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Organic farming and bioenergy production – conflicting goals and approaches to a solution

Summary

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SUMMARY

There has been a significant rise in recent years in the demand for agricultural biomass, both for food production and also for use as an energy and material source, and this is resulting in increasing competition for use and for land. This development is influenced in part by policy objectives and financial support measures. One subsidiary aspect is the competition with regard to the expansion of renewable energies between the two sustainability targets of »Expanding organic agriculture« and »Expanding bioenergy production«.

One of the objectives of the German federal government's Sustainability Strategy is to increase the proportion of organic farmland in the next few years to 20% of the usable agricultural land (proportion in 2010: 6%). Implementing this sustainability target means a certain amount of additional agricultural land will be required for food production since organic food production per produced unit requires the use of more land than conventional production.

At the same time the Sustainability Strategy called for an increase in the proportion of renewable energies in primary energy consumption by 2020 to 10% and also an increase in its proportion of gross electricity consumption to at least 30%. The federal government's energy concept dated 28 September 2010 formulated a significantly higher target of 18% of the proportion of renewable energies in total energy consumption in 2020. With a proportion of some two-thirds, biomass represents the most important renewable fuel and will continue to play a key role in future too. In the course of this process, the increasing cultivation of energy crops takes up land previously used for food production or set aside in the past. The question therefore arises of whether increased competition for land will jeopardise the simultaneous achievement of the two sustainability targets.

The TA project »Organic agriculture and biomass production«, completed by the presentation of this final report, was commissioned by the Committee for Education, Research and Technology Assessment at the prompting of the Parliamentary Advisory Council for Sustainable Development and examined whether organic farming and biomass production for energy utilisation can be combined to a greater degree in future in order to cover the increasing demand for both areas, or whether the relevant targets of the national Sustainability Strategy conflict with each other and therefore agricultural production has to be prioritised towards one of the two sustainability targets.

»ORGANIC FARMING« AND »BIOENERGY« SUSTAINABILITY TARGETS

The federal government's Sustainability Strategy is expressed in specific form using indicators and target figures for the indicators. A total of 21 key indicators are used to demonstrate regularly the progress or setbacks en route to sustainable development.

Sustainability target »organic farming«

Organic farming is regarded as having a pioneering role to play in sustainable agriculture. The target defined in the Sustainability Strategy is that the amount of land used for crop production by organic farms should be 20% of the usable agricultural land. This proportion was originally to have been achieved by 2010, though this was modified in the 2008 progress report: the target is now to be met »within the next few years«.

Numerous financial support measures have been put in place to enable organic farming to expand further and to recompense organic farms for their social contributions. The key instruments are the area-based payment, the agricultural investment grant, support measures for improving the market structure, and advisory, educational and information measures.

The proportion of agricultural land farmed organically rose between 1994 and 2010 from 1.6 to 5.9%. Organic farming in Germany has a high proportion of land in permanent grassland, while the conversion rates for meat and poultry production and for special crops (vegetables, fruit) are low. The German market for organic foods has grown substantially faster in recent years than the area of land farmed organically in Germany. For that reason, the significantly rising demand for organic foods in Germany is increasingly covered by imports.

»Bioenergy« sustainability target

With regard to the »Expanding bioenergy production« sustainability target bioenergy makes a major contribution in the three energy sectors of electricity, heat and fuels. Converting to renewable energies is intended to reduce the emissions of greenhouse gases created by energy generation. The targets for 2010 set out in the federal government's 2002 Sustainability Strategy were achieved ahead of schedule in terms of both the proportion of total energy consumption and the proportion of electricity consumption. The target figures have now been rewritten by the federal government: to 18% for the proportion of renewable energies in total energy consumption and at least 35% for the proportion in electricity

consumption. The targeted contribution of bioenergy was firmly set down in 2009 in the National Biomass Action Plan.

As far as bioenergy is concerned, the support measures mainly apply in terms of generation and use. The key instruments in the development of energy crop production are Germany's Renewable Energy Sources Act (EEG) with reference to electricity and the quota system (previously tax exemption) for biofuels.

There has been a marked increase in the number and installed electrical output of biogas systems for electricity generation since 2004. The proportion of biomass in electricity generation from renewable energies was some 30% in Germany in 2010. Maize silage is the main feedstock used in biogas systems. Developments in biofuels have been less steady. After a significant but short rise, the use of pure plant oil as a biofuel has declined again very markedly in recent years. Between 2000 and 2007 production capacities and sales of biodiesel increased dramatically. Since the change to the quota scheme, the market for biodiesel has been stagnant. Finally, production capacities and output of bioethanol have been on the rise in Germany since 2005. As a result of financial support for bioenergy production, the area under cultivation for energy crops has risen very greatly in the last ten years, to almost 2 million ha.

Degree to which targets have been met

Clear progress has been achieved in respect of the two sustainability targets of »Organic farming« and »Bioenergy« (as part of renewable energies) since the federal government passed its Sustainability Strategy in 2002. However, the relative growth in the field of energy crop cultivation was significantly higher compared with the organically farmed land area between 2002 and 2010. The current gap compared with the set targets is significantly lower for renewables or bioenergy than for organic farming.

FACTORS INFLUENCING THE DEVELOPMENT OF ORGANIC FARMING AND BIOENERGY PRODUCTION

In order to be able to estimate the future development of organic farming and bioenergy production, the factors influencing the conversion from conventional food production to organic farming or energy crop cultivation for bioenergy production are discussed below, and the importance of the relevant economic and political frameworks is examined.

Factors influencing the development of organic farming

Various approaches to organic farming were developed in the previous century as an alternative to conventional agriculture. The pioneer phase up to the 1980s was characterised by the small number of organic farms and a great deal of idealism. 1990 saw the creation of an EU-wide legal definition of organic farming with binding minimum standards. At the same time there was an increasing professionalisation of the organic farmers' associations and processors. 2001 saw the introduction of the official »Bio« eco-label to give consumers a simple means of recognising organic products. The strong growth since then in the market for organic foods has mainly been achieved by food retailers.

Since the introduction of land-related subsidy payments in 1989 economic considerations have become more important in the decision to convert farms. Apart from the level of subsidy, the terms and conditions of the subsidy and the certainty that it will continue play a key role.

The conversion from conventional to organic husbandry represents a major change for the farm in terms of its agricultural production processes and entails a longer-term commitment to the farm's development. A high investment requirement (e.g. for buildings) or problems with production technology (e.g. for crop protection with special crops) represent on-farm barriers to conversion. The social environment and acceptance among their peers still influence the willingness of farmers to convert.

Conversion to organic farming requires the development of new marketing channels. Higher producer prices to at least balance out the rising costs for changes in labour requirements, equipment and capital investment and the resulting changes in yields are, in addition to the subsidies for which the farmer may be eligible, the decisive determinants for or against conversion. In the organic market, which is still small for many product groups, even comparatively minor changes in supply or demand can have relatively pronounced impacts on prices. Instead of the fixed surcharges applied in the past, a trend towards decoupling from the conventional prices can be observed in the main products from Germany's organic farms (cereals, potatoes and milk).

After all, the high agricultural prices in the foodstuffs crisis of 2007/2008 and in 2011 improved the income situation for conventional agriculture and thus reduced the incentive for farmers to consider the possibility of converting. The considerable uncertainty surrounding future changes in agricultural prices does not make long-term decisions such as converting to organic farming any easier.

Factors influencing the development of bioenergy production

The start and development of bioenergy production and energy crop production in Germany are primarily determined by incentive policy schemes. Subsidy policies have been realigned a number of times.

The first oil crisis of 1973 ushered in a renewed interest in bioenergy in industrialised and emerging markets. The reform of the EU's Common Agricultural Policy from 1992 onwards also introduced a compulsory set-aside scheme to limit the food surpluses which were being increasingly produced at that time. Against this backdrop energy crop production was seen as an opportunity to develop a new, alternative source of income for farmers. An exception was granted which allowed renewable raw materials to be planted on the set-aside areas. In the last 10 years climate protection and energy policy objectives then came to the fore in the debate on bioenergy subsidies.

In the 1990s pure biodiesel was standardised and approved for use in diesel vehicles by their manufacturers. Pure plant oil and biodiesel were exempted from petroleum tax, which enabled an adequate price differentiation from diesel produced from fossil raw materials to be achieved. A niche market for plant oil fuels and biodiesel started to develop which was largely the domain of medium-sized producers. The comprehensive tax exemption for biofuels which was passed in 2002 triggered a major expansion of production capacity and sales of biodiesel in particular. The gradual reduction in this tax shield and the introduction of the quota resulted in stagnation of the area of rapeseed under cultivation for biofuels. The transient »boom« in decentralised oil mills and plant oil fuel collapsed.

The fundamental effect of the quotas is to create a price-independent demand for biofuels. Accordingly, the proportion of this material used as an admixture in the domestic consumption of biodiesel has risen constantly since 2007 and is now almost solely responsible for consumption. The volume-related quota regulation generates an incentive for the petroleum industry to use the lowest-cost biofuels for the obligatory blending process. In the EU this has resulted in rising levels of biodiesel imports, primarily based on soya and palm oil. What is uncertain is the extent to which the biofuels required in Germany or the raw materials needed for their production will also come from Germany in future.

Biogas production was very cost-effective because of the payments outlined in the 2004 and 2009 versions of the EEG and therefore represented an attractive option for farmers to develop their farms. In addition, the payment, which is guaranteed for 20 years, provides a high level of investment security. As a result

of the high world market prices for crops in 2007/2008 and again in 2010/2011, however, conventional agricultural production allowed a comparable basic return to be achieved - despite the high EEG subsidy - which meant that biogas systems were not, or were only just, competitive with food production. Different adjustments were made in the various bioenergy fields in response to the marked increases in agricultural prices in 2007/2008: whereas the payment rates for biogas were raised in the EEG in 2009, the quota targets for biofuels were extended. The third EEG reform in 2011 responded to problematic developments such as partially excessive subsidies, dominance of silage maize for energy crop use and regional land competition.

On-farm factors also influence the decision to move into biogas production. If farms are in a poor economic position (e.g. low profitability, low capital resources), this can prevent investment in a biogas system. Furthermore, farm size is a crucial factor for biogas use since the system size and thus its economic efficiency are strongly influenced by herd size and land use. The heat utilisation concept also affects the economic efficiency. In addition, opinions on, and acceptance of, biogas in the farmer's immediate neighbourhood influence the decision to start biogas production.

INTEGRATION OF BIOENERGY PRODUCTION IN ORGANIC FARMING

With the two sustainability targets in mind, it is legitimate to ask to what extent organic husbandry and sustainable bioenergy production can be combined. At the heart of such considerations is biogas production, which has been the most important to date and fits especially well in organic cropping systems.

Organic farms were among the pioneers in further developing biogas technology. The goals of organic farms from the pioneer time, apart from energy independence, were the desire to close nutrient cycles even more effectively and to achieve a revaluation of farmyard manure from the farms' own livestock.

There are currently approx. 160 to 180 biogas systems on organic farms with a total installed electrical output of some 34 to 38 MW. This represents almost 3% of the output of all the biogas systems in Germany. The average feedstock mix of biogas systems on organic farms shows a significantly higher proportion of farmyard manure (slurry, dung) plus clover-grass and grass silage. Many relatively large biogas systems in particular are currently being operated with bought-in conventional feedstocks for biogas production since the systems cannot be operated at a high enough capacity on the basis of the feedstock provided

by the farm alone. In addition to energy production, the bought-in feedstock also helps to increase the fertiliser level on the farm, as part of the permissible nutrient imports. The guidelines of the organic producers' associations call for the use of conventional fermentation feedstocks to end by 2020.

The main opportunities for integrating biogas production in organic farming arise from the fact that leguminous crops such as clover grass are cultivated on organic farms as a source of nitrogen and for soil improvement and weed control purposes and can then, in turn, be used in biogas systems. Since on organic farms over two-thirds of the feedstock mix is made up of already available feedstocks such as farmyard manure, farm residues, clover-grass and grass silage, biogas production on organic farms competes with food production to a significantly lower degree than conventional biogas production using energy crops.

An estimate of the technical potential for biogas production by organic farms in Germany revealed that, taking account of the specific potential methane yields of the individual feedstocks and with an annual growth of 5% in the land area farmed organically, biogas systems with an output of approx. 480 MWel on organic farms could be achieved by 2020, which would equate to an electricity-generation potential of some 3.5 billion kWh. With an average electricity consumption of 3,000 kWh per year for a 2-person household, up to 1.15 million households in Germany could therefore potentially be supplied with electricity.

The costs for organic feedstock production (clover-grass and grass silage) are significantly higher compared with maize silage because of the repeated harvesting required and the lower methane-generation potential. Furthermore, the use of these feedstocks results in higher operating costs for the biogas system and in higher capital costs. The additional costs arising from the use of organically produced feedstocks (e.g. grass silage, catch crops) and of feedstock blends which are expedient with regard to potential savings in climate gases (high farmyard manure content) are still not sufficiently rewarded under the EEG.

Knowledge of the opportunities and potentials of biogas production in organic farming has still not fully reached the farm gate level. One of the reasons for this is that the necessary information and advice has not always been satisfactorily provided to date. Since the advisory and planning activities of those involved in conventional biogas production have only limited transferability to the framework conditions for organic farming, special advice needs to be provided by, for example, the organic farming associations, which would have

to expand their expertise in the field of organic biogas production. A second reason is that many farmers are put off by the relatively high capital costs which generate a lower return than conventional system designs, particularly with smaller systems and a varied feedstock mix.

COMPETITION AND CONFLICTS OF AIMS

The global growth in supply from agricultural production has scarcely been able to keep pace with the increased demand in recent years. The consequence is new competition for use among the different ways of utilising agricultural biomass. The fundamental purposes are conventionally and organically produced food and feedstuffs, material use and energy use. Competition for land use occurs if an increasing demand for a (new) utilisation pathway such as energy crop use is not compensated for by a corresponding reduction in demand for land for food production, for example as a result of increases in agricultural yields or a decline in the demand for food. The design of the financial support policy and other policy frameworks have a significant impact on the economic competitiveness of the various utilisation pathways.

COMPETITION SITUATION UP TO EEG 2012

The development of biogas production, in particular, was relevant in recent years for the sustainability targets of »Organic farming« and »Bioenergy«. Under the payment conditions of the Renewable Energy Sources Act (EEG) 2009 biogas production was very competitive in economic terms. The increasing number of biogas systems impacted on land use: the area of land under silage maize has increased by over 60% in the last ten years. The design of the EEG payment (especially the slurry bonus) up to the 2011 reform resulted in ever greater competition for land, particularly in processing regions and milk production regions with a high proportion of permanent grassland. This has been reflected in a large increase in regional rental costs. Because of its production focuses and regional distribution, however, organic farming experienced only a limited impact.

With the enactment of the EEG 2012 the level of the payment and its terms and conditions were amended with the aim in particular of preventing farmers from turning away from beef production to biogas. It remains debatable, however, whether the changes are sufficient to meet this objective.

Factors influencing the growth of competition for land

The future competition for use between different options for utilising agricultural biomass and the resulting impact on competition for land depends not just on the financial support policy, but also on a number of other factors.

On the one hand, these include factors which determine how much agricultural land will be required in future for food production. Productivity increases in agriculture, especially increases in yields in arable production, ensure that the same amount of food can be produced on less agricultural land. Increases in both the potential yields accomplished by plant breeding and the yields actually achieved in practice by farmers can help in this regard. However, the possible future impacts of climate change mean that there is renewed uncertainty in respect of the achievable growth in yields. Generally more stringent environmental requirements expected of European agriculture, as discussed in connection with the reform of the Common Agricultural Policy (CAP) for the budget period from 2013 to 2020, would mean more extensive operations on part of the agricultural land and thus a higher land requirement to maintain the EU's agricultural production at the current level.

Eating habits are constantly changing and have a substantial impact on the area of land required for food production. Of particular relevance in this regard is the level of consumption of animal-based foods since their production calls for significantly more land proportionally than for the production of plant-based foods. However, reduced consumption of animal-based foods in Germany will only result in a corresponding area of land being freed up in Germany provided the lower domestic consumption is not compensated for by an increase in exports.

The foodstuffs produced by farmers always involve losses en route to the consumer and are then also not consumed in their entirety by this end user. This issue – food waste – has been the subject of growing debate in recent years. Different definitions, varying approaches to data capture, significant gaps in data and different approaches to extrapolations all result in great uncertainty when estimating food waste. Nonetheless, it is expected that a reduction in food waste could impact significantly on the demand for land.

On the other hand, the demand for land for bioenergy production depends on various factors. Productivity per unit area and thus the energy yield per ha vary considerably for different energy crops and ways of use. Very different amounts of land can be used or may be necessary, therefore, to produce the same amount

of energy. Furthermore, there is the expectation with many energy crops that significant increases in yields can be achieved, especially by means of breeding.

The sustainability targets relating to renewable energies specify a proportion of the total primary energy and electricity consumption. The absolute contribution to the energy supply to be achieved by renewable energies therefore depends on developments in consumption. The greater the progress in increasing energy efficiency and reducing energy demand,the lower the absolute growth needed for renewable energies. The implication for the contribution of bioenergy based on energy crops is that lower energy consumption (or electricity consumption) would reduce the area of land needed for agricultural bioenergy production.

Indirect land use changes and competition with other sustainability targets

Discussing competition for land only with reference to Germany is to take too narrow a view. Some of the biofuels or raw materials for biofuel production are already imported. Both the import of biofuels and driving food production abroad as a result of cultivating energy crops in Germany can result in land use changes in the export countries. These can be direct land use changes, on the one hand, if biofuel crops are cultivated on virgin land in the export countries. Direct land use changes relating to environmentally valuable land are now not permitted, as a result of the EU sustainability requirements for biofuels.

On the other hand, the cultivation of biofuel crops on land in the export countries previously used for agricultural purposes can displace the previous use (e.g. food production) and thus result in indirect land use changes if virgin agricultural land has to be developed for this displaced food production. Depending on the location, substantial CO_2 emissions from the surface biomass (especially when converting forest areas) and from the organic soil constituents (especially with peat soils) can exceed, and thus thwart, the climate gas savings from bioenergy use for a long period. That is the background to the controversial debate on taking indirect land use change (ILUC) into account in connection with the sustainability certification of biofuels.

Furthermore, competition for land between energy crop cultivation and organic farming or food production in general are not the only relevant competitive relationships. The cultivation of energy crops can have negative impacts on agricultural ecosystem services such as maintaining biodiversity or groundwater quality and also influence other sustainability targets (e.g. the reduction in surplus nitrogen).

Future development options and feasibility of sustainability targets

The report uses three scenarios to analyse how the future development options for organic farming and bioenergy production and the fundamental policy designs can impact on land use and competition and the feasibility of these two sustainability targets. Key outcomes:

> If the existing priority for bioenergy within the framework of the »Renewable energy« sustainability target is maintained and the financial support policy continues to favour the cultivation of energy crops, the consequence will be that any available future land will largely be used for cultivating energy crops. Competition for land use will then continue or even become fiercer. The continuation of the policy in place to date therefore creates a conflict between the two sustainability targets.
> The sustainability target of a 20% proportion of organic farming in the area of land used for agriculture by 2020 cannot be achieved with the current financial support policy because the incentives for conversion and the economic efficiency of organic farming are not sufficient. Regional competition for land with energy crop cultivation (especially for biogas production) makes the situation worse, but is not the decisive cause.
> Achievement of the »Organic farming« sustainability target requires a corresponding improvement in the financial support policy. Organic farming will replace conventional food production and, because of the lower productivity per unit area, will result in a limited additional demand for land of the order of 0.8 million ha for a land proportion of 20%.
> It will probably not be possible to achieve a proportion of 20% for organic farming solely by means of the relevant financial support policy; rather, this will require a restructuring of the agricultural policy such as to include more stringent environmental requirements for land management overall or a system of linking direct payments to environmental performance. This would remove economic barriers to conversion because the relative economic efficiency of organic farming over conventional agriculture would be strengthened by its higher production costs. At the same time, a corresponding reform of the Common Agricultural Policy would help in achieving further sustainability targets such as reducing the agricultural nitrogen surplus.
> If the »Organic farming« sustainability target were to be met, there would still be land available to permit a moderate further expansion of energy crop use. The challenge then is to design the expansion targets and subsidies in an integrated overall strategy in such a restrained and flexible way that no new competition is triggered by means of excessive financial support.

- With regard to bioenergy, the situation is very complex since, in terms of the higher-level »Renewable energies« target, a range of alternatives to bioenergy are available and, in terms of bioenergy itself, considerable design leeway exists as a result of the different product lines and the two options of »domestic production« and »import of biofuels«. Nonetheless, there are opportunities to remove or prevent competition and conflicts of aims without jeopardising the renewable energies target itself.
- There are, for example, substantial, as yet untapped potentials for the energy-related use of agricultural residues and wastes, with particular reference to the use of farm animal waste (slurry) in biogas systems and the use of catch crops and clover grass. Developing these potentials would make a major contribution to reducing greenhouse gas emissions and not trigger any additional land use, i.e. it would help in avoiding conflicts of aims. However, this would entail higher costs.
- The future level of domestic land to be used for biofuel production is uncertain. Its development is essentially determined by its cost effectiveness compared with biofuel imports and the meeting of requirements relating to reductions achieved in greenhouse gases. At some 1.2 million ha, this affects more than half the current land under cultivation for energy crops. On the one hand, this entails considerable economic risks for German farmers and biofuel manufacturers. On the other hand, a considerable amount of land could be released for other energy crops and utilisation pathways, avoiding domestic competition for land. The import of biofuels entails both the opportunity to use less land for the same energy contribution and also the risk of high climate gas emissions as a result of indirect land use changes.
- In recent years the cultivation of energy crops has contributed to more intensive land use, especially as a result of abolishing compulsory set-aside and shortening periods between crop rotations. Organic farming and the practice to date of cultivating energy crops on conventional farms have fundamentally contradictory objectives. Policy frameworks which result in a more environmentally compatible system of cultivating energy crops would result in greater consistency in terms of sustainability policy. However, additional environmental requirements relating to the cultivation of energy crops entail a higher demand for land and higher costs.
- Changes in the framework conditions have a significant impact on land availability and the future occurrence of competition for land. In particular, lower consumption of meat and other animal-based foodstuffs would free up considerable potential land and at the same time reduce the German agricultural industry's land requirement, provided the lower domestic consumption is not compensated for by rising exports of animal-based foodstuffs. Relevant

land can, in principle, also be freed up by reducing food waste. However, the amount which can realistically be achieved is still very uncertain at present.

WEIGHTING SUSTAINABILITY TARGETS

The federal government's Sustainability Strategy has been set up as a holistic, inclusive approach. Despite this, conflicts of aims between different sustainability targets can occur in the design of the sustainability policy. For this reason, sustainability policy as a horizontal task also includes weighing up between different objectives and development pathways.

Since the enactment of the federal government's Sustainability Strategy in 2002, the expansion of agricultural bioenergy has been a de facto priority as part of the sustainability target for renewable energies. The analyses in this report have shown that meeting the two sustainability targets by 2020 will be determined not only by the competition for agricultural land but also by the respective policy for meeting the two sustainability targets and also by a range of framework conditions. Conflicts of aims between the sustainability targets can, but will not necessarily, occur.

In order to achieve a transparent and well-founded policy design, the future weighting of the two sustainability targets should be explicitly examined. The weighting of the sustainability targets reveals different policy focuses for action and consequences for the future development of land use and competition. Three fundamental approaches can be identified:

> *Priority for the »Bioenergy« sustainability target:* In a continuation of the policy to date, the focus would be on energy and climate protection policy goals. The central objectives would be to contribute to cutting greenhouse gases, increasing energy supply security and promoting employment and added value, particularly in rural areas, by expanding the cultivation of energy crops. By contrast, the »Organic farming« sustainability target would not be pursued more intensively. The anticipated very slow expansion of the land area under organic cultivation would play no role in the issue of competition for land. There would also be scarcely any land available for the expansion of other utilisation pathways (e.g. material use) because the available land potential would be used almost entirely for cultivating energy crops. The outcome of maintaining the status quo would therefore be to resolve the conflict of aims between the »Organic farming« and »Bioenergy use« sustainability targets on the basis of energy crops in favour of bioenergy.

- *Priority for the »Organic farming« sustainability target:* The specific target of increasing the proportion of organic farming to 20% of the usable agricultural land by 2020 (to put a specific figure on the current target of »within the next few years«) is representative of the intention to achieve more sustainable farming in Germany overall. A clear acceleration in the expansion of organic farming would be necessary to enable the 20% target to be met by 2020. An important element would be to significantly strengthen the relative economic efficiency of organic farming compared with conventional husbandry. A proportion of 20% of land for organic farming by 2020 means that there will be a demand for an additional approx. 0.8 million ha because of organic farming's lower productivity per unit area. With regard to the sustainability target for renewable energies, the policy alignment applicable hitherto would have to be changed at the same time. In order to safeguard the priority of food production and to avoid competition for use and land, the area of land cultivated for energy crops ought only to be expanded to the extent permitted by the additional land requirement for organic farming and the extensification of conventional agriculture. Whereas there is a direct relationship to the area of land with the »Organic farming« sustainability target where a proportion of the area of land is specified, there are various options available for meeting the target in the case of the sustainability targets for renewable energies. It would be possible, in principle, to meet the expansion targets for renewable energies without any conflict of aims occurring. The main risk with this approach is that the sustainability target for renewable energies will not be met because waiving a major expansion of energy crop cultivation will not be sufficiently compensated for by obtaining bioenergy from residues or waste or by other renewable energies.
- *Inclusive policy for equally weighted pursuit of both sustainability targets:* The objective would be to meet the two sustainability targets - »Organic farming« and »Bioenergy« - at the same time by 2020, i.e. both more sustainable agriculture and an essential contribution to renewable energy provision. The creation of framework conditions to achieve a significant increase in conversion to organic farming would have to be reconciled as closely as possible with the promotion of bioenergy production in this objective, and synergies would have to be specifically exploited. Improved integration of energy crop production in organic farming would be a key element. To prevent competition for land when simultaneously expanding organic agriculture and the cultivation of energy crops, specific policies which result in more sustainable food consumption would also have to be put in place. In particular, a reduction in meat consumption and the avoidance of food waste could substantially reduce the amount of land needed for food production. However, changes in diet and food use can only be partially influenced by policy frameworks; rather, society as a whole

needs to rethink and restructure its approach. The inclusive pursuit of sustainability targets places particularly high demands on a coordinated policy

OPTIONS FOR ACTION

Achievement of the two sustainability targets – increased proportion of organic farming and expansion of agricultural bioenergy as part of the »Renewable energies« sustainability target – would be significantly aided by avoiding competition for land between the two land use options, removing barriers to the expansion of organic farming and greater integration of bioenergy production in organic farming. Irrespective of the weighting of the two sustainability targets, various measures can help in meeting targets. Options for action relating to further developing bioenergy support, expanding organic agriculture and integrating bioenergy production in organic agriculture are presented below.

Options for action to defuse competition for land when further developing bioenergy support

With regard to continued support for bioenergy, a number of options are available which can help reduce the effect of, or prevent conflicts of aims with, the sustainability target of »Organic farming« and competition for use and land with food production:

- *Increase energy use efficiency:* The target of a proportion of 18% renewable energies in the total energy consumption in 2020 will be achieved more easily and with fewer conflicts of aims if, as a result of energy-saving measures in the three fields of electricity, heat and fuels, less secondary energy in absolute terms has to be provided.
- *Prefer stationary uses of biomass:* To ensure that the biomass which can be produced on the available land area makes the highest possible contribution to renewable energy provision, priority should be given to stationary applications (electricity and heat generation in the form of combined heat and power), and the support instruments should be designed with that in mind.
- *Adjust the relative economic efficiency of bioenergy production:* With regard to electricity generation, the incentive arrangements in the EEG provide a means of regulating the relative economic efficiency of biomass production compared with food production. To avoid competition for land, the relative economic efficiency of biogas production based on energy crops as the main crop should not be too high compared with other uses. A study should be undertaken at an

early stage to verify whether the reduction in the EEG 2012 is sufficiently large or possibly even too great to ensure a moderate growth in biogas production.

- *Link between EEG electricity prices and an agricultural commodities index:* The fixed specification of the EEG incentives to date presupposes an accurate estimate of future developments in agricultural commodity prices, though these are likely to be subject to major fluctuations for the foreseeable future. One option would be to link the EEG electricity payment to a suitable index of agricultural commodity prices. A link such as this could be used to adjust the relative economic efficiency of food production compared with the cultivation of energy crops. Further research is needed in this regard since the implementation and impacts of such a scheme have not been sufficiently estimated to date.
- *Make greater use of agricultural residues and waste:* Improved support for the energy-related use of agricultural residues and waste, which do not generally cause any more land to be used, can help ensure that less land has to be used for the production of renewable energies.
- *Increase productivity of crop production and energy crop conversion:* Future increases in yields will have a considerable influence on how much land will be required for food production. Equally, significant progress in terms of the productivity of energy crop systems would reduce competition for land. Increased public-sector investment in agricultural research and plant breeding and in activities to put this into practice on farms (e.g. advisory service) could help in achieving greater increases in yields in future.
- *Expand EEG monitoring to identify regional land competition hotspots:* The EEG monitoring system should be expanded to ensure that regions with an excessive concentration of systems can be identified and appropriate measures to defuse the competition situation can be developed.

Options for action to promote increased conversion to organic farming

If the sustainability target of increasing the proportion of organic farming in the next few years to 20% of the available agricultural land is to be met, this would require a large number of conventionally managed farms to be converted to an organic system within a short period of time. A combination of various actions would be needed for this:

- *Establish organic farming as the model for sustainable agriculture:* Organic farming is the agriculture system which overall best meets the various demands on sustainable agriculture. This role model function should be communicated more forcefully and anchored in the awareness of the general public.
- *Draw up an »Organic farming action plan«:* The coordinated use of a range of instruments and the interaction of a range of players are needed if the sus-

tainability target for organic farming is to be met. Just as at an EU level and in many other member states, an »Organic farming action plan« should also be drawn up in Germany.

- *Further development of EU agricultural policy:* The upcoming reform of the European Common Agricultural Policy (CAP) for the budget period from 2014 to 2020 opens up the opportunity to achieve more environmentally compatible agriculture overall. Linking the direct payments to specific social and environmental performance, representing greening of Pillar 1 of the CAP, would significantly increase the relative economic efficiency of organic farming over conventional agriculture. However, this should not be done at the expense of Pillar 2 of EU agricultural policy, i. e. agri-environment policy and the development of rural areas.
- *Design of agri-environment schemes:* The provision and design of agri-environment schemes play a significant role in guiding the expansion of organic farming. A relevant increase in conversions in Germany can only be achieved if adequate land-based subsidies are provided for farms which are managed organically. Other important features are a clear distinction between premiums for organic growing and those for other agri-environment schemes, an examination of the agri-environment schemes offered to date in terms of their environmental efficiency and increased cultivation of leguminous crops.
- *Increase the continuity of support for organic farming:* Uncertainties with regard to the financial support policy are a crucial barrier to conversion to organic farming. Financial support for organic farming should be offered ongoingly in every state in Germany, both in the support period expiring in 2013 and in the period from 2014 onwards. To achieve a durable foundation, political priorities need to be established for organic farming in the development programmes of the German states together with corresponding long-term safeguards in the state budgets.
- *Provide nationwide advice on organic farming:* The provision of information and advice is fundamental in ensuring that conventional farms include conversion to an organic system when considering how to develop their farms. For that reason, a nationwide provision of practical, specialised advice related to their particular farm should be available to conventional producers addressing conversion, marketing, production technology, management and farm development for organic farming.
- *Expand the market for organic foods:* Organic farming will only see a marked expansion if there is a corresponding demand for the associated rising supply of organic products. The market structure support should therefore aid in developing the nationwide provision of marketing and sales opportunities for organic products, controls on organic foods should be standardised, and more information should be directed at consumers.

- *Strengthen research for the organic food industry:* Research plays an important role in developing organic farming. Up till now, research into organic farming has only been a minor part of the total expenditure for agricultural research. The German Council for Sustainable Development has called for 20% of the national agricultural research budget to be reserved for organic farming. Government research and the »National Research Strategy BioEconomy 2030« should be designed in line with the federal government's »Organic farming« sustainability target.

Options for action in integrating bioenergy production in organic farming

Greater integration of bioenergy production in organic farming could be achieved in particular in the area of biogas production. In order to avoid causing distortions in the general support for organic farming, schemes relating to bioenergy production in organic farming should largely be managed via the EEG:

- *Support for relatively small, on-farm biogas systems:* The subsidy for relatively small systems up to 75 kWel output with at least 80% slurry as the feedstock introduced for the first time in the 2012 reform of the EEG is intended to promote investment in »farm-scale« biogas systems. Early steps should be taken to verify whether the current embodiment of the EEG is an adequate means of developing the farmyard manure potential of organic farming and achieving a rapid expansion of biogas production from agricultural residues and waste, especially from farmyard manure, without triggering a marked demand for land for energy crops as a co-feedstock.
- *Arrangements for use of farmyard manure:* The use of farmyard manure for biogas production entails a number of problems which are particularly relevant to organic farming. The relevant issues requiring verification or action are the disadvantaging of solid manure over slurry, the disadvantaging of farms using outdoor grazing rather keeping livestock indoors, and the increasing transport of farmyard manure.
- *Sustainability bonus to promote extensive feedstocks:* »Extensification« of feedstock production would improve the relative economic efficiency of biogas production in organic farming compared with conventional cultivation of bioenergy crops. The lower economic efficiency as a result of lower methane yields per hectare should be compensated for via an incentive in the EEG in the form of a »sustainability bonus« in order to reward the positive side effects. Just like the use of extensively cultivated feedstocks, the use of residual material for biogas production could be rewarded by means of a »sustainability bonus«. Such

a »sustainability bonus« would replace the current feedstock payment category II and require a re-assignment of the various feedstocks.

> *Financial support for feedstock from organic systems:* Biogas production in organic farming incurs higher costs than biogas production on conventional farms. The feedstocks mainly used in organic farming, i. e. farmyard manure, clover-grass and grass silage, are very efficient in terms of climate protection and nature conservation. For that reason an »eco-bonus« could be included in the EEG for the use of organically produced feedstocks, which would create a powerful incentive for organic biogas production.

The Office of Technology Assessment at the German Bundestag is an independent scientific institution created with the objective of advising the German Bundestag and its committees on matters relating to research and technology. Since 1990 TAB has been operated by the Institute for Technology Assessment and Systems Analysis (ITAS) of the Karlsruhe Institute for Technology (KIT), based on a contract with the German Bundestag