



**Heat Utilization:**  
Drying 8,000 Hours  
per Year!  
Page 2



**Digestate  
Drying:**  
Successful in Practice.  
Page 3



**Organic  
Fertilizer:**  
Added Value and  
Cost-Saving. Page 5

## Heat Utilization for Drying Biomass: Organic Fertilizers or Fuels

1

Drying digestate offers many advantages – especially the protection of the environment benefits from the innovative procedure. Many regions are affected by a permanent excess of nutrients due to the intensive animal production. Thus, they are forced to export their digestate into other regions. Drying is a good possibility to facilitate the transport of the treated material and thus to apply the valuable components nitrogen, phosphorus and potassium where they are really needed.

In addition, a good portion of the costs for storage and transportation of the digestate can be saved because the storage volume reduces by approx. 90% during the drying process (in the recirculation procedure). Potassium and phosphorus completely remain in the dried digestate. Thus, the excess material which would actually have to be disposed, can be used as a valuable organic fertilizer which the farmer can use to earn real money.

### Humus for dry Soils

However, not only the fertilizing effect is positive: especially soils which react sensitively to aridity can be improved for a long-term by mixing in the dried digestate because the organic material with its high content of humus binds humidity and thus sustainably optimizes the soil structure (See DORSET-customer Jörg Rickel who sprinkles his areas only three times a year after the application of the dried digestate instead of six times before. The precipitation rate remained the same.)

Is it really necessary to clean the exhaust air? Yes!

### There is no Chance to do without an Exhaust Air Cleaning System

When drying digestate, an exhaust air cleaning process is absolutely indispensable because the ammoniac nitrogen which is contained in the digestate is released



## Drying and Exhaust Air Cleaning Important Pillars of a sustainable Agriculture

almost completely during the drying process. This is also valid if solid substances are dried after a previous separation process or if the drying procedure stops at a dry matter content of 45%.

Only an exhaust air cleaning process can avoid the emission of the ammoniac nitrogen. However, the exhaust air cleaning does not only keep the air clean, it also offers more advantages. The resulting product can be optimally utilized as a valuable fertilizer: during the drying process, ammoniac nitrogen is released which transforms into ammonium sulphate during the subsequent process of exhaust air cleaning. Thus, in a 500 kW-drying system, approx. 10,000

to 16,000 kgs of ammonia are released in that way. 90% of that can be trapped in the air scrubber and transformed into ammonium sulphate. This ammonium sulphate is an anorganic fertilizer without any phosphate content and can be applied in a very targeted way for nitrogen fertilization. It is available in a liquid form just like ammonium urea solution and thus, it penetrates the soil directly.

### Replacing mineral Fertilizer: Saving Costs

The product replaces the expensive mineral fertilizer which does not have to be bought. In this way, more nutrients remain in the circulation due to the processes of drying and exhaust air cleaning than if the area is fertilized using

liquid digestate. The reason for that effect is: If you fertilize directly using liquid digestate, a part of the nitrogen will be released and get lost when spreading. However, the valuable nitrogen is completely preserved and can be made available for the crops immediately due to drying, exhaust air cleaning and transformation of the nitrogen into ammonium sulphate. To come to a conclusion, it can be said that the exhaust air cleaning process is absolutely necessary for the drying process because it makes a considerable contribution to a sustainable agriculture.

### English version of Dorset Update :



This paper was sent to all German biogasplants in October 2011 to share practical experience on the use of waste heat by drying. We have received many requests for an English version. So we are now happy to present you this translation. Have a good time. Petra Kastein, Dorset marketing manager.



### Turkey: Drying Chicken Manure

An environmentally sound and value-adding alternative to composting: chicken manure from poultry egg production is now dried by the Turkish enterprise Keskinoglu. This doubles the content of nitrogen in the final product and reduces the fine dust load from the farmexhaust air.

### Premiere in the Drying of Sewage Sludge

After the drying of digestate, DORSET now also offers a plug-and-play-solution in a container for the drying of sewage sludge.







Headquarters of the Dorset Group in Aalten

# Costs saved, image increased

Belt dryers of the Dutch company DORSET offer many advantages for the users

The Dutch DORSET Group comprises the company divisions Green Machines, Identification and Farm Systems. The family business was founded in 1984 and its 100 employees have built belt dryers for over 15 years. The successful systems were first of all applied for drying manure. Large amounts of manure had to be transported over long distance to the fields. This was expensive and counterproductive from an ecological point of view. The solution was boiling the manure down and drying it in order to reduce the amount. Today, DORSET successfully uses its technologically perfected procedure for drying different materials from the fields of biogas, agriculture or industry such as digestate, wood chips, sewage sludge, poultry manure and maize silage. An interview with the managing director of DORSET-Henk Haaring.



#### What are the benefits of the DORSET-belt dryer?

Haaring: For the first time, the belt dryer provides the possibility to optimally utilize the waste heat of the CHP. 100% of the heat can be used every day around the year, not only in winter when a part of the heat is fed into district heating grids or used for heating farmhouses. The operators are paid the heat-bonus for utilizing the heat from their own CHP.

#### Which other advantages occur when drying the digestate?

Haaring: Our customers save storage and transportation volume and enjoy ecological benefits because they do not need to transport the digestate to remote areas. This saves time and fuel costs. Now, many farms with surplus on NPK have the chance to export the nutrients in a compact and

concentrated form from their local environment. Thus, nutrients can be utilized more easily in a compressed state. The improvement of the image is a further considerable advantage: biogas plants which use dryers are better accepted by the population because the volume of digestate is halved and thus there is a considerably lower odour emission when spreading the fertilizer on the field. The transport of heavy loads is no longer necessary and thus, there is no more pollution and damage of agricultural ways.

#### What can you do with dried digestate?

Haaring: There is a wide variety of possible applications for the material: the operator may use it or sell it as fertilizer. The examples in this paper show how various the opportunities are.

#### What is your vision for the future?

Haaring: We concentrate on the upgrading of biomass for the production of electricity by the help of the waste heat. Therefore, the industries offer various possibilities, e.g. sludges from paper industries. Those can be dried using the residual heat and subsequently be stored easily. They have a high calorific value and might replace fossile fuels.

## DORSET in Europe

### Netherlands central office



Ina Schumacher  
i.schumacher@dorset.nu  
Tel. +31 (0) 543 47 21 03



Carla Kreeftenberg  
c.kreeftenberg@dorset.nu  
Tel. +31 (0) 543 47 21 03

### Germany



Sales Germany:  
Andreas Ferch  
andreas-ferch@dorset.nu



Office Germany:  
Renate Lungfiel  
r.lungfiel@dorset.nu

### Turkey



Office Turkey:  
Itir Adiguzel  
i.adiguzel@dorset.nu

### Italy



Office Italy:  
Eloisa Incarbone  
e.incarbone@dorset.nu



# Belt Dryer facilitates the Transport and Storage of Fertilizers

The described 500 kW biogas plant, which constantly produces digestate and heat, is an example for all the plants of this dimension that are already in operation in Germany. The digestate consists of cattle and swine manure and maize.

The operators predominantly use the heat for heating their two broiler stables with a total of 45,000 animals. The residual heat is used for drying the occurring digestate. This amounts to 500 kgs per hour of liquid digestate with a dry matter content of approx. 7%. The junior manager of this biogas plant says: „We can use the dried digestate for fertilizing the fields which would hardly be accessible with liquid material because the heavy manure tank would get stuck in the wet soil of the field and the transportation costs to the remote fields would be too high.“

„The Drying helps us to reduce Storage Volume“

Additionally, there is a further advantage of the drying process: The treated digestate is not only more easily transportable, it can also be stored in a more space-saving way. „Drying helps us to reduce storage volume. We only require a very little final storage place. Of course, also the CHP-bonus of three cents per kWh, which we receive for drying, is a further benefit.“, says the operator of the plant. Per year, 450 tons of the dried digestate, a high-quality, rich-in-phosphate fertilizer, can be produced. The trend goes upward. The boss of the agricultural company says: „We are planning to sell this fertilizer to peat-producing companies in our region which can use it to enrich their peat by mixing in the fertilizer and thus produce high-quality potting soil.“ In order to achieve an extraordinary quality, a DORSET distribution technology is applied: The material that has already been dried is spread on a belt. After that, it is mixed with

wet material or with a mixture of wet and dry material. The junior manager explains: „The advantage is that we can treat a higher amount of digestate. This increases the efficiency and considerably reduces the dust formation.“ The agricultural entrepreneur is convinced by the possibilities of the DORSET-belt dryer: „We have been searching for a good heat utilization concept for a long time. Unfortunately, it was impossible to feed the residual heat into the public heating grid because our farm is too far away from the village.“

## Technical Data

Renewables plant,  
500 Kw el. dryer: RM

## Liquid turns into solid

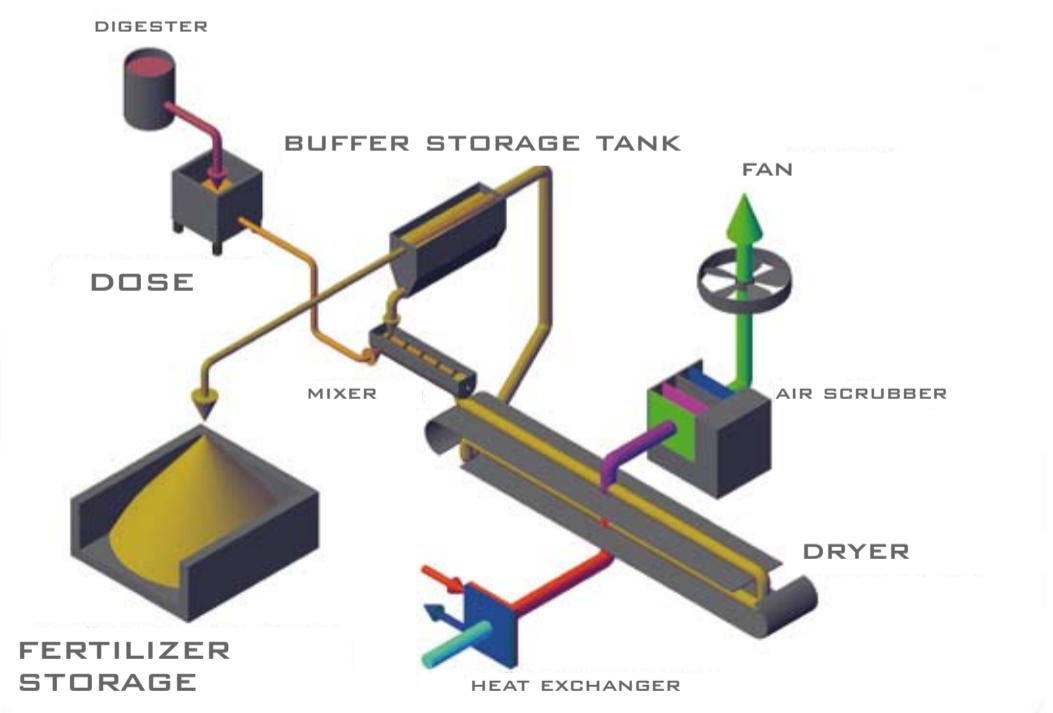
### Drying performance:

On: max 13 t/day  
Off: max 1.2 t/day

On: 8% dry matter  
Off: 85% dry matter

The DORSET-belt dryer provides us with a perfect solution for efficiently using the heat of the CHP and benefitting from a variety of advantages. We are in the same situation as many others: Especially in our region, many animal production companies are dependent on good possibilities of utilizing the occurring manure because in comparison there is too little farm land.“, says the managing director of the farm.

## Convincing Heat Utilization Concept



## Practical Solution for liquid Fertilizer

DORSET delivered a practical possibility of using the waste water from the chemical exhaust air cleaning for this biogas plant: a by-product of the chemical exhaust air cleaning process is an ammonium sulphate solution (ASL) which contains 5% of ammoniac nitrogen and sulphur each. The water-like liquid is stored in a 60 m3 buffer

tank so that a liquid fertilizer which can be applied on land using a crop protection sprinkler or a drag hose is available at all times. The ammonium sulphate solution is a fast and effective fertilizer which quickly penetrates the soil due to its water-like consistency and thus is immediately available for the crops. If more than 60 m3 of this

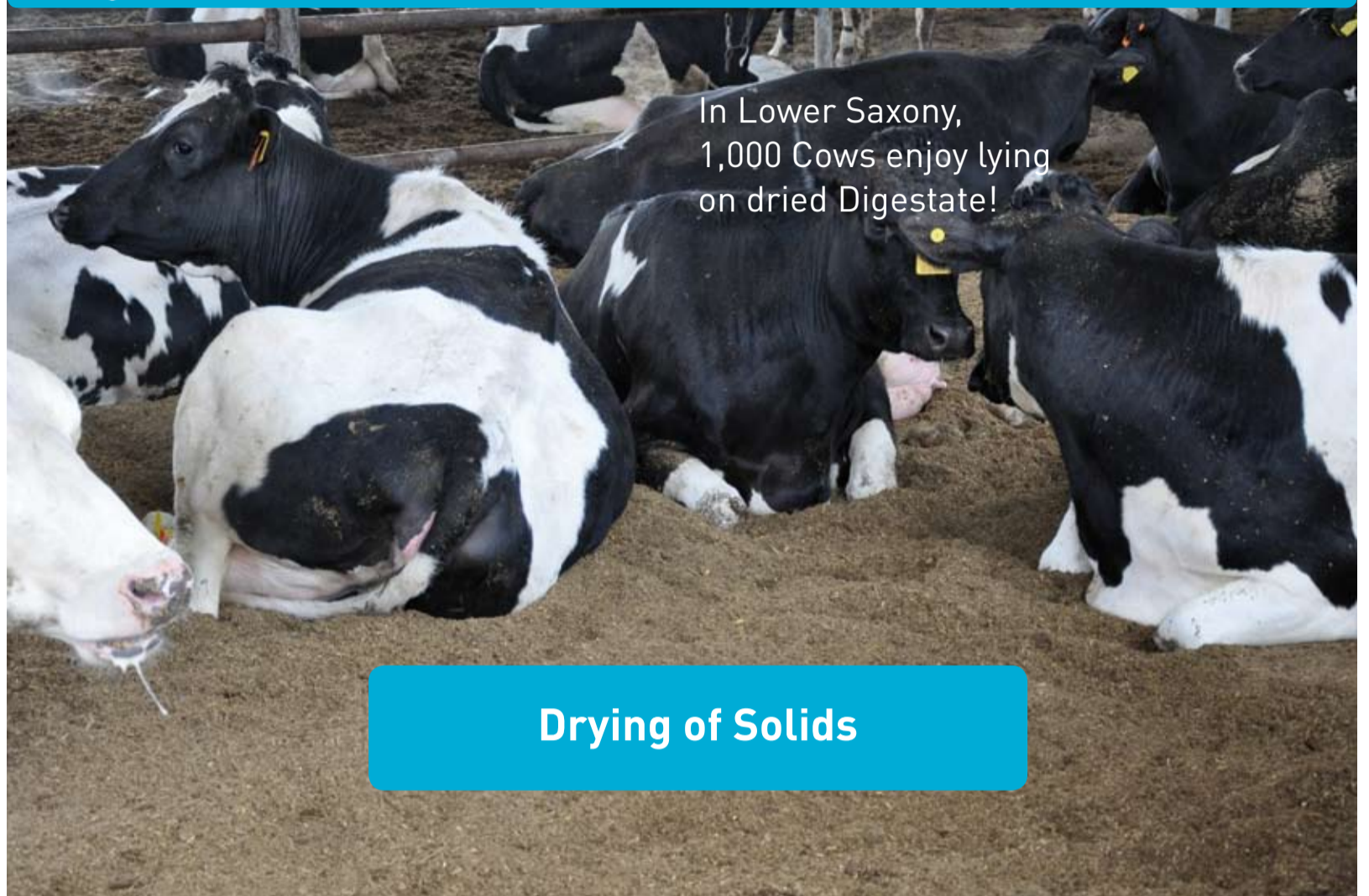
liquid fertilizer is produced, the liquid is automatically pumped into the final storage tank for digestate. This is a practical solution which would also be efficient for other plant operators.



**A farmer from Lower Saxony found an interesting alternative for using his dried digestate:**

he uses the digestate as bedding material for his dairy. The high pore volume and the low density of the material make this possible. The bedding material has a good capacity of absorbing humidity and is almost odourless in the stables. Thus, the operator of a biogas plant and dairy farmer does not only save between 80,000 and 100,000 € per year for bedding, he also benefits from further advantages. He says: „My dairy have felt much better since I stopped dispensing with straw and using my self-dried digestate. Thus, we have a closed cycle, utilize our own material and have fewer germs which can penetrate the cycle from outside.“ „The cows suffer from arthropathy and mastitis a lot more seldomly.“ Fewer sick cows, cost savings – these are not the only advantages which convinced him of the DORSET-dryer. By not using any straw any more for making sure that his 1,200 cows stand on a dry ground, the farmer has also solved another problem: It was a frequently occurring problem that the straw litter blocked the gap floors and manure channels. This cannot happen any more when digestate bedding is used: „The pumps are not blocked by straw any more; this increases the fluidity of the manure. This material then is pumped back to the biogas plant – a perfect nutrient cycle“, says the farmer from Varrel. He is happy about his well-working loop system. After the used litter has gone through the biogas plant for the second or

**Saving costs, more milk, fewer diseases: the better alternative to straw**



In Lower Saxony,  
1,000 Cows enjoy lying  
on dried Digestate!

**Drying of Solids**

## Separated digestate as a perfect bedding material

third time, it usually is mineralised and has decomposed into its components.

**Saving Costs and Time**

This considerably increased the productivity of the biogas plant and thus also the energy yield. Furthermore, there is no more

solid matter that has to be disposed after the digestion process. The farmer says „This is a further advantage: there is no more solid material that has to be spread and so costs and time effort for spreading of solid matter are saved.“ He decided for the dryer in 2005 and therefore receives the CHP-bonus.

His biogas plant disposes of 750 KB of thermal power. The dry matter content of the digestate from his 1 MW-biogas plant, which the farmer feeds with cattle manure and maize, is first of all increased to 9% using two press screw separators. Subsequently, the digestate is dried. A dosage unit takes care

that there is not too much material on the perforated steel belt at the same time. „I am really convinced by the DORSET-belt dryer and would strongly recommend it.“

**Always the appropriate Mixture**

## Dryer at Karp Biopower combines backmixing and separation



**The DORSET-belt dryer offers the possibility to upgrade digestate to high-quality final products such as bedding or organic fertilizer.**

Also Christian Karp uses this chance in his company Karp Biopower near Ludwigslust in Mecklenburg-Vorpommern: Therefore, the operator of a 1.1 MW-biogas plant uses a part of the approx. 80 tons of digestate which occur every day and the waste heat from the subsequent CHP. The diet for

the biogasproduction consists of cattle manure and maize. First of all, by screwseparation the dry matter content input for the dryer starts at approx. 25% dm. Then, the digestate is transported through the belt dryer with a heat input of minimum 500 kW th. After the process, the dry matter content of the treated digestate amounts to 82%. The material is very light-weight and has a high pore volume. Christian Karp says: „I use this material as a bedding in

my cattle houses. This is possible because my biogas plant is subsidized according to the Renewable Energy Sources Act (EEG) 2006. This effect is really practical for me because I can also save the straw in that way.“

However, the farmer has a second option by backmixing digestate, and subsequently uses and sells them as organic fertilizer. A backmixing procedure and separation combination, that also has especially been developed by DORSET, makes it possible to produce fertilizer substrate with different consistencies and varying nutrient contents according to the desired purpose of application. In comparison to the drying procedure with prior press screw separation where many nutrients are lost during the liquid phase, all the nutrients are preserved after drying all the liquids during the recirculation process. The nutrient

content even increases considerably during the recirculation process if compared to the dried solids with prior separation. Christian Karp says that: „The potassic value more than doubles, the contents of phosphorus and nitrogen

with different consistencies and in different qualities can be produced. Christian Karp: „I use this material as a fertilizer for my own agricultural crop land. The fertilizer can be easily spread especially in spring-time when the area is wet.

**Drying solid and liquid digestate**

increase by approx. 50%“. During this specific procedure, a part of the raw digestate is mixed again with material that has already been dried. This causes a higher transportability of the substrate. It is heavier than the material that has only been separated and dried and has a granulate consistency. In that way, customized mixtures

I do not put too much pressure on the soil because no heavy manure tanks are used. The quality of the fertilizer is premium and I can additionally save costs for transportation and storage volume.“ Karp does not only use the fertilizer himself but also sells it to other farmers.



## The Dutch Fertilizer Producer MeMon uses increasing amounts of dried digestate

**In the future, various possibilities will appear for biogas plants which have a dryer. The Dutch organic fertilizer producer MeMon offers advantageous solutions for the operators.**

Agricultural companies receive additional bonuses for the usage of the exhaust heat. Therefore, it might be interesting for the plant operator to purchase a dryer. If he succeeds in selling dried digestate or dried chicken manure as raw materials for organic fertilizers, a double advantage can be achieved. The fertilizer producer MeMon creates possibilities of selling. The enterprise purchases dry organic raw materials, which also includes dried digestate or layer manure, and processes them to high-quality organic fertilizers. A wide product range is offered which includes mixtures, pellets, or granulates. The finished products are used in professional gardening, landscape conservation, public green and DIY-markets. The company MeMon has developed to be the market leader on the international market for organic fertilizer in the last twenty years. Customers in more than 40 countries world-wide are delivered via a comprehensive network of sales agents. Ulrike Meyer-Reiners, product manager at MeMon explains: „We have production facilities in the Netherlands and Germany and dispose of a wide variety of experience in the processing of organic materials and the application and sales of organic fertilizers. We are producing throughout the year and



Ulrike Meyer-Reiners and Rembert Van Noort in the plant in Emst

# We buy your dried digestate and process it for export

the other hand. Then, all the raw materials are weighed, mixed, pelleted and hygienised in a fully automated production process. The finished fertilizer is delivered

marketed world-wide. MeMon co-operates with many forwarding agents in order to transport the raw material and fertilizers to the customers on the road or on the waterways. The employees of the enterprise also dispose of a wide experience concerning the required documents for export, health certificates and customs documents.

### What is the value of dried digestate?

**Digestate** has to fulfil two conditions in order to be used as a raw material for the production of organic fertilizer. The **dry matter content** must be minimum 85% so that the products allow pelleting. **A bulk density** of minimum 300 kg/m<sup>3</sup> should be available for achieving an efficient transport. Furthermore, the value of dried digestate depends on the following parameters: the nutrient value is mainly determined by the content of nitrogen and potassium. For this reason, a digestion product that is not separated before drying is much more valuable than a pre-separated product. The liquid phase removes particularly nitrogen and potassium from the digested substrate.

\* depending from the feedstock of the biogas plant  
Of course, the content of heavy

metals and hazardous substances has to be within a legally determined scope.

The **input of the biogas plant** plays an important part in the evaluation of dried digestate. Digestate,

without any problems and dispose of drying capacities. Suitable raw materials for drying include chicken or cattle dung as well as crop residues. In case of wage drying, the dry matter content of the input material is higher than with diges-



MeMon-Fertilizers

therefore, we are able to process large amounts of digestate and fertilizer. This relieves our suppliers."

MeMon has recently increased its production capacity and guarantees long-term purchases to its suppliers which offers them a long-term security.

During the production process, MeMon can use dried digestate or dried fertilizer as a raw material in the recipes of the different finished products. The optimal composition of ingredients is determined using an optimization program which is based on customer desires on the one hand and ingredients of the different basic materials on

to the customers as a loose item or packed in sacks or big bags. The service that MeMon offers for its customers includes comprehensive analyses, fertilizing recommendations and consulting. „It is our strength that we know the world-wide market for organic fertilizer very well and are able to develop the appropriate fertilizers for the market. Dried digestate is well-suitable as a raw material.", explains Rembert van Noort, Supply Chain Manager at MeMon. The products are hygienised during the production process. The production processes in the MeMon plants correspond with the European Hygiene Directive (EG 1069/2009). Thus, the fertilizers can be

Drying		Value of dried digestate		
		Non-separated	Separated	
Drying digestate	Renewables of 100% plant origin	+++	++	
	Renewables with solid or liquid manure	Cattle	++	+
		Chicken	+	+ / -
		Swine	+ / -	-
	Waste disposer*	+ / - *	+ / - *	
Wage drying		++++*		

\*Depending on the input biogasplant

which consists 100% of plant raw materials (pure renewables plants), achieve the highest market value. If solid or liquid manure are added, the value depends on the type of animal the manure derives from. The value decreases from cattle over chicken to swine manure.

Digestion products from the fermentation of residues from food industries have to be evaluated in detail with regard to their applications.

**Wage drying** is an interesting alternative for companies which can spread or sell their fresh digestate

tate which considerably increases the efficiency of the dryer. Thus, the operator has the advantage that he can sell larger amounts of dried material.

Are you interested in knowing the value of your digestate after drying or if wage drying is suitable for you? Please contact  
Ulrike Meyer-Reiners  
email: meyer-reiners@memon.nl  
phone: 0 0 49 172-1774973  
Rembert van Noort  
email: vannoor@memon.nl  
phone: 0031-26-3523100



## At Enagra in Monzelfeld/Altrich, Digestate from the Biogas Plant is transformed into sustainable Fertilizer

# Successful application



Dryer Type RM – liquid turns into solid

A successful model has stood the test: a high-performance 500 kW belt dryer, which processes digestate from biogas plants to high-quality fertilizer, has been in operation at the Enagra plant in Altrich (Eifel) for almost two years. The granulate fertilizer distinguishes itself due to its particularly high content of nutrients, a good spreadability with the wide-surface spreader and a long-term fertilizing performance.

The project is so successful that a pelleting and sacking plant for the further marketing will be commissioned in the near future and further Enagra biogas plants will be equipped with DORSET-dryers as well.

### Enagra-Concept

Enagra has specialised in the future market of renewable energies

and focuses on different fields. The DORSET-belt dryer is located in an interesting building at the Enagra



This building revolves with the altitude of the sun

### Introduced:

## Dorset-Partner Enagra from Trier

DORSET successfully cooperates with the company group Enagra. Enagra specialises in the future market of regenerative energies. The company offers one-hand solutions for a sustainable energy recovery with its long-term experience and competence. Thereby, Enagra focuses on resource-saving energy technique.

The performance profile of the Enagra group ranges from planning and building construction up to the operation of plants

for the production of renewable energies. Enagra develops and projects wind power plants, photovoltaics plants and biomass plants. Exceeding the standard range, Enagra offers user-friendly and economical system solutions and bases on plants and products that have proven successful on the market. The group is demarcated by intensive consulting and assistance, precise planning and projecting as well as a high flexibility in terms of service.



Biomass Energy GmbH: it is based in a round building on the roof of which solar cells are installed. This building revolves with the sun. The digestate is not pre-treated for the drying process. It can be directly taken from the post-digester and mixed with a little part of the dried material so that it can be placed on the band in a non-drip state. Then, the material goes through the drying process on the steel plate bands. In that way, approx. 550 kgs of digestate can be dried to produce 50 kgs of fertilizer (density of 300 kg/m<sup>3</sup>) in Altrich.

### Marketable organic fertilizer granulate

It contains two to three per cent of nitrogen, three per cent of pho-

shorus and five to six per cent of potassium.

The customer is very satisfied by the performance of the drying system because the maintenance times are very short and the plant runs without any breakdowns. In the specific case, it is a further advantage that the customer could dispense with a storage tank which caused a saving of approx. €100,000. The plant can transform about 4,000 cubic metres of digestate into 400 tons of dried fertilizer. The fertilizer granulate is marketed as „Enagra Natural Fertilizer“ and distinguishes itself by its balanced ratio of nutrients and its high share of humus-forming organic substances. Further Enagra biogas plants will be equipped with belt dryers in the near future.



## Dorset Investments

# Leasing instead of buying

**Those who are interested in a small container drying system do not necessarily have to buy this system: DORSET offers the possibility to lease the plant for 6-10 Years**

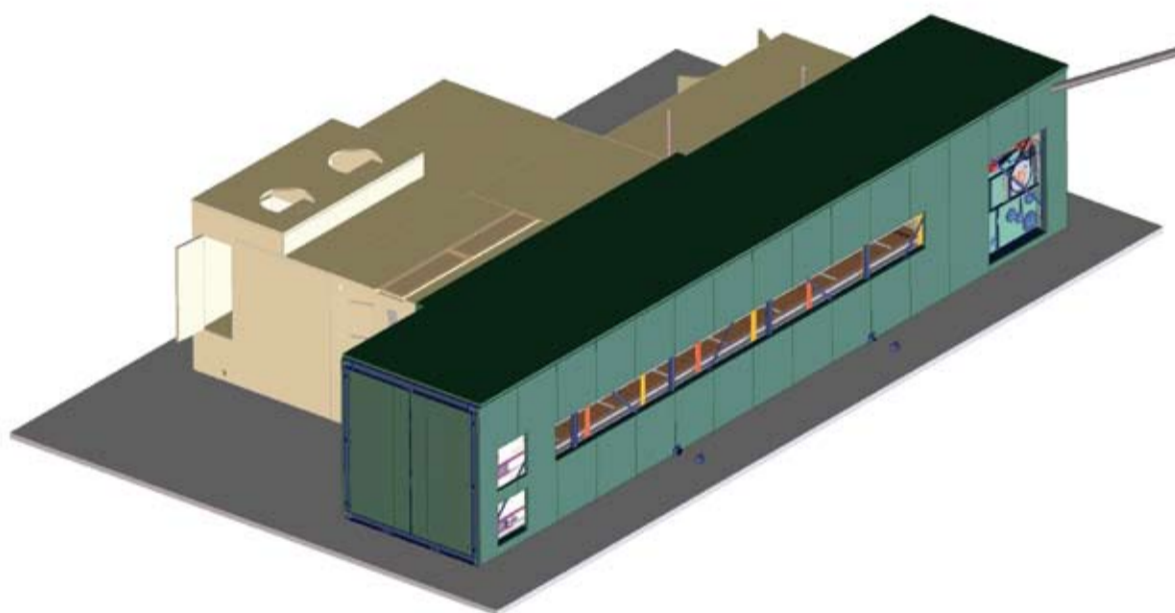
Our leasing concept consists for compact drying plants whose performance does not exceed 200 to 500 KW th. The leasing contract is concluded for the duration of 6-10 years and comprises fixed monthly instalments. The advantage: customers do not need any additional financing concept, but they can benefit from the advantages a container drying system offers.

### Benefit from the advantages!

Those advantages do not only include the utilization of the heat from the CHP and thus the heat-bonus. Furthermore, the digestate transport and storage volume are saved and there is an additional income by the sales of the product as fertilizer.

The leasing concept of the DORSET Investments GmbH comprises maintenance work with regard to material and spare parts (no installation work). We also support you when applying for governmental permissions and expertises. The dryer disposes of an integra-

ted exhaust air cleaning system, an acids tank and an optional sieve drum. The operator only has to pay for the leasing instalments and the additional costs for energy, water and acids. As an alternative to leasing, the customer also has the possibility to rent a plant for a short time for test purposes. This might be efficient for drying sewage sludge. For information concerning leasing and renting, please contact us at [investments@dorset.nu](mailto:investments@dorset.nu).



## Innovation with a high Potential

The belt dryer Piccolo offers a heat utilization concept for smaller biogas plants

In the beginning of 2010, DORSET launched a spectacular new development: The belt dryer Piccolo which makes it possible to submit a heat utilization concept also for smaller family-farm biogas plants with up to 200kWth.

The Piccolo makes it possible to process also digestate from small biogas plants to a high-quality fertilizer. It can also be used for drying woodchips or corn. The granulate fertilizer distinguishes itself by a particularly high nutrient content, a good spreadability and a long-term fertilizing performance. Henk Haaring, the managing director of DORSET, says: „The new development promises to be particularly successful because it makes it



possible to equip also biogas plants with a thermal performance of up to 1 MW with a drying system that works economically.“ The Piccolo requires an average of 6 kW el / at 200 KW heat including the subsequent exhaust air cleaning station. The Piccolo is delivered completely assembled for the outdoor use in a container. Its measures are twelve times three times three metres. There is no more need for a hall for the space-saving solution. The Piccolo is a little bit wider than a sea-freight container which offers the advantage that people can walk along the dryer within the container for service work at the complete length. The machine is only two metres wide. Aside of it, there is a space for a maintenance and service corridor. The container also

offers some space for accessories such as a separator, a receiver tank or pumps.

### Integrated Exhaust Air Filter

If required, an exhaust air cleaning station might also be integrated in the container. This is recommendable for highly odorous material such as digestate. For industrial applications, DORSET carried out some trials in which the Piccolo had to dry several materials. During the successful tests, also different exhaust air cleaners (air scrubbers) were tried out. Besides the Piccolo, which has a performance of up to 200kW, the product range includes several bigger container drying systems with the performances ranging from 250kW to 1MW.







## Another Kind of Recycling

# In Bavaria, sewage sludge is upgraded to a high-quality fuel

**The disposal of sewage sludge is a big problem for many municipalities. This does not apply for about 25 communities in Northern Bavaria:**

They found a solution to transform their sewage sludge into a highly demanded raw material. The AMN Abfallmanagement Nord- bayern GmbH (a waste management company) upgrades its sewage sludge by the help of a DORSET-belt dryer to a high-quality, rich-in-energy fuel briquette. AMN dries approx. 10,000 tons of sewage sludge per year using the DORSET-belt dryer.

### Many Operating Hours

First of all, the liquid material is dehydrated at the local sewage

treatment plants and thus the dry matter content is increased to 25%. Then, the sewage sludge is transported through the dryer. The material is placed on the belt dryer using a walking-floor with a reciprocating conveyor belt. It goes through four drying stages until the dry matter content has reached 80 to 90%. The heat, which is required for operating the dryer, is produced by five woodgas-powered CHPs. The managing director Knut Eschert explains: "In the past the CHPs were using palm oil but we now reconvert the system to a wood-powered oven that local pelleted wood can be burned for woodgasproduction. This is more ecological and economical than importing palm oil." After the

drying process, the dried product is delivered to a cement factory as a replacement fuel. As an alternative, it could also be utilized thermally in a sewage sludge combustion plant for using the residual heat and electricity production.. Knut Eschner praises the DORSET system: „The DORSET-belt dryer opens excellent opportunities for drying sewage sludge for fuel.. It is a simple and really convincing system which already showed its great potential during the first years.“ Also occurring odours are no problem for the farmer: the exhaust air of the sewage sludge drying system is cleaned using a DORSET- biotricklingfilter.



### Technical Parameters:

- throughput performance per year: approx. 10,000 tons
- specific throughput performance: approx. 1.2 tons/h
- water vaporization: approx. 850 - 1,000 litres/h
- operating hours per year: 8,300 hours
- maintenance / repair: 450 hours
- total operating hours: 28,000 hours

4-Floor-Dryer in Cloppenburg produces a demanded raw material for operators of power plants

# How digestate is transformed into fuel briquettes

**The dryer of the biogas plant of Jürgen Bahlmann in Cloppenburg is four floors high – not two as usual.**

The dryer uses the heat from the biogas CHP of 1.5 MWth and input is digestate from the biogas plant that has been correspondingly dimensioned with 1.9 MW. Jürgen Bahlmann explains: "The digestate derives from silo-maize, green rye and dry chicken dung." However, drying is only a secondary usage of the waste heat. The majority of the heat is used for heating the company-internal slaughterhouse and producing hot water for the disinfection pan. Residual heat is used in the dryer, for example at nights or on weekends. Furthermore, there are also season-dependent differences: „In summer, the dryer can consume up to 1.5 MW of heat, in winter this figure is lower, about 800 to 900 kW“, says the farmer from Cloppenburg.

In this case, the dryer input contains the solid phase of a press screw separator. This pre-installed separator is located directly at the post-digester. The material is driven from the separation unit to the tank with walking-floor. Then, it is conveyed to the dryer using a screw conveyor. At the dryer, it is spread on perforated steel plates. While the conveyor belt is moving,

it is filled according to the number of plates that has been selected at the SPS-controlling unit before. After that, the band stops for a short time so that the hot air can flow through the substrate and dehydrate it. This is the way how more and more material is dried discontinuously and consignment by consignment. The first drying floor is followed by a second, third and fourth, each of them is 24 metres long. Bahlmann says: "How long the digestate remains on the bands is depending on the initial humidity and the desired final humidity. The belt dryer works reliably and efficiently." The agricultural entrepreneur found an interesting application for the finished product of this process: "We press briquettes from the dried material which we sell to the industries as fuel. Our customers are operators of power plants.", says Bahlmann. The briquettes have a diameter of approx. eight cm and a very high calorific value. Jürgen Bahlmann is happy: "We sell about 2,000 tons of briquettes every year. This is a very profitable business. We are really satisfied by the performance of the belt dryer. It is also very nice that we do not cause any odour emissions due to the installed exhaust air cleaning unit. This is of particular importance for us because our biogas plant and the slaughterhouse are located in the middle of a business district. We



were also convinced by the low effort for maintenance and the easy handling of the plant."





## 4-Floor-Dryer at Dietz Automation successfully produces bio-fuels



The Dietz Automation GmbH has been a service provider for automation and network technology since 1997. It operates subsidiaries in Neukirchen and Hannover. Facing the problem of the world-wide shortage of energy, the company develops alternative energy concepts for the economy. The Wildungen project is subsidized by the German Federal Ministry for Economy and Technology.

# Successful start into the dry-decade

New life awoke in the former sewage treatment plant in the Hessian town of Bad Wildungen. The Dietz Automation GmbH as a service provider for automation and network technology in the environmental field installed a state-of-the-art DORSET plant for

thermal energy in average. The basic material is conveyed from a receiving tank on a pendant which loads the 4-floor-drying band consistently. The biomass is dried at a temperature of more than 60 degrees Centigrade. The heat which is required for the drying process comes from a 540 kW-biomass oven that is fired using residual wood from forestry. The dried saw dust is stored after it has gone through the four floors of drying. From this interim storage, the dried saw dust is transported to the pelleting device by a screw conveyor.



## Pelleting

At the technology plant in Bad Wildungen, more than 1,000 kgs of saw dust with a humidity of 50% are dried to a humidity of seven up to 13 per cent depending on the further application. This increases the calorific value of this saw dust by 30% compared to the wet product. The calorific value of the dried saw dust amounts to 3,260 kWh heat energy which is made available by applying a heat energy of only 540 kWh and 6 kWh of electrical energy. This is enough for heating a detached house for one month during the winter season. Dietz says: "The drying performance is excellent. The throughput goes beyond all our expectations and we can be absolutely satisfied by the low consumption of thermal energy."

drying biomass.

The plant fits excellently to the innovative utilization concept of regenerative energies of the company: Also solar power plants and a biomass oven are located on the premises. For operating the DORSET-belt dryer, the managing director Norbert Dietz only uses sustainable energy sources such as solar energy and wood. The company invested one million Euros into the plant which was commissioned in February 2010.

## Drying Saw Dust

At the moment, the system is used for drying saw dust which is pelleted and sold as wood pellets afterwards. The managing director Norbert Dietz explains: "Heating with regenerative energy sources opens an interesting and promising new business field. We can also imagine to dry other materials than saw dust, for example sewage sludge, in the future."

## Heat from Biomass and Combustion

The DORSET-belt dryer that is laid out for 500 kWh has been operated since February 2010. The saw dust cannot be used as a fuel for burning when it is wet. However, if it is dried and pelleted, it represents a sustainable energy source. "We increase the energy content by 60% by drying", says the managing director Norbert Dietz. The drying process in the ultra-modern plant can be optimally adapted to the different materials and the amount of input material. Therefore, the energy consumption is low, 6 kW electrical energy and 500 kW



Test container in practice :  
See YouTube [http://www.youtube.com/watch?v=ncdhu74NAMI&feature=youtube\\_gdata\\_player](http://www.youtube.com/watch?v=ncdhu74NAMI&feature=youtube_gdata_player)



## Interesting Development



## Cascata concentrates thin liquid to thick liquid

1. Well-suitable for the digestion of bio-waste
2. Maximum reduction of volume
3. Thin-phase drying after separation
4. Hall installation or plug and play-container

# DORSET-Dryer Cascata thickens digestate

**The drying plant Cascata, an innovation of DORSET, is ideally suitable for the pre-treatment of digestate with low dry matter contents or for thickening sludges.**

Cascata makes it possible to reduce the storage volume because water is evaporated. The plant is able to increase the dry matter content from the initial four per cent up to twelve per cent. This is ideal for the pre-treatment of thickened liquids for the further treatment in the belt dryer or simply for reducing the volume or mass of sludges. Very thin fluid digestate after the separation of digestate from renewables plants and digestate from waste treatment plants are best suitable for the Cascata drying.

### The Drying Procedure

The system consists of rotating disk plates which are dipped into a lower buffer tank again and again. The process resembles to the function of an escalator. The buffer tank is filled with the material that has to be thickened. The disks move through the sludge, are moistened and move upwards again. Then, the air that was heated by the heat exchanger flows through the sludge on the disk and dries it. In that way, the air absorbs the water, the concentration of the substrate increases gradually.

Thus, the sludge gets more viscous. The plant is time-controlled: the thickened sludge is pumped down after a pre-determined time and new substrate is filled into the buffer tank.

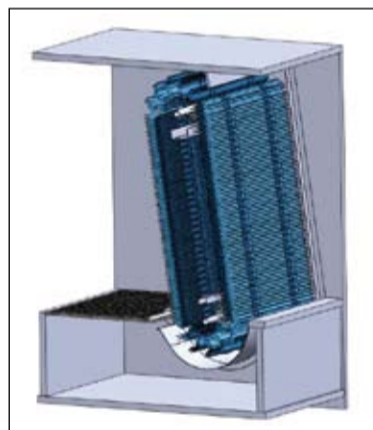
### Exhaust Air Cleaning Unit

Cascata is usually combined with an exhaust air cleaning device which filters the ammonia content from the air. Because the ammonia content of the exhaust air often exceeds the limit of the environmental regulations, in Germany max. 30 mg/m<sup>3</sup>, an exhaust air cleaning process becomes necessary. This exhaust air cleaner consists of two stages which take place one after another – first a chemical cleaning, then a water cleaning. As far as bio-waste plants are concerned, it might be necessary to install a four-stage scrubber in order to reduce the emission of odours: in this case, lye, acid, water, and a trickle-bed biowasher are installed in line. Cascata is delivered completely mounted and can be commissioned within a very short time.

### Cascata in practice for the digestion of bio-waste and cofermentation

Energy recovery from waste is an important component for conserving energy resources: Biogas plants which are used for

the digestion of bio-waste or for cofermentation might make an important contribution to the conservation of resources. Cascata-dryers, which reduce the volume of the occurring sludges, might be an efficient supplementary equipment for being able to use the exhaust heat from the plants. A Cascata-device has been in operation at a bio-waste digestion plant in the district of Cloppenburg for a short time:



A 2.7 MW biogas plant is installed which digests 150 cubic metres of food leftovers from supermarkets and slaughtering waste per day. The plant is located in an agricultural region with a high availability of manure. For that reason, the disposal costs for the occurring digestate are very high. They amount to approx. six Euros per cubic meter. The operator of

the plant says: "We decided for the DORSET Cascata-plant because we aim at reducing the volume and amount of the digestate, but we still want to have a liquid, not a solid, finished product. Therefore, we have enough storage capacity in liquids tanks. Also the neutral smell of the product was important to us." By using the Cascata system developed by DORSET, the operator can save 20% of volume per day – these are up to 30 cubic metres. The financial saving amounts to about 150 Euros of daily disposal costs. Furthermore, the finished product, the fertilizer, is a high-quality product due to its higher concentration of nutrients which is beneficiary for the final customers. The operator explains: "This is customer care – we maintain a very solid position in the increasing competitive pressure with this higher-quality fertilizer." The exhaust air-cleaning unit of the plant consists of a combination of a biological and a chemical scrubber. The operator is satisfied. "We decided for the DORSET-system because we get drying and exhaust air cleaning from one company. The system is highly professional, simple in maintenance, and the components are well-adapted to each other."

Also Maik Plate, who operates a 1.5 MW cofermentation plant in Wildeshausen decided for a

Cascata-system. His biogas plant transforms liquid waste from food industries such as flotates, corn residues or grease separator contents into biogas and heat. He uses the Cascata for thickening between 50 and 100 tons of liquid digestate per day. Approximately 30 cubic metres of water are evaporated during this process. If the spreading costs amount to about six Euros per cubic metre, the operator saves 180 Euros per day. Additionally, he receives the CHP-bonus (3 cents per kWh according to the Renewable Energy Sources Act - EEG) and saves a storage volume of about 3,000 cubic metres. "This was one of the main reasons for our decision for Cascata. Especially in wintertime, we were facing problems because our biogasplant has grown steadily in the past and thus, our storage volume was limited. If we had not purchased the drying unit, we would have needed to expand the storage.", says Mr Plate. In addition to the saving of transport costs and storage volume, Plate also mentions the better quality of the resulting liquid fertilizer and the ASL-fertilizer, that he can also produce as a by-product, as decisive advantages of the Cascata system.

## Biological Exhaust Air Cleaning

The biological exhaust air cleaning of DORSET – also known as bio-scrubber – distinguishes from the chemical exhaust air cleaning by its simpler construction and the lower energy consumption which results in lower operating costs. It presents itself for cleaning highly polluted air with high odour emissions, such as

the exhaust air of drying sewage sludge, or the reduction of odour emissions of swine and poultry production facilities. Thereby, ammonia, dust and other odorants are removed from the exhaust air. The bio-scrubber works with bacteria that degrade bad odours and thus provide fresh air. The plant that was developed by

DORSET is certified according to DLG and passed the DLG-signum-test. The device can be delivered completely pre-mounted with the plastic housing, filter package and control unit.





## Drying of Chicken Manure

# Clean technology for large layer companies

**Premiere in Turkey: DORSET installs an innovative plant for drying chicken manure.**

EinDORSET could implement an unusual project in Turkey recently: DORSET delivered a drying plant for chicken manure to Akhisar by order of the Keskinoglu corporation, a very famous company in the Bosphorus region. The company group Keskinoglu has specialised in the production of chicken meat, eggs and similar products. The belt dryers were installed close to two chicken houses and has run extremely well since the commissioning. It has gone beyond all expectations. The chicken houses are 110 m long and 22.5 m wide and offer a space for 120,000 chickens each. The droppings of those 240,000 chicken is dried using the air from the houses, pelleted and processed to high quality organic fertilizer which is sold to the final customers.



The Pollo belt dryer for drying chicken manure is the first plant of this kind in Turkey. DORSET has been operating numerous reference plants throughout Europe for years. The chicken manure remains in the farmhouse for maximum one day and then is spread on the dryer using a dosage belt. On the dryer plates, the warm air from

layer farms which are wide-spread mostly in Turkey and Eastern Europe. Also in those regions, large layer farms often are not accepted by authorities and residents any more if they do not comply with strict environmental directives for the reduction of odours and dust. DORSET has solved this problem

unit is acknowledged as a successful system for the reduction of fine-dust from poultry houses. The managing director of DORSET, Henk Haaring, says: "The investment is particularly recommendable for large chicken farms because it offers a wide range of advantages." After the drying

and heavy product. 65% of the fertilizer consists of organic substances - 40 kgs of N, 25 kgs of P2 O5 and 23 kgs K2O per ton.

### The Keskinoglu Group

The fast food chain „Tav Vuk“ sells chicken burgers, chicken sandwiches, chicken baklava and doner kebab with chicken meat – it is the Turkish counterpart to „Wienerwald“ or „Kentucky Fried Chicken“. Tav Vuk is a company of the Turkish Keskinoglu group which was founded in 1963 and has expanded to become one of the biggest processors of chicken meat and producers of eggs in Turkey

over the last five decades. Today, it employs more than 2,100 people. Ismail Keskinoglu, managing director of the Keskinoglu group, sets particular value on the fact that the different companies in his group cover all the aspects from production and distribution up to waste disposal. The enterprise is dedicated to meet international quality standards and complies with the directives of ISO 9001 and HACCP. Keskinoglu produces chicken meat and chicken parts, eggs, layers, fodder products, egg boxes, olive oil and soap. The turnover amounted to more than € 253 million in 2009.



the chickenhouses flows through the manure which are dried to a dry matter content of 82% within a two days. Thus, the majority of the nitrogen remains bound in the final product and is not lost as ammonia. Bad odours are prevented and flies rarely have a chance. The emissions of fine dust and odour are reduced by more than 70 per cent due to the drying process. This is an important criterion for large

by developing its environmentally friendly technology and thus contributes to keep the consequences for the residents low. This is especially true for the reduction of ammonia – instead of volatilizing in the air, the ammonia remains in the pellet and thus guarantees an excellent fertilizer value. Its share amounts to approx. 40 to 45 kgs of ammonia per ton of organic fertilizer. The Pollo-chicken manure drying

process, the chicken droppings are processed to organic fertilizer pellets or granulate. They are hygienised according to the European Hygiene Directive (EG 1069/2009) in order to kill off pathogens and weeds seeds. In that way, Keskinoglu can produce two tons of organic fertilizer per hour. The fertilizer called „Organica Dutch Premium“ can be transported over large distances because it is a dry

### Reduction of Fine Dust

#### An important Topic (not only) in the Netherlands

The emission of fine dust, odours and ammonia has been an important topic in the Netherlands for years. More dust occurs when chicken can walk freely in their cage free housing. In 2010, the Dutch environmental authorities investigated the different animal husbandry systems with regard to the emission of fine dust. They found out that the Pollo- poultry manure drying system works like a big fine dust filter for the farmair air. Tests revealed a reduction of fine dust in the air by 70%. Because a part of the air is released directly to outside in summer, the air from the chickenhouse is relieved from fine dust by 55%. The DORSET system for drying dry chicken manure

has been officially acknowledged by the Dutch authorities and gives bigger scopes to the operators when applying for environmental permissions. About 40 farms in the Netherlands are even subsidized by the Federal Ministry for the Environment for the installation of their drying system because they are located close to a village or a big road. Furthermore, DORSET offers the possibility to expand the drying system by further dustfilters or a biological exhaust air cleaning unit. This combination has proven successful in Switzerland for many years and shall be increasingly applied in the Netherlands now in the course of the increasing environmental requirements.



## Service Team

The technical customer support of Dorset targets at a long-term customer satisfaction. A qualified, experienced team is responsible for achieving this target. The employees of the technical customer support are in charge of the assembly and commissioning as well as the clearance of faults, repairs and complaint management.



Dorset service phone number 00316-53578323  
or by email at [service-gm@dorset.nu](mailto:service-gm@dorset.nu).

In addition to the customer support, Dorset offers its customers the possibility to conclude a long-term customized maintenance contract if required. In order to make a fast service possible also concerning the delivery of single parts, the team is supported from three locations.

Although comprehensive instruction manuals are delivered with all plants, Dorset is very active in the personal support of its customers. It is our target to achieve and guarantee the optimum result.

## Service Germany



## DORSET ID IDENTIFICATION

Dorset ID has been involved in the development of systems for the reading Trovan ® RFID-system since 1989. We offer a wide range of transponders and reading devices.

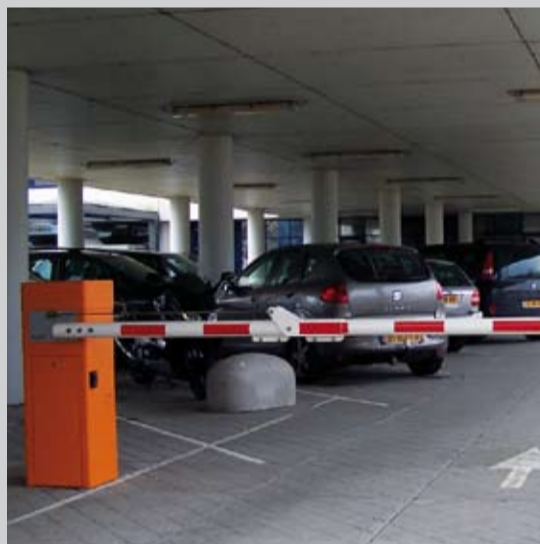
Trovan ® Transponder are used for the marking of animals, industrial purposes and security products.



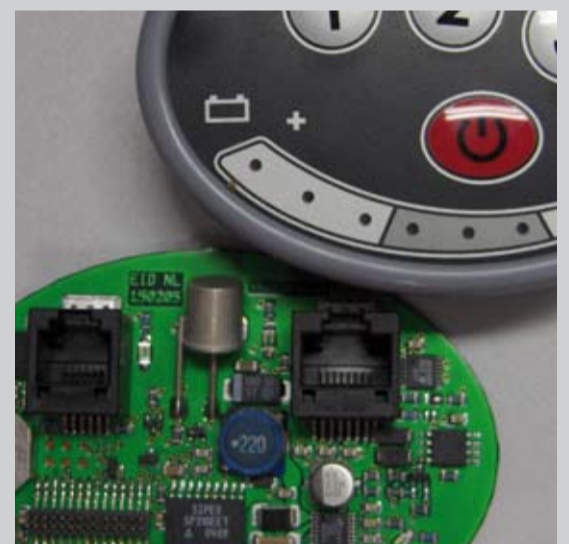
Animals



Industry



Access control



Electronics

**DORSET GP**  
DORSET GROUP

Manufacturer of drying systems for the utilization of exhaust heat

**DORSET GM**  
GREEN MACHINES

Manufacturer of exhaust air cleaning systems for animal production and sorti-sorting systems for fatteners

**DORSET FS**  
FARM SYSTEMS

Manufacturer of RFID-technology for the electronic identification

**DORSET ID**  
IDENTIFICATION

Dorset Green Machines by  
Weverij 26 • 7122 MS Aalten • The Netherlands  
[www.dorset.nu](http://www.dorset.nu) • +31 543 472103 • [GM@Dorset.nu](mailto:GM@Dorset.nu)

**WWW.DORSET.NU**