BARRIERS TO EUROPEAN BIOENERGY EXPANSION
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ABSTRACT: The European Commission has set challenging targets for renewable energy expansion in Europe as part of its strategy to limit greenhouse gas emissions. Expansion of existing bioenergy capacity has a key role to play in ensuring these targets are met. However, significant technical and non-technical barriers to deployment of biomass technologies remain throughout Europe, the latter often being more difficult to address. Non-technical barriers are fundamental obstacles to biomass development. They represent limits or boundaries to the extent of deployment, often related to institutional frameworks, perceptions, socio-economic issues or engagement of and interfaces with related technology sectors. This paper presents an analysis, characterization and prioritization of the current non-technical barriers to thermo-chemical bioenergy expansion in Europe. Policy, economics and stakeholder understanding are strategically important if bioenergy potential is to be realized. Detailed policy evaluation with case study history from 4 European member states shows continuity of policy instruments is critical and specific support instruments work better than more general mechanisms. Improved stakeholder understanding (with the general public as a relevant stakeholder group) is key to increasing the acceptability of bioenergy. This requires different parallel strategies for different sectors/target groups. Promotional campaigns, dissemination of information to key multipliers, provision of independent factual information to the public, appropriate frameworks for handling approvals for new plants, forums for stakeholder interaction and certification schemes all have a role to play in improving bioenergy acceptability.
Keywords: barriers, policies, promotion, implementation

1 BACKGROUND

The European Commission has set challenging targets for renewable energy expansion in Europe as part of its strategy to limit greenhouse gas emissions. Expansion of existing bioenergy capacity has a key role to play in ensuring these targets are met. However, significant technical and non-technical barriers to deployment of biomass technologies remain throughout Europe, the latter often being more difficult to address.

The work described in this paper was executed as part of the Thermalnet network, funded under the Intelligent Energy for Europe programme. The network brought together academics and industrialists to focus on addressing the challenges facing bioenergy in Europe across combustion, gasification and pyrolysis. The barriers task explored the wider barriers to bioenergy development, aiming to identify the key barriers, analyze, characterize and prioritize them, formulate strategies to address them and facilitate relevant exchanges and key results from this task are presented here.

2 IDENTIFICATION OF BARRIERS

A “barrier” is something that separates or prevents or hinders communication or progress. In the context of this work it is a fundamental obstacle to development that cannot be addressed by increased investment or research and development. It represents a limit or boundary to the extent of deployment, often related to institutional frameworks, perceptions, socio-economic issues or engagement and interfaces with related technology sectors.

Literature review, expert consultation and workshop discussions were used to compile a comprehensive list of European bioenergy barriers, Over 40 barriers were identified, which were consolidated and simplified in consultation with participants to result in the long list of barriers shown in table 1. Those involved on the industrial/implementation side focused on high costs, economic viability and inadequate policy regimes. Those working within the research and academic communities highlighted these areas too, but also picked up on other structural issues, such as inadequate technical exchange, difficulty in accessing information and an overall negative perception/image of bioenergy as unimportant

Table 1: Comprehensive list of all barriers identified from literature and Thermlanet members

Original barriers identified	**Consolidated description(s) and hsort identifier**
Complex authorisation procedures Uncertainty around applicable legislation Legislation	Delays and additional effort/costs associated with having to comply with an inappropriate legislative framework – **Legislation**
Inconsistent support measures Uncoordinated support measures Market uncertainties Economic uncertainty Incompetent government policies Incompetent government policy making and implementation Gaining support for demonstration plant3	**Inconsistent policy support** **Inadequate/ineffective policy support** **Inadequate demo plant funding**
Product quality standards Cleaning/upgrading to adhere to quality standards Environmental performance	Absence of appropriate product standards – **Absence of standards** Failure to comply with existing standards – **Quality compliance** Failure to achieve environmental standards – **Environmental compliance**
Operational failures	Unsuccessful plants projecting a negative image that deters further investment in the technology or sector – **Operational failures**
Health and safety compliance	Absence of standards appropriate to new technology, in areas where new technology struggles to comply with H&S standards appropriate for existing technologies. – **H&S standards** Additional costs associated with meeting H&S standards that are inappropriate for the scale or status of technology development e.g. for demonstration projects – **H&S costs**
Grid access	Inability to gain grid access – **Grid access** High costs of grid access – **Grid access cost**
Fossil fuel cost comparison	High bioenergy cost compared to fossil fuel alternative – **Fossil fuel cost advantage**
High capex High project development costs Low value = quality/cost missing economic advantages High costs – only long term profitability	High capital equipment and buildings cost – **High capex** High project development costs – **High project costs**
Feedstock costs Feedstock availability	High feedstock cost making projects uneconomical – **Feestock cost** Lack of suitable feedstock availability resulting in inadequate supply, operational problems, higher costs – **Feedstock supply**
Lack of long term demonstration project	Lack of evidence that technology is proven for long term operation in a semi-commercial environment – **No demo plant**
Risks & guarantees/integration of process and plant/lack of turnkey providers Funding, financing & insuring	Difficulty in obtaining bankable turnkey contract because of unwillingness of turnkey engineering contractors to take on novel technology risk and inability of technology developers to provide bankable guarantees – **Contract guarantees**
Lack of established supply market and infrastructure	Lack of appropriate existing transportation/storage/transfer facilities for feedstock results in higher level of capital investment being required for earlier plants – **Fuel infrastructure**
Lack of technical exchange Competition between research institutes hinders co-oiperation and encourages overlap Knowledge flow between and engagement with stakeholders Lack of business understanding in research community	Lack of knowledge exchange between technical practitioners and from technical practitioners to stakeholders leads to distrust, uncertainty and lack of confidence in technical solutions, which hinders progress – **Knowledge exchange**

Lack of an effective single voice for the industry Different national conditions hinder a strong EU-wide approach to overcome barriers	Dissemination of sometimes conflicting output from many small bioenergy organisations confuses the recipients. – **Too many voices** Following separate national programmes for bioenergy support results in higher overall costs and lower levels of European awareness. – **National differences**
Social acceptability/public perception Lack of understanding of technology Lack of appreciation of external benefits Low external profile Low expectations of policy makers perception of trivial impact no high-tech image Perception of marginal value (benefit/cost) Perceived lack of economic viability	Poor understanding of the technology, its benefits, costs and impacts by stakeholders results in bioenergy not being considered as a real contender in appropriate contexts – **Stakeholder understanding**
Poor attention to fundamental research - not enough support	Insufficient funding of fundamental research delays rate at which applied technical solutions can be developed– **Research funding**

and even backward. Inadequate support for fundamental research was also cited by the academic community and those with less of a technical focus picked up on feedstock availability, the lack of an EU wide approach and competition between research institutes.

3 CLASSIFICATION OF BARRIERS

The barriers were classified in figure 1 by the nature or origin of the barrier, as follows:

Structural barriers - As with other clean technologies, bioenergy barriers frequently arise because a new entity is attempting to develop within a space that was fashioned to suit a previous incumbent. As the characteristics and needs of the new entity are different, its progress will be impeded by boundary conditions that were previously not material. An example of this sort of barrier is the difficulties that may be incurred by renewable energy technologies in accessing grid connection because the grid network was designed to serve a very different power generation infrastructure to the one that is now evolving. This is a physical constraint. However, these structural barriers can also be less tangible, for example the additional complexities associated with having to mould a bioenergy plant into an environmental permitting procedure designed for coal-fired power stations.

Market barriers - Another reason for barriers to many new technologies is that the new technology addresses a need or provides societal benefits that are not valued by the current market, making it difficult for the new technology to compete. For example, the current market might not value the carbon savings or security of supply advantages associated with bioenergy.

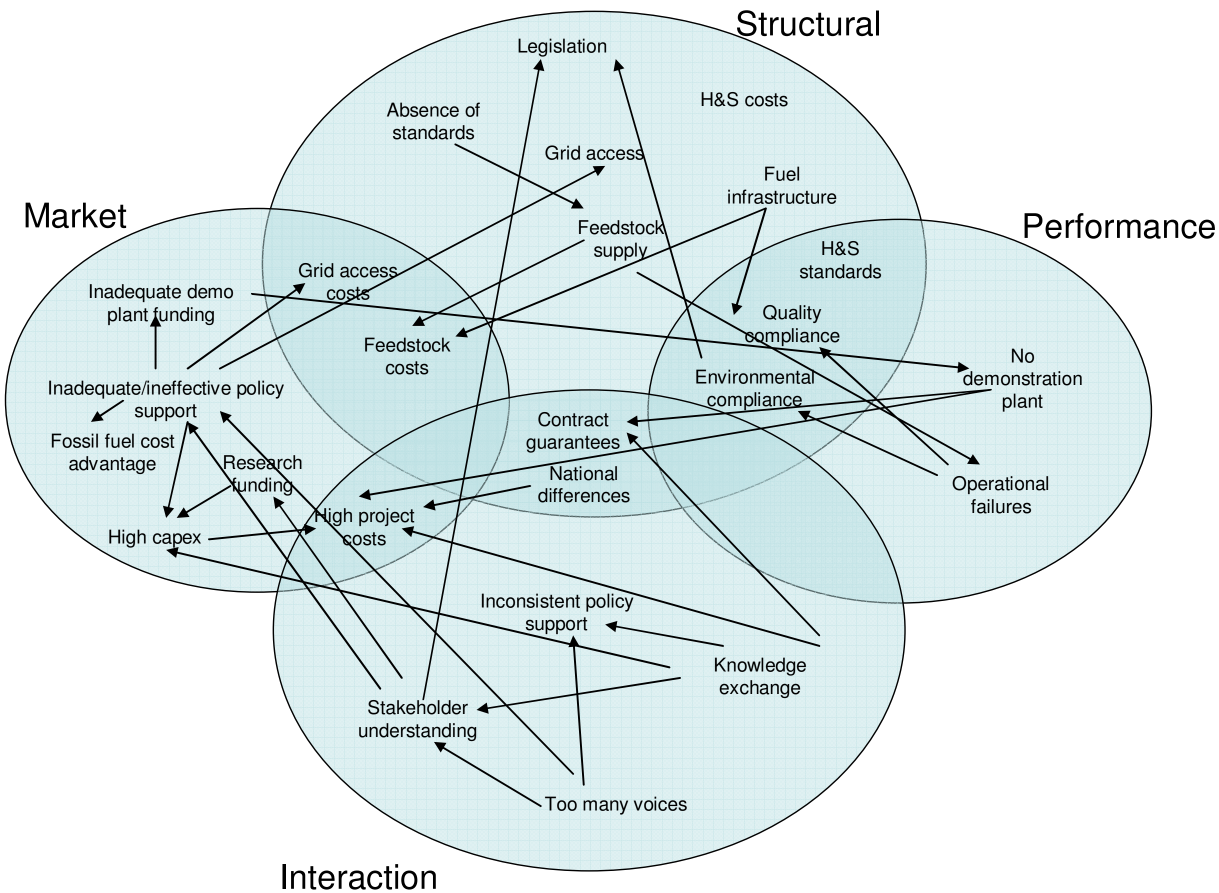
Interaction barriers - A third cause of barriers is that the developing entity draws upon the knowledge, skills and products of different sectors and industries which are not strongly bound with a common goal. This results in development being delayed or obstructed by a lack of knowledge transfer and/or non-alignment of the different parties' objectives. This is more relevant to bioenergy than many other clean technologies, as deployment spans a number of diverse sectors: agriculture, transport, construction and engineering. There are other precedents e.g. the pulp and paper industry, or the industries producing food, feed, bioethanol or sugar/starch based chemicals, where different sectors have been successfully aligned with a good business case and these may provide a good model for the bioenergy industry.

Performance barriers – These are areas where the technology falls short in some way in delivering the end user's requirement. It may be a fundamental characteristic of the new technology which requires an alternative focus for the market application. For instance biomass is an inherently bulky material and naturally not suited to heating in high density, city housing developments; there would be insufficient space for modern householders to store the biomass, but a shift of focus would facilitate the service delivery via a district heating scheme. Alternatively it may be a technological limitation which can be addressed through research and technical development e.g. NOx emission levels from small scale biomass combustion units may need to be reduced to comply with environmental legislation in some cases.

Addressing structural barriers generally requires readjustment of the space that suited the previous industry to be more accommodating to the developing alternatives. Often this requires direct intervention within the industry by capital investment, reorganisation or legislation. Market barriers will generally respond to policy interventions, which attempt to adjust the market to take into account the non-economic attributes of fuels or technologies. Performance barriers either require technical development or a readjustment of market focus to circumvent a technical constraint. Interaction barriers are perhaps the most difficult to address, as they require greater interaction between diverse bodies or individuals with diverse interests, some of whom have commercial or technical rationales for not communicating with other parties. A forum for communication and exchange is needed but also a common alignment of objectives so that participants see both the benefits to themselves and the need for involvement of other parties to more effectively achieve their own/joint objectives.

The relative importance of different barriers was identified in workshops with participants and is displayed in figure 2. In addition linkages between different

Figure 1: Mapping of key barriers identified



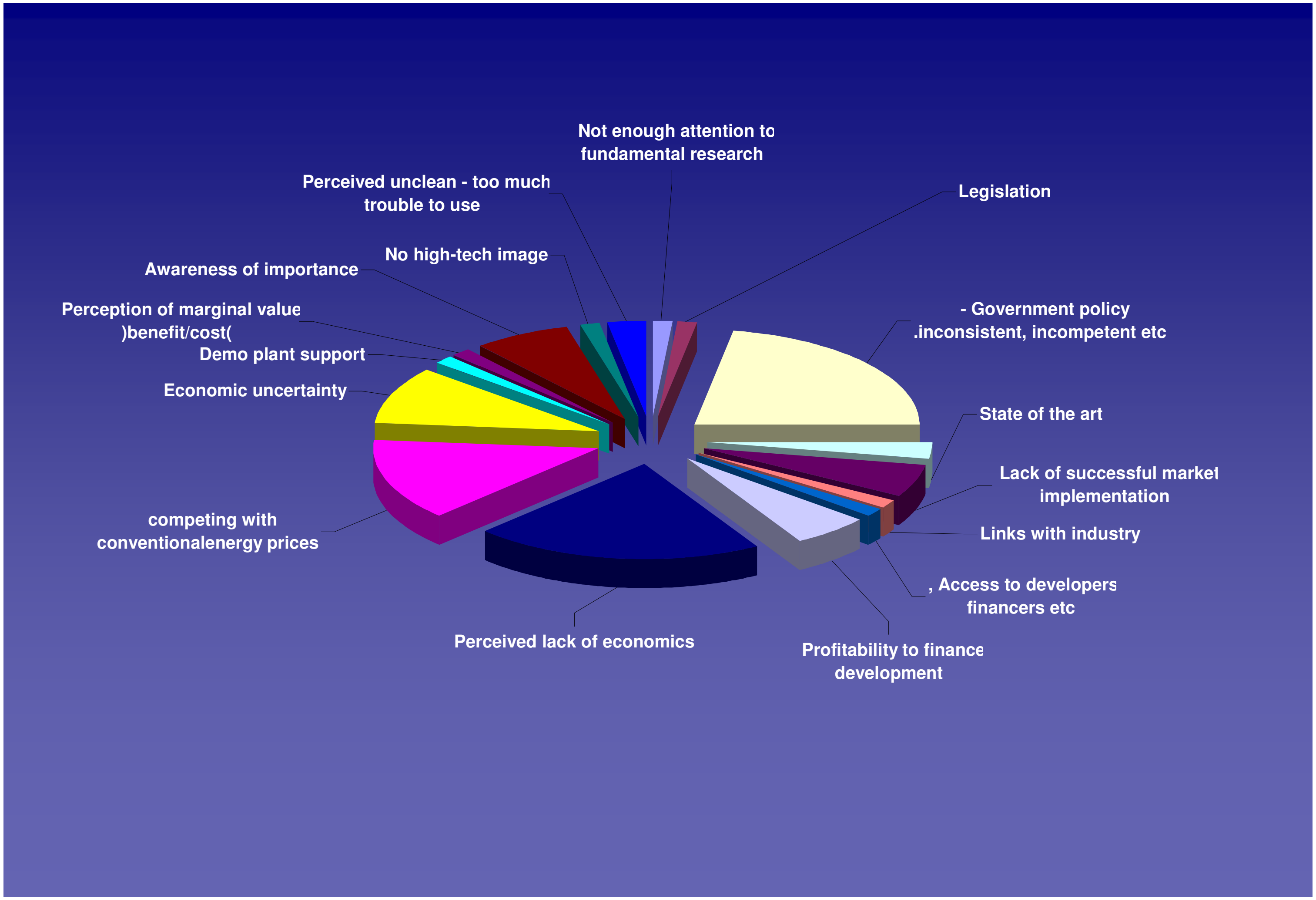


Figure 2: Prioritization of barriers by Thermalnet members

barriers were included in figure 1 in order to highlight "highly linked" barriers. Multiple benefits could be derived from addressing these. They were examined with participants at workshops and led to consolidation of the most significant bioenergy barriers as

- Inconsistent government support
- Inadequate/ineffective policy support
- Stakeholder understanding
- Fossil fuel cost advantage

In all cases, except that of fossil fuel cost advantage, they are also widely linked barriers so that tackling them would have far-reaching implications. The topics of policy and stakeholder understanding/public perceptions were therefore chosen for further evaluation, as described below. Fossil fuel cost advantage should, of course, not be dismissed. In our global market-driven economy the business case is so paramount that all other barriers could conceivably vanish if the fossil fuel cost advantage were abolished with a sufficiently attractive economic case for bioenergy.

4 POLICY BARRIERS

A comparative evaluation was carried out of current and historic bioenergy policy in four European countries, analyzing the policy instruments that had been used in each country, their success or otherwise, the reasons behind this and what implications this might have for future initiatives. Detail of this work can be found elsewhere [1] but a summary of key findings is given below.

The work demonstrated that uncertainty and lack of continuity in energy policy is a key issue that applies to biomass and all other renewables. The time scales over which national governments, or their priorities, change, frequently frustrates long term policy commitments. One example directly experienced by one of the authors of this paper was when BTG Biomass Technology Group b.v. in Enschede, The Netherlands were negotiating in 2005/2006 with Electrabel to co-fire pyrolysis oil produced in Malaysia from empty palm fruit bunches, in one of their power stations, but plans were abandoned when the Dutch government decided suddenly to remove subsidies for biomass co-firing. This is an area where a strong lead from the European Commission and parliament is extremely beneficial. The Renewable Energy Sources directive and Biomass Action plan are steps in the right direction, which must now be built upon and consolidated. Uniformity with respect to definitions of biomass, waste and renewables could also be led at a European level and could help create a level European playing field in the sector.

Regarding the actual policy instruments on a national level, it seems that investment subsidies are useful in the early stages if followed up by other policy initiatives as the industry develops. Whether this is a fixed electricity tariff, trading certificates or taxation is not as critical as ensuring that sufficient levels of funding are actually channeled into the biomass industry. Whilst bioenergy is competitive in some countries under certain circumstances, in others it often requires a higher level of support than other renewable technologies such as wind. This results in a need for higher premiums for bioenergy or ring-fenced funding opportunities specific to a bioenergy sector.

The European Commission is already leading the way for its member states with the implementation of an ambitious Biomass Action Plan. Enthusiastic and determined adoption of its recommendations would provide a long term framework for future biomass development in member states. However, member states need to have a clear vision of what they are trying to develop (the resources, the sectors and the technologies appropriate to them) to ensure appropriate targeting of resources and prevent unnecessary policy and legislative shifts as the industry grows.

Many countries with a less developed biomass industry or scarce resources will focus on investment subsidies. Others, who are further on, will initiate policy instruments such as trading certificates, green tariffs, taxation or a combination of these. These will be most beneficial where the specific contribution of biomass is recognized financially by targeting of funds, rather than open competition with other forms of renewables. The vision of an open, competitive European electricity market where biomass can make a contribution to clean energy is an attractive one, but first requires an interim period of biomass specific funding and development.

5 PUBLIC PERCEPTIONS BARRIERS

The second area on which further work was focused was that of public perceptions. The European public is generally very aware of climate change and supportive of renewables. However, within the renewables sector the awareness of bioenergy is very low [2,3,4].

There are many examples in the literature where bioenergy developments have been objected to and/or resisted by local communities or other interested bodies. Figure 1 shows that knowledge exchange is key to stakeholder understanding, which in turn influences many different barriers to bioenergy development.

Upreti considered a number of developments in the UK [5] and concludes that public distrust is a major barrier to biomass development in Europe. Local people accept the need for renewables but do not accept the need to build locally. They evaluate new projects by subjective criteria such as new technology, unknown consequences of potential failure, less perceived local benefits etc. A similar story is reported by Rohracher, Bogner, Spath & Faber, when considering developments across the European Union as a whole [6]. Local resistance is typically organised by ad hoc groups who feel their local environment is threatened. Conflicts between the public and developers escalate when

- The development is involuntarily imposed on their locality
- The technology is unfamiliar
- They have no decision making power or
- The development is for corporate profit rather than local benefit

Developers tend to argue about rational environmental advantages, while local people use rights and moral based arguments and objective information campaigns will struggle to bridge this gap.

An EU FP 5 project by AEA Technology [7] found that British experiences, where developers are generally private companies, are very different from those in European countries where local municipalities undertake developments. The perception that the development will benefit remote business rather than local communities may engender distrust, which is subsequently amplified.

Another common problem is the belief that approval of a facility may subsequently lead to its use for other means.

6 ADDRESSING BIOENERGY PERCEPTIONS

In order to give some indication of the extent to which access to knowledge can alter concerns about bioenergy, an exercise was carried out with the Thermalnet participants, who are generally very aware of the technical issues, to assess their response to proposed developments compared to the actual recorded objections of local communities. It was found that the issues cited by the participants as important were broadly similar to those raised by the local communities: emissions, smell, traffic, etc. This suggests that educating people in relation to biomass is not going to allay such objections and supports the view of many academics that the issue is more one of engagement than knowledge. Improving the public's understanding of bioenergy by provision of independent information is only a small part of addressing this barrier. This will achieve most if set alongside a more transparent approach to the whole planning and development process. Nevertheless, there is evidence that positive experience of bioenergy facilities help: e.g. Rochraer et al. [6] cites a municipal facility in Vienna, which was generally supported only after the Austrian energy agency organised a study tour to a similar operational facility in Scandinavia. There was a similar case with Elean in England, which initially faced opposition in planning, but arranged a similar visit and modified its design proposals in response to local concerns and now enjoys positive relations with its local community.

In terms of improving perceptions and awareness the concept of bioenergy was considered too abstract to communicate. For domestic systems it was important to get end-user acceptance and interest as acceptance in this sense equated to them purchasing systems. For larger plants the situation is different: as local resistance is frequently well-organized and must be combated.

The information needs and general perceptions related to these two situations are very different and not easily unified. Consequently general PR campaigns covering bioenergy are unlikely to work, as the concept of bioenergy is too abstract. Therefore for small, domestic systems promotion should be using tangible examples, related to bioenergy technology in its social context. Concrete, tangible aspects of wood fuel could be successfully communicated, concentrating on new values (design, modernity etc). For large scale plants targeted information campaigns are best to particular target groups and the use of intermediaries is appropriate e.g. targeting those responsible for issuing permits. This facilitates empowerment of key players, who can then act as multipliers.

When faced with local developments, residents groups are often reluctant to turn to the developer or other involved parties (e.g. local authorities) for information, partly due to a fear that they might not be impartial. There is therefore frequently a requirement for more general technical knowledge and those involved frequently turn to the worldwide web. TU Graz has done some work reviewing websites related to bioenergy and the information available on them [8]. It concluded that while there are many websites they generally lack constructive analysis based on hard facts, such as statistical information. This is an area where communications with the general public and availability of information could perhaps be improved. Part of the conundrum seems to be that the public want information on the real, detailed, impacts of real plants, but want it to come from an independent source other than developers, who are the groups most likely to be in possession of such (frequently commercially confidential) information.

It is human nature that people are naturally resistant to change and common sense is needed to overcome this. The general public are broadly supportive of renewables, but there is a low level of awareness for biomass and work done by Thames Valley Energy [9,10]. had indicated that those who are more educated and have higher incomes tend to be more supportive, although our own work with Thermalnet members seemed to contradict that somewhat.

Despite this, particular projects frequently run into objections with emotional responses and objections. These can often be countered with real facts. A sensible approach is to work with local communities, find a local environmental champion and support them, be sensitive to previous history and connected issues, be transparent and seek to maximise benefits for local communities e.g. community buy-in, energy service companies (ESCO's) etc. Thames Valley Energy had success with the Slough heat & power project, which was shown as an example of working with communities, particularly on the supply chain side, working with tree surgeons, hauliers etc, who would then spread positive messages about the scheme locally. Tree stations have been developed as joint ventures to provide income locally to supply a large plant. This continues to be developed by promoting small scale uses locally.

One solution to avoid these issues may be by pursuing development of big facilities on basis of imported feedstock, these facilities being integrated in existing industrial infrastructures and situated remote from residential areas. Transport of wood and wood pellets over long distances is well established already and transport of liquefied biomass like fast pyrolysis oil seems feasible in the future. Overseas transport of bioethanol and plant oil (for biodiesel production) is increasing rapidly these days due to the obligations of substituting fossil transportation fuels.

There are examples where this strategy seems to become successful e.g. the approval by the UK government of plans to construct the world's largest biomass plant at a port-side location in Port Talbot. However, media reporting of biofuels have raised the profile of sustainability issues related to imported feedstock to the extent that some of the other large bioenergy facilities planned for the UK are more likely to undergo scrutiny of the sustainability credentials of their feedstock in the public arena and robust representation of these is likely to be critical to future success.

Significant efforts promoting bioenergy expansion are being made in a variety of contexts,working on cross-cutting social and economic issues and bringing together people and technology, science and industry, policy makers and the general public. IEA bioenergy task 29 aims at better understanding the social and economic drivers for bioenergy projects, transfer this information to stakeholders and improve assessment of the impacts to improve uptake. Key to this strategy is to put people first, with consultation with local communities as recipients of technology.

An AFBNet project identifies factors that help the success of a bioenergy scheme [11]:

- Support from key local organizations
- Sound finances
- Reliable technology
- A key person/organization within the community driving the scheme forward
- Good communication and recognition of the different aims of different sectors of the community
- Good local partnership and the use of local labour, so income streams flow back into the community
- Local utility as one of the partners

Whereas failure was often associated with:

- Poor economics; poor finance
- Unreliable technology
- Over ambitious schemes
- Indifference or hostility locally
- A feeling of imposition of a scheme by outside developers
- Little or poor track record
- Unbalanced motivation e.g. strong environmental drivers with few economic drivers or strong economic drivers but few society or environmental drivers

Rohracher et al.[6] suggest the following actions:

- Target specific groups with information campaigns e.g. those responsible for giving permits for plants in public authorities
- Get in contact with potential opposition groups e.g. environmental groups at an early stage
- Use established information channels e.g. popular magazines with a technical or environmental focus to disseminate information about new bioenergy conversion technologies
- Guidelines for developers on communication strategies
- Develop and communicate examples of best-practice

The role of non-governmental organizations (NGO's) is seen as particularly critical in forming public opinion. A particularly important task is therefore seen as providing information and access to NGO's as well as listening to their concerns to facilitate development of new concepts and technologies that avoid particular environmental and sustainability issues.

The dominant drivers for bioenergy development are different for different players. The most important for households are improved utility and profitability for firms, increased social welfare for local and national government and for the latter position within the international community. The dominant impacts include things such as standard of living, environment, employment leading to social cohesion and reversing rural depopulation. In 2001 the socio-economic variables were prioritised by IEA task 29 11 and employment and economic activity were the most prominent areas, above CO2 savings. A large number of other areas were identified, many positive, but also some negative ones, such as transport movements, reduction in house prices, impact on tourism etc.

7 DISCUSSION

Public perceptions are seen as a key barrier to bioenergy; surveys have shown that the public don't know a lot about bioenergy and there have been a number of high profile cases where public opposition and misunderstandings have derailed proposed bioenergy projects. Some developments have managed this and recovered from the interaction; others have not. Generalised PR campaigns relating to bioenergy are very difficult to execute, as the concept is so abstract to the general public. Their concerns tend to be related to the local impacts of actual physical developments, frequently focusing on the role of feedstock and related transport, visual impact, impacts on local communities etc. These sorts of concerns tend to be emotive and personal, so that technical detail or development is unlikely to allay them. There is frequently also an innate distrust of developers, particularly in countries such as the UK, where new facilities tend to be by private developers rather than local authorities or municipalities. A frequent grievance is that the local community is paying or suffering in some way for the benefit of others (corporate benefit) or the greater good (global climate policies). This polarizes positions between the local community and those enforcing a "solution" upon them. Distrust forces parties into combative, entrenched positions and the results are all too predictable. The key to resolving this is to avoid the escalation of conflict by building a relationship between the host communities and the developers. This is unfortunately easier said than done. There are a number of areas where appropriate actions will help, but there are no magic bullets. Frustratingly there also appears to be relatively little that the wider bioenergy community can contribute in these scenarios. The only area that has emerged as part of this work is that there is a need for public access to real information about real facilities, focused on the priorities of local communities. This would therefore cover areas such as transport movements, local environmental impacts, safety issues, dust, noise etc, all of which are generally rated highly on lists of concerns when new developments are proposed.

Interaction barriers have been shown to be key to bioenergy development, but very difficult to address. There is a need for stakeholders from different sectors of the industry (agricultural, political, technology developers, NGO's etc) to be brought together with some degree of commonly aligned goals in order to initiate a process whereby they can work together towards this. This is unlikely to be possible at a European level; but could be addressed at national levels. It is necessary to find structures and methods that will align the interests of the diverse set of stakeholders who are required to work together in order to achieve the most significant benefits of a truly integrated bioenergy system. This is possible in countries with adjoining strong timber traditions, such as Sweden or Austria; but in other countries (even those with high levels of environmental awareness and renewables penetration, such as Germany) it has proved much more difficult. Various initiatives, such as those in the Netherlands, bringing together different NGO's have been tried, but there is not clear evidence of their impact. The difficulty is in engaging participants in an area that is remote from their normal priorities to achieve objectives that they do not consider their responsibility. Ways and means of incentivising involvement and interaction of these groups must be devised if this is to work effectively: addressing the question: "What's in it for me?". It is impossible to provide a formula that will work in all cases, but it is certainly worth national governments and other organisations committing some funding to exploring possible structures that might work.

8 CONCLUSIONS

A strong bioenergy policy framework led by European targets and appropriate support measures would help drive the industry forward by enabling profitable, and economically sustainable, bioenergy business cases. Recent developments in this area are to be welcomed and should be focused to achieve a policy climate that supports nation states in implementing their own policy instruments, bearing in mind that:

- Continuity of policy instruments is critical
- Specific instruments for particular forms of bioenergy (e.g. electricity, CHP, co-firing, transport fuels) work better than more general mechanisms
- Fixed prices are good for kick-starting bioenergy industries, but generous premiums are needed to sustain activity
- Investment subsidies can initially help develop a bioenergy industry, particularly where growth of biomass crops is involved, but often do not maintain long term development
- Trading certificates have successfully generated investment in bioenergy, but work best when specifically weighted towards bioenergy
- Long term taxation measures are effective when set at a high level and increased incrementally, but the lower levels of taxation more commonly applied in European member states need to be used alongside another stronger mechanism.

The problem of public perceptions should be viewed as one of stakeholder engagement; with one of the stakeholder groups being the general public. Increasing the acceptability of bioenergy requires different parallel strategies that involve the following:

- Targeted promotional PR campaigns for uptake of domestic systems, focusing on tangible benefits
- Dissemination of information to key multipliers in local communities, such as installers, transporters, planning officers etc
- Provision of factual information to the public in an independent manner about how real bioenergy systems actually perform
- Careful handling of approval structures so that plants being developed are appropriately reviewed and local communities feel associated with rather than disenfranchised from local developments – this is particularly important where private business is responsible for commercial developments
- Identification of appropriate sites with commensurate infrastructure, located away from population centres
- Development of appropriate forums in which stakeholders can interact on common issues

6 REFERENCES

[1] Thornley, P. & Cooper, D., Thornley, P. and D. Cooper (2008). "The effectiveness of policy instruments in promoting bioenergy." Biomass and Bioenergy(32): 903-913.

[2] Kaif, R. (2002). Presentation for Euroforum, Projectbureau Duurzame Energie.

[3] Landsdowne_Market_Research (2003). Attitudes Towards Wind Farms and Wind Energy in Ireland.

[4] Stoer, D. and K. Yang (2003). Who's for Renewable Energy and Why? Answers from a sample survey in Reading, Newbury, TV Energy and University of Reading.

[5] Upreti, B. R. (2004). "Conflict over biomass energy development in the United Kingdom: some observations and lessons from England and Wales." Energy Policy 32(6): 785-800.

[6] Rohracher, H., T. Bogner, et al. Improving the public perception of bioenergy in the EU, European Commission.

[7] AEA_Technology (2005). "Integration of biomass and waste for energy into local authority energy systems, FP5 project report."

[8] Mert, W. (2007). Bioenergy web resources review, TU Graz.

[9] Richards, K. (2007). Socio-economic impacts of bioenergy, task 29. Thermalnet Workshop on Public Perceptions. Vicenza.

[10] Richards, K. (October 2007). Socio-economic impacts of bioenergy, task 29. Thermalnet Workshop on Public Perceptions. Vicenza.

[11] VTT (2001). AFB -net – Targeted actions bioenergy network – Part 1, Final report, VTT Energy.

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