Legislation in different European countries regarding implementation of anaerobic digestion

Åke Nordberg
Swedish Institute of Agricultural Engineering, PO Box 7033, SE-750 07 Uppsala, SWEDEN
ake.nordberg@jti.slu.se

SUMMARY

- Legislation covering agricultural, environmental and energy issues affect the implementation of anaerobic digestion.

- Subsidies, reduced interest on bank loans and higher sale price for electricity have clearly created incentives for building new plants in countries such as Denmark, Germany and Austria.

- In many countries there is a lack of appropriate legislation regarding the limit values of heavy metals in digestate. Therefore, regulations such as the waste, nitrate, fertiliser and sewage sludge directives have a potential impact on the use of digestate as organic fertiliser.

- Legislation on pathogen control in connection with the use of digestate as fertilisers on arable land was first developed in Denmark with other countries following Denmark’s lead.

HIGHLIGHTS

- Survey of policies on renewable energy with impact on biogas implementation for 12 different EU-countries.

- Comprehensive table on limit concentrations of heavy metals in sewage sludge (mg/kg ts) for application on farm land according to regulations in different countries

- Comprehensive table on limit concentrations of heavy metals in compost (mg/kg ts) for application on farm land according to regulations in different countries

- CEN- and national legislation for Austria and Italy regarding planning and construction safety for biogas plants
Contents

Summary and conclusions ........................................................................................................3

Introduction .........................................................................................................................4

Renewable energy and greenhouse gases .................................................................4
  Austria ..........................................................................................................................5
  Belgium .......................................................................................................................5
  Denmark ......................................................................................................................6
  Germany ......................................................................................................................6
  Greece .........................................................................................................................6
  Ireland ..........................................................................................................................7
  Italy .............................................................................................................................7
  The Netherlands ..........................................................................................................8
  Norway .......................................................................................................................8
  Portugal ......................................................................................................................8
  Sweden .......................................................................................................................8
  UK ..............................................................................................................................9

Environmental aspects on digestate management ......................................................9
  Heavy metals ...........................................................................................................10
    Sewage sludge .....................................................................................................10
    Compost ..............................................................................................................13
  Nutrients ..................................................................................................................14

Hygienic aspects of digestate management ..............................................................14

Planning and construction safety ..........................................................................14
  CEN ..........................................................................................................................14
  Austria ......................................................................................................................15
  Italy ...........................................................................................................................16

Acknowledgements ......................................................................................................18

References ......................................................................................................................18
Summary and conclusions

The objective of this paper is to give examples of legislation and policies on an EU-level, as well as in different European countries, which have an impact on the development and implementation of anaerobic digestion. This survey focuses on legislation and policies regarding renewable energy and greenhouse gases, heavy metal and nutrient load on arable land. In addition, pathogen control and some national rules regarding planning and construction security are briefly presented. Most of the information given in this paper was provided by the participants of AD-NETT, unless otherwise stated. However, changes can rapidly occur in legislation related to organic wastes, so it is important that the reader checks the current situation before acting on any of the information provided in this survey.

Legislation covering agricultural, environmental and energy issues all affect the implementation of anaerobic digestion. This is mainly as a result of many different positive qualities with anaerobic digestion.

Among the European countries there is a strong political tendency to support renewable energy, especially after the Kyoto agreement. Most countries are interested in using biogas for combined heat- and power (CHP) production in order to increase the supply of “green” electricity. However, in Sweden, there is a strong interest in using biogas for vehicle fuel, due to the relative low prices on electricity and heat. In countries such as Denmark, Germany and Austria, the investors in anaerobic technology receive investment subsidies (up to 40%), a higher sale price for electricity (up to 80% of the consumer price) and reduced interest on bank loans (up to 4% units). This has clearly created incentives for building new plants and in Germany have nearly 250 small-scale biogas plants have been constructed during the last 3-4 years.

Contaminants such as heavy metals or organic pollutants, which occur in association with the nutrient rich waste, represent a hazard for human and animal welfare as well as the sustainable use of arable land. In general, in many countries there is a lack of appropriate legislation regarding limit values of heavy metals in digestate derived from organic waste. However, there is a significant amount of regulation such as the waste, nitrate, fertiliser and sewage sludge directives that potentially have an impact on the use of these products. For further implementation of biogas technology it is important that digestate will receive the same attention as sewage sludge or compost has received regarding use as organic fertiliser.

In connection with the use of biological wastes as fertilisers on arable land, there is a risk that new diseases can be introduced to an area or a county. The concern for human and animal welfare has therefore in some countries led to legislation regarding pathogen control, which affects the design and construction on biogas plants depending on the type of feed-stock used. Denmark was a “pioneer” country, with regulations since 1989. In countries, such as Germany, Austria and Sweden where legislation is rather new, knowledge and experience from Denmark has been used in creating their own regulations. As a general rule the digestate is pasteurised (70 °C; 1 h), but also alternative combinations of time and temperature, such as 55 °C for 5.5 hours for thermophilic digestion, are applied.
Introduction

Anaerobic digestion of agro-industrial waste facilitates ecological sustainable development and offers several benefits: it is a waste treatment technology which provides renewable energy, thus reducing CO₂ emissions; it facilitates recirculation of nutrients and improves the fertilising quality of manure by increasing the ammonia content and decreasing the carbon content.

The Kyoto protocol on reducing CO₂ emissions has led to government actions that support the development and implementation of technologies for renewable energy sources (RES) in many European countries. In some countries, the governments have introduced investment subsidies or fiscal instruments as incentives for investors in biogas technology. As a result, the interest for anaerobic digestion has been focused on technical solutions in order to supply RES. However, if an ecological sustainable development should be favoured, it is important that the digested residue can be utilised as an organic fertiliser or soil conditioner. The digestate must therefore be considered to be safe environmentally and in respect to hygiene.

Due to the different issues relevant to anaerobic digestion, legislation covering agricultural, environmental and energy aspects will affect its implementation. Legislation may in some cases, due to specific addressed actions, support the implementation. However, in other cases the lack of appropriate regulations may be a hurdle leaving unclear responsibility and rigid bureaucracy. Across the EU there are many different strategies for supporting the development and implementation of renewable energy as well as solving agricultural and environmental problems. These have advanced at different paces in each country.

The objective of this paper is to give examples of legislation and policies in different European countries, which have an impact on the development and implementation of anaerobic digestion. This survey is focused on legislation and policies regarding renewable energy and greenhouse gases, heavy metal and nutrient load on arable land. In addition, pathogen control and some national rules regarding planning and construction security are briefly presented. Most of the information in this paper has been provided by the participants of the AD-NETT, unless otherwise stated. Due to changes that can rapidly occur in legislation relevant to organic wastes, it is important that the reader checks the current situation before acting on any of the information provided in this survey.

Renewable energy and greenhouse gases

The major argument for increasing the use of renewable energy is a concern for our common environment, particularly for how greenhouse gases such as carbon dioxide, emitted by fossil fuels, may influence our climate in the future. Among the European countries there is a general strong political tendency towards supporting renewable energy, especially after the Kyoto agreement. As a result of this protocol, the EU has agreed to an 8% reduction of CO₂ by 2010 on 1990 levels.

In a white paper from the Commission of the European Community [1] the amount of biomass currently utilised for energy corresponds to 1 875 PJ (521 TWh or 44.8 Mtoe). It is considered possible to treble this amount by 2010, providing effective measures are adopted. This would mean additional biomass derived from agricultural, forest, and forest industry residues, waste streams as well as from new energy crops, corresponding to 8.5% of the projected total energy consumption in that year. The advantages of exploiting biomass, based on new technologies, can be clearly seen in the case of biogas exploitation. It is estimated that the total energy content of landfill gas and digestible agricultural wastes in the EU exceeds 3348 PJ (930 TWh or 80 Mtoe). The contribution that could be made by biogas exploitation
from livestock production, agro-industrial effluents, sewage treatment and landfill by 2010 is estimated to 628 PJ (174 TWh or 15 Mtoe). Animal manure contributes with more than 90% of the total digestible waste/biomass resources in Europe [2].

In the following text, national legislation regarding renewable energy affecting the implementation of biogas technology will be presented.

**Austria**

Both the Federal and the nine "Bundesländer" Governments implement renewable energy policy. On the level of the "Bundesländer" there are strong but not always homogeneous political tendencies towards alternative energy supply. The fulfilment of the white paper from the Commission of the European Union [1] concerning renewable energy utilisation for energy production and the EU guideline [96/92/EG] will be realised in Austria through the law "ELWOG". This basic law determines the general conditions for the implementation of the guideline in the nine "Bundesländer":

- A minimum part of 3% of the total electrical energy must be produced from biomass, wind or solar energy until 2005 (ecological or 'green' electricity - "Ökostrom").
- The governors of the "Bundesländer" must fix a minimum feed-in tariff for electrical supply to the grid from renewable energy until the 19th August 1999.
- Monopolised electricity market must be opened and direct sale or purchase of ecological electricity must be achieved.

If the governors do not fulfil their obligation until the indicated deadline, the Minister for Economics will fix the minimum feed-in tariff.

Both the Federal and the “Länder” subsidise investment costs in biogas facilities. Total government subsidies for RES amounted to around 30 M€ (ATS 400 million) in 1994. In 1996, the Austrian government introduced an energy tax on electricity and gas, excluding RES. In 1997 the Austrian minister of Economic affairs signed a “general agreement” with the electric power companies concerning sponsoring of electric power plants on the basis of the sources of energy: biomass, biogas, wind, and sun. A important part of this voluntary agreement is the fixing of a federal minimum of feed-in tariffs of 0.028 - 0.040 €/kWh, depending on the season. In some cases, due to special conditions or contracts with electric power companies, higher feed-in tariffs up to 0.058 €/kWh could be obtained.

**Belgium**

In Belgium, energy policy has been decentralised. While there is no specific target for the energy sector, promoting RES is expected to see a reduction in CO$_2$ emissions of about 20 MT by 2000 in industry. In Flanders the local government has an environmental council that takes care of environmental policy. Today these councils have paid little to no attention to energy issues. In Wallonie the PEDD (Environment plan for sustainable development), adopted in 1995, is expected to be followed by a development programme for RES.

In 1995 the Control Committee for Electricity and Gas, an autonomous public utility organisation that brings together representatives of electricity and gas industries, trade unions, consumer groups and the national and regional authorities, received new terms of reference to allow it to better adapt to legal and institutional changes. This organisation has taken steps to improve the remuneration system for electricity produced by independent power generators and autoproducers and to boost electricity generation from RES. Autoproducers using RES, co-generation or waste energy are granted more favourable tariffs, with no limitations on the
amount of electricity they can sell during off-peak hours. In addition, surplus electricity based on biogas as well as hydro energy, wind energy and biomass receives an extra bonus of Belgian francs $1/kWh. The buyback rate is not high enough to encourage many installations of renewable technologies.

Denmark

In 1996, legislation on the Danish energy and carbon tax system came into effect introducing different carbon tax rates depending on utilisation. Denmark has a goal to reduce green house gases by 20 percent in year 2005 of the 1988-level. It is calculated on CO$_2$ basis and only CO$_2$.

In general, biogas is a very high priority for the Danish Ministry for Energy. Normally, it is dealt with positively in the energy development plans. An Energy Action Plan “Energy 21” including medium and long-term scenarios to 2005, 2020 and 2030 was developed in 1996 [3]. The basic assumptions for the scenarios included a doubling of biogas production between 1996 (2.2 PJ) and year 2000, and a further doubling before 2005. For further development of the sector a new two-year program is being negotiated now for the years 1999-2000. It is the fifth biogas “follow-up” program since the beginning in 1985.

In Denmark, renewable electricity benefits from enhanced buyback rates. Therefore, biogas is used for CHP. The electricity companies (one covering Seeland; one covering Jutland Funen) fix prices. The tariffs are divided into three time zones (peak-, high- and low tariff), but the average selling price is, 0.070 €/kWh (0.52 DKK/kWh) plus a subsidy on 0.036 €/kWh (0.27 DKK/kWh). The subsidy is given to all electricity production on renewable energy, and not specific to biogas. There is also a national law/initiative for decentralised CHP. Some cities have to use RES (not necessarily from biogas, it could also be wood, straw etc.) in the production, and are not allowed to use fossil fuels.

Germany

Federal, regional and local authorities are promoting the use of renewable energy sources with many programmes that are modified frequently, and often applied for a short time and with little money. However, the Federal Government adopted a 5.1 M€ (DEM 10 million) programme for the period 1995-98 aimed at providing a direct investment grant for the installation of plants including biogas facilities. The investment subsidies vary from one region to another within a range of 10-25%. In addition, investors in biogas technology receive a 4% unit reduction on the interest rate. The Act “Stromeinspeisegesetz” of 1991 that obliges utilities to take electricity from renewables at a premium price has had a significant impact on new capacity from RES. Renewable energy production is financed through fixed buybacks and paid for by local consumer levy. In addition, the Electricity Feed Law offers favourable electricity buy-back rates to renewables. The sale price of electricity per kWh is approximately 0.08 €/kWh, which corresponds to 80% of the consumer price. The sale price is independent of peak-hours (the same during night and day). However, recently published regulations and high approval conditions, decreased subsidies and the constant uncertainty with the law of supplying renewable energy to the grid, makes growth difficult.

Greece

The development of renewable energy in general is seen as an important contribution to the improvement of the Greek environmental indicators and to the abatement of CO$_2$ emissions in
particular. The Greek government has a comprehensive approach to encourage RES. The legislation for the promotion of RES and especially for future biogas schemes would be summarised in the following:

- The Law 2244/94 regulates the issues connected to the production of electrical power from renewable sources of energy, conventional fuel, and other provisions. It is going to review soon, replaced by another one that is contacted according to new environment as its coming from the E.U. direction 96/92/EC for the deregulation of power market (the bill is under passage through Greek Parliament).

- Development Law 1892/90 with its amendments, which is replaced by the Law 2601/98 in which investments on RES are enhanced.

- Joint Ministerial Decision (Ministry for Development, Ministry for Environment, Physical Planning and Public Works and Ministry of Economic Affairs) for the promotion of RES and the reduction of emissions CO\(_2\), which is going on after July 1997.

Especially, there are no special provisions for biogas applications. However, in the framework of the Energy Operational Programme (Measure 3.4), two biogas plants have been approved (total installed power almost 20.1 MW\(_e\)) exploiting sewage sludges and landfill biogas. Additionally, the Ministry of Development has granted six applications for license permissions for power plants exploiting biogas; the total installed power amounts 21.0 MW\(_e\). It is expected that significant interest will be expressed for biogas applications in the next coming Energy Operational Programme of the Greek government.

**Ireland**

A clear strategy on renewables has been set out with the aim of steady growth in the electricity sector at the expense of conventional energy investment. The sector is being encouraged to develop the green energy market by measures supporting the development of local involvement. There are subsidies for green electricity and small projects. As a result of the Alternative Energy Requirement programme of 1994 (AER 1 and 2) and the RES Strategy, there are enhanced buyback rates for electricity and an encouragement of privatisation of the energy industries.

**Italy**

As regards the energy regulations, the issue focuses mainly on the basic laws regarding renewable energy sources, including LN 10/91, LN 9/91 and all the legislative support measures. With the support of ITABIA (the Italian Biomass Association) and other experts, the Italian Ministry of Agriculture has officially presented (at the end of September 1998) the National Programme for Renewable Energy from Biomass, which aims to promote the development of different biomass chains, e.g. biogas from animal and agro-industrial wastes.

The programme is the first step of the Italian national policies for reduction of greenhouse gases emissions, according to Kyoto Protocol; specific laws and decrees will better define the amount of financial support to be distributed; finalised agreements among farmers, industries, distribution companies and customers will be fostered. The main methods of intervention, with the target of the production of 334-418 PJ/year (93-116 TWh/year) of energy from biomass before 2010, are contributions on the investments, compensations of price gaps, demonstrative plants and systems, research and experimentation, information and training.
To encourage biogas recovery systems, in 1992 the Italian government outlined a provision offering incentives for self-production of electric energy from biomass, paying 0.135 €/kWh (270 ITL/kWh) in April 1996 against an average cost of 0.08-0.09 €/kWh (160-180 ITL/kWh). This could translate into renewed interest in biogas systems for pig farms.

**The Netherlands**

In the Netherlands a switch from subsidies on renewables to fiscal instruments in order to “ecologise” the economy, occurred during the 1990s. The Ministry of Economic Affairs introduced several regulations to support the production of sustainable energy: ecotax on fossil fuels, subsidies on “green” energy and tax exemptions for “green” energy projects. The normal tariff for independent producers of electricity is 0.036 €/kWh (8 cent/kWh), but for green electricity the tariff is 0.068 €/kWh (15 cent/kWh) [4].

The Ministry of Economic Affairs has promoted anaerobic digestion of animal manure combined with other organic wastes. Investment support for new and innovative projects is channelled through NOVEM, the Dutch Energy Agency, in the “Energy for Waste and Biomass” programme. However, the introduction of anaerobic digestion technologies depends on the policies of the Ministries of Environment and Agriculture both for the licence for the installation and for the application of the digestate in agriculture. Currently, the Ministries of Environment and Agriculture have no official policies to promote the introduction of anaerobic digestion technology for organic wastes and animal manure.

**Norway**

Norwegian legislation requires that methane from landfills should be collected and flared. There is a political wish to convert the gas into efficient energy, but there are no support schemes. The reduction of carbon dioxide is stated to be a general political target, but the economic importance of oil and gas from the North Sea and a decision to build two natural gas power plants contradicts this. In addition, buying CO$_2$-shares from other countries is considered as an option. Anaerobic digestion is not in focus, mainly because of small quantities of residues suitable for digestion.

**Portugal**

AD is affected positively through guidelines for renewable energy in general. The utilisation of biogas produced from AD for CHP is particularly and positively encouraged, with the possibility of injection of the surplus of green energy into the national grid at a special price. There is no special emphasis on using biogas for heat, although it is the most common situation in practically all AD plants, but there are no special rules regarding legislation, guidelines, standards, policies, and fiscal actions. Reducing green house gases is not considered as a particular environmental problem, but is seen as one in whole.

**Sweden**

The energy political decision [5] contains a seven-year program for research, development and demonstration of new energy technology. Since transportation is responsible for a large part of emissions of carbon dioxide it is desirable that the biogas is utilised for vehicles. An investigation of different renewable fuels (SOU 1996:184) found that biogas had the lowest impact on climate, environment and health. The focus on utilising biogas for vehicle fuel implies that the construction of mainly large centralised biogas plants is supported, since the
cost for upgrading biogas to vehicle standards is too expensive at smaller plants. Today there are no subsidies on electricity generated from biogas at CHP-plants, while there is an environmental bonus on sale price of wind electricity of 0.017 €/kWh (SEK 0.15 /kWh). If the growing interest for farm-scale digesters is to be realised it will be necessary for the sale price for electricity to be subsidised in the future.

As a result of the demand to find new waste management solutions to fulfill the visions of sustainable development, the Swedish government has allocated 774 M€ (SEK 6.8 billion) for "sustainable development" in the municipalities (i.e. not necessarily biogas, it could be any investment in sustainable technology). In this way locally tailored solutions should be favoured. The municipalities can apply for 30% funding and the money will be distributed during the period 1998–2001. During 1998 approximately 10 municipalities were after applications granted support for constructing biogas plants in the program for "sustainable development". In 1999, 17 municipalities received this support.

**UK**

The Electricity Act (1990) requires regional electricity companies to secure specified renewable energy generating capacity. This capacity is specified through the Non Fossil Fuel Obligation (NFFO). NFFO is a competitive process. Periodically bids are requested under specified types of renewable energy. The Government decides how much capacity they will contract and a maximum bid price is agreed. Projects that bid under this ‘strike’ price receive a contract for a fixed term (currently 15 years) at the price they bid. Depending on the technologies these prices can be much higher than fossil fuel generators would get. For example the national grid annual average purchase price is 0.036 €/kWh (2.4p/kWh). Domestic consumers pay about 0.09 – 0.1 €/kWh (6-7p/kWh). The last NFFO contracts for AD plant were for just over 0.075 €/kWh for 15 years (increasing with inflation).

Government policy on renewable energy is set out in Energy Paper 62 [6]. This paper sets a target of 1500 MW electricity from renewables by 2000. The main mechanisms for achieving this are NFFO and the New and Renewable Energy Programme. However, the new government has suggested a new target of 10% of UK electricity from renewable sources by 2010.

**Environmental aspects on digestate management**

In accordance with the EU-directive on landfilling, there will be a ban on landfilling organic waste by the year of 2005. The main reasons are the negative environmental impact of leachate and that landfilling is not a sustainable solution for organic waste treatment. In the efforts to facilitate a sustainable development, the incentives and rules for recycling plant nutrients between urban and rural areas is an important aspect. However, in the EC and EU states there is generally little regulation directly concerned with organic waste derived soil improvers, and particularly for digestate.

Contaminants in municipal waste such as heavy metals or organic pollutants represent a hazard to human and animal welfare if they accumulate in the soil from the reuse of waste products. Therefore, the willingness of farmers to use digestate from plants co-digesting municipal organic waste as soil conditioner would probably be low if proper regulations are not adopted. Similar concerns are also true for spreading of sewage sludge on farmland. These concerns has resulted in an EC directive (86/278) regulating, for example the maximum concentration limits in sludge (mg/kg total solids) for a range of metals in agricultural soil receiving sewage sludge. In addition, there is work underway to develop an EU Directive for
compost and CEN, the European Standard Organisation, has been working on a standard for soil improvers and growing media since 1990. Moreover, in 1991 the EC adopted a scheme for endorsing products that had improved performance on environmental criteria – Eco-labels (Table I).

Another environmental concern is the load of nutrients on farmland. Leachate of nitrate can be caused by the agricultural activities during handling and storing manure, fertiliser and other organic fertilisers. The nitrate–directive (91/676/EEC nitrate) was created with the purpose of protecting ground water and lakes. According to the directive, the maximum application of manure corresponds to 170 kg N/ha/year. However, during a transient period up to 210 kg N/ha/year can be allowed. Moreover, the directive contains a general demand on the Member States to develop and support good agricultural practices (GAP).

It is likely that the waste, nitrate, fertiliser and sewage sludge directives will be used for guidance or adapted for legislation regarding the use of digestate, since it is reasonable to compare compost residues with digestate regarding concentration and maximum application on arable land.

**Heavy metals**

In Tables II, III EU and national levels for heavy metals in sewage and compost are presented. The limits are developed from risk assessments of the negative impact of the different heavy metals on soil, plants, humans and animals. However, the time perspective in these risk assessments are different from one country to another and spans from a few years to perspectives of thousand years. The EU-directives are minimum-directives, which means that only the minimum acceptable level is defined. The member states can enforce more restrictive rules depending on national conditions (soil structure, soil-pH etc.)

**Sewage sludge**

The most restricted values are applied in the Netherlands (Table II). Other nations with low limits are Denmark, Finland, Norway, Sweden, Switzerland and Austria. The remaining nations follows the directives or have, to some extent, lower values. In UK the contamination of heavy metals are regulated with maximum amounts per year in combination with limits for soil compatibility (i.e. if the soil contains more than a limiting concentration of heavy metals, spreading of sewage sludge is not allowed).

Regarding the application of sewage sludge limit values for maximum application (kg/ha/year) exist in the EU-directive and on a national level. The most restricted rules are to be found in Scandinavia, the Netherlands and Austria. France, Germany and Ireland have more restricted rules compared to Italy and UK. One reason for the differences is that the Nordic countries apply the principle of mass balance, i.e. the heavy metal load should not exceed the run off and absorption in plants. In other countries, risk assessment has been the guide for determination of limits. Related to maximum loads per ha and year are also regulations regarding soil compatibility. In many countries These limits are based on pH-value in the soil and other physical and chemical parameters.

The limits in Table III are the most frequent used in different countries. The limits are regulated in some cases by authorities and in some cases the limits are recommendations or voluntary agreements between producers and consumers. Apart from the limits for heavy metals, limits for other contaminants (glass, plastic etc) exist in several countries.
Table I. Criteria for European Eco-label for soil improvers [7].

<table>
<thead>
<tr>
<th><strong>Criterion</strong></th>
<th><strong>Level require to pass</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Product source</td>
<td>Organic matter must be provided by re-use or processing of waste must not contain sewage sludge</td>
</tr>
</tbody>
</table>
| Soil degradation and water pollution   | The final product must not contain more of the following elements on a dry basis  \[
Zn  \quad 300 \quad \text{mg/kg} \\
Cu  \quad 100 \quad \text{mg/kg} \\
Ni  \quad 50 \quad \text{mg/kg} \\
Cd  \quad 1 \quad \text{mg/kg} \\
Pb  \quad 100 \quad \text{mg/kg} \\
Hg  \quad 1 \quad \text{mg/kg} \\
Cr  \quad 100 \quad \text{mg/kg} \\
Mo*  \quad 2 \quad \text{mg/kg} \\
Se*  \quad 1.5 \quad \text{mg/kg} \\
As*  \quad 10 \quad \text{mg/kg}  \\
\]
* only needed where product contains material from an industrial or municipal waste  
Must not contain bark treated with lindane, cypermethrin or promocarb. If product contains bark lindane concentration must not exceed 0.1 mg/kg |
| Nutrient loading                        | Concentration of Nitrogen must not exceed 2 % (of dry matter)  
When used at the recommended rate of application the product must not exceed:  
17 g/m² total nitrogen  
6 g/m² P₂O₅  
12 g/m² K₂O  
Products are exempt from this if less than 10 % of the nutrient content is available in the first growing season. |
| Labelling                               | Detailed labelling requirements including  
major feedstock  
recommended use and storage conditions  
safety instructions  
nutrient concentrations  
heavy metal concentrations |
| Product performance                     | Products must be solid and not less than 25 % dry matter and not less than 20 % organic matter  
Must not adversely affect plant growth in growth test |
| Health and safety                       | Must not exceed  
Salmonella not detectable in 25 g  
E. Coli 1000 MPN/g |
| Nuisance                                | Shall not produce offensive odour after use  
Shall contain no glass, wire, other metal or hard plastic that constitutes a hazard to health  
Shall not contain unacceptable numbers of weed seeds or vegetative reproductive parts of aggressive weeds |
Table II Limits concentrations of heavy metals in sewage sludge (mg/kg ts) for application on farmland according to regulations in different countries. (After [8])

<table>
<thead>
<tr>
<th>Country/region</th>
<th>Cd</th>
<th>Pb</th>
<th>Hg</th>
<th>Ni</th>
<th>Zn</th>
<th>Cu</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU, recommendation</td>
<td>20</td>
<td>750</td>
<td>16</td>
<td>300</td>
<td>2500</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>EU, maximum value</td>
<td>40</td>
<td>1200</td>
<td>25</td>
<td>400</td>
<td>4000</td>
<td>1750</td>
<td>1500</td>
</tr>
<tr>
<td>Austria</td>
<td>4</td>
<td>500</td>
<td>4</td>
<td>100</td>
<td>1000</td>
<td>400</td>
<td>150</td>
</tr>
<tr>
<td>Belgium, Flandern</td>
<td>6</td>
<td>300</td>
<td>5</td>
<td>50</td>
<td>900</td>
<td>375</td>
<td>250</td>
</tr>
<tr>
<td>Belgium, Wallonien</td>
<td>10</td>
<td>500</td>
<td>10</td>
<td>100</td>
<td>2000</td>
<td>600</td>
<td>500</td>
</tr>
<tr>
<td>Denmark a)</td>
<td>0.8</td>
<td>120</td>
<td>0.8</td>
<td>30</td>
<td>4000</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Denmark, from 000701 a)</td>
<td>0.4</td>
<td>120</td>
<td>0.8</td>
<td>30</td>
<td>4000</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Denmark, mg/kg P a)</td>
<td>200</td>
<td>10000</td>
<td>200</td>
<td>2500</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Denmark, mg/kg P from. 000701 a)</td>
<td>100</td>
<td>10000</td>
<td>200</td>
<td>2500</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Finland b)</td>
<td>1.5</td>
<td>100</td>
<td>1</td>
<td>100</td>
<td>1500</td>
<td>600</td>
<td>300</td>
</tr>
<tr>
<td>France c)</td>
<td>20</td>
<td>800</td>
<td>10</td>
<td>200</td>
<td>3000</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Germany</td>
<td>10</td>
<td>900</td>
<td>8</td>
<td>200</td>
<td>2500</td>
<td>800</td>
<td>900</td>
</tr>
<tr>
<td>Greece, recommendation</td>
<td>20</td>
<td>750</td>
<td>16</td>
<td>300</td>
<td>2500</td>
<td>1000</td>
<td>-</td>
</tr>
<tr>
<td>Greece, maximum</td>
<td>40</td>
<td>1200</td>
<td>25</td>
<td>400</td>
<td>4000</td>
<td>1750</td>
<td>-</td>
</tr>
<tr>
<td>Ireland</td>
<td>20</td>
<td>750</td>
<td>16</td>
<td>300</td>
<td>2500</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Italy</td>
<td>20</td>
<td>750</td>
<td>16</td>
<td>300</td>
<td>2500</td>
<td>1000</td>
<td>-</td>
</tr>
<tr>
<td>Luxembourg, recommendation</td>
<td>20</td>
<td>750</td>
<td>16</td>
<td>300</td>
<td>2500</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Luxembourg, maximum value</td>
<td>40</td>
<td>1200</td>
<td>25</td>
<td>400</td>
<td>4000</td>
<td>1750</td>
<td>1750</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.25</td>
<td>100</td>
<td>0.75</td>
<td>30</td>
<td>300</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Norway</td>
<td>4</td>
<td>100</td>
<td>5</td>
<td>80</td>
<td>1500</td>
<td>1000</td>
<td>125</td>
</tr>
<tr>
<td>Spain, soil pH &lt; 7</td>
<td>20</td>
<td>750</td>
<td>16</td>
<td>300</td>
<td>2500</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Spain, soil pH &gt; 7</td>
<td>40</td>
<td>1200</td>
<td>25</td>
<td>400</td>
<td>4000</td>
<td>1750</td>
<td>1200</td>
</tr>
<tr>
<td>Sweden</td>
<td>2</td>
<td>100</td>
<td>2.5</td>
<td>50</td>
<td>800</td>
<td>600</td>
<td>100</td>
</tr>
<tr>
<td>Switzerland</td>
<td>5</td>
<td>500</td>
<td>5</td>
<td>80</td>
<td>2000</td>
<td>600</td>
<td>500</td>
</tr>
<tr>
<td>UK</td>
<td>–</td>
<td>1200</td>
<td>d)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

a) Limits for Cd, Pb, Hg and Ni can either be calculated based on total solids or based on phosphorous. Limits for Zn, Cu, and Cr are based on total solids.
b) Limits for Cd can be exceeded with 20%. Limits for other heavy metals can be exceeded occasionally and should be judged in every single case. The concentrations of Cu and Zn are allowed to be twice as high if there is a lack of these metals in the soil.
c) Recommended. Maximum limits are twice as high as in the values in the table. The total concentration of Cr, Cu, Ni and Zn are not allowed to exceed 4000 mg/kg ts.
d) Only for surface fertilising on pasture to protect animals.
### Compost

Table III. Limits concentrations (mg/kg ts) of heavy metals and arsenic in compost according to regulations in different countries. (After [8])

<table>
<thead>
<tr>
<th>Country</th>
<th>Cd</th>
<th>Pb</th>
<th>Hg</th>
<th>Ni</th>
<th>Zn</th>
<th>Cu</th>
<th>Cr</th>
<th>As</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>1</td>
<td>150</td>
<td>1</td>
<td>60</td>
<td>400</td>
<td>100</td>
<td>70</td>
<td>–</td>
</tr>
<tr>
<td>Denmark</td>
<td>0,8</td>
<td>120</td>
<td>0,8</td>
<td>30</td>
<td>4000</td>
<td>1000</td>
<td>100</td>
<td>–</td>
</tr>
<tr>
<td>Denmark, from 000701</td>
<td>0,4</td>
<td>120</td>
<td>0,8</td>
<td>30</td>
<td>4000</td>
<td>1000</td>
<td>100</td>
<td>–</td>
</tr>
<tr>
<td>Finland</td>
<td>3,0</td>
<td>150</td>
<td>2,0</td>
<td>100</td>
<td>1500</td>
<td>600</td>
<td>–</td>
<td>50</td>
</tr>
<tr>
<td>France a)</td>
<td>8</td>
<td>800</td>
<td>8</td>
<td>200</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Germany, class I b)</td>
<td>1,5</td>
<td>150</td>
<td>1</td>
<td>50</td>
<td>400</td>
<td>100</td>
<td>100</td>
<td>–</td>
</tr>
<tr>
<td>Ireland</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Italy c)</td>
<td>10</td>
<td>500</td>
<td>10</td>
<td>200</td>
<td>2500</td>
<td>600</td>
<td>10^3/500^3</td>
<td>–</td>
</tr>
<tr>
<td>Netherlands, &quot;superclean compost&quot; e)</td>
<td>0,7</td>
<td>65</td>
<td>0,2</td>
<td>10</td>
<td>75</td>
<td>25</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Netherlands, &quot;clean compost&quot; e)</td>
<td>1</td>
<td>100</td>
<td>0,3</td>
<td>20</td>
<td>200</td>
<td>60</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Norway, class I f)</td>
<td>0,8</td>
<td>60</td>
<td>0,6</td>
<td>30</td>
<td>400</td>
<td>150</td>
<td>60</td>
<td>–</td>
</tr>
<tr>
<td>Norway, class II f)</td>
<td>2</td>
<td>80</td>
<td>3</td>
<td>50</td>
<td>800</td>
<td>650</td>
<td>100</td>
<td>–</td>
</tr>
<tr>
<td>Spain</td>
<td>40</td>
<td>1200</td>
<td>25</td>
<td>400</td>
<td>4000</td>
<td>1750</td>
<td>750</td>
<td>–</td>
</tr>
<tr>
<td>Sweden (guidelines)</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td>50</td>
<td>300</td>
<td>100</td>
<td>100</td>
<td>–</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1</td>
<td>120</td>
<td>1</td>
<td>30</td>
<td>400</td>
<td>100</td>
<td>100</td>
<td>–</td>
</tr>
<tr>
<td>UK</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

---

a) No official legislation. The values given are required to be allowed to use ANRED-AFNORs certificate.
b) Class I-compost is used for food production.
c) Values given are for centralised sorted compost. Regulations for source sorted compost varies between regions.
d) Chrome (III) 500 mg/kg ts. Chrome (VI) 10 mg/kg ts.
e) The division into two classes was made in order to stimulate an improved compost quality. The quality is generally so good that a change to only one class is discussed.
f) The maximum application of class I is 40 tonnes/ha during 10 years and for class II maximum 20 tonnes/ha during 10 years.
**Nutrients**

In Table IV gives legislation regarding maximum nitrogen load, storing capacity and when spreading is allowed for five EU countries.

Table IV. Legislation regarding nutrient load on farmland.

<table>
<thead>
<tr>
<th></th>
<th>Max. nutrient load</th>
<th>Storage capacity</th>
<th>Spreading season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>100 kg N/ha/year</td>
<td>6 months</td>
<td>28 Feb-25 Nov</td>
</tr>
<tr>
<td>Denmark</td>
<td>Individual quotas</td>
<td>9 months</td>
<td>1 Feb - harvest</td>
</tr>
<tr>
<td></td>
<td>Based on livestock units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>170 – 500 kg N/ha/year</td>
<td>90-180 d</td>
<td>Feb – Dec</td>
</tr>
<tr>
<td>Sweden</td>
<td>Based on livestock units</td>
<td>6-10 months</td>
<td>Feb - Dec</td>
</tr>
<tr>
<td>UK</td>
<td>250 – 500 kg N/ha/year</td>
<td>4 months</td>
<td>-</td>
</tr>
</tbody>
</table>

**Hygienic aspects of digestate management**

The use of organic waste from industry or municipalities offers opportunities for extra income from gate-fees and increased gas production. However, there is concern to avoid the introduction of disease through the use of biological wastes as fertilisers on arable land. Large-scale changes in waste treatment strategies may also result in the creation of new routes of disease transmission between animals, humans and the environment. The cases of BSE and swine fever in some EU-countries have further emphasised these issues.

The concern for human and animal welfare has led some countries to legislate on pathogen control. This affects the design and construction on biogas plants depending on the type of feed-stock used. However, these matters have thoroughly been covered in a recent workshop [9]. Briefly, Denmark has been a "pioneer" country in this aspect, with regulations since 1989. In countries, such as Germany, Austria and Sweden where legislation is rather new has used knowledge and experience from Denmark in creating their own regulations. As a general rule the digestate is pasteurised (70 ºC; 1 h), but also alternative combinations of time and temperature, such as 55 ºC during 5.5 hours for thermophilic digestion, is applied. The whole issue of pathogen control and hygiene issues is dealt with in more detail in another technical summary produced for AD-NETT.

**Planning and construction safety**

Biogas is an explosive gas and its production, storage and distribution requires regulations in order to prevent accidents. However, the often complicated administrative procedures involved in applying for construction permission can be a hurdle for the implementation of small-scale facilities. Thus, farmers with limited time cannot spend resources on these matters to the same extent as municipalities are able to do for larger facilities. In the following text the CEN rules and national rules for Austria and Italy regarding planning and construction safety are presented.

**CEN**

According to the CEN rules for the construction of anaerobic digestion systems [10], the biogas plant has to be constructed of material that can withstand pressurised gas and gas should not be able to accumulate at unsuitable places in the building if leakage occurs.
Different zones with different degrees of danger are defined [11]. Gas motor and machine rooms have to be well ventilated and caution must be taken to prevent gas to accidentally enter the machine room. For a desulphuring plant it is of highest importance to prevent air penetrating into the biogas conduit and to prevent the biogas entering the air conduit, due to risk of explosion. In the desulphuring container the biogas temperature must not exceed 60°C and the gas conduits should be designed to resist mechanical, chemical or thermal injury.

The gas flare should be large enough for the total gas production and be constructed in a way that prevents fire. A certain security distance is needed from the surrounding buildings and the biogas plant. The digester must have at least two openings, one towards the soil and one towards the air with a width of at least 0.8 m. The digester and low-pressure storage should be secured from frost to prevent the pressure exceeding the maximum or fall below minimum. The condensed water has to be led out of the system in a suitable manner. The plant should be inspected at suitable intervals. There must be ways of evacuating the staff in case of danger.

**Austria**

In general, agricultural biogas plants only need construction permission according to the respective provincial regulation [12]. The main conditions for the assessment of a plant as an agricultural biogas plant with co-digestion are:

- the main purpose of the plant must not be waste treatment
- biogas yield must increase with the co-substrate (sustainable reutilization)
- reuse (recycling) of waste fed must be obtained

If organic wastes are the main substrate (> 50% w/w), a further permission with respect to the industrial code [13] must be obtained. According to a new guideline [14], this permission would be necessary if the addition of co-substrates in agricultural plants exceeds 30% w/w.

If dangerous wastes according to the classification in the catalogue of waste [15] are to be co-digested, a further permission with respect to the law concerning waste management is necessary [16].

For plants with a treatment capacity higher than 20,000 tons of wastes per year, an Environmental Assessment must be carried through [17].

With respect to security aspects, numerous regulations concern the management and the utilisation of biogas as an explosive substance. The main security rules and regulations concerning anaerobic digestion plants are described in a guideline from the Austrian Association for Water and Waste Management [18]. In a guideline security rules with specific regard to agricultural biogas plants can be found [19].

A complete overview of all concerned laws, regulations and guidelines in relation to anaerobic digestion will be presented in a guideline from the Austrian Association for Water and Waste Management [20], which will be released by the end of 1999.
## Italy

Table V. Procedures required and channels for seeking financing in Italy for setting up a biogas and co-generation system on a pig farm

<table>
<thead>
<tr>
<th>Organisation of reference</th>
<th>Requirement</th>
<th>Subject of requirement</th>
<th>Time (months)</th>
<th>Result</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipality</td>
<td>Application</td>
<td>New building or volumetric increase</td>
<td>2-24</td>
<td>Issue of building permit</td>
<td>For internal works, notification is sufficient</td>
</tr>
<tr>
<td>Region</td>
<td>Application</td>
<td>Contribution in capital account (art. 8 and 10 LN 10/91)</td>
<td>12-24</td>
<td>Regional measure</td>
<td>Refer to regional laws</td>
</tr>
<tr>
<td>MICA</td>
<td>Application</td>
<td>Contribution in capital account (art. 11 and 12 LN 10/91)</td>
<td>12-24</td>
<td>MICA Decree</td>
<td>Result of application within: 6 mos. (art. 12) 7 mos. (art. 11)</td>
</tr>
<tr>
<td>ISPESL</td>
<td>Declaration</td>
<td>New system under pressure (DLvo 30/06/82 no. 390) Protection against atmospheric discharges Earthing system (DM 15/10/93 no. 519)</td>
<td>-</td>
<td>Certificate of homologation</td>
<td>Only for steam production</td>
</tr>
<tr>
<td>Fire dept.</td>
<td>Application</td>
<td>Examination of the project Fire prevention certificate</td>
<td>1-2</td>
<td>Approval</td>
<td>Issue of certificate</td>
</tr>
<tr>
<td>Region Envir.Min. Mayor</td>
<td>Application</td>
<td>Air pollution (DPR 203/88)</td>
<td>3-6</td>
<td>Regional measure</td>
<td>If power &lt; 3W, notification is sufficient</td>
</tr>
<tr>
<td>MICA ENEL UTIF</td>
<td>Notification + sworn declaration</td>
<td>Co-generation from renewable source (art. 22 LN 9/91; CIP 6/92, title I)</td>
<td>2</td>
<td>MICA determines IEN</td>
<td>In the case of admissibility, a sworn declaration to MICA is required. MICA communicates IEN to business and CCSE</td>
</tr>
<tr>
<td>ENEL</td>
<td>Hook-up Report Preliminary agreement Other</td>
<td>Assignment of electrical energy</td>
<td>6-12</td>
<td>Agreement between ENEL and business</td>
<td>Other specific contracts stipulated. Other procedures c/o CIP and MICA for price of assignment (where necessary)</td>
</tr>
<tr>
<td>UTIF</td>
<td>Declaration</td>
<td>Electrical workshop</td>
<td>-</td>
<td>Verbal compilation of certification</td>
<td>License to be renewed each year. Exempt if &lt; 20 kW</td>
</tr>
<tr>
<td>Region Municipality MICA</td>
<td>Notification</td>
<td>Start of operation</td>
<td>-</td>
<td>-</td>
<td>Notification to send at least 15 days before start of operation</td>
</tr>
</tbody>
</table>
The greatest restrictions arise from the series of regulations concerning environmental protection, safety in the work place, etc., which involve numerous bureaucratic-administrative procedures and thus often discourage those who want to set up a system. This can be seen, for example, in the results of a study conducted by CRPA (Table V) to verify the various steps of the procedures required for setting up a co-generation plant operating with biogas on pig farms.

Though in a completely different light, the recently approved DM 05/02/98 is also of great importance. Enclosure 2 of this decree dictates certain fundamental requirements for the use of biogas (as waste). Inter alia, it defines in detail:

- Origin: anaerobic digestion of organic wastes or from the landfill
- Characteristics of the gas: combustible gas with methane content no less than 30% of volume, H₂S content no greater than 1.5% of volume, lower calorific value of the product as is no less than 12,500 kJ/Nm³
- Recovery activities and methods: the use of biogas is permitted in energy conversion systems with nominal thermal power greater than 0.5 MW under the conditions indicated in Table VI.

As concerns the technical regulations, the only document to be mentioned is the UNI 10458 standard, which regards the classification of systems for biogas production; also specifying the construction requirements and the regulations for the offer, ordering, and testing.

### Table VI. Conditions of biogas energy recovery in Italy

<table>
<thead>
<tr>
<th>Systems allowed</th>
<th>dedicated and industrial</th>
<th>fixed internal combustion engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustion efficiency (CO₂/CO+CO₂)</td>
<td>≥99%</td>
<td>-</td>
</tr>
<tr>
<td>Continuous control of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Dust</td>
<td>if &gt; 6 MWt</td>
<td>if &gt; 6 MWt</td>
</tr>
<tr>
<td>NOx</td>
<td>if &gt; 6 MWt</td>
<td>if &gt; 6 MWt</td>
</tr>
<tr>
<td>HCl</td>
<td>if &gt; 6 MWt</td>
<td>if &gt; 6 MWt</td>
</tr>
<tr>
<td>Gaseous effluent T</td>
<td>yes</td>
<td>if &gt; 6 MWt</td>
</tr>
<tr>
<td>COT</td>
<td>if &gt; 6 MWt</td>
<td>if &gt; 6 MWt</td>
</tr>
<tr>
<td>HF</td>
<td>if &gt; 6 MWt</td>
<td></td>
</tr>
</tbody>
</table>
| SO₂² | if > 6 MWt | if > 6 MWt (SO₂)

| Emission limits (mg/m³): | Mg (O₂ = 3%) | Mh (O₂ = 3%) | M₃₀ (O₂ = 3%) | mh (O₂ = 5%)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>10</td>
<td>10-30</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>50</td>
<td>100</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>NOx</td>
<td>200²</td>
<td></td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>SO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COT</td>
<td>10</td>
<td>10-20</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>HF</td>
<td>1</td>
<td>2-4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>HCl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cd + Tl (and compounds)</td>
<td>0.05</td>
<td>0.05</td>
<td>10-60</td>
<td>10</td>
</tr>
<tr>
<td>Hg (and compounds)</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:

mg = average daily value; M₃₀ = average value on 30’ (when two values are indicated, all the m₃₀ must not exceed the highest, or 97% of them the lowest); mh = average sampling value 1 h
Acknowledgements

This paper was written within the framework of the FAIR-sponsored AD-NETT network (Concerted action contract # FAIR-CT96-2083; DG XII – SSMI). All the participants in the AD-NETT are gratefully acknowledge for providing information on national legislation.

References

12. NÖ Bauordnung - LGBI. Nr. 129/1996 in the case of Lower Austria
15. Abfallkatalog - ÖNORM 2100.

19. Guideline Nr. 62 from the "Österreichisches Kuratorium für Landtechnik - ÖKL" (Sicherheitstechnik für landwirtschaftliche Biogasanlagen).

20. Österr. Wasser- und Abfallwirtschaftsverband – ÖWAV.