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HDPE plastic blocks: Flexible solution for fodder silos  ▶ P. 26
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The German Biogas Association presents the booklet “Safety first! Guidelines for the safe use of biogas technology”, which was published with the support of the Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ) GmbH.

The guidelines provide an overview of the dangers on a biogas plant and provide recommendations for the implementation of safety-relevant measures and thus for the safe operation of biogas plants.

Technical, organizational and personal protective measures are described for most components of a biogas and a biogas-upgrading plant. Moreover, information on the inspections and testing, documentation and the organization of the legal framework, as well as recommendations for decision-makers in communities and ministries are also to be found.

The publication is available in English, Spanish, French, Portuguese and Indonesian.

The booklet in all languages can be downloaded on the website www.biogas-safety.com

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Dear Readers,

a new Renewable Energy Act has been in force again in Germany since the start of the year. This is the sixth act of its kind to encourage the use of renewable energies. However, it is the first to completely disrupt the existing support schemes with its clauses. It is no longer possible for biogas plants to simply be connected to the electricity grid after planning and approval, and then to automatically count on feed-in remuneration. Anyone who wants to build a new plant or further operate an existing one after its previous 20-year remuneration period, must take part in so-called tenders.

The only positive aspect of the new law is that there are follow-up regulations for existing plants. The first tendering process will take place in September. The maximum bid value for existing plants is 16.9 cents per kilowatt hour (ct/kWh), and for new plants it is 14.88 ct/kWh. Currently, both plant operators and new investors are diligently checking whether the maximum bid values stipulated give them any opportunity at all to produce biogas. Especially since the use of maize and grain has also been capped. You can read a detailed report on the 2017 Renewable Energy Act on page 6.

The German biogas community is therefore eagerly awaiting the tender in September and the ensuing results. Waiting also means that no biogas plants are currently being built, despite the Renewable Energy Act. They simply do not have the acceptance of bids. Only so-called small manure plants up to an installed electrical capacity of 75 kilowatts that use up to at least 80 percent slurry or manure are being built, because these plants are excluded from the tender system. On the other hand, some plants that feed biomethane into the natural gas grid are still being put into operation. You can find detailed figures on plant development on page 16. In view of the non-existent biogas market in Germany, another biogas plant manufacturer gave up at the beginning of May and announced that it was stopping the planning and building of plants. This was Schmack Biogas GmbH, which belongs to the Viessmann Group. In future, Schmack will only be involved in providing services to existing plants.

However, it is not only the new Renewable Energy Act that is now causing turbulence. Tightening and new regulations in fertiliser laws and water protection related to the area of biogas plants mean that plant operators are faced with new challenges. Shorter fertilising windows, lower extractable amounts of nutrient and potentially longer storage periods for fermentation residues have to be implemented at plants, sometimes with considerable investments.

Despite all the difficulties, the German biogas industry is very innovative. On page 22 you can read how a plant operator is flexibly feeding power into the grid as and when required. And there is an article that begins on page 26 that paves the way for the cost-effective and flexible construction of bunker silos with new types of modules. It is also particularly pleasing that the subject of biogas is reverberating outside of Germany. In this issue of the Biogas Journal we give you information about India, a small-scale plant project in Colombia, a large-scale project in South Tyrol, biogas production near the nuclear power plant of Temelin in the Czech Republic, and a project in Brazil.

A new parliament will also be elected in Germany in September. All kinds of organisations concerned with renewable energy as well as the environment expect the future federal government to lift the restrictions on the expansion of green electricity, and that renewable energy will have a huge impact in the heating and mobility sectors. Otherwise German politics will reduce the Paris climate agreement to an absurdity.

Yours sincerely,

Martin Bensmann, Dipl.-Ing. agr. (FH)
Biogas Journal Editor
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New terms of reference for existing and new facilities

On 1 January 2017 the amended Renewable Energy Act, EEG 2017, came into force. What does this act mean for operators of existing facilities? How should facility operators adjust to the new version of the law? The following article is dedicated to these questions.

By René Walter

Once again a new EEG has come into force in Germany. Once again the industry has to implement a complex set of regulations. The past does however show explicitly that operators of biogas facilities and their supplier companies have also impressively managed to handle the complex regulatory frameworks of past amendments. Therefore there is no question that this will succeed again!

This amendment differs from the previous ones: For the first time follow-up financing has been secured! A new funding mechanism has been introduced for biogas! How will the industry continue to fare? Is it worth investing? Can I strategically adjust my facility? These are questions that many facility operators had put to us. Today the answer can be summed up with one word. And that’s: Tender!

The invitation to tender – criticised in many quarters, yet leaving no alternative due to the political situation and European legal requirements. And even those who criticise the tender mechanism are forced to admit that the biogas industry was the first industry to get a mechanism for follow-up financing accepted into the EEG. Biogas facility operators, companies, and especially our President Horst Seide, the committee and leadership have fought hard for this. However, without the intervention of the Bavarian Minister-President Horst Seehofer, the huge commitment of the Bavarian Ministry of Economic Affairs led by Ilse Aigner and the huge support of the states of Rhineland-Palatinate and Thuringia this success would not have been possible.

Of course it is correct that many – certainly the committee and the German Biogas Association – wanted greater and different funding and that the design of the tendering process is difficult in certain places. But it is also right that politically and in terms of European legal requirements the tender mechanism left no alternative. Furthermore anyone who goes deeper into EEG 2017 will recognise that the latter offers more than the maximum value of 16.8 cents per kilowatt hour (kWh) suggests.
Of course it goes without saying that some rules are defective and others very impractical. In addition to this even better and more economic incentives need to be put in place. Moreover unintended substrate distortions with regard to waste facilities must be avoided. But the industry can and must continue to fight and struggle for these changes. There are some opportunities for changes. So the ministry can adjust the rules by virtue of statutory order and it is foreseeable that a few smaller amendments are still to come.

Crucial for operators of an existing facility for each amendment of the EEG are the transitional provisions because these govern what significance the new rules have for existing facilities. Therefore these are presented first. Then follows the subject of “tender”. Then these rules are dealt with which also affect the running operation of existing facilities and may be of great economic significance for operators. Suggestions for amendments to the law follow, to which the industry in the author’s opinion should devote much of its energies to.

This contribution concludes with a brief assessment of the amendment.

**Transitional provisions**

In principle EEG 2017 is also to apply to existing facilities. This results in the application of modified general provisions that do not concern payment in the narrower sense (general provisions on payment, network connection, EEG surcharge, legal protection, Clearingstelle-EEG etc.) to existing facilities as well. However in contrast to EEG 2014 only a few amendments were made here which concern the generation of energy from biogas. With regard to provisions on payment in the narrower sense, the transitional provisions of EEG 2017 ensure that existing facilities and those that have gone into operation can be operated almost without change under the previous payment framework with regard to payment requirements and above all in regard to payment rates. For the rest, the rules on tendering do not affect existing facilities until they want to make and assert a further claim or period for payment. This means that operators of existing installations are entitled to their previous payment under the previous requirements for payment even after EEG 2017 has come into force (for exceptions see transitional provisions). They are also not debarred from claiming new bonuses as far as this is provided for by the EEG version that is authoritative for the payment requirements and payment amounts. For example if an installation operator has not yet claimed the additional KWK bonus or technology bonus additional payments, they can also claim or optimise this in future as far as they meet the requirements and the EEG version authoritative for their payment provides for the bonuses referred to. However general payment provisions have also been extended via the general regulations to facilities that came into operation before EEG 2017 came into force, which may be of greater economic significance. Moreover various regulations for power supply and the EEG surcharge have been refined which are also shown under the point “Effects of EEG 2017 on the running operation of existing facilities”. Further amendments follow from the reworking of other general provisions. For example these result in the facility operator, when assigning a new network connection point, having to have assessed under the new law whether the reduced penalties in contrast with EEG 2014 also apply to him with regard to the system register and the legal protection of the decisions of Clearingstelle-EEG clearing house follows the significantly better regulations of the EEG 2017.

**Invitation to tender**

What is the importance of the subject of tender for operators of an existing biogas facility? Operators of existing biogas facilities are affected by the subject of tendering if the power generated in the existing biogas facility is to be financially supported beyond the first subsidy period of 20 years. It is possible that as part of the tendering process a new claim for subsidy beyond 10 years will be made.

Therefore because facility operators must with the second funding period fully comply with the requirements of EEG 2017, the latter for example providing for other substrate requirements, but also because the previous flexibility premium can be very nicely combined with the “flexibility surcharge” additional payment granted in the second funding period, it makes sense that facility operators start looking seriously at the subject of “tender” 10 years before the expiry of their first payment entitlement.

Within the framework of the second subsidy period facilities will be funded via the market premium model already well known from EEG 2012. In addition the flexibility surcharge can be claimed. When tendering, the applicable value for the market premium will be determined as part of a bidding process carried out by the federal network agency. For this purpose facility operators must bid (above an applicable value and for the intended installed capacity). If the overhead is applied to this, the facility operator is entitled to claim further subsidy.
Bids for other biomass facilities and new biogas facilities are also taken into account as part of the tendering process. Wind- and solar energy sources have their own bidding procedures carried out. Surcharges are received by the most cost-effective bids that have to have overhead added in order to reach the tender volume. If the capacity which is being bid for is lower than the tender volume, the remaining tender volume increases the volume of the next tender.

If a bid receives the surcharge, the bid price forms the applicable value for the second payment period. For existing biogas systems below 150 kilowatts (kW) the special feature occurs that their surcharge is not measured by the bid submitted but by the highest price offer still having overhead added.

Based on political and European legal requirements a tender system was the only way of allowing follow-up financing to biogas facilities above a certain size. Only new systems with a lower capacity than 150 kW, new slurry systems and so-called already authorised systems (authorisation before 1 January 2017; commissioning before 1 January 2019) may still claim a payment as part of the fixed payment system (legally determined fixed payment rates) after EEG 2017 comes into force.

With the introduction of tendering, the German Biogas Association will pursue the aim of keeping power gen-

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eration from biomass in the medium term at least at today’s level. The first framework principles of the Federal Ministry for Economic Affairs for an EEG 2017 did not envisage a tendering process for biomass facilities. It is owing to tough association work and pressure from various states that a power to issue statutory ordinances and then regulations on a tendering process have only just been included in EEG 2017 itself. Starting in 2017 a tender process will also be implemented for biomass facilities. From 2017 the bid date for the tendering process is 1 September of each year. One tendering process per year is envisaged in which existing facilities (for the second payment period) and new facilities take part. Participation in the tender process is subject to conditions. Conditions of participation include the facility operator providing a security. This security amounts to 60 euros per kW. The deciding factor here is not the rated output but the installed capacity which is being bid for. Moreover only such existing facilities as were taken into operation before a certain deadline may participate. So the first funding claim under the EEG for electricity from this facility may at the time of tender exist for no more than eight years. If for example a biogas facility was put into operation in 2006, the funding period will end on 31 December 2026. The earliest possible date for participation in a tendering process is eight years before the end of the funding period, therefore after 2018. The tender volume is to amount in the years 2017–2019 to 150 megawatts (MW) and the years 2020–2022 to 200 MW of installed capacity. Calculations have shown that this tender volume is sufficient to enable in principle follow-up financing for those facilities whose first funding period has ended. It is however open as to for which and how many facilities the conditions are sufficient to guarantee economic operation of facilities. In particular facility operators who have low substrate costs and a good heating design have however made it known that the economic incentive is sufficient to continue facility operation. This at least now provides an outlook for these facilities. Subject to individual limit controls, no differentiation will be made when tendering between facility size and materials used. In principle the surcharge is therefore...
decided by the bid price alone. Differences occur however for the maximum bid price (maximum value): For new facilities this amounts to 14.88 cents per kWh. For existing facilities on the other hand the highest value amounts to 16.9 cents per kWh and at the same time must not exceed the amount of the average funding in the three previous years.

It must also be noted that the maximum value is subject to degression. This means that the maximum value will sink by 1 percent per year. If predominantly biomass with separately registered biowastes under certain waste codes is used, the applicable value will be limited to the payment rates for biowaste fermentation facilities regardless of the surcharge value. This is to avoid biowaste fermentation facilities from having substrates removed to any large degree.

To what extent a facility operation at a maximum level of funding of 16.9 cents per kWh is possible cannot be evaluated here as a flat-rate assessment. But in discussing profitability it should not be forgotten that in addition to the applicable value the flexibility surcharge can be claimed. For a facility with 1 MW of installed capacity the flexibility surcharge amounts for example to 40,000 euros per year and corresponds to about 0.9 cents per kWh. Moreover various reports show that revenues achievable on the electricity market for electricity from facilities which can make electricity available on demand will rise.

Also it must not be forgotten when evaluating the maximum value that this can be increased in three ways: The Federal Grid Agency is constrained to increase the maximum value if for the last three tenders carried out before introduction of the determination process the indicators show that the maximum value is too low. In addition to this there is the possibility of increasing the maximum value by decree or law.

Existing facilities bid for the installed capacity and an applicable value (applicable value = value for the market premium). If your offer has overhead added, you will receive the applicable value bid for 10 years for a measured capacity for a rated output that matchs 50 percent of the installed output. Below 100 kW this "double superstructuring regulation" will probably not apply. If the double superstructuring regulation is infringed, the applicable value is reduced to zero for each kilowatt hour produced in addition to this. This system allows existing facilities to increase or reduce their capacity in the second funding period.

If an existing facility is receiving the surcharge, it is entitled to a further funding period of 10 years. When this second funding period begins is in principle up to the facility operator. However a change to the new funding period cannot start before a period of twelve months after the date of the surcharge. The second funding period begins automatically three years after the tender has been won, if it has not already been changed over to.

With the commencement of the second funding period the facility operator loses all privileges arising from previous versions of the EEG. The facility operator is then fully subject to EEG 2017. Therefore the facility operator must also adhere to the additional biogas-specific funding conditions of EEG 2017. These also include the proportion of grain or maize used for generating biogas amounting at most to 50 percent by mass, to the extent that the 2017 or 2018 surcharge is applied. For the surcharge year 2019 or 2020 47 percent by mass is envisaged, and for the surcharge year 2021 or 2022 44 percent by mass.

With the second payment period flexibility is funded solely via the flexibility surcharge. How the latter can be properly claimed should be thought through at an early
stage. A payment claim for existing facilities that have successfully participated in a tendering process exists for the rest only if it can be proven that they are being operated flexibly. For this purpose an environmental expert must certify that the facility is technically suitable for demand-oriented operation. If such certification by an environmental expert is not submitted to the grid operator within 6 months after the start of funding with the new claim, the surcharge becomes void.

There is still much to do!
The first big steps in terms of connection funding have been taken. The Act saw not just a statutory ordinance enacted, as originally intended by the Ministry of Economic Affairs. Under pressure from the states and the German Biogas Association the tendering mechanism has also been adopted in law for biogas. Moreover the expansion corridor has been increased with an intermediate stage of 150 MW from 100 MW to 200 MW despite massive resistance from the Ministry of Economic Affairs. This is an important success in order to open up a perspective to the existing facilities with regard to the volume of the corridor.

Nevertheless there is still much to be done. The big task ahead will be to adapt the rules, boundaries and maximum values more to their economic requirements. Currently the tendering process still does not take into account the fact that small facilities have significantly higher electricity production costs than larger facilities. In order to give small facilities fair opportunities as well, factors must be introduced which increase the applicable value the smaller the facility is. In particular it is not proper that as part of the tendering process the surcharge value for existing facilities with a capacity not exceeding 150 kW is determined by the level of the last offer that still had overhead applied. Because this

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bid is made for a larger facility. According to the current EEG 2017 the applicable value to be determined via tender is largely independent of the substrates used. This however leads to unfair treatment if existing facilities cannot bid above their historical payments. For this results for example in one facility being allowed to offer 14 cents per kilowatt hour and the other facility 16.9 cents per kilowatt hour, solely because of historically different payments.

Both systems may however from the perspective of EEG 2017 use the same substrates, and they have the same revenue opportunities on the electricity market. Therefore the tie to historical payments already appears unacceptable. A solution to this problem needs to be found with the operators of renewable resource- and waste facilities.

For the rest the ministries should be supported in resolving mistakes and ambiguities. But also far beyond the tendering process the EEG must be corrected to relieve the burden on current facility operations and avoid threats to their existence. Despite the difficult environment, corresponding subjects and problems unnoticed by most have been introduced into the amendment to EEG 2017. Some important gains that will save you considerable expenditures have been wrung out. Representative of about 10 areas of responsibility the following two subjects are to be raised, which although not solved in this amendment should emphatically be tackled in future by the industry – including with your help.

Already nearly every week we are having to state that facility operators have lost their payment for several months due to the absolutely excessive, disproportionate and therefore mistaken contractual penalties (penal regulations). So the facility operator loses their entire EEG payment if they do not adhere to the requirements for supply management, fulfill certain notification requirements for the facilities register or meet the requirements of the System Stability Regulation through no fault of their own. Even operators who have actually done everything correctly have sometimes lost their payment this way.

As part of a multitude of discussions and via constitutional opinions we have at least succeeded in getting the Ministry of Economic Affairs to lower the penalties for infringements of the notification requirements for the facilities register from 100% to 20% cancellation of payment. Even taking into account the notification requirements which are still insufficiently comprehensively formulated, the mistaken requirements for communication, but also because of the missing fault requirement, a penalty, even to the amount of 20 percent of payment, which generally matches the cancellation of the double overall yield, is absolutely excessive. Furthermore the penal regulation was only amended retrospectively for 2016. But most of the operators affected lost their pay-
ment in the years 2014–2015. A possible threat to their existence is also being feared based on supply management. On the one hand with EEG 2014 the legislator created a (probably unintended) problem. A Berlin court had ruled that the requirements for supply management are not fulfilled if only one feed-in management device is available in a wind farm. To save the payment for this wind farm, the legislator decided with retroactive effect that one mechanism was also sufficient for several facilities.

In doing so it was ruled with possibly fatal effect that this is only possible for identical energy carriers. Until this amendment, according to a local legal evaluation a mechanism for the feed-in management for one biogas and one photovoltaic facility would have sufficed to meet this requirement if both facilities were situated in the same location. However, due to the recently introduced “identical energy carriers” restriction this may no longer be the case.

On the other hand, contrary to the legal opinion of the Department of Energy Law and Energy Trading, representation is being made on the part of the grid operators associations that the EEG payment will also be lost if the mechanism for feed-in management does not work. Since a facility operator can scarcely ensure that the mechanism always works, according to the interpretation of the grid operators associations risks to the facility operator's existence then arise which he or she can only influence to a limited degree.

In any case facilities operators should try to regularly check the mechanism and in the event of a defect immediately ensure repairs. Despite a report from the Department of Energy Law and Energy Trading which expressly shows that this regulation is also disproportional and therefore in all likelihood unconstitutional, up to now the Federal Ministry of Economic Affairs (BMWi) has been intransigent as regards amending the penalty. We must therefore continue to fight for an amendment in order to further reduce your risk.

A further item which the industry and the association should support, because it would lead to considerable financial relief, is a regulation on the exchange of satellite and biomethane CHP plants. After several conversations with the BMWi an appropriate regulation was promised. However, suddenly when the wish was also expressed on the part of members of the Reichstag, this was rejected with incomprehensible arguments.

What is this about? If because of a fire or wear the container of a satellite CHP plant or biomethane CHP plant is exchanged for a new container with a new CHP plant, there is a grave danger that the changeover CHP plant will be considered to have been newly put into operation. Therefore it is recommended by lawyers to first operate both CHP plants in parallel and only then to dismantle the CHP plant to be changed over. Such a way of proceeding leads to significant costs and generally requires a permit under public law. In order to avoid these (technically unnecessary) costs, a regulation on exchange should be enacted which avoids these costs.

The industry should fight for this and other points to remove the burden from facility operators. In doing so an implementation should be sought as part of the minor amendments which are still expected before the next major amendment in 2019.

**Evaluation of EEG 2017**

Not going under was and is the name of the game after the brutal right hook of EEG 2014. A large step has been taken. The fight is going on to the second round – the tendering round. The tendering process coming with EEG 2017 will allow facility operators in particular who have cost-effective substrates and appropriate revenues from heat generation to operate their facility for another ten years. Also the specified tender volume will suffice for existing facilities whose payment period will be ended in the next few years. After that it must be increased.

There is however no question that improvement of economic funding via the EEG must still be fought for in order to allow all facility operators to continue to operate. In addition the facility operation of every facility must be optimised and new revenue options must be developed. Good heat generation revenues, use of new technology (network voltage-oriented operation mode, disposal of heat, environmental products etc.), the improved revenue options in a few years’ time on the market for a demand-oriented electricity supply, safe facility operation and good integration of the facility into the local community are the ticket for the second round, the contin-
When should the facility operator start getting involved with the tender process? The answer is obvious! It’s “now”. With the new funding period the facility operator is falling into a new payment and substrate system. Already this requires the facility operator to have a lead time of several years when dealing with the subject. Furthermore the second funding period may be of crucial importance if it concerns the refinancing of investments. Also with early planning the flexibility funding in the first funding period can be optimally matched with the flexibility funding in the second period.

As the flexibility in the first funding period is funded over 10 years, every facility whose remaining payment period is less than 10 years is invited to think through the flexibility system in the second funding period.
Furthermore every facility operator is called upon to strive for an improvement in the tendering conditions. However they can only do this if they know the system. How should the facility operator get involved with the subject? The first step must be for the facility operator to learn to understand the system generally. For this purpose a one-off study of the subject generally does not suffice. The second step should be to analyse what the tendering process means for one’s own facility operation. In this evaluation the operator should free themselves of all preconceived ideas about the tendering process. It must be determined what costs will be incurred for the generation of a kilowatt hour in future, which investments must be made, how the substrate logistics can be aligned with the EEG 2017 and what additional revenues (heat, fertiliser, etc.) can be generated with an optimised operation.

The third step must then be to determine using one’s own cost and revenue structure whether a sustainable bid can be submitted in a tender. In doing so it should not be forgotten that the flexibility surcharge is still granted on top of the applicable value and that mechanisms exist for increasing the maximum value of the tender. Since these three steps are not simple, the German Biogas Association will assist them with intensive training sessions.

How is EEG 2017 to be assessed with regard to current facility operation? Due to the temporary regulations the tendering amendment EEG 2017 makes little change in the short- and medium term to the economic terms of reference for operators of existing facilities. The facility operator can in principle also continue to operate their facility as before even after EEG 2017 comes into force and will receive the same payment rates for electricity fed in.

However in any case the facility operator should keep an eye on the themes addressed of “Measurement” and “Electricity tax”. In addition to this it is of vital significance that the facility operator avoids the completely disproportional penalties which EEG 2017 also provides for. This means that the facility operator must ensure that they meet their notification requirements to the facility register and guarantee the technical requirements for facility operation (feed-in management, 150 days etc.) at all times.

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Industry performance 2016: Expansion dominated by small slurry plants

In August last year, the German Biogas Association (GBA) published the latest industry statistics for 2015 and its predictions for 2016.

By Manuel Maciejczyk, Dipl.-Ing. agr.

Initiated by the German Renewable Energy Sources Act 2014, a focus on small slurry and waste fermentation plants is clearly reflected in the number of new installations for 2015 and 2016. The figures show the lowest expansion since the Renewable Energy Sources Act was passed in 2000, with just 150 new biogas plants in 2015 (see Figure 1) and an additional installed electrical capacity of 23 megawatts (MW). At the same time, plant shutdowns meant that output in 2015 increased by only 3 MW net, while the number of biogas plants in operation grew just by 630 in total.

12 MW of these 23 MW are relevant, which means the output leads to additional electricity generation. The remaining 11 MW are "surplus" and are available as flexible output. The 150 new biogas plants are made up of 130 small slurry plants and other biomethane feed plants, waste fermentation plants and on-site agricultural power plants, which generate more than 75 kWp.

As of the end of 2015, a total of 9,861 biogas plants were operating in Germany (including 183 biomethane plants), with an installed capacity of 4.018 MW (see Figure 2). According to the Association’s calculations, the relevant capacity adds up to 3,723 MW. GBA also estimates that based on the number of existing and new biogas plants, the surplus, i.e. the increased output which does not affect the generated volume of electricity (flexibility), amounted to around 111 MW, in 2015 (see chart).

The gross electricity produced by biogas plants thus added up to 29.38 terawatt hours (TWh) in 2015, which theoretically could supply 8.4 million households with electricity and avoid a total of 19.0 million tonnes of CO₂. A total of 27.06 TWh of heat is available from these biogas plants, 57% of which is already being used by various heating options. Some 42,000 people were employed in the biogas industry in 2015, including plant operation and construction, export, maintenance, repowering and plant optimisation, generating a turnover of 8.2 billion euros.

At this point, as in previous years it must be noted critically that although the German Renewable Energy Sources Act plant register has taken full effect, the data basis is extremely doubtful and not very reliable. GBA’s estimates had to be verified and adjusted using other sources of data (plant statistics from the German states, network operators’ data) and corresponding assumptions (closures, false reports and reports missing from the plant register). It is to be hoped that credible data will...
Overview of selected industry statistics for Germany

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<th>2014*</th>
<th>2015**</th>
<th>Forecast 2016***</th>
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<tr>
<td>Number of plants</td>
<td>8,731</td>
<td>8,861</td>
<td>9,009</td>
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<td>(of which biogas plants)</td>
<td>(162)</td>
<td>(183)</td>
<td>(193)</td>
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<td>Additional electric output in MW per year (incl. overcapacity and shutdowns)</td>
<td>268</td>
<td>114</td>
<td>142</td>
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<tr>
<td>Additional work-relevant electric output in MW per plant (incl. overcapacity and shutdowns)</td>
<td>116</td>
<td>12</td>
<td>14</td>
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<tr>
<td>Additional electric output through overcapacity in MW per year</td>
<td>162</td>
<td>111</td>
<td>142</td>
</tr>
<tr>
<td>Installed electric output in MW (excluding electricity feed-in from biogas plants)</td>
<td>3,505</td>
<td>4,018</td>
<td>4,166</td>
</tr>
<tr>
<td>Gross electricity production in TWh per year (without overcapacity)</td>
<td>28,58</td>
<td>29,38</td>
<td>29,41</td>
</tr>
<tr>
<td>Households supplied with biogas electricity, in million</td>
<td>8.3</td>
<td>8.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Co₂ savings from biogas, in million tonnes</td>
<td>18.7</td>
<td>19.0</td>
<td>19.1</td>
</tr>
<tr>
<td>Sales volume in bn euros in D</td>
<td>8.4</td>
<td>8.2</td>
<td>8.3</td>
</tr>
<tr>
<td>Jobs</td>
<td>45,000</td>
<td>42,000</td>
<td>43,000</td>
</tr>
</tbody>
</table>

© German Biogas Association  * Own extrapolation based on data from the State authorities/plant register  ** Based on a survey of experts/plant register extrapolation

Figure 2: Trend in plant numbers taking into account installed and workrelevant output in Germany

![Graph showing trend in plant numbers](image)

Sources Act 2017 as well as the tenders for existing and new plants. The Association assumes, however, that interest in small slurry plants will remain around the same level as in 2016. Export business is not expected to be able to fully compensate for German plant manufacturers’ declining business. Instead, there are reports that the negative developments in Germany are leading to critical discussions in other, previously flourishing and expanding biogas markets.

The overall mood of plant designers and manufacturers is poor. In addition to the lack of political will to allocate biogas its special role in the renewable energy system, companies also criticise the increasingly complex legal requirements in terms of energy, licensing, emissions, fertilizer and safety law. These requirements, which have massively increased, are leading to significant cost increases that cannot be compensated for by the fixed feed-in payments.

Finally, it is to be hoped that the Renewable Energy Sources Act 2017 as well as the tenders will open new doors for an efficient development of the biogas industry in Germany and that the German biogas industry’s technological leadership and innovative force will continue.

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be available with the planned introduction of a master market data register.

Forecast for 2016
GBP’s forecast on the industry’s development in 2016 is based on expert surveys as well as extrapolations from the Renewable Energy Sources Act plant register. Thus, a total of 168 new installations is expected, including 150 plants classified as small slurry plants. The remaining 18 plants, consist of biomethane plants, waste fermentation plants and on-site power plants generating more than 75 kW.

The newly constructed plants provide a total installed capacity of 26 MW, of which 14 MW are relevant and 12 MW are surplus as well as flexible capacity. If we add the flexible production by existing plants to this, a total of 142 MW, surplus capacity will then be able to be calculated for 2016. According to this forecast, approximately 9,009 biogas plants were in operation at the end of 2016 and about 4,166 MW of installed electrical capacity were connected to the grid. As in the previous year, compared to the new plants about 20 existing plants were closed down for various reasons (insolvency, termination of business, etc.). According to the Association’s forecasts, this overall very small addition of new plants and relevant output will have very little impact on gross electricity generation (29.41 TWh), net heat production (27.09 TWh), CO₂ savings (19.1 million tonnes) and turnover (8.3 billion euros) as well as jobs (43,000).

Forecast for 2017
At present it is difficult to predict the impact of the new German Renewable Energy
Wood inspection prior the on-site visit

For some years now wooden roof structures of biogas plants have been presenting damage. Beams deformed and came loose from their supports, or broke in two which, amongst other things, has caused the timber ceiling to collapse. It was not possible to completely rule out danger to people working on or in the biogas storage tanks, carrying out inspection or maintenance work on the wooden roof structures, for example, or underneath it. To date there has been no specific advice available on how to proceed when carrying out a safety inspection on the wooden roof structures. The recently published recommendations from the German Biogas Association are intended to provide initial guidance.

By Dr. Johann Müller and Dr. Johannes Welling

So far there has not been a thorough, scientific inspection of the damage sustained. Nevertheless, experts and specialized institutes have concerned themselves with researching the cause and compiled initial explanations on the damage's cause. The broken wood beams generally exhibit short-fibre breaks, as is usual when wood has been attacked by fungus. But there were no indications of a fungal attack, which is why it was necessary to seek other causes.

A relatively low pH value of around three was often determined in the damp wood beams’ breakage zone, which is obviously to be ascribed to the chemical processes occurring in the digester. Very strong-smelling hydrogen sulphide gas (H₂S), which is harmful to the gas motors, is generated in addition to desirable biogas (mostly methane) during microbial fermentation. Thiobacteria are used to convert this harmful gas into harmless elementary sulphur. With its rough surface, the wooden roof structure provides a good habitat for the bacteria. In addition, plywood is often placed over the beams and cotton fleece placed on the wood surface to create another habitat for the microorganisms. With the addition of atmospheric oxygen, the thiobacteria convert the hydrogen sulphide to elementary sulphur, which is deposited on the wood parts. The resulting sulphur layers, which are often several centimetres thick, cause an increasing load on the wooden roof because of their weight. The conversion process also produces sulphuric acid in addition to the elementary sulphur. This penetrates the wet wood through the surface where, over an extended period, it causes changes in the wood, leading to a loss of strength in the structural element.

Dubious static calculations

The relative humidity in biogas digesters is at a constant 100%. Even if the wood used for the roof structure has supposedly been dried beforehand, it exhibits wood moisture which far exceeds the fibre saturation and must therefore be described as wet. The competent DIN Building and Civil Engineering Standards Committee therefore discussed the question of whether measurement of the load-bearing structure in such humid conditions is even covered by the...
technical regulations contained in DIN EN 1995-1-1 (Eurocode 5: Design of Wooden Structures).

To answer this question, the wood component must first be allocated to a utility class (UC) according to DIN EN 1995-1-1. The UCs are chiefly used to allocate strength values for calculating the expected deformation under specified environmental conditions. UC 1 applies for very dry conditions, such as heated living rooms, for example, and so does not require further consideration here. UC 2 is characterised by a moisture content in the construction materials which corresponds to a temperature of 20 degrees Celsius and a relative humidity in the surrounding air which exceeds 85% for just a few weeks per year.

Most softwoods do not exceed an average equilibrium moisture of 20% in utility class 2. UC 3 is not defined by specific climate data; it uses general climate conditions which lead to higher moisture contents than in UC 2. This is primarily conceived for components outdoors subject to direct weathering, but in exceptional cases roofed load-bearing structures can also be classed in UC 3. A range of 12-24% is regarded as a reference value for the equilibrium moisture ensuring in UC 3 wood components. Appropriate modification coefficients were used in static calculations because wood's strength declines as wood moisture increases. In the event of relative humidity of 100% occurring over an extended period and water condensing on the wood surfaces, moisture far exceeding the fibre saturation range (i.e. above 30%) can ensue in softwood. The modification coefficients for UC 3 stipulated in DIN EN 1995-1-1 cannot, however, be used for this. Consequently, static calculations based on these UC 3 values require scrutiny.

This is aggravated by the fact that the usual computing programmes do not take into account the partly extreme wood moisture and the wet wood's resulting high dead weight. The DIN Building and Civil Engineering Standards Committee consequently came to the conclusion that the special conditions which prevail in biogas plants must urgently be taken into consideration and suitability of the planned wooden construction subjected to critical analysis and scrutiny from these points of view.

**Accident prevention**

The Expert Commission on Construction Technique, an institution composed of representatives from the most senior building control authorities in the German states, last year addressed the safety of wooden structures in biogas plants and formulated a sample document to serve as a basis for decrees by the Federal states. The resulting document emphasised the obligation of biogas plant owners and operators to regularly inspect and monitor their wooden structures. It was not possible to infer from the decrees how the inspections are to be carried out; it merely referred to the general "Hinweise für die Überprüfung der Standis-..."
Break pattern from a bending test on a beam from a damaged biogas plant. The short-fibred break indicates changes in the wood’s structure.

For Construction and Transport. The result of the work is a recommendation to review wooden roof structures in biogas storage systems. The recommended action is not a substitute for the static calculation methods which have been previously lacking, but to avoid danger to life and limb of employees or maintenance staff. To protect personnel, it is necessary to prove adequate de facto load-bearing ability, as any weakening in the wood beams is not apparent purely from a visual inspection.

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The recommendation specifically proposes an approximate calculation of the load to be applied in order to check the load-bearing ability of wooden roof structures in gas storage systems, with and without lagging. The test load is to be laid on the wood beams to be walked on before it is set on the roof or digester. The rule of thumb mentioned in the recommendation for calculating the test load is an estimate and is intended to ensure that injury to staff as a result of the roof construction falling can be ruled out to a great extent.

If the maximum burden calculated using this rule of thumb is not sufficient (for example, if there is a blanket of snow, or equipment or components such as tarpaulins, agitators or similar are to be deposited on the timber ceiling), walking on the timber ceiling construction is generally prohibited so long as an individual inspection with suitable safety margins, taking into account the statics, has not been carried out. Such a detailed review of the structural stability of biogas plant wooden roof structures must only be carried out by experts, such as construction engineers or engineers from comparable disciplines, who can prove at least five years’ experience of designing, executing and surveying biogas plant wooden roof structures and who have acquired special knowledge in the field of statics, wood construction and building chemistry.

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Too much electricity in the grid – biogas can take care of it!

Biogas plants have to take on more and more roles. Not only can they gear their production to fluctuating consumption, in future they will have to provide ancillary services to the electricity grid. Plants such as Bioenergie Stoetze are already able to provide control energy to maintain the frequency and reactive power to maintain the voltage when the grid gets out of step.

By Thomas Gaul

In Germany, the expansion of wind and solar energy continues to make giant strides. In near future, these fluctuating energy producers will bear the main burden of electricity production. The expansion of biogas, on the other hand, has practically succumbed as a result of the last two amendments to the German Renewable Energy Sources Act (Erneuerbare Energie Gesetz – EEG 2014 and 2017). This contradictory trend in control and fluctuating electricity production can lead to massive problems in the long term. Biogas plants which are operated flexibly will be able to modify their generation profile to generate electricity when electricity production from wind and solar energy is relatively low, but consumption is relatively high. And otherwise, they are also able to cut back on electricity production if the sun and wind are producing too much electricity and consumption is relatively low. But flexible biogas plants can and must make the most of their advantages in the future, with regard to more than just fluctuations from other energy producers. They will also have the task of safeguarding the electricity grid’s stability through provision of ancillary services. In addition to control energy to maintain the frequency and the provision of reactive power to maintain the voltage.

A pioneer in the far north

The biogas plant in Stoetze is among those which have already turned towards the future of energy. “The electricity grid structure here in north-east Lower Saxony is too weak. The numerous wind farms repeatedly cause overvoltage because the grid is full. We wanted to do something about this,” reports plant operator Michael Borgard. The dedicated farmer and spokesperson for the Council of Plant Operators in Lüneburg Heath within the German Biogas Association is convinced that biogas has an important role to play in the future electricity mix. “We need to show that we can do more than just produce electricity.”

One such role is drawing reactive power from the grid to keep voltage around 21.5 kilovolts (kV). This form of ancillary service is disappearing faster and faster, with
“The engine responds so quickly that it can achieve a control speed of one percent per second”

Michael Borgard

the old power stations which are gradually withdrawing from the grid. Unlike wind and photovoltaics, biogas plants are already able to make an important contribution to grid stability. “We started cooperating with Leipzig energy trader Energy2market (e2m) back in 2012, through the direct marketer German Renewable Energy Federation (Genossenschaft der Grünennergie-Erzeuger – GDeE).” At that time Stoetzte was already producing 300 kilowatts of secondary control power from each of two older motors. After two years of successful direct marketing, real flexibilisation started two years later, with the addition of a 370 kW gas CHP unit from the company 2G.

Things really took off in 2016, when a new Jenbacher CHP unit (412 series) started operating at the plant. The plant’s installed output increased from 6.97 megawatts (MW) to 1.87 MW. Michael Borgard is enthusiastic about the biogas CHP: “The engine responds so quickly that it can achieve a control speed of one percent per second.” This means that if required, the output can be increased by 10 kW in a second. “It is exciting to watch,” says Michael Borgard. And to hear – because although the rapid ramp-up is similar to starting a turbine, it stays remarkably quiet in the machine container. The motor works relatively quietly for 901 kW. At the same time, it meets all the requirements for being part of primary control power. If the motors had five minutes to respond when forming part of secondary control power, being part of primary is more demanding. As the primary control power is supposed to cushion short-term changes in the grid load, the necessary output has to be supplied within 30 seconds. Unlike the secondary control power, the primary control power is not activated by a request from the transmi-
sion system operator (TSO), is to be provided independently and depending on the frequency permanently. A change in the grid frequency requires an immediate response to bring about a rapid modification.

30% of the installed total power should be available as primary control power. At the same time, he explains the significance of it for the plant: “As primary control power always has to be available for the whole of the following week, up to and including Sunday, maintenance has to be planned 14 days in advance.” This is heavily dependent on the TSO’s tender cycle — the primary control power requirement will be put out to tender weekly by the transmission system operator and is currently around 783 MW. Tendering for the primary control power for the whole of the German control block takes place via the Internet platform www.regel-leistung.net. A provider must conclude a framework agreement with the respective TSO, in this case TenneT, in order to take part in the auction. Marketing partners GDGE and e2M have taken this on as Biogas Stoetze cannot cope with this technically or in terms of volume. A supply range which includes positive and negative output is always offered (a minimum of 1 MW is offered). The bids, which the TSO deems most cost effective, are accepted — until the need is met. The output offered must then be maintained for the following week.

But what decided this close cooperation between biogas plant operator, direct marketer and TSO? Ultimately Borgard relies fairly heavily on GDGE and e2M for guidance. “It certainly requires a reasonable amount of trust,” says the operator. But four years of successful cooperation, significant additional financial revenue and a high level of expertise on the direct marketer’s part have welded them together. “We are fully guided by GDGE and from our side we just take care of gas management at the plant.”

But Borgard wanted to do more and so the existing CHP unit has been converted for primary control power and to maintain voltage. Service engineers from manufacturer 2G have also converted their CHP unit to flexible operation. This required not inconsiderable innovative programming, which was successfully implemented. The plant in Stoetze is now fully flexible. Borgard sums up by saying: “We biogas plant operators have to show that we can do more than just produce electricity”.

Cooperation as partners key to success
Borgard’s plant has also carried out pioneering work for direct marketer GDGE. Martin Buchholz, GDGE Chairman, says with satisfaction that in the future at least

“We are fully guided by GDGE and from our side we just take care of gas management at the plant”

Michael Borgard
in the fermenter roofs for a period of 8.5 hours, without the need for the CHP to run. It is possible to adjust the gas volume by "fine tuning", with the addition of trace elements.

Heat for houses and drying hall
The biogas plant doesn't just produce electricity flexibly. It also uses 60% of the heat generated during electricity production. Homes in the villages nearby are supplied via a local heat grid. A large buffer tank has been built at the plant in order to even out operational fluctuations. Also, in order to further improve heat utilisation, a drying hall for agricultural products has just been constructed. The region grows lots of potatoes, so a warehouse with a biogas-powered adsorption refrigerator would make sense. But Michael Borgard demurs: "At present the technology is too expensive." Borgard considers his plant to be equipped for the future with the investment in flexibilisation. This is the only way to earn money ready for when the renewable energy sources payment ends. "We are now in the 11th year and have another nine years of EEG payments ahead." Ulrich Gerigk from e2m is of the opinion that biogas plants will play a bigger role in Electricity Market 2.0 than the politicians have so far granted it. "When coal and nuclear power disappear from the grid, biogas plants will have to be able to do what these plants can." The current trend indicates that he is right – the number of biogas plants that have the same high level of flexibility and are run like Bioenergie Stoetze is steadily increasing. This is a clear sign that operators have recognised the opportunity offered them by the current legislative situation. And it seems hopeful that more and more operators will implement flexible operation in conjunction with their direct marketers. This clearly signals to politicians that biogas can and will make an important contribution to the energy transition.

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Flexible solution for fodder silos

It is a problem familiar to many biogas plant operators – the customary construction method of concrete and asphalt for bunker silos makes it difficult to build a "watertight" structure. The “Flex-Silo” from Schmack, which consists of a surface which is asphalted throughout, with variable wall elements, is a completely new approach. The system has been tried and tested at a biogas plant in Brandenburg.

By Thomas Gaul

The sheer size of the silo plot for the biogas plant in Pessin (Havelland/Brandenburg district) is impressive. But silo stores of up to 12,000 tonnes of silage are required to supply the plant, which has an output of seven megawatts, with substrate. The biogas is converted to biomethane using Schmack Carbotec pressure swing adsorption and fed into the local natural gas grid. The plant is operated by BayWa r.e. and has been feeding into the natural gas grid since 2015. In addition to cattle slurry, the main substrates used are corn, grass and sugar beets, supplied by local farmers.

The innovation can be found at the bottom of the silo plot, still half full at the end of April – edging which, at first glance, is reminiscent of big toy building blocks. They are joined together and surround the bunker silo. Although the edging is only a metre high, the silo can be surrounded by a wall almost ten metres high, as at Pessin. “This is because of the elements’ special geometry,” explains Rüdiger Eckel, Project Developer in Technical Sales for Schmack Biogas GmbH. Together with his colleague, Markus Wolf, he developed the system, known as the “Flex-Silo”, to production-readiness. The innovation received a prize in the “Industry” category at the Biogas Innovation Congress in Osnabrück at the end of April.

“The practical problems of bunker silos are well-known,” says Manfred Wolf. “Many operators of classic bunker silos and A-shaped or I-shaped concrete silos are regular customers of redevelopment firms.” Attempts to make them watertight using coatings or similar are unsuccessful, or only successful in the short term. The construction method alone causes leaks between the concrete modules or the joint between wall and floor.

In the meantime the authorities have also started to take notice, as substances which contaminate water, such as silage effluent, must not escape. The anticipated Regulation on Plants Handling Substances which Contaminate Water (AwSV) will regulate handling of...
substances from biogas plants throughout Germany which contaminate water. This will then include the rainwater which runs off the silos. Under no circumstances will it still be possible to direct this into the dry well. This requirement will also apply to the biogas plant at Pessin.

Building blocks not fixed to the floor area
It therefore quickly became clear to Wolf that “It would be necessary to find a new technical solution in view of the inadequacies in existing bunker silos.” It was the developer’s idea to be able to build silo walls which are as flexible as possible at the plants, using a system of building blocks, as in practice there are great differences in local conditions at the biogas plants. In August 2015 the whole of the silo plot was asphalted to avoid leaks from the outset. As the elements interlock it is not necessary for them to have a footing or to be secured to the floor area. The advantage of this in Pessin was that the bunker silo could be created within a very short time. Once the asphalt works was completed in August 2015 it was possible to start to erect the Flex-Silo blocks immediately.

The blocks are made from recycled HDPE plastic. This material is also used to manufacture vehicle tanks, for example. The material is not prone to corrosion, is acid resistant and the blocks are made using blow moulding. There are two plastic bodies which can be used to build the silo wall – one silo block underneath and one on top. There are two openings in each block. The blocks are filled with concrete on site to ensure the necessary stability. “We first considered using sand or gravel. But we felt the risk of the wall deforming into the silo was too great,” explains Eckel. Assembly can begin as soon as the blocks have been delivered in the container. The blocks are precisely lined up along a chalk line and then filled from a concrete mixer operating laterally.

No concrete pump required
“One big advantage is that we don’t need a concrete pump,” says Rüdiger Eckel. Without further ado they built a special nozzle from the drainpipe in Pessin which, like the spout on a watering can, extended the existing rubble chute on the concrete mixer. The concrete was filled in two stages, so that the bottom layer could harden properly. It only takes one day in warm weather. Unfilled the bottom block weighs around 19 kilograms and the top block 13 kg. When filled with concrete, the weight increases to more than 780 kg and 400 kg respectively. The blocks can also be moved about the biogas plant using the telescopic or wheeled loaders. There are recesses on the bottom of the blocks for the pallet handler. After filling the top silo block is covered and the holders for the sand bags can be affixed to this later. Finally the silo wall has a trapezoid transverse section. The half blocks and corner elements can be erected with any angles desired.

The plumbing work started once the silo boundary had been built using the blocks. In the process the retaining bracket which takes in the rain gutter suspended in front on the one side and has a mounting device for the silo cover on the other, is mounted. The protective grille which sits above it is fixed with a retaining bracket, which at the same time takes in the tie-down strap. The gutters are supplied by a tinsmith. “It is important for the business to also be capable of chamfering sheets of tin that are as long as possible,” points out Rüdiger Eckel. At Pessin the pieces are six metres long – according to Eckel they need to be at least four metres.

Rainwater and effluent are removed separately
The gutter removes the rainwater which runs off the silo plot. It is impossible for the rainwater and effluent to mix, as the gutter is above the effluent discharge. Unlike classic bunker silos, the silo is designed so that the highest point is beneath the silo plot. Silage effluent and contaminated water are guided into a gutter formed in the asphalt with a gradient of up to 3%, which in turn carries the water into a ground-level sump. Beneath this is a concrete pipe, as a sewer overflow which collects the contaminated water. From here it can be pumped away and spread on the fields by liquid manure spreader, or taken to the digestate store. As is apparent, the effluent which accrues is still considerable, even more than six months after silage. A constant trickle flows over the asphalt to the sump. The “driving lines” between the silos are supposed to be cleaned now and again.
The filled bunker silos are to the left and right of the photo. The asphalted floor plot with run-off channel and sump can be seen between the bunker silos. The gutters to left and right, which are affixed to the silo blocks, can also be clearly seen.

Crossover points in straps create anchor point for personal safety equipment

As usual, the silage is then covered with silo sheeting and a protective cage. Another advantage of the Flex-Silo concept is that consideration has been given to safety. The crossover point in the tie-down strap on top of the silage simultaneously provides an anchor point for fall safety equipment which, according to the German Institution for Statutory Accident Insurance and Prevention, is prescribed for working in areas where there is a fall hazard.

With a construction time of not even four months in total, including the floor slab, timely silaging was possible for the first time. A conventional bunker silo could be expected to have a construction time of six to seven months. The issue of costs still remains: depending on the size of the silo and how much work you do yourself, a metre of silo wall, including brackets and gutters, costs 300 to 500 euros, says Rödig- ger Eckel. When making a comparison with conventional silos, it must, however, be considered that the tie-down strap brackets are included and there are no costs for maintaining the joints and concrete.

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CZECH REPUBLIC

Biogas plants close to Temelín Nuclear Power Station

Just over 500 biogas plants are in operation in the Czech Republic. Most digest energy crops. Manure and slurry are hardly used due to the decline in animal husbandry. Very few new plants are being built. By 2040 renewables are supposed to account for at least a 20% share (in 2013 it was 13%).

By Martina Bräsel, Dipl.-Ing, Dipl.-Journ.

The town of Týn nad Vltavou in Southern Bohemia is very special from the point of view of Czech energy supply. It is very close to the contentious atomic power station at Temelín, meeting around one-fifth of Czech electricity consumption. Five villages which all lay within a two-kilometre barrier zone around the NPS were demolished in 1980 because of it. The majority of the inhabitants were relocated to Týn nad Vltavou.

Here, though, there are also good basic approaches to renewable energies and three biogas plants. The two plants of Jarošovice I (526 kW) and II (635 kW) digesting energy crops are close together and there is also a 300 kW compost plant in the immediate vicinity. This plant density is unusual for the Czech Republic. “The Jarošovice I plant was built in 2010, followed by expansion to Jarošovice II in 2011,” recalls Hendrik van der Tol, managing director of EnviTec Biogas Central Europe s.r.o. – at that time the company covered the entire value creation chain for biogas production, which included design, turnkey construction and commissioning.

Marked decline in cattle farming
The customer for both plants was František Janovský. In fact Janovský owns a small farm in Dobšice, located in the region of southern Moravia. This was where Jarošovice I was first supposed to be built. The investor changed locations because there were too many dissenting voices in his home village. He bought an old school site, far from the town centre, in Týn nad Vltavou. “There are very few settlements here,” he says, “so no-one complains.” In addition the energy farmer manages 1,300 hectares of agricultural land near the plant. This supplies the necessary input material – the digester uses 65 tonnes of feedstock daily for biogas production. The main input materials are renewable raw materials such as corn and grass silage. Manure and slurry are not used, as the country has seen a big decline in animal husbandry: there is only the occasional pig or beef farm, according to van der Tol.

There are various reasons for this: the sanctions against Russia caused overproduction of milk, so the prices for dairy products fell. Also the milk quotas were lifted in
April 2015. For the first time in 30 years, European countries were able to produce as much milk as they wanted. “The western countries had prepared for this with investment,” according to van der Tol. This wave of modernisation passed many Czech farmers by, so they are no longer competitive.

**Financing problems**
At the time the costs for Jaroslavice amounted to 74 million Czech koruna, in other words 2.7 million euros. The investor needed another 2 million euros for plant 2. Initially it was difficult to find financing because the first construction project took place during a period of economic crisis. “At first the banks would not lend to me,” says Janovsky. He finally obtained the money from alternative financiers at high rates of interest. He was only able to switch after two years, once the bank was convinced of the investment.

The plant operator receives a payment for 15 years. According to the Czech “Green Bonus System”, he receives a total annual bonus of 4,120 CZK/kWh, which corresponds to around 0.164 euros/kWh (2007 to 2011). The payment is for combined electricity and heat production and for heating third-party buildings. “The payment fell to 3.55 CZK/kWh (2012 to 2013) for plants built later,” reports Envitec’s managing director.

**Special feature: using waste heat**
In addition to the payment the farmer also receives income from the biogas plant’s waste heat. He uses it to dry cereal crops. “That’s not common here either,” says van der Tol. Around 1.1 megawatts of heat is generated. Around 10% is used in winter to heat the farmhouse. From July to September, on the other hand, all the heat is used to dry corn and wheat.

The drying plant turns over a total of 3,000 tonnes (July to September). Every two hours the material’s humidity reduces by around two percent at a temperature of 30 degrees. The plant comprises a total of six vessels. The large storage vessels each have a capacity of 1,500 tonnes, the small vessels each hold around 1,000 tonnes. Another three small vessels are soon to be added because the plant is well used.

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The biogas boom

“Green energy and German know-how were a perfect combination in the Czech biogas plant market until 2014,” explains chairman of the Board of EnviTec, Olaf von Lehmden. From 2006 the government development programme created a positive investment climate for biogas plant builders. There was a massive boost in construction, especially in 2010 to 2012. EnviTec was part of this from the very start. After it entered the market in 2006, the Lower Saxony biogas plant builder constructed a total of 27 biogas plants in the Czech Republic, with a total electric output of 16.5 megawatts (MW).

According to the Czech Biogas Association, at the end of 2015 there were 507 biogas plants in the country, with an electric power rating of 358 MW. The biogas is mostly used to produce electricity, because there are no feed-in regulations for biomethane processing and feed in to the natural gas network.

As early as 2013, because of government assistance, the Czech Republic met the EU’s requirements for the proportion of renewable energy sources. According to the Czech energy regulation authority (ERU), in 2013 more than 13% of domestic electricity consumption originates from hydroelectric power, photovoltaics, wind turbines, biogas and biomass plants. In fact the Czech Republic was not supposed to meet these targets until 2020. In addition, the Czech legistlator wanted to curb the effects of renewable energies funding on the price of electricity.

The government withdrew renewable energies funding in 2013 after the climate targets were achieved.

Top marks for sustainability

Very few plants have been built since 2013. “To us this wasn’t a reason to bury our heads in the sand,” asserts Hendrik van der Tol, “the majority of our plant customers rely on our service expertise.” The services provided by the technical and biological departments are in particular demand. In addition to eight customer service employees in the Velké Meziříčí sales office, another five EnviTec professionals ensure that the services offered are delivered speedily and to the customer’s complete satisfaction.

The original spare parts stored on site facilitate prompt repairs to and short downtimes for the plants. “Whilst most plant builders have withdrawn from the market, we are winning because of our longevity,” continues van der Tol. EnviTec has therefore been proving its reliability and its high quality standards for a decade.

Funding for heat from biogas

In 2015 the Czech government revised the law on funded energy sources. There continued to be no funding for electricity produced from renewable energy sources (excluding hydroelectricities) and the tax exemption for green electricity was repealed with effect from 2016. But small renewable energy plants with a capacity of less than 10 kilowatts electrical output were exempted from the obligation to obtain a licence. In addition, funding was introduced for biogas plants with a maximum capacity of 500 kW, which use their waste heat via a heat grid.

The Czech Republic notified the EU Commission of these plans in October 2015. The EU approved them in August 2016. The plants for which funding is available will generate heat by burning biogas, at least 70% of which is obtained from animal by-products, manure or biodegradable waste. The total funding for the campaign amounts to CZK 522 million (around 19 million euros).

“Unfortunately, only use of heat is funded, not electricity generation,” according to van der Tol. This new
incentive is insufficient for investment in new plants. “But it is more important that the EU Commission has thereby upheld the existing regulation, which applies to all current plants.” This is good news and a great relief to all biogas plant owners. The Czech Republic continues to have great potential for biogas; the Czech Biogas Association estimates it at around 800 plants.

Long-term goals
In addition, the government passed a new, long-term energy strategy. According to the energy plan, renewable energies’ share of gross electricity production is supposed to rise, despite little government funding. By 2040, renewables are supposed to account for at least a 20% share (in 2013 it was 13%). Until then, the Ministry of Industry and Trade is anticipating a new build with 3,200 MW solar capacity, 1,000 MW output from new wind farms and more than 500 MW from more biomass power plants.

It is as yet unclear how expansion of renewables will be financed following abolition of the feed-in payments in 2013. The energy strategy provides for examination of various long-term options (tax relief, net metering and tendering models). The remaining electricity is to come from coal-fired, gas-fired and nuclear power stations. The government also wants to increase nuclear energy’s share of the Czech Republic’s energy mix from 35% at the start of 2015 to 50% in 2040. “Expansion of the Temelín and Dukovany nuclear energy plants is under discussion,” says van der Tol.

There was even provision for the construction of two new nuclear reactors in Temelín by 2025. But amongst the Czech population there are more and more voices speaking out against this technology. And there have been repeated protests in Germany and Austria against the NPS in Temelín since the first chain reaction in December 2000. Environmental protectionists regard the nuclear power station, which is just 60 kilometres from the Bavarian border, as failure-prone and dangerous. Yet the chairman of EnviTec’s board is optimistic despite this energy strategy, market stagnation and the withdrawal of many competitors. “Green energy and the agricultural industry are two of the most stable global factors for economic growth,” according to Olaf von Lehmden, and green energy source biogas is a combination of both.

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The art of downsizing

ÖKOBIT GmbH, from Föhren, designs and constructs big, technically sophisticated biogas plants. Three years ago the company developed a plant which will fit into any garden. How did it come about and who will benefit from this compact plant?

By Claudia Lohmann

To begin with it was sort of a bet. In 2012 Christoph Spurk, co-founder and managing director of ÖKOBIT GmbH, wanted to convince his engineering colleagues that it was possible to develop a simple and cheap biogas plant with a few basic components. The internal discussion was triggered by modification of Germany’s Renewable Energy Sources Act (EEG) in the same year, which promoted 75 kW plants. It quickly became clear to everyone at ÖKOBIT that to be economic, the much smaller slurry and manure plants would have to be technologically adapted.

But what quality of components is actually indispensable for an efficient, low-tech biogas plant? Spurk, who is himself a qualified utility engineer, waste expert and has been in the high-tech industry with ÖKOBIT for 16 years, decided to go back to technological basics. Whilst his colleagues concentrated on plant development compliant with the German Renewable Energy Sources Act, the company boss started to conduct research in his spare time. He wasn’t bothered about developing alternatives to the 75kW plant.

As an experienced biogas professional, Spurk knew that the basic principle behind generating methane from organic waste is several thousand years old. He also knew that functioning mini-plants operate in India and Nepal, to a greater or lesser extent. Spurk discovered why none of the three current plant types has been successful: there are problems with corrosion and therefore loss of gases and fluctuations in gas pressure. The existing solutions are sub-optimal due to high material costs, and the high cost of transport and maintenance. Also the need to dilute the feedstock generates a need for water that is hardly environmentally friendly and, in some places, impossible. Above all, sink layers in the fermenter represent a functional problem and considerably reduce gas yield.

The outcome of his research was that future mini ÖKOBIT plants must be easy to transport, erect and operate. They must experience as little wear as possible and a mixer aggregate is an essential part of a efficient plant that runs well. In a nutshell, Spurk wanted to equip his mini plants with simple components which, if possible, should be available anywhere in the world. He found the model for his mixer aggregate in a museum in Trier.

Test in his own garden

Most of the components in a patented B whimethan (from “home” and “methane”) mini biogas plant, as it is known, are available from any do-it-yourself store, including the safety equipment. Only the fermenter bag is a special solution from ÖKOBIT GmbH. In spring 2013 it was time for a test and Christoph Spurk set up a prototype plant in his own garden. A pit was dug and lined with the special film. The earth fermenter created in this way was fed with grass cuttings. As May, when it was installed, was relatively cool, “harvesting” of the gas did not start until June. Spurk recalls that
“One evening my daughter came into the kitchen from the garden and said “We’ve got gas!”.” ÖKOBIT made contact with Colácteos, an agricultural cooperative in Pasto, Narino region, Colombia, through the mediation of RLP AgroScience GmbH, a German non-profit company in Rhineland-Palatinate. Colácteos was very interested in Homethan, because it hoped that with it, it would be possible to solve several of the region’s problems at the same time. Up to that point, the farmers had been reliant on energy imports. Local capital went towards buying expensive fossil fuels, such as liquid gas or diesel, and fertilisers. At the same time the forests of Páramo la Paja Blanca were coming under attack from the need for firewood for heating. On the other hand, considerable biomass potential was being wasted, which also caused environmental problems, as the farm workers simply dumped the animal slurry in the surrounding area. There was no such thing as waste management.

Transfer of technology and knowledge
There was an urgent need for change in Narino. A two-year project, supported by DeveloPPP (funded by the German Federal Ministry of Economic Cooperation and Development and executed by sequa gGmbH), was developed in conjunction with the Colombian vocational education institution SENA in the region of Narino. Know-how transfer was key to the project implemented between 2014 and 2016 in addition to installation and commissioning of several Homethan plants. Together with SENA, for three days ÖKOBIT provided ten teachers with theoretical and practical instruction on site as part of a train-the-trainer biogas tutorial. These later passed on their knowledge to their trainees, because the idea is that local experts should be able to independently set up, operate and maintain the mini plants as quickly as possible.

Biogas production at 3,000 metres above sea level
Homethan’s operation is exclusively mechanical and requires sunlight for the substrate inside the earth fermenter to heat up. The stable biological process of methane production commences when the fermenter temperature reaches 22 degrees Celsius. Of the ten plants installed between 2014 and 2016, one was set up at Centro Agroindustrial y Pesquero, SENA’s training centre in Pasto, which is located at sea level. The remaining nine plants have been set up by trained colleagues at agricultural businesses at 2,600 to 3,300 metres above sea level. Homethan had to be adapted to conditions in the Andes, because the temperatures at these altitudes are not sufficient for continuous gas production. But Christoph Spurk had also prepared for this, with a winter ver-
Picture on the top of the page: View over the Farm Chambard on 3,266 metres above sea level close to Pasto, District of Nariño.

Course participants are trained in biogas production.

In the Nariño region, ÖKOBIT installed the first HiMe-than biogas plant in Pasto and is supporting three more projects. The cooperation took over installation from the second plant. Two of the three plants have been installed and commissioned by trainees. The desired know-how transfer was successful. And freedom from construction materials and components from Germany was also achieved, as planned; only the special sheet to cover the pit was imported from Führen.

The ten HiMethan plants have been adapted to their respective sites. Like all ÖKOBIT biogas plants, the new mini plant is designed to be flexible in the use of different feedstock. This means it can use manure, organic waste and even agricultural waste which, to European eyes, is exotic, such as coffee bean husks.

Great benefit to small businesses

The advantages for Colombian agricultural businesses are obvious, as it is clear from the example of a dairy business: HiMethan produces five cubic metres of biogas per day when fed with 200 kilograms of slurry. This

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corresponds to around 75 kilograms of liquid gas per month, or 90 litres of diesel. The gas is mainly used for cooking (up to 10 hours per day), or to heat water for washing and cleaning. In addition the dairy farmer can produce around 200 kilograms of organic fertiliser every day.

An average farm in the cooperative comprises four to five hectares of land for grazing and cereal cultivation, plus a vegetable and ornamental garden. The fermentation residue does not require further treatment before being used as fertiliser on these areas. This has been highly successful. “Our grazing land is much greener and the grass roots are longer and stronger. And the palomille de la papa (South American tomato leaf miner) has disappeared,” says Jorge Meneses, member of the Coleccio cooperative, of the improvements at his farm La Pradera, at an altitude of 3,255 metres.

The problems which ensued from unregulated disposal of slurry, such as the smell, have also been resolved. Alberto Quintana is also a member of the Coleccio cooperative and runs the El Imacal farm at 3,013 metres. He reports two other benefits: “Since we use biogas instead of wood the smell in the kitchen has disappeared and we are now no longer dependent on the gas supply. I have also used the organic fertiliser for grass, cereal crops, vegetables and fruit. The yields are similar to those for mineral fertilisers. This has simply completed the cycle.”

Initial resistance overcome

As a result of savings on LPG and fertiliser, the project’s amortisation period for a HoMethan plant averaged 18 months. Project manager Montserrat Lluch Queva says that it was a comparatively short route to all these remarkable results in technological terms, but somewhat lengthier culturally: “The first challenge was integrating our technology into the agricultural process and winning over the local people.” The farm workers initially balked at controlled collection of manure and slurry. The ice was not broken until the first HoMethan plant supplied gas. From then on all those involved were enthusiastic. “For ÖKOBIT it’s also about the mission,” explains Christoph Saurk, “Mini plants are a good way to increase awareness of the enormous benefits of biogas plants in developing and emerging countries. We hope that in this way we will be able to access new markets in future for our high-tech solutions too.”

A follow-up project in Colombia has already been agreed. A sustainable home, including biogas plant, will be erected in conjunction with SENA.

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SOUTH TYROL

63 farmers in Wipptal producing biogas

Excessive nitrate loads caused Wipptal farmers to come up with an idea. A biogas plant should convert manure and slurry into electricity, heat and fertiliser. But the green economy project hasn't had unreserved support.

By Martina Bräsel, Dipl.-Ing., Dipl.-Journ.

After numerous setbacks the Wipptal biogas plant in South Tyrol was finally able to go into service last May. 65,000 tonnes of manure and slurry per year are to be converted into electricity, heat and fertiliser according to the “Green Economy” project. According to the project manager, the plant is “unique in Europe”. Helmut Döhler deplores that “In essence it’s an environmental protection project, but unfortunately not everyone sees it that way.” As far as he is concerned, there is a need to suitably process for the region’s farm manure: “Otherwise, it harms not only the environment,” he says, as the smell also impairs the population’s quality of life and harms tourism. The project manager explains the background: “There are around 380 dairy cattle farms in the Wipptal villages.” Milk production and production intensity have steadily been increasing in recent years. The farmers now keep around 11,100 adult cows on 4,800 hectares of productive land, which produce 42 million kilograms of milk per annum. In total, the region’s dairy farms produce around 600,000 kilograms of farmyard manure.

Italy fussy about groundwater quality
The manure and slurry from some 5,000 cows are a problem, as there is not enough space to spread it. The permitted nitrate levels are exceeded with increasing frequency because around half of the fields are also steep and difficult to farm. The EU limit for ground- and drinking water is 50 milligrams per litre (mg/L), WHO recommends 20 mg/L. “Compliance with the benchmarks is more strictly controlled in Italy than in Germany,” says the expert. According to Döhler, implementation of the EU regulation comes under the German Fertiliser Ordinance, with violations being penalised under regulatory law. This has consequences – the EU Commission is suing before the Court of Justice of the European Union as ground water at many measuring sites in Germany exceeds the benchmark of 50 mg/L. “In Italy, on the other hand, environmental law applies; if the benchmarks are exceeded this entails criminal prosecution,” says the project engineer. Even prison sentences are possible.

Solution: biogas plants with fertiliser production
To date there have only been three options for individual farms. “Of course the herd
of cows can be reduced, but that endangers many farms' economic survival," reports farmer Josef Mayr. It is also difficult to lease new agricultural land, so the only other option is to transport manure and slurry over long distances to other regions. Out of this need farmer Josef Mayr and agricultural engineer Helmut Döhler developed the idea, back in 2004, of making profitable use of the nutrients. A biogas plant seemed to be the best solution to the problem. It can convert the surplus manure from local farms into sustainable electricity and, thanks to the heat generated, the fermentation residue is turned into an easily transportable, natural fertiliser.

Biogas Wippatal GMbH was founded in 2008 because other Wippatal farmers were also enthusiastic about the concept. 63 farmers are now members of the limited company. Other farmers in the region can join as well, as the plant still has one third free capacity. Some farmers only supply manure to the plant. "Our catchment area covers the region, with a radius of about 15 kilometres," according to Josef Mayr. The biogas plant processes about 220 tonnes of manure and slurry every day, generating an output of one megawatt. The plant produces around 22,500 kilowatt hours of electricity and roughly the same in heat per day. The waste heat is fed into the drying plant. Some 4,500 adult cows supply the 65,000 tonnes of slurry and manure to be fermented annually. About 60,000 tonnes of fermentation residue remain. Half of this amount is returned to the farmers to fertilise their own pastures and fields. The rest is processed to create fertiliser for sale.

**Accompanying university research**

The Tramin Winery Cooperative, the Free University of Bolzano and the University of Turin have also partnered with the farmers. The Free University of Bolzano takes care of fertiliser production and tests the effect of the nutrients on various plants. The organic, mineral fertiliser is destined to provide the state's orchards and vineyards with nutrients. The Tramin Winery also wants to avoid industrial fertilisers and pesticides as much as possible and instead use natural products for its wines.

"Our fertilisers would be a good alternative to spreading slurry in 'NATURA 2000' areas," notes Döhler. These protected areas are supposed to secure long-term biodiversity within the European Union. There is a pan-European network for maintaining endangered or typical habitats and species. In South Tyrol a ban on slurry fertiliser is being promoted for those areas.

The University of Turin is responsible for the technical aspects of the manufacturing process and determines the environmental impact. "On the one hand we are cutting carbon dioxide through green energy production and replacing industrial fertiliser, on the other we have transportation to the plant," explains Döhler. On the site itself, traffic management is designed in such a way, that there is as little traffic as possible.

**Manure is moved by crane**

"For safety reasons, the lorries only drive forwards when delivering the slurry," explains the project manager. Loading and unloading takes place on a waterproof plot with controlled outflow, so contamination can be immediately remedied. "And because wheeled and telescopic loaders are very hazardous for workers, all the work in the building is carried out by a gantry crane," according to Döhler. The plant is complete and biogas production has been running full since June 2016. Only the hall in which fermentation residue processing and fertiliser production is housed looked last summer really empty. Now the fermentation residues are separated into its solid and liquid components. Topically the fertiliser production plant works under full load.

The solids which, in the first stage of development, will comprise around 7,000 tonnes per year, are then turned into fertiliser using a belt dryer. At full capacity the almost 40-metre long belt dryer can process around 15,000 tonnes per year. The liquid components, on the other hand, are processed using wastewater treatment.

"We want to feed some 50% of the fermentation residue into the River Eisack as treated water," reports Döhler. The remaining liquids could be sprayed as concentrated nutrient solutions onto the soils, as required.

**Local community complained about the plant**

Until completion, the plant will have cost around 12 million euros. The EU is contributing 1.9 million euros as the project "is
63 farmers are now members of Biogas Wippatal GmbH. Josef Mayer (left) and Josef Pfanzner (center) are two of them. Holmut Döhler is the project manager and assists the group as a technical consultant.

Receiving vessel for slurry, the filling station with fixed filling nozzles and the floor slab in front.

contributes to development and implementation of the EU’s environmental policy and environmental law.” The construction is also supported by the Italian Ministry of Environment and leading Italian environmental associations, but not everyone was enthusiastic about the project: “The plant is located in the parish of Pfitsch, but adjoins the parish of Sterzing,” explains Döhler. Sterzing filed several court actions and tried to stop the project. Above all they feared that smell would be a problem. “Slurry and manure hardly come into contact with the air at the plant,” reports the project manager. When slurry is spread for months on the fields the res

Visual and technical highlight

The hoped-for cooperation with the neighbouring Wippatal Thermo heating plant also proved to be problematic. “Our original thought was that we would dry the fertiliser in summer and use the heating plant’s waste heat for this,” says Döhler, as Thermo Wippatal supplies 933 properties (as of 2015) with some 57,000 megawatt hours of energy for heating, generated from wood waste. The district heating plant supplies several hotels and heats the feed to 100 degrees Celsius for hygiene regions, as otherwise there is a risk of legionella. In summer, the return flow is often still at 90 degrees. “On the other hand, in winter, they need additional heating oil,” explains Döhler, in which case the biogas plant could have supplied the necessary heating. Unfortunately it has not been possible to achieve a cooperation so far, but the project engineer is optimistic that in time things will calm down. “Not only is our plant a Green Economy project, it is also a visual and technical highlight,” says Döhler. It is still lacking the final touch, as the buildings are not yet rendered, but even now wooden walls and stairs make a very pleasant impression. “The overall image is harmonious, cement and wood are synonymous with South Tyrol, which is why there are no metal walls,” says the project manager. No doubt cleanliness is also exemplary. This is why the community hopes that the critics will actually visit the site to gain a first-hand impression of the plant. “We would be delighted and remain open to further dialogue,” according to Döhler.
Small and community-sized biogas plants — the energy solution for rural India

By Abhijeet Mukherjee, Project Coordinator, IBA

The encouraging aspects of biogas rely on its globally distributed production and on the environmental benefits of avoiding large scale methane and carbon dioxide release into the atmosphere, while using bio-methane as a substitute for conventional fuels and to supplement other renewable sources of energy. In recent times, India has brought innovation to biogas by exploring new and unique feed options, such as rotten potatoes, vegetable waste, fruit waste, rotten grains and agricultural waste. In contrast to the international approach, energy crop-based biogas plants are still unpopular, which is mainly attributed to avoidance of the food versus fuel security debate. In effect, in India biogas primarily comes through the “waste to energy” route. Small and community-sized biogas plants are a common sight in rural India. According to the latest survey, the estimated potential for annual biogas generation is about 18.240 million cubic metres, based on the availability of cattle dung from about 310 million cattle in India. As per the latest MNRE (Ministry of New and Renewable Energy) estimate, about 4.9 million family-type biogas plants have already been installed, compared with the potential for 12 million biogas plants in the country, which is a mere 39 percent of potential biogas plants, based on cattle dung alone. MNRE has already set a target of 1,000,000 biogas plants for the current financial year. Such plants are mainly based on cattle dung as their primary substrate. Nevertheless, in recent times MNRE has taken several positive steps towards promoting multi-feedstock-based biogas plants too. India mainly adopts a three-tiered hierarchical approach, linking central and state government with private parties to deliver biogas to the rural masses through small-scale and community-based plants. In other words, the biogas programmes for achieving a certain target in a year, like that mentioned above, are devised by the central ministry (MNRE) and implemented through the state nodal agencies. These agencies, in turn, mobilize participation of state-level machinery, local institutions, non-government organisations (NGOs) and village-level organisations to implement these programmes. A lot of social issues have been perceived, leading to improper functioning of such small-scale/community plants. Several social engineering models, like “gobar” (Hindi word for dung) banks and animal hostels have been developed and are tailored to Indian conditions to ensure a smooth supply chain and sustainability of such projects. The gobar bank involves villagers collecting cattle dung, depositing it in a virtual bank (the collection area) where deposits are weighed and recorded in a passbook, as for a bank account. The dung collected from the villagers is fed to the digester and the biogas generated is distributed to the villagers through the pipeline, with the help of the gas pressure regulator system. Net payment is made to the villagers on a monthly basis, for the cost of the deposited dung minus the cost of biogas used for cooking and manure for farming. Biogas is not only a sustainable source of energy, employment, healthy lifestyle, and organic farming for India’s rural population, but also contributes to empowering women by alleviating gender discrimination issues.
BRAZIL

Biogas works!

DeveloPPP.de Biogas Lab Automation and Gas Analysis (“BILAGAB”) Project in Brazil.

By Christian Etzkorn

A

wite Bioenergie GmbH, based in Langenbach in Germany, has started a long-term project in Brazil to facilitate entry into this promising market with a sustainable concept that includes the foundation of a local subsidiary company. The project is supported by the DeveloPPP.de programme of the German Federal Ministry for Economic Cooperation and Development (BMZ), accompanied and coordinated by Sequa gGmbH.

The activities include technology transfer and installation of a gas analyser, automation and desulphurisation technology at important reference sites, and providing a platform for exchanges between future experts in the use of the technology as well as their training. The project represents an approach towards increasing the acceptance of biogas technology by showing working productive scale plants and by improving the local infrastructure in terms of technology and knowledge.

The cooperation partners are the department of swine and poultry from the Brazilian agricultural research institute EMBRAPA (Embrapa Suínos e Aves), the Federal University of Santa Catarina (UFCS) and the Brazilian companies CHP Brasil and AUMA Agronegócios. Further universities and education institutions (UNIVATES and IFF Itaperuna) are also involved via participation in courses and workshops and by validating the project results.

A modular course concept for educating future Brazilian biogas specialists and employees in the sector is being conducted as part of the project. The modularity allows development of technically detailed and specific material and at the same time creates an opportunity to address participants from a wide range of careers in the biogas sector, who have different demands with regard to the technological or economic aspects. In this way, existing courses and structures can be retained and expanded to include new parts, topics and experiences from Europe and other parts of the world that are not currently offered in Brazil.

The laboratory at Embrapa Suínos e Aves will be equipped with Awite’s fully automated laboratory gas analyser system, which has been designed for academic and non-academic training approaches. Furthermore, an existing biogas plant will be equipped with an automatic gas analyser and desulphurisation solution. The plant is located at a commercial farm in the state of Santa Catarina, consisting of one fully mixed (European-type) fermenter and two covered lagoons.

Finally, an existing biogas plant in the state of Minas Gerais, treating manure from more than 15,000 pigs, will receive a fully automated information and control system, equipped with sophisticated remote control functionalities. Combined with a mobile education and demonstration system, these measures are intended to provide the participating universities and educational institutions with the necessary technology and material to provide detailed state-of-the-art training courses.

Biogas technology in Brazil has had many bad experiences in the past, where cheap and extremely simplified biogas plants were constructed in large numbers to benefit from the trade of carbon credits. Many plants built during that time have only been in operation for a short period of time as a result of design faults, construction errors, and in particular due to the lack of experienced operators with knowledge of how to address problems in the biogas process. Therefore, although there is an enormous and indisputable potential for biogas in Brazil, the sector still suffers from a lack of good and functioning examples, trust and technology and a low number of available experts.

The BILAGAB project welcomes enquiries from any public and private institutions and companies, schools and universities as well as private individuals, to participate in courses and workshops, exchange ideas and make the best possible use of the project activities.

More information is available on the project homepage (www.cursosdebiogas.com.br) or by contacting Awite in Germany or Brazil.

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