

People and Bioenergy

Results and Findings from IEA Bioenergy Task 29: 'Socio-economic Drivers in Implementing Bioenergy Projects'

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INTRODUCTION

Bioenergy has provided millions of households with incomes, livelihood activities and employment. The essence of sustainability of bioenergy projects from a social aspect is how they are perceived by society, and how different societies benefit from this activity in different ways. Other 'big issues' such as mitigating carbon emissions, ensuring wider environmental protection as well as providing security of energy supply are an added bonus for local communities where the primary driving force is much more likely to be employment or job creation related. Overall, these benefits will result in increased social cohesion and create greater social stability.

Considering the high importance of socio-economic impacts when looking at the whole picture of biomass utilisation, Task 29 of the Bioenergy Implementing Agreement of the International Energy Agency, as implied by its title 'Socio-Economic Drivers in Implementing Bioenergy Projects', is focusing its activities specifically in this field. The overall aim of the Task 29 initiative is to promote the use of biomass for energy over fossil-based competitor fuels in the participating countries through achieving a better understanding of the social and economic impacts of bioenergy systems at the local, regional, national, and international level. The Task appreciates the fact that the promotion and implementation of bioenergy projects can be more effectively performed by supporting, educating and mobilising dedicated stakeholders (e.g., environmental and other interest groups, local communities, individuals, etc.).

Additionally, specific aims of Task 29 include achieving a better understanding of the social and economic drivers and impacts of establishing bioenergy markets at the local, regional, national and international level, to synthesise and transfer to stakeholders critical knowledge and new information, and to improve the assessment of the socio-economic impacts of biomass production and utilisation in order to increase the uptake of bioenergy as well as providing better guidance to policy makers. Task 29 also deals with issues such as stakeholder involvement, local income creation, public acceptance, local NGO involvement, long-term financial and political support, technology transfer, technology diffusion, distribution of benefits, fuel substitution aspects, policy aspects, education and capacity building, definition of collateral effects, market development in relation to timber and non-timber products markets (e.g. shift of income or changes in financial sourcing towards sustainable development), institutional development, and other means relevant to secure the long-term success, to minimise leakage, and to maximise additionality of projects.

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Task 29 started its activities in January 2000 with a defined working period for three years and with participating countries including Austria, Canada, Croatia, Japan, Sweden and the UK. After the successful and fruitful work performed in the first working period, the prolongation proposal for the next three year period (2003-2005) was approved at the IEA Bioenergy Executive Committee meeting, and Ireland and Norway joined the Task for a total of eight participating countries. In June 2005 the third and final Task international workshop in the second work period was organised, with representatives from all participating countries agreeing that the accomplishments and results produced within the framework of the Task activities justify the continuation of the work. In line with this conclusion, the prolongation proposal for the third working period (2006-2008) has been prepared and is expected to be approved at the next Executive Committee meeting in October 2005.

SOCIO-ECONOMIC ASPECTS OF BIOENERGY

Using biomass for energy can bring extensive economic and social benefits. At a local scale employment and social cohesion can be enhanced, especially in rural areas where unemployment is often high and de-population is a problem. On a larger scale the production of energy without adding to the overall emissions of greenhouse gases serves national and international policy goals of GHG reduction and environmental responsibility. The choice between highly mechanised and labour intensive methods is based on local needs, energy demands and labour costs. Local economies and national trade balances benefit from the replacement of imported fuels with local, indigenous fuels, since the revenue from the production of biofuels tends to be retained by the local community. An increase in national self-sufficiency is a policy goal for many countries in response to uncontrolled increases in the price and availability of fossil fuels.

Modern industrialised societies function within a series of trade and political relations with a variety of countries, trading blocs, as well as economic and political alliances. Bioenergy use with its associated activities, production, harvesting, and utilisation is integrated with political, economic and environmental agreements. Recently, in addition to the normal trade, political and economic agreements, countries have developed a range of environmental agreements, conventions and protocols designed to address issues of sustainability of resources and communities. There is an increasing interest in shifting to a bio-based economy which uses as a feedstock agricultural crops, mill waste and fast-growing trees. The associated bio-processes; fermentation, biocatalysis, biosensors, and metabolic engineering growth areas by definition must rely on biomass rather than fossil fuels.

Socio-economic impact studies are commonly used to evaluate the local, regional and/or national implications of implementing particular development decisions. Typically, these implications are measured in terms of economic indices, such as employment and monetary gains, but in effect the analysis relates to a number of aspects, which include social, cultural and environmental issues. An integrated approach thus needs to be taken in the investigation of and sharing of knowledge on these separate aspects. A specific complication when analysing these aspects lies in the fact that a considerable number of elements are not always tractable to quantitative analysis and, therefore, have been precluded from the majority of impact assessments in the past, even though at the local level they may be very significant (table 1).

Table 1. Benefits associated with local bioenergy production

Dimension	Benefit
Social Aspects	<ul style="list-style-type: none"> • Increased Standard of Living – Environment – Health – Education • Social Cohesion and Stability – Migration effects (mitigating rural depopulation) – Regional development – Rural diversification
Macro Level	<ul style="list-style-type: none"> • Security of Supply / Risk Diversification • Regional Growth • Reduced Regional Trade Balance • Export Potential
Supply Side	<ul style="list-style-type: none"> • Increased Productivity • Enhanced Competitiveness • Labour and Population Mobility (induced effects) • Improved Infrastructure
Demand Side	<ul style="list-style-type: none"> • Employment • Income and Wealth Creation • Induced Investment • Support of Related Industries

Another important effect related to the increased use of bioenergy is the stimulated revival of cultural traditions. In the boreal forest, many remote communities have no year-round road or connections to electricity grids, and are dependent on diesel generators supplied by fuel flown or barged in at high cost. These communities are often surrounded by forest that could provide the necessary biomass for energy generation, making the community more self-sufficient, reduce costs, provide employment, and integrate well with a forest-based culture. There are examples where a shift to locally-produced bioenergy has been very successful and these successes need to be communicated and fostered.

OVERVIEW OF TASK 29 RESULTS AND ACTIVITIES (2000-2002, 2003-2005)

Much has been achieved in the **first three years** of activity addressing the complex topic of socio-economics as applied to bioenergy systems. The Task has been able to clearly set out the 'state-of-the-art' and begin to apply new methods and thinking to community centred initiatives, based on community interaction and feedback. Moreover, a clear impact has been manifest as a direct result of the activities of the different research groups in participating countries and beyond. Education and the contribution that education can make in removing different barriers for bioenergy around the world was seen as an important part of the Task 29 activities.

The Task was investigating and giving profile to differing regional and national achievements in terms of social and economic benefits of biomass utilisation and drivers in implementing bioenergy projects. A further key activity was to design, develop and apply an ‘easy-to-apply and use’ socio-economic tool for local bioenergy projects based on both existing models and recommendations derived from work accomplished during the first working period of the Task. Through the Task activities it became very clear that the technique likely to yield the best match was highly dependent on the state of development of bioenergy/renewables in that region. For example, in Croatia or England there are very few if any reference plants for the study and so some very basic modelling is needed in order to facilitate project build (addressing both the technical and political requirements). By contrast, in Sweden and Austria there are numerous fine examples of projects, which are ready for enhanced consideration. Hence, it is unlikely that one model only can be used for all countries. Considering this fact, an overview of the existing tools for socio-economic modelling of different bioenergy systems was completed, [2], and further activities were targeted on preparing a 'toolbox' of existing models and methods for using in participating countries and for application to selected study communities. The analysis and modelling work in communities with chosen case studies or regions for each participating country were completed and future actions were identified, as detailed below:

Table 2. Selected regions for socio-economic modelling

Country	Region/ Case Study
Austria	Styria
Canada	Remote communities
Croatia	Gorski kotar
Sweden	Växjö City
UK	Thames Valley

As part of this activity the Task sponsored one student per each participating country. They were involved in data gathering, data analysis and application of models to the regions, and also participated in the final Task workshop in September 2002. The initiative provided an excellent opportunity for young people from the communities under study to participate, exchange ideas and provide a ‘living link’ to the work and actively demonstrate Task commitment.

Deliverables produced by the Task in the first three year period include:

- The brochure ‘Bioenergy in Our Community’, which explains the most important aspects of biomass and bioenergy utilisation;
- Three workshop proceedings and a selection of scientific papers presented at various conferences and seminars;
- Two Task posters, giving a brief overview of activities, participating countries and results;
- The Task website, which contains all Task publications available for download in .pdf format, as well as several video files explaining various socio-economic issues related to bioenergy.

An important part of the Task activities is focused on collaboration and the forming of linkages with other IEA Bioenergy Tasks as well as organisations, initiatives and projects relevant to the increased utilisation of biomass and bioenergy. During the first three year period Task 29 actively collaborated with Task 31 - Conventional Forestry Systems for Sustainable Production of Bioenergy, Task 38 - Greenhouse Gas Balances of Biomass and

Bioenergy Systems, the UN Food and Agriculture Organisation – FAO, and others.

Apart from regular Task 29 workshops, there were two joint events co-organised with others:

- International workshop Socio-economic aspects of bioenergy systems: Challenges and opportunities, co-organised with Task 31 in the Rocky Mountain region, Alberta, Canada, 28-31 May 2001, connected with the bioenergy seminar 'Energy from Forestry – Issues and Opportunities' hosted by the Canadian Forest Service in Northern Forestry Centre, Edmonton, Canada on June 1, 2001;
- COST E21 WORKSHOP (co-organisers Task 29 and Task 38): The economics of substitution management to reduce net GHG emissions & Forest-based carbon mitigation projects: dealing with permanence, leakage, additionality, uncertainties, and socio-economic and environmental issues; Graz, Austria, 22-24 April 2002.

During the Task **second three year period (2003-2005)** the main activities were focused on education and the contribution that education can make in removing different barriers for bioenergy around the world; biomass use in urban communities and national, regional and international partnerships in implementing bioenergy projects.

Looking at the subject of biomass and bioenergy, the lack of public awareness of the various benefits (environmental, social, economic) and the consequent lack of acceptance of their use is constantly pointed out as one of the major barriers to a greater use. Raising this awareness is a complex problem which cannot be solved in one step. Usually the first step involves a public survey in order to determine the current situation among the population as precisely as possible. Two such surveys were performed in 2003 in cities of Zagreb and Rijeka, Croatia and in Reading, UK. The surveys were coordinated by Task participants and results were discussed during the Task workshop organised in the UK.

As a flagship project of the Task, a recognised and extensive educational web site was developed as a successful and powerful educational tool for the wide audience. The web site is conceptualised as an easy-to-apply tool mainly on socio-economic issues, aimed at a wide audience and designed in a user-friendly and interactive manner. The web site can be visited at www.aboutbioenergy.info and number and structure of the visitors as well as established links from the world leading institutions and organisations proved the great success of this activity. Since the start of the recording of visits to the educational web with the tool WebStat in May 2004, more than 18.500 visits have been logged from 101 countries (Figure 1 and 2).

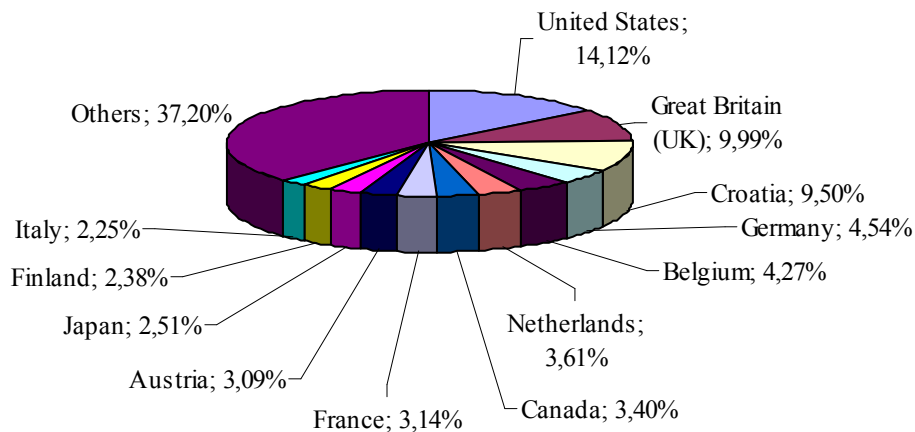


Figure 1 Educational web site visitors by country from May 2004 – February 2005

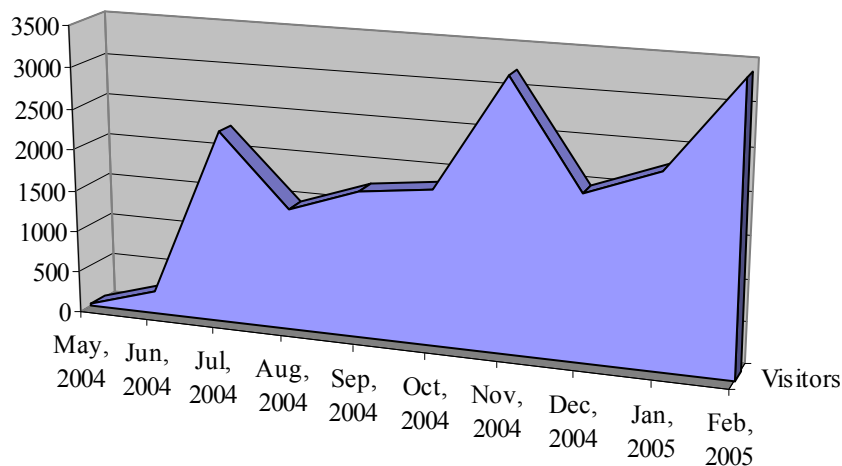


Figure 2 Educational web site, number of monthly visitors from May 2004 – February 2005

Apart from the interactive tool aspects, the web site also contains sections such as ‘How to learn more’ (with a selection of downloadable scientific papers and useful links), ‘Test’ (where visitors can test their knowledge), or ‘Did you know?’ (a database and search engine). Questions about biomass and bioenergy are stored in a database to be answered by the webmaster or, if more complex, by a panel of experts. The site will not only allows adults to extend their knowledge in the field of biomass and bioenergy, but is also a very useful educational tool from secondary school children upwards.

Another important topic covered by the Task is related to the utilisation of biomass in urban communities. The second Task workshop organised in Japan in 2004 was entirely devoted to this subject with the objective to facilitate the exchange of information and knowledge about the latest developments and achievements in participating countries, and also included participation of invited experts outside the Task. As one of the conclusions of this workshop it was agreed to produce case studies illustrating the opportunities for biomass use in urban and communities, best practice procedures and socio-economic drivers. Several case studies are already completed or near completion and made downloadable as a .pdf file on the Task website.

Task 29 experts contributed to the preparation of the Position paper entitled ‘Benefits of Bioenergy’, published by the IEA Bioenergy Executive Committee in March 2005. The publication presents bioenergy in the context of energy choices and identifies linkages to wider sustainable development outcomes. Furthermore, it outlines the wide range of biomass sources and conversion technologies available, discusses social, environmental and economic aspects of bioenergy systems.

During the second three year period Task 29 actively collaborated with Task 30 – Short Rotation Crops for Bioenergy, Task 40 – Sustainable International Bioenergy Trade, the Energy and Poverty Thematic Group of the World Bank and others.

Joint events co-organised with others and invited participation from the Task included:

- IEA Bioenergy Task 29 International Workshop *Biomass in Urban Communities*, Tsukuba City, Japan, October 18-21, 2004;
- South East Renewable Energy Conference 2004, Reading, UK, November 3-4, 2000;
- LAMNET International Workshop, Vina del Mar, Chile, November 8-10, 2004;
- International workshop Sustainable Biomass Trade co-organised with Task 40 as a official side-event of the World Bank Energy Week 2005, March 17-18, 2005, held in the World Bank Headquarters, Washington D.C., US.

FUTURE WORK PROGRAMME 2006-2008

The proposed new Task will give new direction to the programme undertaken in Task 29. It will encompass the results and the findings realised previously in the Task and also embrace the international state-of-the art socio-economic evaluation of bioenergy programmes and projects. The scope will be world wide, but focus primarily on participating countries, taking into account their different international frameworks. The work will include the sharing of research results, stimulation of new research directions in national, regional and local programmes of participating countries, technology transfer from science to resource managers, planners and industry as well as beyond national borders. The emphasis will be on an integrated approach to economic, environmental and social aspects of bioenergy systems from production through supply chains to eventual consumers. Multi-disciplinary partnerships of key stakeholders in forest biomass production and utilisation research, planning and operations will be fostered. A clear linkage with Universities will be made in order to ensure a strong **scientific** component and participation in Task activities. Likewise, stronger links will be encouraged with **industry** partners and communities able to deliver projects and data for analysis and that generate real change on the ground.

Continuing and injecting new direction to the programme undertaken in the IEA Bioenergy Task 29, this new three years programme will focus on social and economic impacts and opportunities of bioenergy systems, taking a more holistic view of the totality of Bioenergy activities which in some instances will involve linking bioenergy projects with specific frameworks and issues such as:

- Urban communities;
- Security of energy supply / Vulnerability of bioenergy communities;
- Long term and sustainable supply of biomass;
- Local communities along biomass supply chains, addressing town and country issues;

- The impact on local biomass markets and growers of large scale co-firing
- Agricultural policy;
- Training and education at higher education institutions (universities).
- Training and education of industry/ developers.

Although biomass-based energy systems are more common in rural areas, there are more and more examples of large scale use in **urban communities**, as demonstrated in Vienna (Austria), Stockholm (Sweden) and many other cities around the world. Small scale biomass applications are also increasingly important for heating individual homes. Biomass is also gaining significant profile in the case of re-building or regeneration of urban areas where a ‘greening’ marketing strategy is being embraced by both public and private sector developers. An example of this is the Bracknell development in the UK. Moreover, an interesting and relatively new category – **urban biomass**, which is represented by *municipal green waste, landfill gas, biogas* from organic households waste and *used cooking oils* for biodiesel production is becoming more and more important.

The security of energy supply, together with import/export balance is an important macroeconomic and strategic issue for any country. The growing import dependence ratio in the European Union (estimated at 70% before 2030, 90% for oil), influenced several legislative initiatives (Directives) intended to facilitate development of the biofuels market in Europe. The importance of reducing **energy dependence** is so high that The Ministry of Foreign Affairs of Japan has established a so called ‘energy diplomacy’ initiative working to secure the stable supply of energy (energy security) for Japan.

Biomass is often considered to be a **secure and reliable energy source**. However, biomass supply can be affected by unsuspected event like a strong hurricane in South Sweden, events that might become more frequent with the change of climate. Kronobergs County in south Sweden is an area where waste material from forestry is used for most of the heat production and electricity production to a very high extent. The hurricane Gudrun that stroke south Sweden in January 2005, damaged more than 70 million cubic meters of timber, equaling many year's normal cuttings. In a few years, shortage of waste material from forestry can be expected. This case study will examine the socioeconomic effects of the hurricane with special focus on recommendations for future resiliency.

Local communities along biomass supply chains, have a crucial role to play in bringing about real change in newly developing biomass markets or in securing existing markets. Often neglected, farmers, growers, estate owners (public and private sector) need to be more involved with the overall push to expand the uptake of bioenergy. There is also the matter of the ‘interplay’ of town and countryside. Most opportunities for medium to large scale deployment of biomass projects is in town/ urban environments whilst the resource is in the surrounding rural hinterland. This interdependence is a unique factor for bioenergy, differentiating it from most, if not all, other forms of energy provision. The bioenergy community has failed to grasp the significance of what can be a major problem in that town and country have very different issues and socio-economic drivers. These need to be fully understood and addressed together. In this way, a problem can be turned into a virtue.

The impact on local biomass markets and growers of large scale co-firing, there is an increasing move in some countries to the greater use of biomass in hybrid facilities, most notably wood fuel in co-fired facilities. Such initiatives are seen to be ‘market enabling’ and to help with the establishment of wood fuel supply infrastructures. Additionally, such a strong

market pull can assist with the establishment of large scale energy plantations (such as short rotation coppice). However, unless carefully regulated and managed, such initiatives can have a profound effect on the more local dedicated biomass market. An investigation into local benefits and costs could provide useful insights for both future policy and local practical actions.

Feedstock development activities are *planting the seeds* for an integrated energy crop industry. Fast growing wood and grass varieties are mechanically planted and harvested as an alternative crop. The farming techniques that will make energy crops cost-competitive and provide a new market for the rural economy are beginning to be demonstrated across the EU and in the U.S. The increasing focus of **agricultural policy** on environmental and rural development aspects of sustainable agriculture could lead to opportunities for biomass energy. The enlargement of the EU will have significant implications on a common agricultural policy and could provide further opportunities for biomass energy.

A common barrier preventing a more intensive uptake of bioenergy is the lack of awareness and knowledge among the key stakeholders in the economy, society, and politics more generally. An improved awareness combined with significant educational effort could make major difference. Existing **education on bioenergy** in various countries (Austria, Denmark, Finland, France, Germany, Sweden, and the United Kingdom) at undergraduate and postgraduate levels is often a component in a sustainable energy specialisation in engineering disciplines. A number of courses have been identified which focus on non-engineering aspects of sustainable energy or bioenergy, including agriculture, building services, climate change, design, economics, forestry, law, rural development, sustainable development and waste management. These broader approaches are critical and need to be more strongly promoted.

The key priority will be the analysis of the economic and social aspects of initiatives along with the net overall benefits of bioenergy use. This will include the development and promotion of tools and guidelines for their determination. The Task will also deal with connected environmental considerations and the contribution that biomass makes to rural and remote areas, in which biomass production for energy often takes place.

CONCLUSIONS

Bioenergy continues to provide a significant amount of global consumer energy. To this end, modern biomass is developing rapidly. Many new and improved bioenergy technologies are reaching the market and, in some cases, are successful in competing with fossil fuels even without government incentives. Bioenergy in its traditional forms, is still the main source of energy in many developing countries, and will continue to be so for the foreseeable future. Bioenergy has often been associated with poor environment and health hazards but these attributes are not inherent to bioenergy but are the consequence of underdevelopment, cultural factors and so forth. In fact, modern biomass use systems often result in many local health benefits, whether as a result of better wood stove design for people living in rural areas, as a consequence of avoided emission of sulphur dioxide or particles when biomass replacing coal in modern power plant, or even more, as a result of reduced pollution through the use of biofuels for those living in the many urban centres.

An encouraging trend is that in many countries policy makers are beginning to perceive the potential economic benefits of commercial biomass e.g. employment/ earnings, regional economic gain, contribution to security of energy supply and all others. This represents a significant policy shift with regards to the old view in which biomass was viewed as a non-commercial rural source, or 'poor man's fuel'.

IEA Bioenergy is one of a number of Implementing Agreements established by the International Energy Agency and its Committee of Energy Research and Technology (CERT). In the past 25 years, IEA Bioenergy has been at the forefront of the world efforts to improve the production, harvesting and utilization of biomass resources and to more efficiently use these and related wastes. The Task 29 is an important element of this, actively contributing to the better understanding of all social and economical implications of biomass and bioenergy.

References and Further Reading

- [1] Domac, J., Madlener, R., Richards, K. (2000). Socio-Economic Aspects of Bioenergy Systems. A New International Research Cooperation within IEA Bioenergy. In Proceedings from 1st World Conference on Biomass for Energy and Climate Protection, Seville, p. 155-159.
- [2] Madlener, R., Myles, H. (2000). Modelling Socio-Economic Aspects of Bioenergy Systems: A survey prepared for IEA Bioenergy Task 29, September (available at: www.iea-bioenergy-task29.hr/Task29/pdf/models.pdf).
- [3] Domac, J., Richards, K. (2002). Final Results from IEA Bioenergy Task 29: Socio-Economic Aspects of Bioenergy Systems. In Proceedings from 12th European Conference on Biomass for Energy and Climate Protection, Amsterdam, The Netherlands, p. 1200-1204.
- [4] Domac, J., Richards, K., Madlener, R., White, B., Healion, K., Lunnan, A., Nilsson, S., Yagishita, T., Segon, V. (2004). Educational Work of IEA Bioenergy Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects. 2nd World Conference on Biomass for Energy and Industry, Rome: 2421-2424.