlled by a highly user-friendly software designed and developed by Seko Agripower to facilitate management of a complex system with ingenious simplicity and in all working conditions, even when routine and extraordinary maintenance is scheduled.

- The modular standardised configuration adopted in the production of our biogas plants allows substantial simplification of the entire process with consequent financial savings and easy management.



## Seko Agripower technology is a worthwhile investment



Seko Agripower is a manufacturing firm which ensures global technical design, including construction, mechanical, electrical, process and service engineering for turnkey supplies, not an engineering company that sources the various components on the market and then assembles them. It is therefore able to offer a complete plant production and operation service and this is one of its distinguishing features.



# The Seko Agripower patented biomass pre-treatment system

The innovative and exclusive Seko Agripower technology for pre-treatment by mechanical and biochemical process allows effective efficient use of the ingoing biomass.

The first phase of this process is developed by a special bio-mixer called Bio Refiner, produced in stationary or self-propelled version, which performs an exceptional crushing and grinding action and also ensures perfect uniform blending of the various materials. This first mechanical phase increases the specific surface area of the materials, thus optimising enzymatic breakdown by the bacteria.

The pre-treated biomass is then fed to the Global Energy pre-fermenter which, to all intents and purposes, is a bio-reactor where hydrolysis of the organic macromolecules such as glucides, lipids and proteins occurs. These are broken down into their simplest components, producing a concentration of acetic acid and other short chain organic acids which, by simple metabolic processes, then become acetic acid, the vital substrate for the methanogenic bacteria which produce the biogas. By transformation of this acid, the plant produces approximately 70% of the biogas sent to the cogeneration engine; the remaining 30% is produced by hydrogenotrophic methanogenesis, i.e. using carbon dioxide and molecular hydrogen.

If we consider a real case in which the mean quantity of biomass fed by the “Global Energy” pre-fermenter to the digesters is 11 m3/h, the quantity of organic acids present in the biomass (see table below) results in an immediate production of approximately 100 Nm3 of biogas, in addition to the biogas that will develop during the plant retention time. As highlighted in the table, the biological processes are exceptionally stable, as demonstrated by the low concentrations of organic acids present in the digesters and post-digesters; this translates into an excellent biogas production rate and quality (55-60% of methane) and also means a saving on the biomass fed to the plant.

Efficient exploitation of the biomass is confirmed by the actual production of biogas, resulting in biogasification of 94.6% of the biomass. This breakdown efficiency has been confirmed by biomethanation tests performed by the University of Padua on the digestate produced by the Seko Agripower biogas plants, which have confirmed a very low quantity of residual biogas.

It is also important to point out that the Seko Agripower plants have been designed not only for the use of traditional biomass but also for future types of biomass specifically developed for this production chain.



Self Turbo Refiner during loading, grinding and mixing of silage.



Self Turbo Refiner during loading, grinding and mixing of manure.



Self Turbo Refiner during loading pre-treated biomass into the Global Energy pre-fermenter

| CLASS EXAMPLE<br>(Mean values) | Acetic acid<br>mg/kg | Propionic Acid<br>mg/kg | i-Butyrric Acid<br>mg/kg | n-Butyrric Acid<br>mg/kg | Valerico Acid<br>mg/kg |
|--------------------------------|----------------------|-------------------------|--------------------------|--------------------------|------------------------|
| PRE-FERMENTER                  | 2200                 | 1500                    | 80                       | 1000                     | 300                    |
| 2 DIGESTERS                    | 35                   | 20                      | < 1                      | 8                        | 2                      |
| 2 POST DIGESTERS               | 15                   | 8                       | < 1                      | 4                        | < 1                    |

Mean values of organic acids in the pre-fermenter of a Seko Agripower biogas plant



## The control software

A highly user-friendly control software, designed and developed by SEKO Agripower, ensures maximisation of biogas production, constantly monitoring the entire process and, in particular, independently controlling the supply of material to the plant.

In order to optimise energy exploitation of the biomass, the software regulates all the operating parameters to maximise the quantity and quality fed to the cogenerator for production of the biogas, at the same time preventing any excess in order to avoid waste.

All variations in the optimal operating parameters are detected, so that operators always have a clear complete picture of what is happening in each section of the plant; if necessary, reset procedures or emergency signals are automatically sent to the operator who can intervene on site or in remote mode.



# The anaerobic biodigestion process in the Seko Agripower biogas plants

## > THE FEED SYSTEM

The treatment of the vegetable biomass is one of the most delicate phases of the anaerobic digestion process.

Seko Agripower has developed an exclusive micro-chopping unit for this operation called "Bio-Refiner" and a pre-fermenter called "Global Energy", both patented.

The job of the Bio-Refiner is to perform a first chopping of the biomass which is then conveyed to the pre-fermenter located at the beginning of the anaerobic digestion process.

In this phase the various types of biomass fed into the plant are mixed in order to obtain a uniform mass.

The "Global Energy" pre-fermenter is one of the main Seko Agripower innovations for improving plant performance as it allows pre-digestion of the biomass, saturating it with the enzymes and bacteria inside the biodigesters.

In this pre-fermenter, therefore, the biomass undergoes a biochemical-enzymatic pre-digestion process.

The "Rotocut" ultra-refinement system enhances the blending function of the "Global Energy" pre-fermenter which is equipped with an efficient electronically controlled tube bundle heating system to maintain a constant operating temperature.

## > ANAEROBIC DIGESTION

After the pre-tank phase the biomass is pumped into the digesters where the anaerobic digestion proper takes place and the biogas develops. The digesters are made of monolithic reinforced concrete, covered with an insulating layer and then coated in painted aluminium corrugated sheet metal, working height 5 m, with domed roof made of a special membrane.

The Seko Agripower plant configuration features large digesters so that the bacteria proliferate with a higher production of gas. In the near future, this sizing will permit an increase in the production of biogas and consequently energy up to a max of 50%. Each digester can be managed as an independent unit provided with its own loading pump.

The plant piping has been designed with a series of valves controlled by the digestion software so that one section can be isolated if necessary without having to stop the cogenerator, thus maintaining a constant production of electrical power.

## > MIXING

Correct mixing inside the tanks is a fundamental operation because:

- > it maintains the uniformity of the biomass
- > it reduces sedimentation
- > it reduces the risk of formation of scale and foam
- > it ensures immediate extraction of the biogas which forms inside the biomass in order to maintain the chemical equilibrium and avoid the formation of gas traps which can prevent intimate contact between the aqueous phase, which also contains the bacteria, and the fragments of vegetable biomass.

The Seko Agripower mixing system consists of three electric submerged propeller mixers for each digester.

If necessary, the work height and horizontal orientation of the mixers can be modified and their functions can be planned via software.







## > BIOGAS COLLECTION AND STORAGE

The biogas produced is collected in pressostatic accumulators located on the top of each digester and made of flexible plastic sheets guaranteeing perfect impermeability and seal.

A sophisticated automatic system for controlled intake of air into the digesters allows the development of desulphurising bacteria which convert the sulphuric acid into elementary sulphur.

## > THE MACHINE ROOM AND CONTROL CENTRE

The heart of the control system is housed in a technical room positioned between the primary and secondary digesters.

The fully automated control system consists of a hardware system and related software, both produced by Seko Agripower exclusively for its plants.

A remote control system allows the plant to be monitored both in real time and by verifying any historic data sequence.

The software processing operations allow monitoring of mechanical, hydraulic, electrical and biological efficiency and plant performance in economic terms.

Any anomalies are automatically identified and signalled in real time, allowing dual control (on site and in remote mode).

## > COGENERATION

The cogeneration unit is a unique integrated system of engine and current generator with transformation unit for converting the biogas into electricity and heat, thus creating a self-contained cogeneration system.

Production of the "Challenger One" cogeneration units is exclusive to Seko Agripower. They are the star of our biogas plants, offering a dependable guaranteed solution with high energy efficiency.

They are equipped with the best engines on the market, they provide maximum energy efficiency and programmed maintenance is required much less frequently than in other cogenerators.

The exclusive container, with patented design, provides a functional housing for all the components, ensuring easy access for control and maintenance operations.

Ease of maintenance is enhanced by slides for extraction of the engine for extraordinary maintenance operations and engine rotation.

## > DIGESTATE AND STORAGE TANKS

At the end of the process, the digested substrates create a fluid residue called digestate, which is odourless, uniform and in the form of a very fluid paste.

It undergoes a further process of refinement in which it is separated by centrifugation into the two final parts: solid and liquid.

The solid part can be used as an organic fertiliser, which can be dehydrated and bagged.

The liquid part is used for agricultural spraying as it has a high organic fertilisation capacity.

In addition, it contains all the macro, meso and micro-elements removed from the ground by the crops and it therefore returns these elements to the soil. It is the ultimate demonstration of the fact that the Seko Agripower anaerobic biodigestion plants represent an added value for the countryside.



## Tailored design with turnkey solutions

Our experience in agriculture and in particular in the field of renewable energy, our cutting-edge solutions and knowledge of the rules and regulations are underlying factors in the professional skills of our plant designers who are able to offer biogas plants developed on the basis of the latest biological research, produced with modern components, high-performing and controlled in a simple but intelligent way.

Independent effective management of all engineering activity leads to the implementation of safe dependable projects using the best know-how on the international market and combining all plant requirements, including construction, electromechanical, process and service engineering.

The Agripower Division therefore offers a complete consulting service to identify the most suitable plant size, implement the feasibility study, carry out the project based on specific customer needs and coordinate execution of the work, testing and start-up operations, optimising investment times and costs.











## Production of simple functional plants with cutting-edge technology

Seko Agripower produces the biogas plant solutions most suited to the capacity of the farm and equipped with the latest technologies, designed to last generations and obtain the highest profits.

Our cutting-edge plant solutions, our highly qualified on-site works management which coordinates and controls all the construction phases right from the beginning via skilled assembly teams, are the key factors that enable us to ensure rapid accurate plant construction with maximum safety.

The production of our turnkey plants therefore comprises execution of all civil and electromechanical works, testing, technical and biological start-up and consulting and training of plant management personnel after completion.

Good coordination in the execution of such important and complex work allows savings on materials and time with consequent reduction in costs and this means optimisation of the economic return on the plant.









## A complete service: from development to management of your plants

### BIOLOGICAL SUPPORT

The biological process in biogas plants requires careful study, and effective management and control supports are therefore fundamental to ensure a safe stable process in order to achieve constant production levels with maximum efficiency.

This is why we provide a biological consulting and support service during start-up of the plants and throughout their life via a staff of biologists who constantly monitor the process biological and biochemical parameters via a remote control system which also allows any corrective actions to be taken directly on-line.

The entire process is controlled and managed by an extremely user-friendly software developed by Agripower via which the mechanical, hydraulic, electrical and biological efficiency and the economic return on the plant can be monitored on site and in remote mode.

Our production premises also comprise a modern laboratory completely dedicated to biogas where periodic sampling analyses of the organic material used for fermentation are performed, thus providing immediate feedback for process optimisation.

### TECHNICAL SUPPORT

The plant energy efficiency determines the success of the investment and is closely linked to process stability and maximum biogas production.

For these reasons we ensure the operator a highly specialised technical support service not only during plant start-up but also throughout its working life, for both the biological process and the operating process, both controlled in real time and managed in remote mode by an innovative software designed and developed by the Agripower Division.

We also offer maintenance contracts configured according to customer needs to guarantee dependable and cost-effective management of the biogas plant, thus ensuring a rapid constant technical support service via a team of highly specialised technicians with original spare parts always available from our stocks.



## AGRICULTURAL CONSULTING

The Agripower Division offers a qualified agricultural consulting and technical support service for the production of energy crops for profitable environment-friendly management.

With its staff of agricultural experts specialising in the entire process of cultivation and conversion of the biomass to energy, Seko Agripower has developed a project which entails an integrated agricultural model comprising design, installation and start-up, management and monitoring of correct use of soil and water resources. The latter is a vital element for sustainable agriculture in the third millennium, in synergy with agricultural strategies designed to bring out the full production potential of the land parallel to a progressive increase in organic matter in the soil and, consequently, overall fertility.

## AUTHORISATION PROCEDURE

In the preliminary biogas plant construction phase, the Agripower Division staff, also comprising professionals with specific knowledge of the national guidelines and regional regulations concerning renewable energy, can also deal with all the paperwork if requested by the customer.

Thanks to their environmental, engineering and legislative expertise, our technicians can prepare all the necessary documentation rapidly and efficiently and supervise the procedure until the necessary authorisations have been obtained.

## FINANCIAL ASSISTANCE

For the construction of its biogas plants, Seko with its team of financial experts works closely with the banking and insurance world, guaranteeing its customers an effective consulting service in all technical, legal and administrative aspects connected with the raising of capital.

We provide complete business plans and project financing, developed on the basis of calculations in tune with the current requirements of the banks, which offer important supports for any financing needs.



## Elements determining the size of a biogas plant



Choosing the size of a plant requires careful thought.

On the one hand large-size plants are often proposed for reasons of economy of scale; on the other, for environmental reasons, it is essential to consider the plant in relation to the area in which it is located.

The choice of the most appropriate size should not be the starting point of the project but the arrival point, the result of an analysis of the potential of the area and the farm in terms of:

- **Availability of raw materials:** information relative to quality and quantity and the cost of procurement (including transport) means that the optimal procurement basin can be defined, availability of material can be ensured throughout the year and storage requirements and methods can be predicted;
- **Quality and quantity of the animal wastes;**
- **Management of the digestate:** information relating to quality and quantity of the material, availability of land for agricultural use of the product, any post-treatments, storage requirements and transport costs will permit environmentally and economically sustainable management.

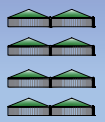
Careful assessment of the entire production chain and all the conditions that lead to choice of the optimal solution are therefore fundamental, not only in terms of energy but also in terms of the environment; if these factors are not accurately assessed right from the beginning, they can negatively affect the financial results.

The Agripower Division staff, formed of professional experts in agronomic, biological and environmental sciences and plant engineering, will be able to advise you on the best solution.

## Our plant engineering solutions for all needs

Our plants represent the most advanced technology in the world because in addition to their unrivalled performance, they use 20-30% less biomass with consequent considerable savings and have a constant linear production not found in any other plants.

This is a distinguishing characteristic of the Seko Agripower plants which makes them a model for and precursor of a new generation of high quality biogas plants, in which the objective is maximisation of electricity production together with a reduction in biomass due to improved energy exploitation.

|                                                                                                      | Installed horsepower | Co-generator's efficiency |                        | Energy            |                             | Plant's self-consumption                      | Standard biogas values: |                 |                |             |                  |
|------------------------------------------------------------------------------------------------------|----------------------|---------------------------|------------------------|-------------------|-----------------------------|-----------------------------------------------|-------------------------|-----------------|----------------|-------------|------------------|
|                                                                                                      |                      | ELECTRIC                  | TOTAL electric+thermic | produced ELECTRIC | available THERMIC           |                                               | CH <sub>4</sub>         | CO <sub>2</sub> | O <sub>2</sub> |             | H <sub>2</sub> S |
|                                                                                                      | (Kwe)                | %                         | %                      | kWh/year          | smoke recovery included kWe | Co-generator and Turbo-Refiner not included % | (from/to) %             | (from/to) %     | (from/to) %    | (from/to) % | (from/to) ppm *  |
| <b>FARM POWER</b>                                                                                    |                      |                           |                        |                   |                             |                                               |                         |                 |                |             |                  |
| <br><b>50/1</b>   | 50                   | 38,5                      | 86,5                   | 410000            | 60                          | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <br><b>100/1</b>  | 100                  | 38,5                      | 87,7                   | 820000            | 128                         | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <br><b>180/1</b>  | 180                  | 38,6                      | 88,3                   | 1476000           | 245                         | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <br><b>250/1</b>  | 249                  | 38,9                      | 86,2                   | 2041800           | 283                         | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <br><b>300/1</b>  | 300                  | 39,9                      | 82                     | 2460000           | 316                         | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <b>POWER</b>                                                                                         |                      |                           |                        |                   |                             |                                               |                         |                 |                |             |                  |
| <br><b>530/2</b>  | 526                  | 40,4                      | 83,1                   | 4313200           | 556                         | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <br><b>600/2</b>  | 600                  | 40                        | 82,9                   | 4920000           | 691                         | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <b>BIG POWER</b>                                                                                     |                      |                           |                        |                   |                             |                                               |                         |                 |                |             |                  |
| <br><b>1000/4</b> | 999                  | 40,6                      | 83,2                   | 8191800           | 1049                        | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |
| <br><b>2000/8</b> | 999 x2               | 40,6                      | 83,2                   | 8191800 x2        | 1049 x2                     | 4%                                            | 58/62                   | 34/38           | 0/0,42         | 0/4         | 10/100           |

\* = parts per million



# FARM POWER

Simple small-size plants  
from 50 to 300 kWhe

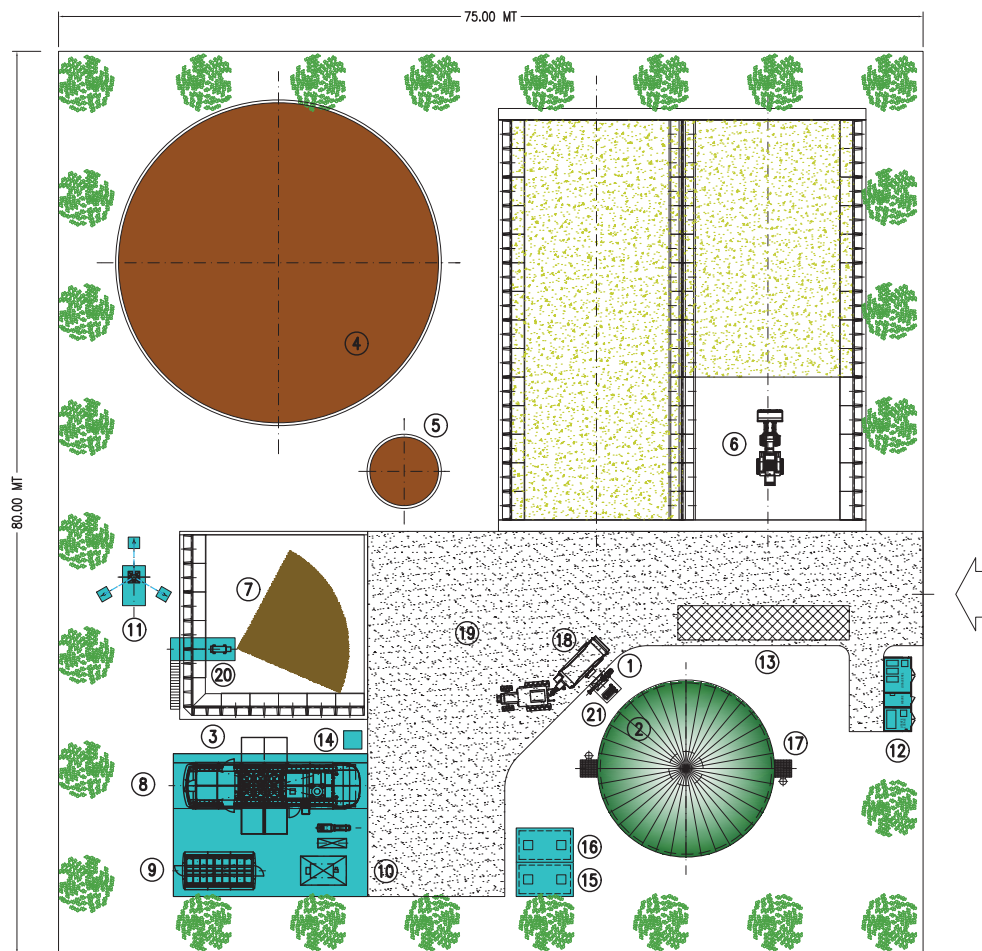
FARM POWER 50/1

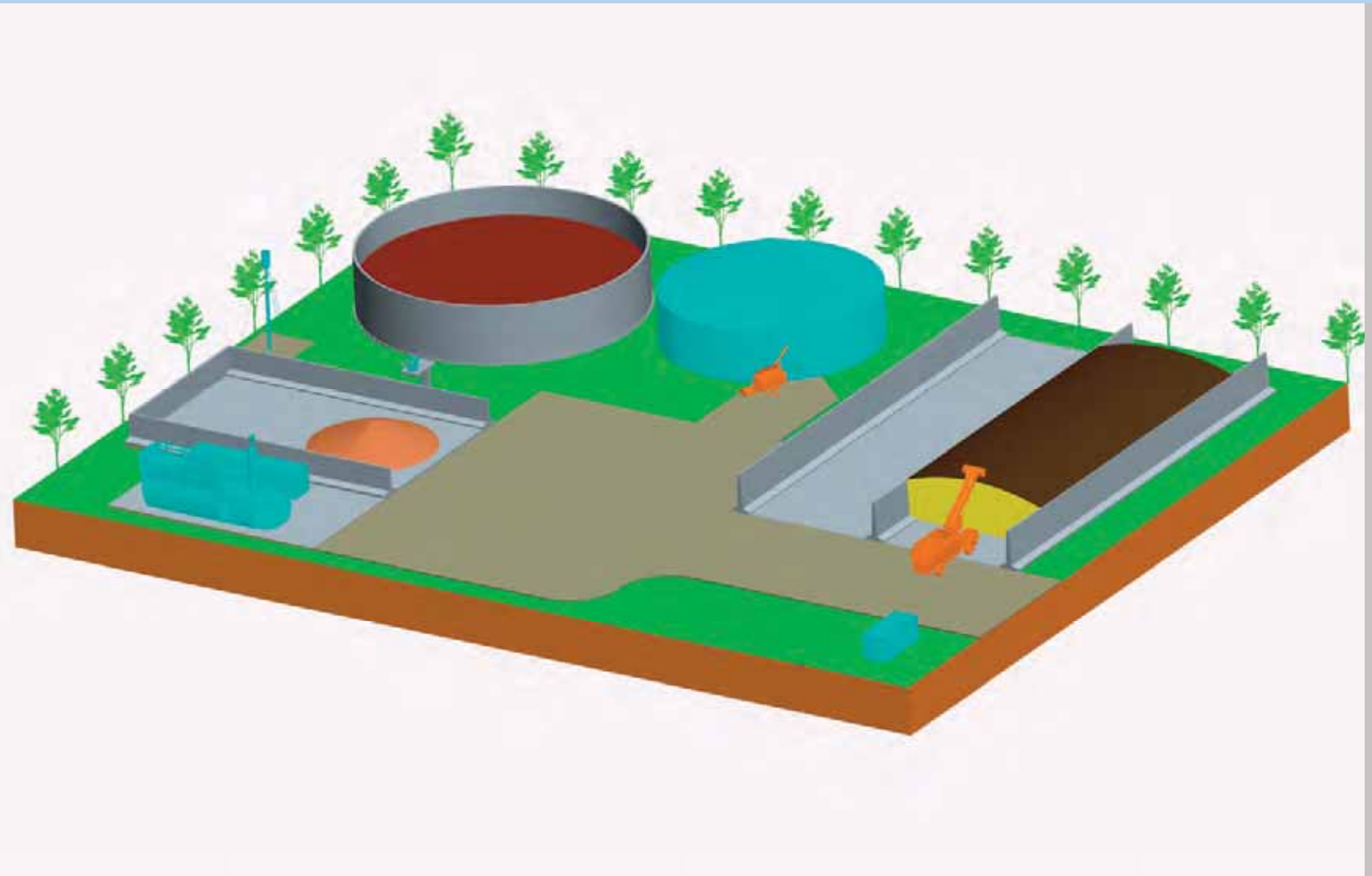
FARM POWER 100/1

FARM POWER 180/1

FARM POWER 250/1

FARM POWER 300/1





These small plants are the ideal solution for arable/livestock farms with 100 to 300 head of cattle which use mainly animal waste with the addition of a quantity of biomass for energy/economic optimisation.

They have one single digester featuring the best technologies in terms of both pre-treatment and anaerobic digestion.

The extreme flexibility of the system allows optimisation of the ingoing materials like slurry, manure, fowl dung and/or by-products in general.

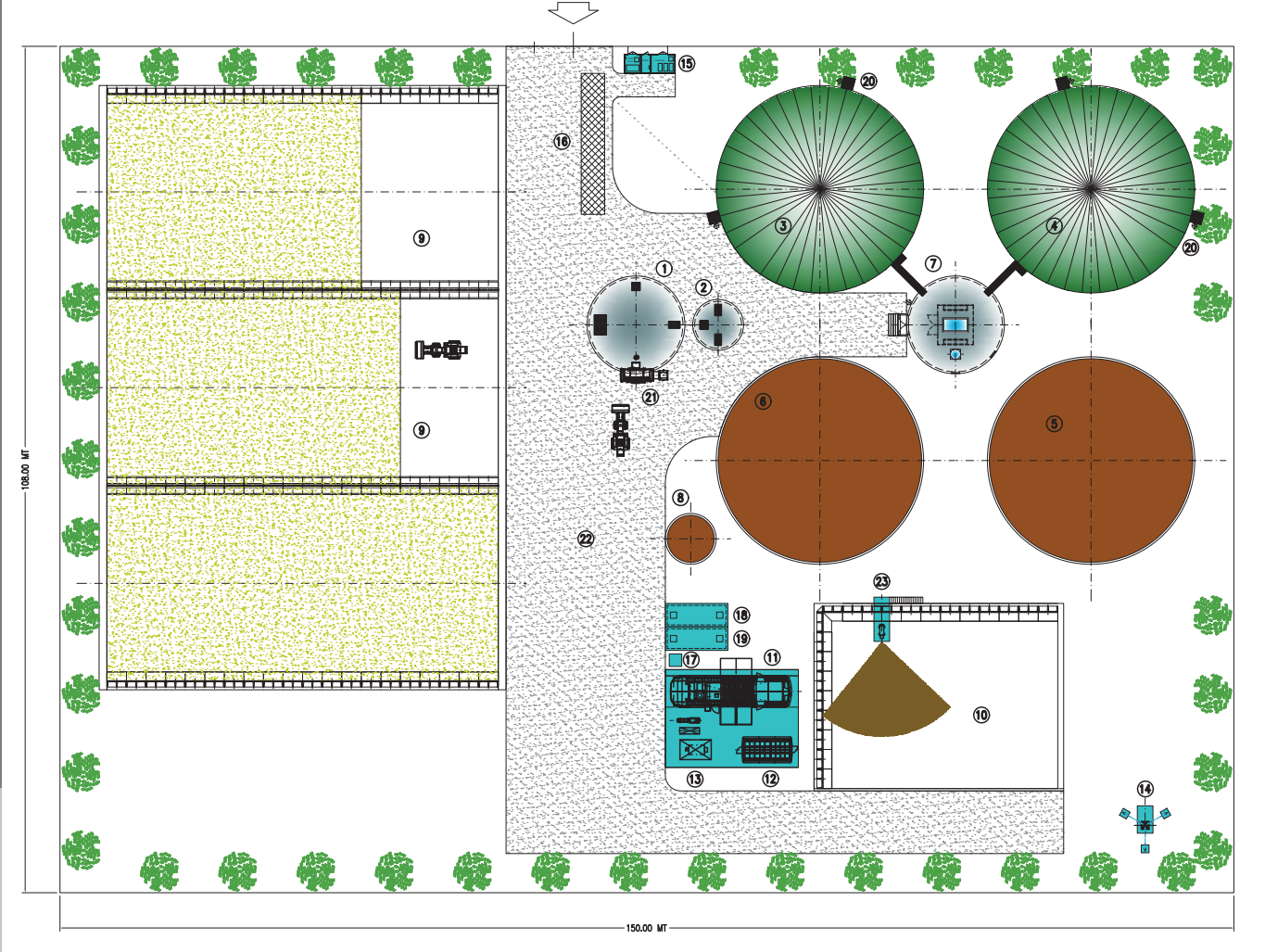
The fully automated plant management system guarantees process efficiency and control with complete vision of the main operating parameters, both technical and biological.

# POWER

## Medium-sized plants from 500 to 600 kWhe

POWER 530/2

POWER 600/2







The configuration of these plants represents the ideal solution for arable/livestock farms with 300 to 500 head of cattle which use above all animal waste with the addition of a suitable quantity of biomass for energy/economic optimisation.

Our patented biomass pre-treatment system, which uses the Bio-Refiner micro-chopping unit combined with the effectiveness of the Global Energy pre-fermenter, allows significant savings in biomass management.

The structure with 2 digesters guarantees maximum flexibility in the use of livestock material such as slurry/manure, in addition to vegetable biomass and various by-products which have a lower energy efficiency but are cheaper.

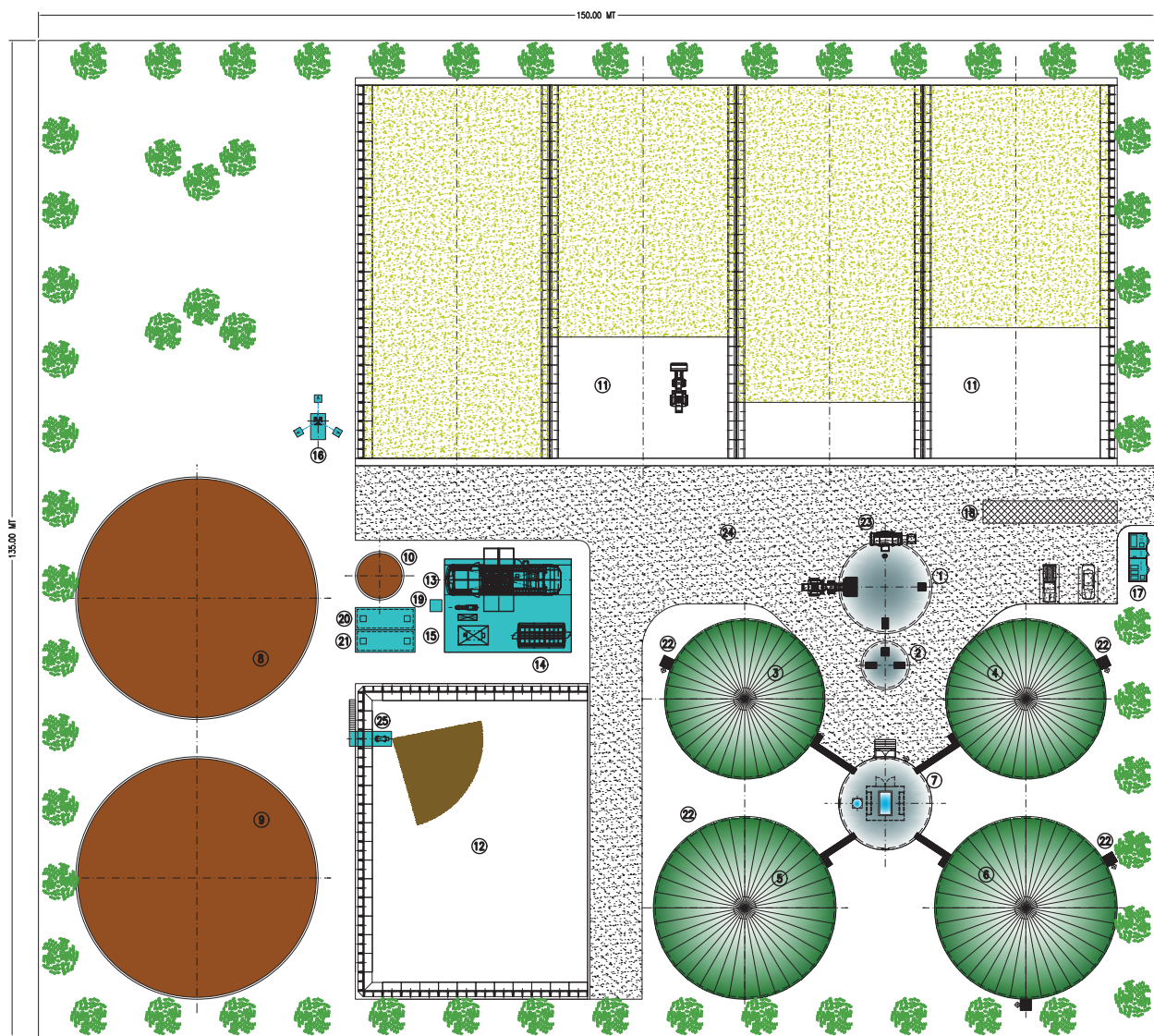
The fully automated plant management system guarantees process efficiency and control with complete vision of the main operating parameters, both technical and biological.

# BIG POWER

Large-size plants  
from 1000 to 2000 kWhe

BIG POWER 1000/4

BIG POWER 2000/8





These extremely versatile plants are able to use any type of biomass even with oversized volumes.

A total of 4 digesters for a power of 1 MWe, providing an overall efficiency that does not require any subsequent post-fermentation stage since the biogas is fully extracted from the biomass.

The reasons for this efficiency are:

- The pre-fermenter injects into the primary digesters material which has been mechanically and biologically pre-treated via the Bio-Refiner until it becomes a pumpable fluid able to immediately produce biogas as soon as it enters the digesters;
- Maximum plant flexibility which can withstand high rates of variation in the material fed to the biodigester (comprising the dedicated vegetable production and many different by-products);
- Perfect digestion with final production of digestate completely free from biogas;
- Energy efficiency resulting in the highest efficiency ever found by GSE: 8,560 hours/year of operation at 999 kWe



## *Challenger One* Cogeneration Units with high energy, and environmental efficiency



The cogeneration units produced by Seko Agripower meet the most demanding needs for efficient production of electricity and heat thanks to the wide range of models available, all with very high quality and overall efficiency, able to fully exploit the agro energy used, focusing in particular on the cogeneration of biogas from agricultural biomass.

Available in a modular range starting from small 50 kW plants up to 2000 kW, they are designed and built entirely at our works to high quality standards, using the best engines and the best components on the market to ensure maximum performance. The unit is of very high quality and programmed maintenance is required much less frequently than in other cogenerators.

The electrical efficiency varies from 40 to 43% according to the engine power, while the thermal efficiency is approximately 50%. Considering the high quality of the biogas obtained in our plants, with a high concentration of methane and a very low sulphur content, these cogeneration units feature low maintenance and improved oil change intervals, in some cases using the oil for twice as long as usual.

The exclusive container, with patented design, provides a functional housing for all the components, ensuring easy access for control and maintenance operations. Ease of maintenance is enhanced by slides for extraction of the engine for extraordinary maintenance operations and engine rotation.



## From the digestate, a fertiliser without additional costs

The agronomic use of the digestate represents the most natural and economic purpose according to the current matters regulation.

Therefore it is always more necessary to reduce the most part of nitrogen presents on the digestate to its right of its right agronomic employment.

After a careful sector study, the Agripower Division has carry out a new technology that, in addition to solve the problems of the nitrogen, converts it in a NPK fertiliser especially rich in organic substance.



**The Agripower nitrogen abatement system through the “Evaporation-Drying” process is the only one on the market that does not involve extra cost for the farm**

The separated (clarified) liquid obtained after the separation, is evaporated and then condensed to obtain a distilled liquid which can be used in a subsequent purification treatment or as irrigation water. As the water volatilizes in the evaporation system, a saline liquid containing the dissolved mineral salts (NPK) is concentrated on the bottom. This concentrated liquid is then dried, obtaining further distilled liquid and an organic-based water-soluble solid fertiliser with dry substance equal to approximately 90%. The product can be classified as fertilizer in accordance with the current laws and can be used as it is in agriculture like other chemical fertilisers or can be used as a base for fertilisers and therefore sold to a fertiliser

manufacturer at a price which will depend on its nutrient content. The liquid distillate can be processed by reverse osmosis treatment, after which the product is discharged to a collection unit.

The process is very simple in plant engineering terms and equally dependable, with limited energy consumption and very low maintenance costs.

### **An economic and profitable system**

The Agripower technology, envisaging the sale of the NPK fertiliser produced, permits to manage in a efficient way the plant's investment costs reaching to obtain a further profit in addition to the one of the biogas plant.







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