

PEOPLE AND BIOENERGY

RESULTS AND FINDINGS FROM IEA BIOENERGY'S PROJECT ON SOCIO-ECONOMIC DRIVERS IN IMPLEMENTING BIOENERGY PROJECTS

[J. Domac](#)¹ and V. Segon

on behalf of IEA Bioenergy Task 29, with contributions from researchers from Austria, Canada, Croatia, Ireland, Japan, Norway, Sweden and the United Kingdom

THE CONTEXT

In many parts of the world, there is increasing interest in shifting to a bio-based economy where agricultural crops, mill waste and fast-growing trees are used as feedstock. The associated bio-processes, involving fermentation, bio-catalysis, biosensors and metabolic engineering, are growth areas where, by definition, biomass becomes a substitute for fossil fuels.

Some 14% of the world's primary energy supplies is already provided by bioenergy resources such as forestry and agriculture crops, biomass residues and wastes. Bioenergy today provides millions of households with incomes, livelihood activities and employment.

From a social standpoint, the sustainability of bioenergy projects is essentially a question of how they are perceived by society, and how different societies benefit from these activities in different ways. Other 'big issues', such as mitigating carbon emissions, ensuring wider environmental protection or providing security of energy supply, are an added bonus for local communities where the primary driving force is much more likely to be related to employment or job creation. Overall, these benefits can be expected to increase social cohesion and stability.

When one looks at the full picture regarding biomass use, it is clear that socio-economic factors are of crucial importance. Task 29 of the [Bioenergy Implementing Agreement](#)² of the International Energy Agency accordingly focuses its activities specifically on the 'Socio-Economic Drivers in Implementing Bioenergy Projects'. The overall aim of Task 29 is to promote use of biomass for energy over fossil-based competitor fuels in participating countries and world wide by gaining a better understanding of the social and economic drivers and impacts of bioenergy systems, at the local, regional, national, and international levels. The Task works on the premise that the promotion and implementation of bioenergy projects can be most effectively conducted by supporting, educating and mobilising dedicated stakeholders like environmental or other interest groups, local communities and individual energy consumers.

¹ Energy Institute Hrvoje Pozar, Savska 163, 10000 Zagreb, Croatia;
e-mail: jdomac@eihp.hr
Tel: +385 1 6326 109
Fax: +385 1 6040 599

² IEA Bioenergy is one of some 40 energy technology R&D and information dissemination programmes established by the International Energy Agency and its Committee on Energy Research and Technology (CERT). They operate within the IEA's [Framework](#) for International Energy Technology Collaboration.

Additionally, specific aims of Task 29 include synthesis of its findings on both the social and economic drivers and the impacts of establishing bioenergy markets, and transferring to stakeholders the critical knowledge and new information obtained. The Task works also to improve the assessment of socio-economic impacts of biomass production and utilisation in order to increase uptake of bioenergy and provide better guidance to policy makers. Activities focus on stakeholder involvement, local income creation, public acceptance, local NGO involvement, long-term financial and political support, technology transfer and diffusion, and distribution of benefits.



Household pellet stove production in Macinec, Croatia (J. Domac)

They address fuel substitution aspects, policy aspects, education and capacity building, definition of collateral effects and market development in relation to timber and non-timber product markets (e.g. shifts of income or changes in financial sourcing towards sustainable development). Further work deals with institutional development and other relevant means of securing long-term success, minimising leakage and maximising the additionality of projects.

Task 29 started its activities in January 2000 with the following participating countries: Austria, Canada, Croatia, Japan, Sweden and the United Kingdom (UK). Ireland and Norway subsequently joined the Task, bringing the total to eight countries.

SOCIO-ECONOMIC ASPECTS OF BIOENERGY

Using biomass for energy can bring extensive economic and social benefits. On 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 (GHG) serves the 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 demand and labour costs. Local economies and national trade balances benefit from replacing 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 of fossil fuels and availability issues.

Modern industrialised societies function within a series of trade and political relationships with a variety of countries, trading blocs or economic and political alliances. Bioenergy use, with its associated activities – production, harvesting, 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. The appeal of a bio-based economy is growing and so, therefore, is use of the associated bio-processes that depend 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 also relates to a number of aspects of a social, cultural and environmental nature. An integrated approach thus needs to be taken in investigation and the sharing of knowledge on these separate aspects. A specific complication when analysing these questions lies in the fact that a considerable number of elements are not always tractable for quantitative analysis and have therefore been precluded from the majority of impact assessments in the past, even though they may be very important at the local level (Table 1).

Table 1. Benefits associated with local bioenergy production

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

Another important effect associated with increased use of bioenergy is the stimulus it provides for revival of cultural traditions. In boreal forests, for instance, many remote communities have no year-round road or connections to electricity grids and they 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. This would make the community more self-sufficient, reduce costs, provide employment and integrate well with a forest-based culture. There are examples like [Charlottetown on Prince Edward Island, Canada](#) or [Växjö Municipality in Sweden](#) where a shift to locally-produced bioenergy has been very successful and these successes need to be communicated and fostered.

The IEA Bioenergy position paper '[Benefits of Bioenergy](#)', published by the IEA Bioenergy Executive Committee in March 2005, presents bioenergy in the context of energy choices and identifies linkages to wider sustainable development outcomes. It outlines the wide range of biomass sources and conversion technologies available, and it discusses social, environmental and economic aspects of bioenergy systems.

OVERVIEW OF ACTIVITIES AND RESULTS

During its early years of activity, IEA Bioenergy’s Task 29 defined clearly the ‘state-of-the-art’ in the complex field of socio-economics as applied to bioenergy systems. It began to apply new methods and thinking to community-centred initiatives, based on community interaction and feedback. Moreover, a clear impact has been manifested as a direct result of the activities of the different research groups in participating countries and beyond. In parallel with their participation in Task 29, involved experts launched several projects and initiatives which are already recognised at the national level, but also internationally. Among many, we could mention the [EC Renaissance project in Bracknell, UK](#), or a public opinion survey and subsequent educational campaign in Croatia, now part of the [EC Sustainable Energy Europe Campaign](#), or again a study on [Bioenergy training needs for Ireland](#). Education and its potential contributions to removing different barriers to bioenergy around the world were identified as important parts of Task 29 activities, a perception that subsequently generated its [Educational Web Site on Biomass and Bioenergy](#), described below.

The Task investigated and shaped a profile for differing regional and national achievement rates in terms of securing social and economic benefits from biomass utilisation and it identified drivers for implementing bioenergy projects. A further key activity was the design, development and implementation of an ‘easy-to-apply and use’ socio-economic tool for local bioenergy projects, based on both existing models and on recommendations derived from work accomplished during the early working period of the Task. It became very clear that the technique likely to yield the best match is 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, so some very basic modelling is needed in order to facilitate project building (addressing both the technical and political requirements). By contrast, in Sweden and Austria there are numerous fine examples of projects which are ready for closer investigation. It is therefore unlikely that one single model can be used for all countries.

This being noted, an overview of the existing tools for socio-economic modelling of different bioenergy systems was completed, [2], and further activities were targeted to prepare a 'toolbox' of existing models and methods for use in participating countries and for application in selected study communities. The analysis and modelling work in communities was completed, using chosen case studies or regions for each participating country, 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; they 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, provide a 'living link' to the work and actively demonstrate Task commitment.

An important part of Task 29's activities focuses on collaboration and the forming of linkages with other IEA Bioenergy Tasks as well as other organisations, initiatives and projects targeting increased utilisation of biomass and bioenergy. The team has collaborated actively with IEA Bioenergy's projects dealing with "Conventional Forestry Systems for Sustainable Production of Bioenergy" and with "Greenhouse Gas Balances of Biomass and Bioenergy Systems" and it has worked with the United Nations Food and Agriculture Organisation (FAO). Co-organisation of events with other stakeholders is another important feature in the Task's work programme, alongside its own [workshops](#), which have taken place regularly since the outset.

Some of the Task's notable contributions to the worldwide body of knowledge on socio-economic aspects of bioenergy are given below.

- The brochure '[Bioenergy in Our Community](#)', which explains the most important aspects of biomass and bioenergy utilisation.
- Workshop proceedings and a selection of scientific papers presented at various conferences and seminars (see [Web site](#)).
- 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, several video files explaining various socio-economic issues related to bioenergy and much other information material.

EDUCATION

More recently, one major focus of activities has been education and its potential contribution to removing different barriers to bioenergy use around the world. Public education has a key role to play. The lack of general awareness of the various benefits of biomass and bioenergy (environmental, social, economic) and the consequent lack of acceptance of their use is constantly pointed out as one of the major barriers to wider implementation. Enhancing this awareness is a complex challenge which cannot be solved in one step. Usually, the first step involves a public survey in order to measure current awareness among the population as precisely as possible. Two such surveys were performed in 2003: one in the Croatian cities of Zagreb and Rijeka, another in Reading, UK. The surveys were co-ordinated by Task participants and the results were subsequently discussed during a [Task workshop](#) in the UK.

As a flagship project of the Task, the [Educational Web Site on Biomass and Bioenergy](#) has been developed as a powerful, user-friendly interactive educational tool. The Web site is designed as an easy-to-apply information source dealing with mainly socio-economic issues and aiming at a wide audience. (Modules of information can be accessed by clicking on the [Web site's](#) headings in the horizontal row of buttons: "definition", "technologies", "sustainability", etc.)

The number and nature of the visitors, as well as the ties some visits have established with world leading institutions and organisations, bear witness to the considerable success of this activity. Since the start of recording visits to the educational Web site with the tool WebStat in May 2004, more than 35 380 visits have been logged from 122 countries (Figures 1 and 2).

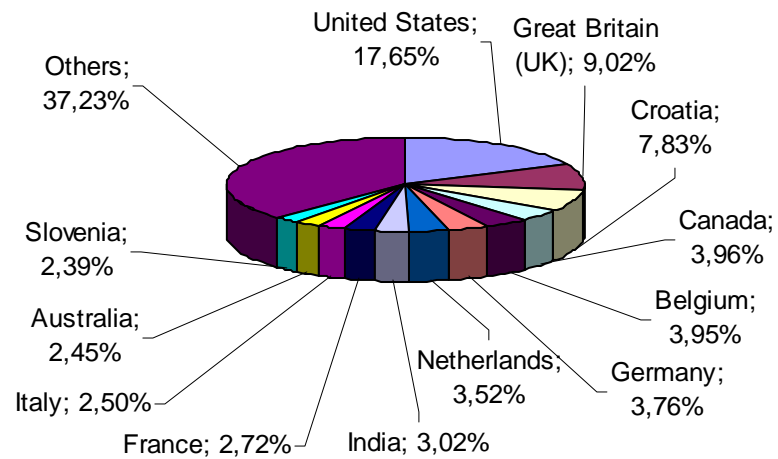


Figure 1. Educational Web site visitors by country, May 2004 – August 2005

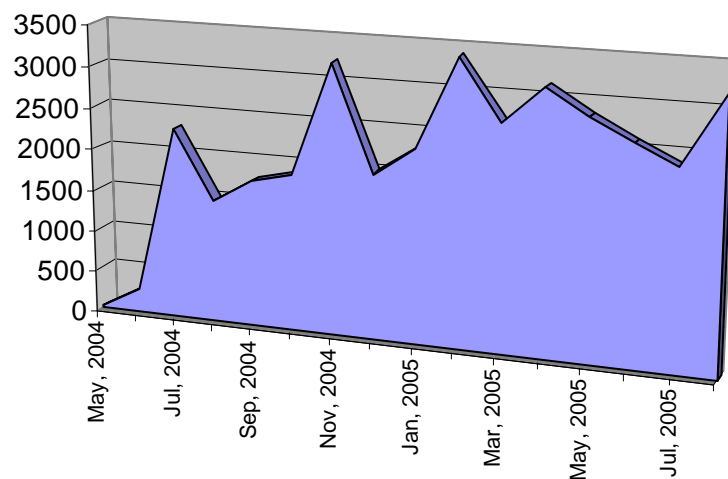


Figure 2. Educational Web site, number of monthly visitors, May 2004 – August 2005

Apart from its 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), and a ‘Test’ (where visitors can test their knowledge). Questions about biomass and bioenergy are stored in a database for answer by the webmaster or, if more complex, by a panel of experts. The site not only allows adults to expand their knowledge in the field of biomass and bioenergy, but it is also a very useful educational tool for children from secondary-school age upwards.

LOOKING AHEAD

Based on findings to date, how does Task 29 see the priorities for the future? Without question, the emphasis must be on integrated approach to economic, environmental and social aspects of

bioenergy systems, from production through supply chains to eventual consumers. It is important to foster multi-disciplinary partnerships of key stakeholders in forest biomass production and utilisation, in research, planning and operations. This is why IEA Bioenergy's Task 29 will establish clear linkages with universities 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 so generate real change on the ground.

Having identified the key issues to be tackled, Task 29 stresses the need to take a more holistic view of the totality of bioenergy activities, which in some instances will involve linking bioenergy projects with specific frameworks and structures, but also with national and international efforts, to address specific challenges. These approaches are outlined below.

Urban communities. 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 increasingly important, indeed, for heating individual homes. Biomass is also gaining significant profile in the case of rebuilding 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 is *urban biomass*, which is becoming more and more important. This incorporates notably *municipal green waste*, *landfill gas* and *biogas* from organic household waste, also *used cooking oils* for biodiesel production.

A Task [workshop](#) in Japan in 2004 was devoted entirely to use of biomass in urban communities, with the objective of facilitating exchange of information and knowledge on the latest developments and achievements in participating countries; it also included participation of invited experts outside the Task. One of the conclusions of this workshop was agreement to produce case studies illustrating opportunities for biomass use in urban communities, best practice procedures and socio-economic drivers. Several case studies are already completed or near completion and will be downloadable in pdf format from the [Task website](#) by the end of 2005. Building national, regional and international partnerships for implementing bioenergy projects is likely to play a very strong role.



Large-scale ethanol production, Barra Grande, Brazil (J. Domac)

Security of energy supply.

Along with the import/export balance, this 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) has catalysed several legislative initiatives (Directives) intended to facilitate development of the biofuels market in Europe. Meanwhile, in Japan, the importance of reducing energy

dependence is so high that Japan's Ministry of Foreign Affairs has established a so called 'energy diplomacy' initiative working to secure the stable supply of energy (energy security) for Japan.

Long-term and sustainable supply of biomass. Biomass is often considered to be a secure and reliable energy source. However, biomass supply can be affected by unexpected events that could become more frequent with climate change. An example is the recent powerful hurricane in Kronobergs County, southern Sweden, an area where waste material from forestry is used for most of the heat production and electricity generation. The hurricane Gudrun that struck the area in January 2005 damaged more than 70 million cubic meters of timber, equaling many years' normal cuttings. In a few years, shortage of waste material from forestry can now be expected. A Task 29 case study is examining the socio-economic effects of the hurricane, with a special focus on recommendations for future resiliency.

Local communities along biomass supply chains. These 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 or 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 are 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 of large-scale co-firing on local biomass markets and growers. There is an increasing move in some countries towards 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 establishing 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.

Agricultural policy. 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 European Union and in the United States. 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 European Union will have significant implications on a common agricultural policy and could provide further opportunities for biomass energy.

Training and education. A common barrier preventing a more intensive uptake of bioenergy is clearly the lack of awareness and knowledge among the key stakeholders in the economy, in society and in political spheres more generally. Improved awareness, combined with significant educational effort, could make a major difference. Education on bioenergy at undergraduate and postgraduate levels is already often a component in a sustainable energy specialisation in

engineering disciplines in various countries (Austria, Denmark, Finland, France, Germany, Sweden, the United Kingdom). 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 promoted more strongly.

The key priority is the analysis of the economic and social aspects of initiatives and the net overall benefits of bioenergy use. This includes the development and promotion of tools and guidelines for their determination. IEA Bioenergy's Task 29 will also deal with connected environmental considerations and the contribution that biomass makes in rural and remote areas, where biomass production for energy purposes 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 successfully competing with fossil fuels, even without government incentives.

In its traditional forms, bioenergy 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 features are not inherent in bioenergy; they are the consequence of underdevelopment, cultural features or other factors. In fact, modern systems for biomass use often bring many local health benefits. These can result from better wood stove design for people living in rural areas, they can stem from avoided emission of sulphur dioxide or particles when biomass replaces coal in modern power plants or, even more, from reduced pollution through the use of biofuels for those living in the many urban centres.

An encouraging trend shows that, in many countries, policy makers are beginning to perceive the potential economic benefits of commercial biomass, notably employment/earnings, regional economic gain, and contributions to security of energy supply. This represents a significant policy shift compared with the old view, which held that biomass was a non-commercial rural source, or 'poor man's fuel'.

We can expect more take-up of bioenergy options in urban areas, but public and political awareness of the various socio-economic benefits needs to be expanded. Energy decisions at local, regional and national level should automatically take into account the potential of bioenergy solutions, and that includes integrated agricultural policies and involving the farming community. The scientific expertise of academia and the practical know-how of the industrial sector have much to contribute to informing decision-taking. While there is still far to go before modern biomass and bioenergy can realise their full potential within the world's energy systems, there is every reason to be encouraged by progress so far.

Over the past 25 years, IEA Bioenergy has been at the forefront of efforts around the world to improve the production, harvesting and utilisation of biomass resources and to use these and related wastes more efficiently. IEA Bioenergy Task 29 will continue to strive for better understanding of all social and economic aspects involved in advancing efforts to give biomass and bioenergy their full role in our societies.

References and Further Reading

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