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Public participation in decision support for regional biomass energy planning

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Abstract

Over the last decade, the UK government has encouraged the development of biomass fuelled electricity plants. However, obtaining local planning permission has proved to be an important obstacle for the developers who won a government contract. On a number of occasions, local public opposition forced elected councillors to reject the proposal. These were examples of the typical siting controversy; local people were not involved in the original decision making (which took place at the national level), and rose to protest when they realised they may be exposed to the local disbenefits of the proposed plants. One of the most important questions which they felt was insufficiently answered was; why here? In response to these problems, the UK government is now trying out a regional approach to renewable energy. This approach combines target setting based on physical resource assessments with public consultations to develop a consensus on how and where within the region these targets should be met. Academics have developed Spatial Decision Support Systems (SDSS) to select the best fuel, technology, size and location for biomass power plants within a geographical area. This paper argues that such a system can be used to resolve siting controversies in the real world, but only if it is developed openly and interactively, in dialogue with the various stakeholders, rather than technology driven and top-down which has often been the case. Drawing on the considerable literature on risk communication and siting controversies, a number of best practice guidelines are proposed.

Keywords: siting controversy, biomass energy, regional planning, DSS, consultation

The UK experience with siting of biomass plants

Over the last decade, the main obstacles to the development of biomass energy plants in the UK have been of a non-technical nature. Economics have undoubtedly been the main obstacle [1]. This paper is concerned with another important obstacle, that of gaining planning permission. To date, wood or straw fuelled electricity plants which have failed to gain planning permission outnumber those which have been realised (Table 1). Of the four wood or straw fired electricity plants which have had their initial planning application refused, one has been withdrawn, one has appealed and lost again, one has been resubmitted (ongoing) and only one has won the appeal and is now operational. Even if planning permission is eventually granted, it is clear that the direct cost and loss of revenue resulting from a lengthy planning process are serious problems to such a young and relatively under-funded industry. What is the reason that the planning permission has been so hard to obtain? Although biomass fuel is on the whole clearly environmentally benign in comparison with fossil fuel, its support through policies at the national level does not guarantee support for developments by the local community. Ongoing and previous studies at the Centre for Environmental Strategy (Hargreaves, 1996; Sinclair, 1998) show that in each case, it was strong local public opposition which resulted in a negative planning decision. The multitude of objections raised by the public and various interest groups suggests a mistrust of the validity of the statements about environmental impacts which the developers have prepared as part of the planning application. In a number of cases, the local planning department has provided positive planning advice to the local council, recognising only the validity of concerns related to amenity (especially visual impact). Despite this advice, the pressure from local public opposition made councillors reject planning permission.

Table 1: Rejected and operational wood or straw fuelled power plants in the UK[2]

Location	MW	Fuel, technology	Planning permission & status
Selby, Yorkshire	8	SRC/FR, gasification	Won, **operational (2001)**
Newbridge, Wales	15	FR, fast pyrolysis	Lost, resubmitted (in process)
Ely, Cambridgeshire	31	Straw, combustion	Lost, appealed, won, **operational (2000)**
Calne, Wiltshire	20	Straw, combustion	Lost, withdrawn (1994)
Cricklade, Wiltshire	5.5	SRC/FR, gasification	Lost, appealed, lost again (2001)

SRC = Sort Rotation Coppice (willow grown on set-aside land)
FR = forestry residues (branches, bark, etc.)

Emerging policy context; regional planning for biomass energy

Politically, the problem of securing planning permission for renewable energy projects in the UK centres on the fact that local councillors have to vote on schemes which contribute to national targets or even international agreements but may have more disadvantages than advantages to offer at the local level. The planning process allows the plant developer some flexibility in changing the design, visual appearance or management strategy of the plant. Most developers have been keen to use this flexibility to address public concerns and have indeed made an effort to improve landscaping, change the fuel mix (e.g. more SRC and less FR) and restrict the travel routes and travel times of heavy goods vehicles. However, the biggest public concern with biomass energy, is that of location. Unfortunately location is not something which can be negotiated in the formal planning process.

In recognition of this, the UK government has recently undertaken two initiatives to allow more flexibility in the siting debate. First of all, developers who had won a (so called 'NFFO') contract to develop renewable energy projects are now allowed to select alternative sites for these projects. Secondly the government has initiated a regional approach to renewable energy development. Each of the nine regions of England has developed a Renewable Energy Strategy. Based on a standardised GIS-assisted methodology, the natural endowment of each region has been mapped with respect to a range of renewable energy types. These resource assessments have been used to translate the 'political' national target for renewable energy (10% of the UK electricity use by the year 2010) into physically achievable regional targets. These regional targets are statutory (i.e. legally binding), although the methods for enforcement (and indeed a willingness to enforce) are far from clear at the moment. A regional strategy about how and where the targets should be achieved is developed in a 'bottom-up' fashion, through consultation with the various stakeholders at the regional and sub-regional level. Once such a regional consensus is achieved, it should be much easier for a developer to assess the chance of a successful planning application with a local council.

The regional strategies, it is believed, will allow a much more flexible and positive debate about the trade-offs involved, starting at an earlier stage and considering a much larger number of options in terms of location, technology, size, fuel type and so on. However, at the moment the regional planners are still struggling with the practical problem of how local stakeholders can be persuaded to accept that their 'back yard' may indeed be the most suitable location for a specific type of biomass powerplant. This is where a purpose built decision support system might be of use.

The shortcomings of a top-down SDSS

A Spatial Decision Support System (SDSS) such as the one developed for the MULTISEES 1 project (Rozakis *et al.*, 2001) can be a powerful analytical tool for identifying the most suitable location and design of a biomass plant, both from economic and environmental perspectives. There is little reason to doubt that the use of such a SDSS could benefit developers of biomass plants and their sponsors in the UK. But does such a SDSS have the capacity to assist in obtaining planning permission? Rozakis *et al.* (2001) acknowledge the role of a number of agents but exclude the general public, except perhaps for mentioning that "another constraining factor that is often ignored, has to do with visual or noise disturbance in the vicinity of the plant installation site". In the UK context, developers need to engage in real communication and negotiation with the public and other interest groups to secure local political support for projects. It will not suffice to simply insert public opinion variables as constraining assumptions into a predefined modelling structure. It is also doubtful that providing public access (e.g. via the Internet) to any model hidden behind the choice of site and technology would in itself be sufficient to guarantee a greater level of public support. What is needed then to engender constructive public involvement in multi-stakeholder decision making about plant type, location, technology, energy crops, and so on?

The aims of this paper are to address the above question, drawing from the extensive literature about risk perception, communication and social trust, as well as many siting case studies over the years.

Risk communication and trust between experts and lay people.

It may be tempting for scientists to dismiss local public concern about such a seemingly benign development as a biomass-to-energy plant. Local public opposition may be labelled as NIMBY ("Not In My Back Yard") behaviour, and most health and safety fears may stem from ignorance. The pragmatic need to "appease the public" in order to secure planning permission, however, means that these concerns cannot idly be brushed aside as selfish or stupid. A closer look may in fact reveal that many concerns can be explained and understood in less dismissive terms. First of all there is an issue of equity. Local inhabitants are indeed most likely to experience adverse effects from the plant, including noise, smell, visual intrusion and falls in property prices. They are also the most likely victims when residual risks (those viewed by experts as unlikely) actually do occur. Second, some of the concerns may relate to a context which is wider, apparently, than a single project, and that allows a more appropriate systems approach to modelling (Kasperson *et al.*, 1992). Biomass plant proposals, for example, typically entail increases in local haulage traffic for biofuels, and these can have knock-on effects on access and roads provision. Third, such systems modelling itself is subjective. For example, instead of having access to specialist literature and statistics, the public has local and lay circumstantial knowledge, which may highlight diverse and relevant concerns such as the proximity of local schools and hospitals to the plant, claims of local councillors' unethical behaviour, and knowledge as to what they will accept locally regarding noise disturbance or visual impact. The existence of a gulf between expert and lay framings of scientific phenomena is well established in cases where both are relevant (Wynne, 1996). In the case of biomass siting, similar gulfs may exist between developers, the public, planners and scientists, being distinctive groups.

The above examples underline the need and challenge for experts to understand lay people and communicate with them effectively about their concerns. Effective communication is a two-way process which requires time and trust. Slovic (1993) showed that trust is very fragile and easier to destroy than to create. The reasons for that are (A) a combination of psychological tendencies to notice, believe, and give more weight to trust destroying than to trust building information, and (B) social factors, such as the tendency of mass media to favour bad news and of some special interest groups to encourage distrust to influence policy debates (see also Kasperson *et al.* 1992; Leiss 1996; Renn and Levine 1991).

The development of biomass technology has resulted, at least when Combined Heat and Power (CHP) is not being considered, in plants that do not directly produce energy under individual or local control (or provide direct local benefit). It has been observed that social change beyond individual control diminishes trust experienced by local communities (Giddens, 1990). Control and trust in decision making is largely achieved through communication. Communication is a central element of modern public policy, reflected in aims for improved transparency, accountability, inclusion of stakeholders and integration of social, economic and environmental objectives (sustainability) at different political and administrative levels.

Some case studies on siting controversy

A review of the literature on siting controversies is beyond the scope of this paper. A number of cases are reported here for illustrative purposes. The above review of the risk communication literature suggests that failure to secure planning permission may be attributed to ineffective communication strategies by those who seek to promote development. The experience of Hampshire County Council in the late 1980s underlines this view. The County Council had five old waste incinerators which would not meet the new emissions standards, and sought planning permission for a modern energy-from-waste plant in Portsmouth to replace them. The proposal met with strong, well-organised and concerted local opposition not only from the local community but also from Portsmouth City Council itself, and permission was denied. It was recognised that the consultation process that has been used had been too passive (Petts, 1995). Subsequently, Hampshire embarked on a proactive community involvement programme not only to gain support for policies in development but also for the shaping of policy itself. The importance of risk communication at the public-expert interface was more widely recognised (Petts, 1997, 1994) and integrated waste management received a higher priority (Hampshire County Council, 1997, 1996; Hampshire Local Authorities, 1995). In November 1999 an energy-from-waste proposal was approved in the north of the county, at Chineham, followed by another at Marchwood, near Southampton, in December 2000.

Both Sinclair (1998) and Hargreaves (1996) found that opposition to developers' proposals can usually easily be marshalled if communications are not handled with sensitivity. Non-governmental organisations (NGOs) may use this fact to their advantage at the local level. As a general rule, NGOs do not have to assume specific responsibilities for the solution of pressing problems in siting debates and favour public participation (Marris *et al.*, 1997). This favour may be quite sincere on the part of their members but nevertheless they may openly demand it more as a delaying tactic, and succeed in persuading corporate, governmental or other institutional actors on account of public sympathies with what are perceived as their good intentions. NGOs, more than anyone, have an interest in captivating public support by their endorsement of public participation.

The issue of social amplification (Kasperson *et al.* 1988; Renn 1991) and the effect of press coverage is also important in local siting debates. In the case of Elm Energy's attempt to site a waste tyre incinerator in Guildford, UK, for example, plans appeared in the local press prior to any communication to local residents, and this caused public opposition immediately (Löfstedt, 1997). Similarly, early announcements in the local press of the developer's plans for a straw burning plant at Ely, Cambridgeshire, led to organised local opposition at a hastily convened meeting (Sinclair, 1998).

The ways in which interest groups, the press and the public have responded to the announcement of proposed biomass projects (or other renewables such as wind farms or energy-from-waste) in the UK is by no means unique. The siting of hazardous waste facilities in the USA has been particularly well studied since the late 1970s. Between 1980 and 1987, only six out of 81 applications were actually realised (New York Legislative Commission on Toxic Substances and Hazardous Wastes, 1987, in Kunreuther *et al.*, 1993). Sandman (1985) points out that in the absence of trust (see Box 1), one must understand the siting technology in order to decide whether the proposal was right in spite of vested interests. He therefore recommended methods to help communities inform themselves in the early stage of the process. He also recommended the development of new communication methods.

As a result of the protracted problems in the USA, a National Workshop on Facility Siting took place in the USA in 1990, resulting in a set of guidelines known as the 'Facility Siting Credo' drawn from the experiences of numerous sitings. It recommended Procedural steps and Desired outcomes as follows (Table 2).

The Facility Siting Credo provided guidelines only; the precise implementation would vary with circumstances. For example, Renn and Webler (1992) used the 'consensus model' in the State of New Jersey with limited success as a learning process concerning options for local sludge management. Although as a result the New Jersey Department of Environmental Protection reviewed its sludge disposal policies, looked for better regulatory tools and began an integrated waste management plan, the citizens rejected the proposed sludge application project and refused to submit suggestions for making it more feasible, articulating their discomfort at having no input in designing or reviewing different options. The implementation of participation is therefore still fraught with difficulty, as its format and scope can be the source of dissension.

The deadlock in siting new facilities continues in the USA, and now also in Europe and sometimes in Asia (Linnerooth-Bayer and Löfstedt, 1996). Kunreuther *et al.* (1996) recommend working towards increasing public trust in risk management and the early involvement of the public. Linerooth-Bayer and Fitzgerald (1996) distinguished culturally between views of fair siting and suggested designing siting strategies accordingly.

Table 2: Guidelines of the Facility Siting Credo (Kunreuther *et al.*, 1993).

<u>Procedural steps</u>
1. Institute a broad-based participatory process
2. Seek consensus
3. Work to develop trust
4. Seek acceptable sites through a volunteer process
5. Consider a competitive siting process
6. Set realistic timetables
7. Keep multiple options open at all times
<u>Desired outcomes</u>
1. Achieve agreement that the *status quo* is unacceptable
2. Choose the solution that best addresses the problem
3. Guarantee that stringent safety standards will be met
4. Fully address all negative aspects of the facility
5. Make the host community better off
6. Use contingent agreements
7. Work for geographic fairness

Two recent examples perhaps give cause for optimism. In 1996, a case study in siting a municipal waste disposal facility in the eastern region of Aargau Canton in Switzerland used a competitive siting process to limit the possible sites from a group of thirteen to between three and five. Results using citizen panels there indicated that it promoted procedural fairness and competence, while the panels were "able to assimilate information, both qualitative and quantitative" (Renn *et al.*, 1996). Löfstedt (1999) described another study undertaken in 1996 in the North Black Forest region by Renn's group at the Centre for Technology Assessment in Baden-Württemberg, regarding the siting of a waste incinerator and two aerobic digesters in the region. Again the siting process was competitive and the panellists proved themselves competent. In both the Swiss and the German study, agreement on sites was reached within the allotted time period.

In summary, the many siting case studies in the literature display the frequent public desire for learning and participation, differences in values between the participants, the importance of fairness and the need for properly managed risk communications concerning the range of particular issues of concern perceived by local people. When personal knowledge is lacking, lay public relies on social trust for making judgements of risks and benefits. The building of trust requires the host community and the proponents of the projects to engage with the host community in an iterative and participatory learning and decision making process.

A SDSS to assist public consultation on regional biomass planning?

By the nature of its regional scope and its ability to investigate a large number of alternative plant scenarios, the spatial DSS developed by Rozakis *et al*. (2001) is conceptually of relevance to the regional renewables planning agenda emerging in the UK. The above mentioned case studies show that there are no easy or foolproof ways to avoid or overcome public opposition. Nevertheless, the literature allows for the identification of a number of general guidelines to aid the developers of the DSS. Within the context of the above-mentioned SDSS and the participatory regional planning context emerging in the UK, the developers of a SDSS could play an important facilitating role. Their chances to succeed would be enhanced if they:

(1) Present themselves in a neutral assisting role and spend time and communicative effort to develop a relationship of trust with the participants, seeking to fully understand their concerns. Discuss issues related to (geographical) equity. When a good relationship has been established, timetables must be set and participants must be made to understand the need for urgent solutions and that the *status quo* is unacceptable.

(2) Help the participants to learn and understand about bioenergy in general and modelling behind the DSS in particular (e.g. through computer based learning). Risks should be described in context and computer interfaces should be 'public friendly'. Spatial decision support systems are especially promising in that respect because their key graphical interface is a GIS map. A number of recent studies (Jankowski *et al.,* 1997; Nyerges and Jankowski, 1998; Bojorquez-Tapia *et al.,* 2001) underline the potential of GIS-fronted DSSs to engage non-experts in land use or siting decisions.

(3) Allow for (the participants to suggest) the use of alternative data, assumptions or models, the inclusion of additional models and for the exploration of alternative scenarios, e.g. 'competitive siting' in the region.

(4) Address the issue of scientific uncertainty carefully. People are unfamiliar with uncertainty in risk assessments and science. They may recognise it when it is presented in simple terms or with the use of graphics but a willingness to discuss uncertainty in risk estimates may be perceived as honesty by some members of the public and incompetence by other (Johnson and Slovic, 1995).

Conclusions: the agenda for flexible support

This paper has outlined a framework of principles for decision making in risk-based multiple decision maker problems in regional biomass planning. The agenda for this decision support in this field encompasses the DSS but is considerably wider. We feel that the following areas of work urgently need to be addressed:

(1) Provision of up-to-date learning software and other material concerning proposed plant applications for planning permission. This could be accomplished, for example, by "core biomass learning" from a generic CD-ROM or from the Web, with other learning occurring from bespoke software for each application. This learning would be designed to be *contextual*, that is about general questions that the public might have. Such material will, like many learning packages, work best if it is *interactive* and *stimulating*.

(2) Exploration of *systems* approaches to the modelling of biomass sitings, so that "knock-on" effects such as traffic congestion, or "life cycle" effects such as those from the "avoided burdens" of producing electricity, can be modelled.
(3) Use of both (1) and (2) to inform participants in preferred (flexible) participatory *decision making* regarding particular plants.
(4) Use of the research data arrived at in (3) to arrive at more generic tools and conclusions for biomass siting.

This is a general and non-exclusive checklist for the SDSS developers, constituting both risks and opportunities for their involvement in a participatory decision making process. The integration of formal decision support systems and participatory decision making, is an important development as it can make a very useful contribution to the implementation of the sustainable development agenda. It clearly merits further efforts by researchers and practitioners alike.

Notes:
[1] Biomass to energy technologies can hardly be expected to compete with fossil fuel technologies in a market that does not take account of the environmental externalities mostly associated with fossil fuel. Renewable energy policies such as the UK Non Fossil Fuel Obligations (NFFO) in the 1990s and the current Renewables Obligation (RO) strive to level the playing field though taxes and incentives which benefit biomass energy. However these policies have been challenged by the success of a competing policy, that of market liberalisation. In the last decade, liberalisation of the UK electricity market has resulted in almost halving the UK electricity prices in real terms.
[2] A number of other proposed wood/straw fuelled plants have gained planning permission but have for various reasons not (yet) reached the construction phase (September 2001). The UK has also four operational chicken litter combustion plants (72 MW in total) and several micro CHP plants (less than 0.5 MW heat and electricity) based on biomass gasification.

References

Bojorquez-Tapia, L.A., Diaz-Mondragon S., and Ezcurra E. (2001) GIS-based approach for participatory decision making and land suitability assessment. *International Journal of Geographical Information Science*, Vol 15(2), 129-151.
Fischhoff B. (1995) Risk perception an communication unplugged: Twenty years of process. *Risk Analysis*, Vol 15, 137-145.
Fischhoff B., Slovic P., Lichtenstein S., Read S. and Combs B. (1978) How safe is safe enough? A psychometric study of attitudes towards technological risk and benefits. *Policy Studies*, Vol 9, 127-152.
Giddens A. (1990) *The Consequences of Modernity*, Polity Press, Cambridge, UK.
Hampshire Local Authorities (1995) *Dealing with Hampshire's Waste: The Proposed Solution*, Project Integra and The Local Authorities in Hampshire, September.
Hampshire County Council (1996) *Deciding on an Integrated Waste Management*

Strategy, Hampshire County Council, January.

Hampshire County Council (1997) *Tackling the Rise in Hampshire's Domestic Waste and Disposal Options for South West Hampshire: a consultation*, Project Integra, War on Waste and Hampshire County Council, November.

Hargreaves D. (1996) *An investigation into risk communication issues surrounding a proposal to site a 20MW straw-burning electricity-generating plant at Calne, Wiltshire, in 1994*, MSc Dissertation, University of Surrey, Guildford, UK.

Jankowski P., Nyerges T.J., Smith A. Moore T.J. and Horvath E. (1997) Spatial group choice: a SDSS tool for collaborative spatial decision-making. *International Journal of Geographical Information Systems* Vol. 11, 556-602.

Johnson B. and Slovic P. (1995) Presenting Uncertainty in Health Risk Assessment: Initial Studies of Its Effects on Risk Perception and Trust, *Risk Analysis* Vol 15(4): 485-494.

Kasperson R. E., Golding D. and Tuler S. (1992) Siting hazardous facilities and communicating risks under conditions of high social distrust, *Journal of Social Issues*, Vol 48, 161-172.

Kasperson R. E., Renn O. and Slovic P. et al. (1988) The social amplification of risk: A conceptual framework, *Risk Analysis*, Vol 8, 177-187.

Kunreuther H., Fitzgerald K. and Aarts T. (1993) Siting Noxious Facilities: A Test of the Facility Siting Credo, *Risk Analysis* 13(3): 301–318.

Kunreuther H., Slovic P. and MacGregor D. (1996) Risk Perception and Trust: Challenges for Facility Siting, *Risk: Health, Safety and the Environment*, 7, 109-118.

Leiss W. (1996) Three phases in the evolution of risk communication practice. *Annals of the American Academy of Political and Social Science*, Vol.545, 85-94.

Linnerooth-Bayer J., and Fitzgerald K. (1996) Conflicting Views on Fair Siting Processes: Evidence from Austria and the US, *Risk: Health, Safety and the Environment*, 7 [Spring 1996]: 119-134.

Linnerooth-Bayer J. and Löfstedt R. (1996) Fairness and Siting: Introduction to a Symposium, *Risk: Health, Safety and the Environment* 7 [Spring 1996]: 95-98.

Löfstedt R. (1997) Evaluation of Siting Strategies: The Case of Two UK Waste Tire Incinerators, *Risk: Health, Safety and the Environment* 8 [Winter 1997]: 63-77.

Löfstedt R. (1999) The Role of Trust in the North Blackforest: An Evaluation of a Citizen Panel Project, *Risk: Health, Safety & Environment* 10 [Winter 1999]: 7-30.

Marris C., Langford I. and O'Riordan T. (1997) *Integrating Sociological and Psychological Approaches to Public Perceptions of Environmental Risks*: Detailed results from a questionnaire survey, CSERGE Working Paper, GEC-96-07.

NRC (National Research Council) (1989) *Improving Risk Communication*. National Academy Press, Washington DC, USA.

New York Legislative Commission on Toxic Substances and Hazardous Wastes (1987) *Hazardous Waste Facility Siting: A National Survey,* Albany, New York.

Nyerges T., and Jankowski P. (1998) *Empirical Research Strategies for Investigating the Use of Public Participation GIS*. Paper presented at the international workshop on groupware for Urban Planning, Université Bernard Lyon, France.

Petts J. (1994) Effective Waste Management: Understanding and Dealing with Public concerns, *Waste Management & Research* 12:207-222.

Petts J. (1995) Waste Management Strategy Development: A Case Study of Community Involvement and Consensus-Building in Hampshire, *Journal of Environmental*

Planning and Management 38(4): 519-536.

Petts J. (1997) The public-expert interface in local waste management decisions: expertise, credibility and process, *Public Understanding of Science* 6: 359-381.

Renn O. (1991) Risk communication and the social amplification of risk, in Kasperson, R.E. and Stallen P.M. (eds) *Communicating Risks to the public: International Perspectives*, Kluwer, Dordrecht.

Renn O. and Levine D. (1991) Credibility and trust in risk communication. In Kasperson R.E. and Stallen P.M. (eds) *Communicating Risks to the public: International Perspectives*, Kluwer, Amsterdam.

Renn O. and Webler T. (1992) Anticipating Conflicts: Public Participation in Managing the Solid Waste Crisis, *Gesellschaft & Umwelt* 2: 84-94.

Renn O., Webler T. and Kastenholz, H. (1996) Procedural and Substantive Fairness in Landfill Siting: A Swiss Case Study, *Risk: Health, Safety and the Environment* 7 (2): 145-168.

Rozakis S., Soldatos P.G., Kalivroussis L., and Nikolaou E. (2001) *Multiple criteria decision-making assisted by G.I.S.: Evaluation of Bio-Electricity Production in Farsala Plain, Greece*. J. Geographical Information and Decision Analysis. Vol. 5(1), 49-64.

Sandman P. (1985) Getting to Maybe: Some Communications Aspects of Siting Hazardous Waste Facilities, *Seton Hall Legislative Journal* 9: 442-465.

Sinclair P. (1998) *Social Capital and Trust in Planning a Biomass Plant*, MSc dissertation, University of Surrey, Guildford, UK.

Slovic P. (1987) Risk Perception. *Science*, Vol 236, 280-285.

Slovic P. (1993) Perceived risk, trust, and democracy. *Risk Analysis*, Vol 13, number 6, 675-682.

White G. (1945) *Human Adjustment to floods*, Dept. of Geography Research Paper no. 29, University of Chicago, Chicago, IL, USA.

Wynne B. (1996) May the sheep safely graze? A reflexive view of the expert-lay knowledge divide, in Lash S., Szerszynski B. and Wynne B. (eds) *Risk, Environment and Modernity*, Sage, London, UK, 44-83.