Energy Delta Institute

EDI Quarterly

Volume 5, No. 1, March 2013

Q1

Contents

Editor's Note

by Jacob Huber

Welcome to the March edition of the EDI Quarterly!

This issue focuses on issues of public acceptance and public engagement. In addition, the theme of Polish gas is continued with a contribution from Gaz System and a piece giving the perspective of the Polish chemical industry on the Polish gas hub.

The themes of the next Quarterly include energy services and an update on developments in the Asian gas market. Should any of our readers be interested in writing on either of these topics please contact us at the address below. We hope that you enjoy all of the informative contributions in this issue.

quarterly@energydelta.nl

EDIAAL

Social acceptance of low carbon energy and associated infrastructures

Patrick Devine-Wright
University of Exeter

Abstract

Although the theme of social acceptability is widely recognised as being an important element of the transition towards a low carbon energy system, I would argue that in-depth of understanding of why local residents oppose 'green' technologies is less widely held. The 'NIMBY' (Not In My Back Yard) concept has been strongly discredited by academic social scientists as an appropriate means of describing and understanding public objections, yet its impact lingers on in certain ways of thinking, particularly the emphases by policy makers upon community benefit provision and streamlined planning. Here it is argued that redefining benefit provision in a discourse of distributional justice is an important step forward, as would be a better recognition of the importance of emotions and place related identity processes in influencing public responses. The implications of these points for how companies engage with affected communities are discussed.

For almost a decade (cf. Ekins, 2004), the notion of 'social acceptance' has been a key concept driving the way academics, policy makers and industrialists think about controversies associated with siting large scale infrastructures for low carbon power generation and transmission such as onshore wind farms and high voltage power lines. In particular, it has taken over from the 'NIMBY' concept as a means of thinking about why members of the public, and particularly local residents living near to a siting proposal, become emotionally upset and contest the value of putting particular 'green' technologies in a specific place. The necessity for low carbon technologies to be socially accepted is widely agreed. It is recognised that public opposition can delay or even prevent development proposals from going ahead. Yet despite many recent academic social science studies of this topic, I would argue that we are still only beginning to appreciate and fully understand the range of factors that shape public acceptance.

The value of the 'NIMBY' concept has been strongly and widely criticised by social scientists as an appropriate and valid means of describing siting conflicts, and particularly those individuals or groups making objections (Burningham, 2000; Devine-Wright, 2005; Wolsink, 2006). It has been argued that NIMBYism pejoratively labels objectors by presuming them to be emotional, selfish and ignorant people and falsely presumes those living closest to a development site to have the most negative attitudes towards the proposals. Yet despite the fact that academics have rejected the concept, its impact lingers in the ways that siting conflicts are conceptualised. In particular, I would argue that it lingers in some of the pathways that policy makers have taken in seeking to address siting conflicts.

Most clearly, it has driven an attempt to provide financial (and other) benefits to communities directly affected by siting proposals. If objectors are conceptualised as inherently selfish individuals driven primarily to maximise their own economic welfare, then the obvious response is to rebalance the financial costs and benefits equation associated with any development project. Yet this approach is fraught with difficulties, from the obvious potential of laying companies open to accusations of bribery (Cass et al., 2010) to more subtle yet equally important issues of how benefits should be distributed, to whom, why and where (Aiken, 2010). An important recent argument recasts the community benefit debate in the language of environmental justice, specifically distributional justice, proposing that the provision of benefits is necessary in order to ensure that low carbon energy technologies are sited in ways that are fair, equitable and transparent (Cowell et al., 2012).

I would argue that this is an important step forward, as it recognises that objectors are motivated by issues of fairness as much as personal costs and benefits. Additionally, I would make the observation that an emphasis upon community benefits could become a self-fulfilling prophesy in which a norm of self-interest (Miller, 1999) becomes strongly associated with public acceptance by affected communities – in short, that it reinforces a discourse of cost/benefit analysis as the most important issue to discuss or resolve in each case, lessening the importance of other issues such as alternative means of achieving national energy policies for carbon reduction. It may also 'spill-over' across technology sectors. If a community has been offered a community benefits package by a wind farm developer, is it not also likely then to expect something similar from a transmission system operator seeking to build a new high voltage power line, an infrastructural project not in the past associated with distributing financial benefits to locally affected communities?

Less obviously, but equally relevant, has been an attempt to streamline planning procedures to lessen the ability of local groups to delay or prevent projects deemed to be 'nationally significant' from going ahead (Cowell and Owens, 2010). The passing of the Localism Act in the UK by the present Coalition Government was wrapped up in arguments about the value of decentralising power from the state to local communities. Despite considerable scepticism that empowerment is the likely outcome of such a move during a time of economic austerity (e.g. Featherstone et al., 2012), I would argue that representations of the Act as a 'NIMBY Charter' by the media (Orme, 2010) show how prevalent a negative portrait of public involvement in planning has become. They also reveal the many tensions and conflicts involved in environmental planning, shaped by the conflicting currents of centralisation and decentralisation of power. This has particular importance for large scale energy infrastructure projects that impact upon several communities, notably high voltage power lines – projects in which, despite the rhetoric of localism, most members of the public feel disempowered to influence (Devine-Wright et al., 2010).

Although academics have contested the depiction of objectors as selfish or emotional individuals that parochially seek to block important projects from going ahead, there is an important way that matters of the self are related to public responses to energy projects, and one that I think tends to get overlooked in debates about siting controversies. For several decades now, there has been an appreciation that people's sense of identity can become wrapped up not only in their past experiences or which social groups they are a member of, but also what places or landscapes they live or dwell in. Notions of place attachment and place identity in Environmental Psychology, and Sense of Place and Topophilia in Human Geography, are examples of attempts by social scientists to capture the important emotional and existential roles that places can play in people's lives. Developing from this recognition has been the idea that summary change or disfigurement to a place or landscape is not only a process of physical change, but also an important cultural and psychological one, implicating and impacting upon the selves of affected individuals and communities. If where you are shapes who you are, then changing that environment can have important consequences for the self.

Evidence has begun to accrue over the past few years that matters of place attachment and place identity are part of the explanation for why siting conflicts occur (e.g. Devine-Wright and Howes, 2010; Devine-Wright, forthcoming). In a manner of speaking, local residents cannot help being selfish in responding to energy technology proposals if their sense of identity is wrapped up in local places and landscapes. Yet this is not at all to say they are inevitably narrow minded or doomed to exert a parochial response; far from it, as individuals in contemporary developed societies are highly likely to hold multiple and shifting place and social identities. Rather, it is a challenge to policy makers and industrialists to rethink their approaches to affected communities.

To conclude, how might public engagement be informed by a perspective that recognised the importance of place identities? Two suggestions are offered. First research has shown how emotionality is typically viewed by developers as a bias or deficiency amongst local residents affected by energy projects (e.g. Cass et al., 2010). This is a mistake. Instead, methods of engaging with publics affected by energy infrastructure proposals should take emotional responses into account, rather than seeking to avoid or undermine them. Less emphasis upon information provision and more emphasis upon what has been described as 'strategic listening' (Pidgeon and Fischhoff, 2011) would be a useful way forward. Second, energy projects should be viewed as instances involving the 'fit' (or lack of) between specific technologies in specific places. Projects are inescapably spatial, despite conventional attempts to view the technologies in the abstract. What this suggests for companies engaging with affected communities is to look outwards from the place, to do more to uncover the rich set of narratives that those living locally tell about that place and to reconsider their technology proposals in that light, in short to seek to emplace technologies not just to site them (Devine-Wright, 2011).

Acknowledgements
The insights presented in this article arise from empirical research projects on renewable energy and electricity grids funded by UK Research Councils as well as the SusGrid project, funded by the Norwegian Research Council with co-funding from industry bodies.

References

Aitken, M. (2010). Wind power and community benefits – Challenges and opportunities. *Energy Policy,* 38, 6066-6075.

Burningham, K. (2000). Using the language of NIMBY: A topic for research, not an activity for researchers. *Local Environment,* 5, 55-67.

Cass, N., Walker, G., Devine-Wright, P. (2010). Good neighbours, public relations and bribes: the politics and perceptions of community benefit provision in renewable energy development in the UK. *Journal of Environmental Policy and Planning,* 12, 255–275.

Cowell, R. J. W. and Owens, S. (2010). Revisiting ... Governing space: planning reform and the politics of sustainability. *Environment and Planning C, Government and Policy 28,* 952-957.

Cowell, R., Bristow, G., Munday, M. (2012). *Wind Energy and Justice for Disadvantaged Communities: What Role Can Community Benefits Play?* Viewpoint for Joseph Rowntree Foundation. JRF, York.

Devine-Wright P. (2009). Rethinking Nimbyism: the role of place attachment and place identity in explaining place protective action. *Journal of Community Applied Social Psychology,* 19, 426 – 441.

Devine-Wright, P. and Howes, Y. (2010). Disruption to place attachment and the protection of restorative environments: a wind energy case study. *Journal of Environmental Psychology,* 30, 271-280.

Devine-Wright P. (2011). From backyards to places: public engagement and the emplacement of renewable energy technologies. In: Devine-Wright P, ed. *Public Engagement with Renewable Energy: From NIMBY to Participation.* London: Earthscan; pp. 57–70.

Devine-Wright, P. (forthcoming in 2013). Explaining 'NIMBY' objections to a power lines: The role of personal, place attachment and project-related factors. *Environment and Behavior.*

Ekins, P., (2004). Step changes for decarbonising the energy system: research needs for renewables, energy efficiency and nuclear power. *Energy Policy,* 32, 1891-1904.

Featherstone, D., Ince, A., McKinnon, D., Strauss, K. & Cumbers, A. (2012). Progressive localism and the construction of political alternatives. *Transactions of the Institute of British Geographers, 37,* 177–182.

Orme, J. (2010). Why are some campaigners calling the Localism Bill a Nimby's charter? The Independent Newspaper, Friday, 17th December. Available at the following internet site: http://www.independent.co.uk/property/house-and-home/why-are-some-campaigners-calling-the-localism-bill-a-nimbys-charter-2162630.html (last accessed 28th February 2013).

Miller, D.T. (1999) The Norm of Self-Interest. *American Psychologist,* 54, 1053-1060.

Pidgeon, N. F. & Fischhoff, B. (2011). The role of social and decision sciences in communicating uncertain climate risks. *Nature Climate Change,* 1, 35-41.

Wolsink, M. (2006). Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY. *Transactions of the Institute of British Geographers,* NS31, 85–91.

Societal acceptance: todays challenge of the energy sector

By Ynke Feenstra
Independent Researcher

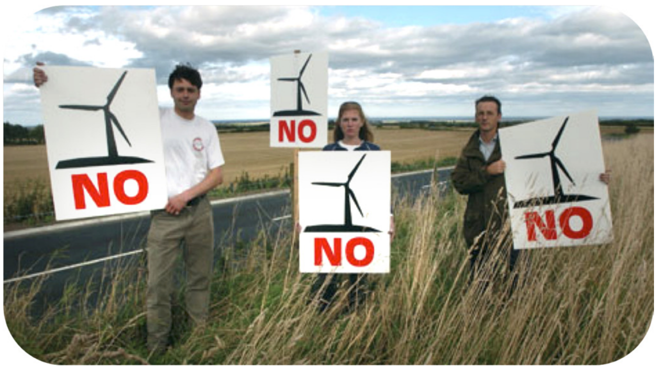
A carbon capture and storage project in the Netherlands; an offshore wind farm in the North Sea, a grid extension project in Scotland, a hydrogen project in London, a biomass fuelling station in the US; these are just a few examples of hundreds of energy projects worldwide that are being delayed or even cancelled due to a lack of social acceptance.

Whether they are based on fossil fuels or renewable resources as well as grid extensions and smart meters; many energy projects face resistance from authorities, politicians, service providers, NGOS or community members: individuals or groups opposed to the implementation of (a part of) the new energy project. This resistance, or lack of social acceptance (sometimes also called NIMBY or "Not in My Back Yard") has become the third most important challenge of energy project developers worldwide, besides financial and regulatory issues.

But how can outsiders have such an impact on energy projects? And why is this happening more now than in the past? More importantly, what can energy project developers do to avoid or decrease opposition in order to avoid delays and cancellation of their project? In the following paragraphs I'll provide some insight into the answers to these questions.

Energy is integrating in society

To understand the current challenges of energy projects in relation to social acceptance, one must quickly look at the past. Beginning with the discovery of fossil fuels, the modern world shifted towards a centralised energy system in which oil, gas, coal and uranium provided electricity



and heat. These fossil fuel plants are located mainly in industrial areas, physically outside society and far away from living and working areas. In such a system, energy users in society exhibit low levels of awareness and have little experience with and consequently little knowledge about energy demand, energy resources and production processes. In a centralised system there is thus little (need for a) relation between society and energy; energy is not "part" of society.

Recently, however, the energy system has been changing and evolving. Due to resource depletion, the rising extraction costs of fossil fuels and growing awareness of energy's impact on the climate, other energy technologies, including renewable energy, are becoming more interesting. These new energy technologies are characterized by greater resource availability and are often small scale, and distributed partially due to the fact that generation close to consumers is more efficient. We're thus moving from a centralised energy system towards a decentralised energy system in which energy projects are literally closer to people's living environment. Together with the liberalisation of energy markets, increasing energy prices and discussions about security of supply and energy independence, energy is not only physically becoming part of society, but is also a topic discussed more often in politics, the media and households. Instead of existing as a separate system, energy is becoming more and more integrated in society.

Due to this integration of energy in society, people and organisations that were hardly involved or interested in energy before have become stakeholders in energy projects. These stakeholders are either directly (and formally) involved in the projects like (local) authorities, service providers, technology developers and investors or are indirectly involved or affected by the projects (i.e. NGOs, neighbours, media, communities and citizens and the general public).

Research on social acceptance of different energy projects and technologies [1] shows that both direct and indirect stakeholders can oppose projects and thus have the power to cause delays or even cancel complete projects, leading to huge financial losses. This can result from authorities refusing to provide the needed permissions, investors stepping out of the project team, community members or groups protesting and mobilising politicians and NGOs and media influencing public opinion.

Nimby or Not? Why do people oppose to energy projects?

The integration of energy in society implies that different groups and individuals are confronted with energy projects in their environment impacting their work, lives or community. When opposing these projects' stakeholders use a wide range of arguments related to noise, traffic, environmental or visible impact, safety issues, financial and social consequences, partnerships, environmental justice, etc. Project

developers and media often call this opposition NIMBY-ism (Not In My Back Yard) stating that people do not want any energy projects or other changes in their direct environment.

When investigating these debates further, we see that most opposition is rooted in a lack of engagement in the project [1-5] and predominantly top-down decision making processes, also referred to as the 'decide-announce-defend' model [6,7]. When stakeholders have the feeling that they are not informed well, not listened to and that their situation and opinions are being neglected by project developers, distrust of the project increases. This is especially true when stakeholders experience an imbalance between the distribution of costs (often negative local impact) and (financial) benefits of the project. They have the feeling that others are taking control of their environment and that they are not involved in the decisions. This distrust is often transformed into opposition against the project and is translated into the more rational arguments focusing on factual impacts.

Opposition is thus rooted in a lack of engagement in the decision making process of energy projects. Research and practice show that when stakeholders are well engaged in the decision making process and have the feeling that the project developers are incorporating their views and expectations, they are much more willing to accept the changes in their environment due to the project. In the engagement of stakeholders it is key to identify relevant stakeholders and their expectations and the differentiation between process and project, and between acceptance and proponence [1,5,8]. This makes experts, including myself, reluctant to use the term NIMBY to explain resistance. This term insinuates that there is no way to overcome resistance because people do not want any changes in their environment and justifies the lack of stakeholder engagement [6].

Engagement is the solution. But how?

Every energy project is unique. Although the technology might not be different or new, the location and stakeholders influenced by the projects are always different. The engagement process of each energy project therefore must always start with the identification of all stakeholders. Additionally, it must be acknowledged that every stakeholder has different values and interests in relation to the project. The second step is to investigate the needs and expectations of all stakeholders in relation to the project; this is the start of the engagement process. By meeting the stakeholders, presenting the potential energy project and asking for first input and reactions, stakeholders become involved in the project decision process.

Timing and transparency are important elements in these. A project developer must be clear about what is already decided upon and what is still open for discussion, i.e. whether to build wind turbines or a geothermal plant. At the same time there must be room in plans for negotiation and integrating the opinions and needs of stakeholders related to the exact location, the infrastructure, additional research, financial participation or compensation, the design, etc.

The third and most important step in the engagement of stakeholders is incorporation of their views and interest in the project, which takes place at different levels. Some ideas are easily realised, such as a different colour of the wind turbine. More challenging however are the conflicting needs of stakeholders and wishes that are not easy or even possible to integrate in the project. These are sources of possible conflicts and thus opposition. Such conflicts can only be avoided by a transparent decision-making process in which these issues are discussed and negotiated by the stakeholders, project developers and experts. When stakeholders notice that their needs are taken seriously and that negotiation is possible, they will more easily accept the outcome of the decision making process even though it may not be similar to their own wishes.

Engaging stakeholders thus implies transparency about and incorporating stakeholders' ideas in the decision making process of an energy project. Stakeholders mostly accept the outcomes of these processes and thus accept the implementation of the energy project accordingly. This does not mean nor implies that they are in favour of the project; there will always be people not in favour of the application of a specific energy technology or implementation of an energy project at a specific location. Nonetheless, it is crucial to engage these stakeholders in the process in a way that they do feel taken seriously and accept the

outcome of the process.

To illustrate this I like to use the example of a home party including noise impact on your neighbours. To avoid your neighbours' irritation and a subsequent call to the police, you inform them in advance about your planned party, negotiate with them about the end time of the loud music, and invite them to come and play some of their favourite music as well. In this way you engage them in your party plans and slightly adapt your party to their wishes in order to be able to enjoy a party without police intervention.

Three important lessons

To summarize, three important lessons for energy project developers can be drawn. Firstly, energy projects are influenced by an increasing number and variety of stakeholders. The first important lesson for energy project

developers is to realise that all stakeholders, every group and individual influenced by the project, are equally important when it comes to societal acceptance and minimizing opposition to their projects. Secondly, energy project developers must also be aware that every project is unique in terms of location, context and stakeholders and that a lack of societal acceptance is rooted in a lack of engagement of the right stakeholders (in the right manner and at the right moment) in the decision making process of a project. And finally, they must realise that the engagement process starts with identification and inventory of stakeholders and their needs. It is key is to incorporate these needs in an open and transparent decision-making process involving and negotiating with stakeholders and experts to reach decisions about the project. Acceptation of the decisions in the engagement process is more important than finding proponents.

Ynke Feenstra is independent researcher and consultant specialised in social acceptance of energy technologies and changing energy related behaviour. She can be reached at feenstra@fynergy.nl.

References

1. Heiskanen, et al (2008). Factors influencing the societal acceptance of new energy technologies: Meta-analysis of recent European projects. Deliverable 3.1, 3.2 and 4 of the Create Acceptance project. ECN, Petten, The Netherlands. ECN-E--07-058
2. Ashworth, P., J. Bradbury, C.F.J. Feenstra, S. Greenberg, G. Hund, T. Mikunda and S. Wade (2010). Communication, project planning and management for carbon capture and storage projects: An international comparison http://www.globalccsinstitute.com/publications/communication-project-planning-and-management-carbon-capture-and-storage-projects
3. Breukers, S en M. Wolsink (2007). Wind power implementation in changing institutional landscapes: an international comparison. Energy Policy 35 (2007) 2737–2750
4. Dowd, A.M., N. Boughen,P. Ashworth, S. Carr-Cornish (2011). Geothermal technology in Australia: Investigating social acceptance. Energy Policy 39 (2011) 6301–6307
5. Devine-Wright, P. (2011). Renewable energy and the public. From NIMBY to Participation. Earthscan Ltd, London.
6. Devine-Wright, P. (2011) From Backyards to Places: Public engagement and the Emplacement of Renewable Energy Technologies. In Devine-Wright, P. (2011). Renewable energy and the public. From NIMBY to Participation. Earthscan Ltd, London.
7. Wolsink, M. (2007) Planning of renewable schemes: Deliberative and fair decision-making on landscape issues instead of reproachful accusations of non-cooperation.
8. Jolivet, E. et al (2007) General manual for the application of the ESTEEM tool. http://www.esteem-tool.eu/fileadmin/esteem-tool/docs/ESTEEMmanual.pdf

Renewable energy and the public: the case of the Spanish photovoltaic solar sector

Iñaki Heras-Saizarbitoria
iheras@ehu.es

Ibon Zamanillo
Ibon.zamanillo@ehu.es

Iker Laskurain
Iker.laskurain@ehu.es

Department of Business Management, The University of the Basque Country UPV/EHU, Spain

The successful adoption of technologies is a complex social process. In other words, the design and implementation of technology is patterned not only by a range of 'technical', 'organisational' and 'economic' factors, but also by a range of 'social', 'political' and 'cultural' ones (Williams and Edge, 1996). Indeed, although it may very often be overlooked, social acceptance is one of the most important requirements for the successful adoption of any technology, such as energy infrastructure. In the case of renewable energy technology, and despite the fact that the theoretical importance both of its social and public acceptance have been highlighted (e.g. Walker, 1995), these interrelated issues have not been given adequate attention.

Figure 1. Dimensions of social acceptance of renewable energies.
Source: Wüstenhagen et al. (2007).

Wüstenhagen et al. (2007) distinguished three dimensions of social acceptance of renewable energy technologies: socio-political acceptance, community acceptance and market acceptance. Socio-political acceptance refers to the social acceptance on the broadest, most general level, by the public, by key stakeholders and by policy makers. Furthermore, the public acceptance issue is closely linked to those of public perception, debate and attitudes. Considering the aforementioned studies, the specific case of public acceptance of renewable energy technologies has failed to stand out as an issue which merits further study. Most stakeholders thought this issue was not a problem, because the first surveys of public opinion on these technologies revealed very high levels of support. Nevertheless, as Walker (1995) pointed out, the complexity of developing an understanding of "what the public thinks", and of how attitudes are formed, change and develop, must not be underestimated in the case of renewable energy.

In the more specific case of photovoltaic solar energy, issues regarding social and public acceptance have not been well documented, perhaps because of the particularly positive public opinion that has tended to prevail with regard to this source of energy. In order to make a contribution to fill this gap, a survey was carried out whose results were published in Heras-Saizarbitoria et al. (2011). This paper will act as short contribution update as we have spent two additional years on our analysis. Our original research focused on an analysis of the media coverage of the aforementioned case study with the intention of analysing the issue of public acceptance of solar energy. Geographically the research focused on Spain, where photovoltaic solar energy had a big boost in the first decade of this century. The study was carried out during a very tumultuous period when the growing trend of economic and social crisis became apparent. In short, the main questions that this article aims to address are the following: How has the Spanish press represented the intense evolution of photovoltaic energy in the period under consideration? What types of content and perspectives regarding photovoltaic energy have prevailed? What are the main frames and types of discourse that have been "generated"?

Study summary

An empirical study was carried out during a period of major expansion followed by contraction of the Spanish photovoltaic sector. The core of the study involved analyzing general public discourse on the subject via an analysis of the media published in Spain between January 2004 and December 2012. Written media's role in the construction of the forum in which matters of public interest and social representation of the environmental field are discussed is currently undeniable and such written media was taken as the raw material on which this study is based. Spanish written press media of a general nature with a nationwide circulation, as well as media specialized in financial and business media were analyzed.

In brief, analyzed media could be classified into positive or favourable, negative or unfavourable, and balanced cases of impact. The latter would correspond to cases of impact that adhere to the journalistic norms of balanced reporting, i.e. giving roughly equal coverage to both sides in any significant dispute, a norm that is generally considered to be a vital tool in carrying out "objective" reporting that provides both sides in any significant dispute with roughly equal attention, despite the fact that various authors stress that the use of this media could be problematic due to the informational bias they can generate. News was classified as "positive" if the majority of statements and overall impression of photovoltaic energy were positive, and "negative" if they were negative and "neutral" if a balanced reporting perspective was used.
In quantitative terms, as shown in Figure 2, and leaving aside opinion articles, it can be noted that a certain balance exists, over the studied period of time, between negative and positive standpoints on photovoltaic energy, although the former are predominant. However, attention should be drawn to the fact that, if their evolution is analyzed, the vast majority of cases of impact expressed a positive standpoint during the phase in which there was limited impact up until the end of 2007, whereas more negative cases of impact subsequently became more apparent and were clearly in the majority in recent years, especially in the case of 2011 and 2012.

Broadly speaking and as far as discourse is concerned, attention can be drawn to the prevalence of two instances of markedly different discourse in terms of the way they deal with the media coverage on the evolution of the photovoltaic sector: on the one hand, a discourse of a clearly conservative, non-interventionist, anti-reformist nature and even including a certain negationist-determinist standpoint with regard to the possible positive influence of renewable energies in the future, rooted in the long-dominant environmental discourse of industrial society defined by Dryzek (2005). On the other hand, the existence of a pro-environmentalist discourse is also proven, one which carries far less weight publically since the development of the sector entered the recession phase. The latter is a discourse fed mainly by sources from the photovoltaic sector and other stakeholders such as groups of ecologists and trade unionists who, in marked contrast to the previous discourse, propose a pragmatic adjustment to the constraints of industrialism, highlighting the need to invest in PV energy in order to gradually reform the predominant energy model.

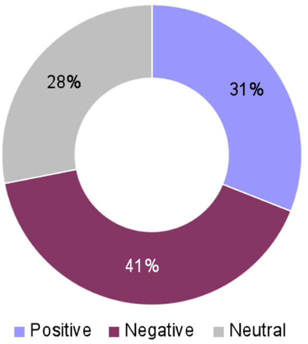


Figure 2. Classification of the news analyzed according to the standpoint they convey
Source: Put together by the authors from the media analysis carried out. Note: contributions by way of opinion have been excluded.

Table 1 attempts to summarize the main arguments in favour of and against PV energy used in the general public debate analyzed via media coverage. As can be observed, attention should be drawn to the importance of those arguments related to the socio-economic impact within the situation of crisis currently being experienced.

In favour	*Against*
• *Socio-economically profitable in the long term* • *Clean and inexhaustible source of energy* • *Reduces energy dependency* • *Helps to combat climate change* • *Safe* • *Potential to create jobs* • *Economic benefits for/ locally-established installations*	• *Is an expensive energy proposal* • *Unable to replace other sources (small percentage)* • *Limited yield* • *The technology has not reached maturity* • *Makes electricity tariff more expensive* • *Entails a loss of competitiveness* • *A very profitable investment for just a few*

Table 1. Regarding Spanish general public debate: main arguments in favour of and against photovoltaic energy. Source: Put together by the authors based on the media analysis carried out.

Lessons learned

The positive results of initial polls on renewable energy in general, and the solar photovoltaic energy in particular, have led researchers and policy makers to believe that public acceptance is not an issue, however this acceptance, like all social processes, is not static. Rather, it is subject to change. Similarly, mass media coverage and framing that can affect the aforementioned public acceptance so much is itself a non-static volatile process. Thus as has been evidenced in our research, following the aforementioned period of public positivity in the growth of photovoltaic energy capacity in Spain there has then been an intense media debate during the phase of decline experienced by the sector. This debate has tended to highlight negative aspects related to the development of the sector. In a socio-economic environment at a time of major economic crisis on an institutional level, the predominant discourse regarding photovoltaic energy has tended to focus on the markedly conservative and non-reformist standpoint, which, in short, is opposed to the development of renewable energy technology.

Moreover, a discourse has been produced and expanded in the Spanish press in recent years which, despite the lack of full analysis, appears critical and negative towards the development of the photovoltaic sector. Some pro-renewable stakeholders even allude to the fact that certain pro-nuclear media who are deeply opposed to the establishment of renewable energy technology have even resorted to information manipulation. This, however, is an issue that is difficult to research rigorously and thoroughly.

Concluding remarks

Media discourse is an essential context for understanding the formation of public opinion on renewable energy technology and its public acceptance, since media discourse is part of the process by which individuals construct meaning. The media impact analyzed in our research could hypothetically end up influencing Spanish public and social acceptance of this and other sources of renewable energy. Thus, the question that should be asked in the short and long term is whether public support and goodwill towards renewable energy could be easily eroded or not (as would seem to be happening in the case of some specific projects). Indeed, despite the fact that photovoltaic solar energy in Spain has received major social, political and trade union support, (above all in parts of the country where it has been most intensively introduced) what would seem to have been in jeopardy in recent years is that same "clear" social support.

Looking to the future, there is a need for research that combines qualitative and quantitative approaches on the public debate and public acceptance issue of renewable energy technologies. As Walker (1995) underlined several years ago, more research is needed in order to give us a clear, harder, more sensitive and more sophisticated awareness of how attitudes are formed, changed and developed as experience with renewable technologies progresses. For that purpose, contributions need to be made from a inter-disciplinary perspective by taking into consideration the complex interrelations that exist between the technical, political, economic and social implications of renewable energy sources.

Sources

Dryzek, J.S. (2005): The Politics of the Earth: Environmental Discourses, Oxford University Press, New York.
Heras-Saizarbitoria, I.; Cilleruelo, E.; Zamanillo, I. (2011): "Public acceptance of renewables and the media: an analysis of the Spanish PV solar experience", Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, 4685-4696.
Walker, G. (1995): Renewable energy and the public, Land Use Policy 12, 49-59.
Williams, R. and Edge, D. (1996) The social shaping of technology, Research Policy, 25(6), pp. 865-900.
Wüstenhagen, R.; Wolsink, M. and Bürer, M.J. (2007): Social acceptance of renewable energy innova¬tion: an introduction to the concept, Energy Policy 35, 2683-2691.

Brief biography of author(s)

Iñaki Heras-Saizarbitoria is an Associated Professor at the University of Basque Country in Spain. He has a PhD. in Economics by the University of the Basque Country and an ESST (European Studies of Society, Science, and Technology Master) from the University of the Basque Country and Roskilde University (Denmark). One of his research lines is related to the study of the adoption of environmental technologies, such as the renewable energy technologies. He has published several academic articles and books.

Ibon Zamanillo is an Associated Professor at the Faculty of Engineering of Bilbao of the University of Basque Country in Spain. He has a PhD Degree in Organizational Engineering. One of his research lines is related to the study of the adoption of renewable energy technologies. He has published several academic articles and books. Likewise, he has participated as a researcher in several projects financed by businesses and institutions such as the Basque Country University, the Basque Administration and the Spanish Administration.

Iker Laskurain is an Associated Professor at the Faculty of Engineering of Bilbao of the University of Basque Country in Spain. He has a Degree in Industrial Engineering and is currentely working in his PhD Thesis that analyses the adoption of renewable energy technologies from an interdisciplinary perspective.

The next phase in social acceptance of renewable innovation

Maarten Wolsink
University of Amsterdam

With atmospheric CO_2-eq increasing rapidly, there is an urgent need to switch to low carbon energy sources. Policies on the utilization of renewables, such as solar, wind, geothermal, biomass and marine sources have been drafted in most countries. Although such policies have existed for more than three decades now, the acceptance of renewables by society has hardly been recognized as an important issue. Currently, the slow development of renewable energy sourcing in most countries is often blamed on this oversight[1], and within policy and among developers there still is little understanding of social acceptance issues[2]. Moreover, the next crucial phase in the deployment of renewable energy systems for electricity (RES-E) concerns the integration of several different RES-E sources in the power supply system and with electricity demand. This requires the introduction of 'intelligent grids' (frame) that facilitate 'distributed generation' (DG), i.e. geographically dispersed power generation using renewable sources. However, such intelligent grids imply a fully different way of organizing the power supply, and all elements of the reorganization may suffer from lack of acceptance in society, just as the 'simple' deployment of renewables within the existing power supply has shown to be problematic.

Distributed Generation

The social dimensions of intelligent grids are, just as originally in deployment of renewables seem hitherto largely neglected, as research again focuses merely on technology[3]. Why would social actors accept all changes in energy supply the way the power sector is defining them and take part in this development? And under what conditions?

Essential for smart grid development is that it furthers so called 'Distributed Generation' (DG)[3], and smart grids should serve efficiency and reliability. Systems with a large amount of DG preferably tapping variable renewable energy sources, attuning the production patterns of multiple generation systems, and matching their production to the variable loads of end-users is needed to prevent a huge increase of required power transmission infrastructure. The most enlightening and comprehensive definition is that a 'smart grid' is a *'network of integrated microgrids that monitors and heals itself'*[6] Figure 1 shows that central to this definition is the recognition that the development of smart grids completely changes the underlying organizational principles. A single public power grid will cease to exist, to be replaced by many different interconnected 'microgrids'. In these grids energy flows from different sources, regulated and fine-tuned to local demand within the same microgrid.

With the on-going splintering of central power grids, there is already a move towards DG. An important new development is the possibility for reloading plug-in electric vehicles with DG, at home or at the work-place. Opening the option to apply storage capacity for fine-tuning demand and supply in microgrids may become crucial for advancing the deployment of RES-E[8]. The integration of numerous microgrids marks a revolutionary turn that requires many fundamental changes in the social construction of power supply. However, currently technology development follows strong but highly questionable assumptions of expected social acceptance of the basic principles and crucial elements of these smart grids.

The possible paths for development will be the following ones or somewhere in between:

(a) Policies will be increasingly designed to enhance the autonomy of (local) groups of end-users to further their options to become co-producers who apply renewable sources and smart meters and regulating devices to adapt their energy use to the variability of their production units; or

(b) The options for decentralised generation capacity and smart metering will be used for regulating individual consumption behaviour by increasing the surveillance of domestic consumers by network managers with the aim of regulating demand in line with central policy prescribed levels.

Line (b) is the current dominant line of thinking, as it matches with the existing institutional framework in the power sector as well as in policy. Path (a) is likely to open up much more social acceptance and will therefore create more potential to implement renewables.

Intelligent Grids and Distributed Generation

Smart grids are 'hot'. Some projects applying demand managing devices claim to be 'smart', and some companies sell devices labelled 'smart' as a marketing strategy. Despite the popularity of this label, the 'smart grid' still lacks a precise definition and to date, there is no functioning smart grid in existence[4,5]. Smart grid is still a buzz-word, but there is substantial and accelerated technology driven progress towards developing it. Companies sell devices, and, in pilot-projects meters are implemented that collect data for analysis of consumer demand, and increasingly these are applied by smart end-users to make their own renewable co-production more effective. Technically a smart grid is defined as two networks: one for electricity connecting multiple power generation and consumer units and a parallel information network for data generated by smart metering devices that monitor, analyze and regulate energy production and consumption. Why social actors would accept all this and take part in this development –and under what conditions– remains a largely neglected topic.

Distributed Generation (DG): Traditional power plants are large centralized units. Today's trend is towards smaller, numerous geographically dispersed power generation units situated close to energy consumers, so called Distributed Generation[3]. Together with improvements in smart grids that serve efficiency and reliability, a system with a large amount of DG and preferably tapping renewable energy sources is considered an environmentally friendly alternative to the traditional power supply system[4]. Attuning the production patterns of multiple generation systems, and matching their production to the variable loads of end-users increasingly requires a 'smart grid'[6,7].

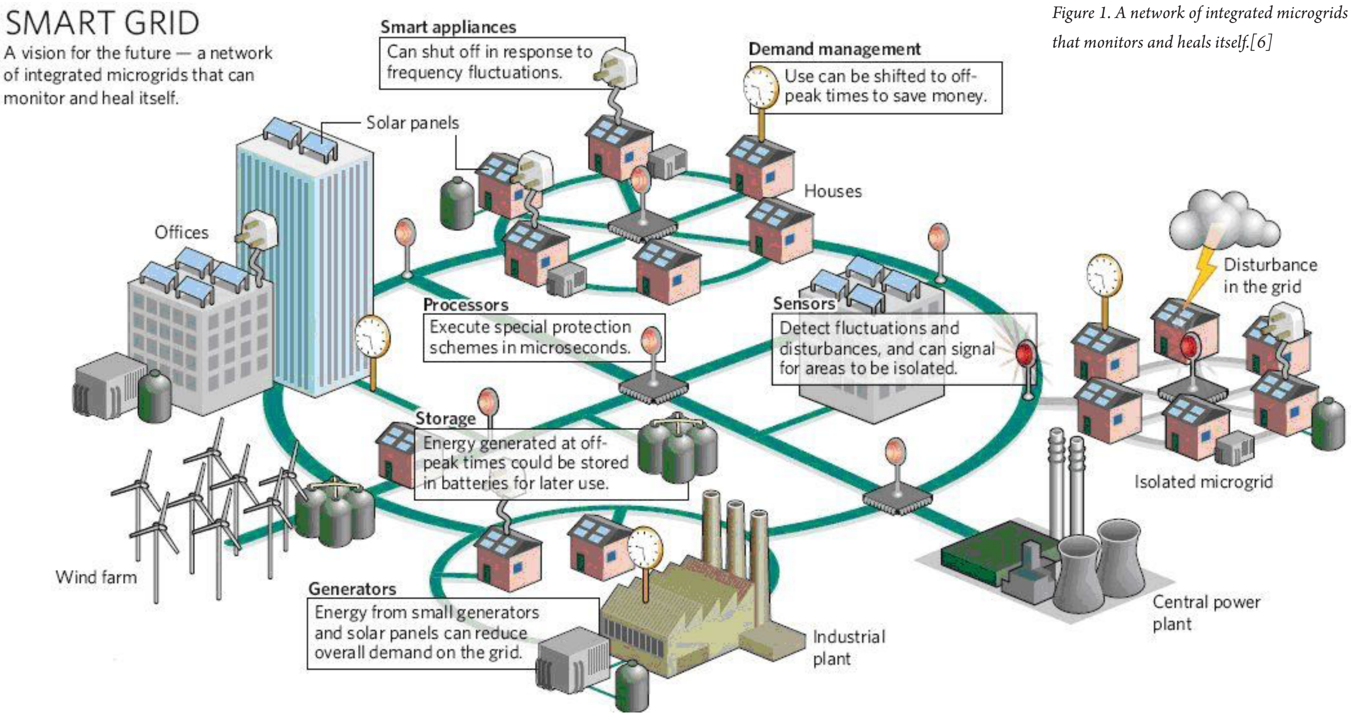


Figure 1. A network of integrated microgrids that monitors and heals itself.[6]

Social acceptance: common sense misunderstandings

The construction of smart grids and implementing RES-E is not simply a matter of individual choice. Whether this option can be used depends on several choices, to be made by many actors, including actors outside the power sector. It is an extension of the question of 'social acceptance' of renewable energy innovation. Many persistent misconceptions exist on the importance and complexity of social acceptance (Table 1). In the concept of social acceptance, three dimensions are distinguished[1]. Figure 2 shows these dimensions with the main issues associated with them, and these dimensions can be viewed as layered[9]. Deployment is ultimately an aggregation of all positive decisions at the community level to invest, install and site renewable infrastructure. Such positive decisions require the willingness to accept the consequences of implementing renewables among market actors, and their willingness is in turn heavily depending upon socio-political acceptance of institutional changes that are needed to create the necessary conditions for market acceptance and community acceptance. The figure illustrates that social acceptance is relevant in all layers and sectors of society. Public acceptance is only a small component, and in fact not the most important one.

In Table 1 some selected issues in the current state-of-the-art knowledge on social acceptance of renewables are summarized. For example, contrary to common sense views in policy and among developers, acceptance of wind power is something entirely different from acceptance of a wind power project. Actually, there are no theoretical foundations to expect a clear relationship [10], and empirically the relation between both is found to be weak indeed [11].

Another example: the common assumption that social acceptance equals public acceptance. Many developers and authorities alike still think social acceptance equals public acceptance, and unfortunately, this theoretically fully unfounded common sense assumption is reproduced all the time. However, current knowledge about acceptance is that public acceptance –aggregated individual preferences– is a poor proxy for social acceptance[10]. The idea that the main "barriers" to renewable innovation are found on the community level in local resistance is in fact

Figure 2. Three dimensions of social acceptance of renewable energy innovation with their main associated issues [1,9]

a myth reproduced over and over again. However, most problems with social acceptance of innovation in renewables are in fact found in the socio-political acceptance dimension, as illustrated by the following conclusion by Lund, from a study on 12 decision-making processes in Denmark, the first country that was successful in renewable energy implementation:

"Alternatives representing radical technological change have to come from outside organisations representing the existing technologies,

Acceptance **Renewable Energy**	≠	Acceptance renewable energy **Projects**
Social Acceptance	≠	**Public** Acceptance
Acceptance **technology**	≠	Acceptance **socio-technical system**
Basic acceptance	=	Acceptance of **institutional changes**
Barriers to deployment	**NOT**	Primarily **community acceptance**

Table 1. State-of-the-art fundamentals of social acceptance of renewable innovation

whereas the existing organizations even make efforts to eliminate alternatives from decision-making processes."[12].
The real issue of acceptance concerns the lack of acceptance to break down current institutional lock-ins that impede acceptance in most countries [13,14,15]. Country comparisons show that institutional factors have proven to be the main determinants of RES-E deployment. The institutional changes needed for full deployment are resisted, mainly among actors that are linked to the existing energy supply system, including government agencies and policy makers. This lock-in issue will probably become even more important for smart-grid developments. Distributed generation in microgrids with a fair amount of control for the new co-producers, run counter to today's highly centralized power grids[7].

Acceptance of renewable DG in microgrids

The geographical space required for the infrastructure needed to achieve a shift towards a low-carbon energy system with little environmental impact is highly underestimated[16]. In fact, in policy realms there is little awareness of key aspects of renewable power generation. For example, centralized, large-scale generation (e.g. offshore wind, desert solar etc.) can only provide a part – and in a relatively unreliable and inefficient fashion – of the renewable energy needed for satisfying current energy demand. All space, particularly at close distance to the energy user, must be utilized intelligently, and to encourage acceptance, the RES-E system should match with the character of the community[7].

Beyond the technological characterization, all potential participants in microgrids (Fig.1) are social actors. Their characteristics, their behaviour and their preferences are unknown. Their willingness to support innovation by participating in the new power supply system is questionable, as smart grids imply a drastic departure from the current, predominant centralized power supply systems. Innovation is not merely the introduction of new technology, but rather of socio-technical systems (STS)[17]. Microgrids with DG are socio-technical systems, characterized by the active management of both information and energy flows, and by the community in which members cooperate to construct the microgrid and manage it. Such co-producing communities should replace the existing social characteristics of the energy supply system. This requires new 'patterns of social practices and thinking', which is exactly the definition of institutions[18]. Existing institutional frameworks are serving the advantages of incumbents ("path dependency"), so they create lock-ins for innovations[13,14]. In energy, these patterns are manifested in the organization of the energy sector as well as related sectors; in particular in regulation, standardization, and existing infrastructure.

Effective integration of renewable DG is unlikely to be made without changes to the transmission and distribution network structure, and planning and operating procedures. For example, Fig.1 only shows a peripheral 'central' power plant. Regarding innovation, the close connection between the sector's incumbents and policymakers induces strong inertia and retards the innovation processes[19]. This is why socio-political acceptance is necessary to establish the institutional conditions that are conducive for implementing innovations should be high on the agenda to escape from the policy scenario (a) described above. The community and market acceptance (Fig.2) concern the decisions about installation of renewable energy generating units, and about willingness to take part in investing in such installations. The introduction of DG integrated in microgrids completely changes the picture of market acceptance relations between incumbents, new firms, consumers, and authorities as investment decisions shift from the market to communities, so market and community acceptance will coincide more at this level. The literature on the implementation and acceptance of RES-E shows that high transaction costs (money, time, efforts) are principally determined by institutional conditions and policies at national levels. Meta-analysis also reveals that policies generally fail to address issues of local RES-E implementation[20].

Acceptance issues in the next phase of renewables

As renewable energy generation integrated with demand comes close (geographically) to end-users, territorial acceptability is prominent in acceptance. This is mainly a question of space and of the siting of infrastructure facilities, and particularly who is in control over the infrastructure and over decision-making about siting them. Decisions on siting energy infrastructure are strongly determined by the connections between the energy system and the community in which it is sited. In fact the organization of co-production by renewables in microgrids, integrated with adaptation of demand, is becoming a question of proper and sustainable management of a natural resource. The overall question in regard to renewable DG should become: how would such a common good be managed properly, primarily to create it, then to maintain it and to optimize its application? In those systems we are dealing with:

a. *Natural resources* – renewable energy flows;
b. *Scarcity,* in particular the space needed to locate the power generating units and the time patterns of the availability of the resources;
c. *Co-production of a common good:* electricity for anyone participating in the micro-grid, and abandonment of environmental impact of conventional power generation;
d. *Self-organization,* which makes up a community applying and investing in DG, the micro-grid and energy consuming equipment that can easily be applied for adapting demand – cooling, heat storage in home or underground, electric vehicles;
e. Huge *diversity* in optimal design of systems, both with regards the natural conditions – landscape, climate, resources – as well as the socially defined identity factors of the community of end-users and co-producers.

The position and role of all actors in the electricity production-consumption chain will change. All can become co-producers, but co-production of public goods must be supported by institutions. "Citizens are an important co-producer. If they are treated as unimportant or irrelevant, they reduce their efforts substantially"[21]. This observation corresponds with the recognition that for RES-E deployment, the socio-political and market acceptance of institutional changes are the bottleneck for the application of the Common Pool Resource of renewable energy[7].

Research agenda

Though we must recognize that, due to the institutional lock-ins in the power supply system, the current policy scenario tends to match line (b) described above, the challenge is to bend it towards (b). However, most knowledge needed to do that is lacking, so currently an urgent research agenda is unfolding. CPR studies show that simple governance strategies, applied in the name of efficiency, that rely on imposed markets on only one-level, or on centralized command and control, tend to fail[22], and such conclusion are fully in line with those in research on the problems in the governance of RES-E implementation. The acceptability is usually low in cases of exogenously initiated projects that are disconnected from the communities' socio-economic and environmental context. This applies to both renewable energy projects initiated and defined by community outsiders (e.g. energy companies) as well as demand side management projects applying devices that energy companies themselves call 'smart meters'[23]. Such projects are much more likely to face resistance. As DG is located close to end users, the deployment of renewables depends upon securing a good match between energy schemes and host communities, in particular collaborative manners of decision-making and by effective involvement and participation in the management and property of the RES-E systems[24].

Founded on those two domains of knowledge, some general questions with regards social acceptance of renewables in the next phase can be formulated. Among others, for example:

- What are the institutional conditions that determine, impede or foster the creation of renewable DG in smart microgrids?
- How does decision-making – and institutional frameworks such as spatial planning systems that tend to overrule or impede necessary collaborative planning – about infrastructure associated DG affect the creation of new socio-technical systems?
- Under what (geographical and institutional) conditions are actors willing (and do policies allow them):
  - To invest and install renewables' generating units?
  - To cooperate in microgrids and mutually exchange the co-produced renewable energy, regulated by smart metering devices?
  - To adapt their energy behaviour, shaping demand patterns that match the supply of renewables?
  - To achieve reasonable access for all under conditions that avoid free-rider behaviour?

Associated with the previous questions: what about the property and control of the assets in the energy system? This includes smart metering devices and the data generated by them: are they controlled by remote companies serving large scale centralized and inflexible production, or are they controlled by the co-producing end-users serving the feasibility of their RES-E distributed generation units and the management of their microgrid?

Furthermore, are the actors with a strong position in the current institutional framework willing:

- To accept these new configurations and infrastructure of power supply?
- To accept the institutional arrangements that are required to create and maintain DG in microgrids that shaped for co-production with renewable DG?

There are many more prominent questions[10], but the main issue of social acceptance of renewables innovation should be emphasized once more. As in the first phase, questions seem to focus on community acceptance, but the fundamental question beyond that is how we can escape from the institutional lock-ins connected to the existing power supply system and policy structures that are preventing most of the innovations needed for optimal deployment of renewable energy.

References

1. Wüstenhagen R, Wolsink M, Bürer MJ (2007) Social Acceptance of renewable energy innovation: an introduction to the concept. Energy Policy 35, 2683-2691.
2. Aitken M (2010) Why we still don't understand the social aspects of wind power: A critique of key assumptions within the literature. Energy Policy 38, 1134-1141
3. Ackermann T, Andersson G, Söder L (2001) Distributed Generation: a definition. Electric Power Systems Research 57, 195-204

4 Hammons TJ (2008) Integrating renewable energy sources into European grids. Electrical Power and Energy Systems 30, 462-475

5 Ajmone-Marsan M, Arrowsmith D, Breymann W, Fritz O, Masera M, Mengolini A, Carbone A (2012) The emerging energy web. European Physical Journal – Special Topics 214, 547-569

6 Marris E (2008) Upgrading the grid. Nature 454: 570-573.

7 Wolsink M (2012) The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. Renewable and Sustainable Energy Reviews 16, 822–835

8 Charles D (2009) Renewables test IQ of the grid. Science 324: 172-175

9 Sovacool B, Lakshmi Ratan P (2012) Conceptualizing the acceptance of wind and solar electricity. Renewable and Sustainable Energy Reviews 16: 5268-5279

10 Wolsink M (2012) Wind Power: the Basic Challenge concerning Social Acceptance. Robert A Meyers (Ed.) Encyclopedia of Sustainability Science and Technology. Vol.17, 12218-12254. Springer, New York

11 Bell D, Gray T, Haggett C, Swaffield J (2013) Re-visiting the 'social gap': public opinion and relations of power in the local politics of wind energy. Environmental Politics 22, 115–135.

12 Lund H (2010) The implementation of renewable energy systems. Lessons learned from the Danish case. Energy 35, 4003-4009. p.4008

13 Jacobsson S, Bergek A (2004) Transforming the energy sector: the evolution of technological systems in renewable energy technology. Industrial and Corporate Change 13, 815-849

14 Unruh GC (2002) Escaping carbon lock-in. Energy Policy 30, 317-325

15 Wolsink M (2000) Wind power and the nimby-myth. Institutional Capacity and the Limited Significance of Public Support. Renewable Energy 21, 49-64

16 MacKay DJC (2009) Sustainable energy – without the hot air. UIT, Cambridge. http://withouthotair.com

17 Geels FW (2004) From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory. Research Policy 33, 897–920

18 North D (1990) Institutions, Institutional Change and Economic Performance. Cambridge University Press, Cambridge.

19 Walker W (2000) Entrapment in large technology systems: Institutional commitment and power relations. Research Policy 29, 833-846

20 Michalena E, Hills JM (2012) Renewable energy issues and implementation of European energy policy: The missing generation? Energy Policy 45, 201-216

21 Ostrom E (2010) A long polycentric journey. Annual Review of Political Science 13, 1-23. p.10

22 Ostrom E (1999) Coping with tragedies of the commons. Annual Review of Political Science 2, 493- 453

23 Darby S (2010) Smart metering: what potential for householder engagement? Building Research and Information 38, 442-457

24 Walker G, Devine-Wright P (2008) Community renewable energy: What should it mean? Energy Policy 36:497-50.

Navigating the minefield of stakeholder participation

Stakeholder involvement strategies for successful project development

Suzanne Brunsting
Energy Research Centre of the Netherlands

Sytze Dijkstra

Major investments in difficult conditions

The European energy sector is entering a major investment cycle to replace existing power plants and to decarbonise supply. This involves the deployment of a range of low-carbon options, such as renewables, nuclear power and CCS, as well as flexible conventional power sources. Existing network infrastructure must also be strengthened and extended to integrate this new capacity into the system.

The timing for making these changes is hardly ideal. Utilities must make these investments in the framework of an emerging liberalized single European energy market and at a time of economic uncertainty. Moreover, the public's view of energy companies is at a low, as people complain about rising prices and 'windfall profits', or oppose energy projects locally.

In the past, energy companies operated in a regulated business environment, and contact with end-users consisted mostly of commodity supply. For the public, energy was a low-profile topic which received little attention. Energy has risen on the public agenda as prices increased, and as people experience changes in their daily life through new energy facilities or infrastructure and emerging technologies. In this context, energy companies recognize that engaging with the public is important, both for competing successfully in the open market, and for obtaining support for realizing projects.

Stakeholder participation aims to help energy companies secure public backing. But the complexity of stakeholder processes have proven a minefield for many projects. Protests against wind farms and overhead transmission lines have been seen across Europe. In the Netherlands, for instance, wind farms in Urk and Borger-Odoorn, and gas storage in Bergen and Pieterburen have faced public opposition. Public opinion was also a primary driver for the German government's decision to phase out nuclear power by 2022 after the accident at Fukushima in Spring 2011.

This article analyses why opposition to energy projects can emerge, and discusses the stakeholder participation processes that help energy companies secure public backing for their initiatives. This is illustrated with lessons learned from projects that were abandoned due to public opposition, contrasted with examples of successful stakeholder involvement.

Casualties of the minefield of stakeholder participation

Examples of projects that have been abandoned due to public opposition abound. The abandoned Carbon Capture and Storage (CCS) pilot in Barendrecht, one of the most controversial cases in the Netherlands, illustrates the challenges of stakeholder participation.

The Barendrecht project

Stakeholder participation in Barendrecht

In 2006, Shell Storage B.V. started preparations for a CO_2 capture and storage demonstration project in two depleted gas fields under the town of Barendrecht in the South-West of the Netherlands, near the Rotterdam Harbor area. Shell first informed the municipal government of Barendrecht about the project in 2007 and started engaging the local public early in 2008. Soon local politicians started voicing opposition, and residents raised questions about the procedure, safety, and risks for public health. The Environmental Impact Assessment (EIA) was approved early in 2009, but increasing resistance against the project called for additional discussion and research into the potential impacts. The National Government, however, decided that the project was safe and should continue. Coincidentally, Spring 2009 also saw the introduction of new planning legislation for major energy project, which shifted the final say for approving projects like the CCS pilot at Barendrecht from local to national level.

Figure 0.1 Polarised views: protests in Barendrecht, and a Shell advertisement about CCS.

The stakeholder process polarized relations between the main stakeholders – the national government, the local government, the project developer Shell, and the local public, making effective dialogue impossible. By the end of 2009, the project was at least two years behind schedule, and the project was abandoned altogether in 2011.

Lessons from Barendrecht

In Barendrecht, misunderstanding and disagreement between stakeholders existed in three areas: the purpose and need of the project; the values and interest of different parties; and the integrity of the stakeholders involved.

Insufficient discussion of purpose and need

The project development in Barendrecht took place against a backdrop of a debate about the utility and necessity of CCS. People asked 'Do we really need this?' and 'Don't we need something else instead?' The answers of stakeholders varied with their values, beliefs and objectives approaching the problem and its possible solutions. In Barendrecht, the national government and Shell focused on the techno-economic aspects of the CCS project, whereas the Municipality mainly took a social and local perspective.

The different perspectives on the utility and necessity of the project became problematic because local parties were involved late and could not influence decision making. Their perspectives on the socio-economic, health, and safety consequences of the project were therefore not given equal consideration to those of national stakeholders. The introduction of new planning legislation reduced municipal power even further. Faced with this inability to contribute to the formal process, local interest groups sought other means of influencing decision making, organizing (public) protest activities, voicing opinions in the media, and demanding additional independent research. These methods may not have been used, or at least not to this extent, if the Municipality had been at the negotiation table from the beginning.

Focus was on facts, not values
The discussion in the Barendrecht case addressed specific policy or technological options, but not the value framework of the stakeholders themselves. Both proponents and opponents to the project aimed to advocate their case in 'facts and figures', questioning each other's expertise. For instance, both sides made exaggerated claims of the risks in the media, varying from "100.000 people could be killed" to "CO_2 is completely harmless".

Discussing values is difficult, as these cannot be classified as 'right' or 'wrong' – rather, they are lenses through which people view reality. Attacking a stakeholder group's perspective or labeling arguments as 'emotional' does not result in a useful discussion, but tends to end in deadlock. The absence of value perspectives from the discussion in Barendrecht meant that misunderstandings and disagreements on the underlying viewpoints and objectives persisted.

Aimed to spread knowledge, without establishing integrity
Many CCS experts regard a lack of understanding of the technology among laypeople as one of the greatest challenges to the employment of CCS. They expect that opposition disappears with better knowledge. With this in mind, the filling of knowledge gaps featured highly in the debate in Barendrecht. The public had access to all relevant reports, minutes, and Q&A overviews through the project website, but this proved to be unable to overcome local resistance.

It is clearly important that comprehensible and accessible public information is available, but information is only used if it is trusted, and trust was absent in Barendrecht. The public had to rely upon information from the project proponents initially, which was for the larger part not endorsed by multiple stakeholders. Moreover, much of the information told people about the overall need for CCS (to prevent climate change), paying little attention to local costs and benefits, reinforcing the idea that Shell was the only beneficiary. A website with general information that was explicitly tailored to the public and was endorsed by multiple stakeholders was launched only late in the process, and was financed by the government and Shell. By this time, the polarized relations led the stakeholders to question each other's integrity, and effective communication of knowledge had become impossible.

Navigating the minefield – establishing trust

The discussion so far has centred around the things that can go wrong, but abandoned projects could have gone ahead if the stakeholder participation had left all main parties satisfied with the process. This section explains how this can be achieved, using examples from successful stakeholder processes.

Trust first, content later
Effective dialogue is only possible if trust is established first. Stakeholder involvement often covers content only, be it technologies, impacts, or regulation. Discussing these topics aims to address knowledge gaps, assuming that resistance will disappear with better understanding of the project. However, the information is only accepted if people trust the source, so the knowledge discussion should be preceded by a process of trust-building. This requires acknowledgement, influence and transparency (Figure 0.2).

1. Acknowledge each stakeholder's identity, values, knowledge and views.
Asking the public to contribute to the discussion is one thing; for effective participation people's views must also be taken seriously. Values or 'emotional' arguments should not be dismissed as 'wrong' or 'unreasonable'.

Energy companies must know their target group well to tailor the core messages that should be communicated, and the objectives that should be leading in a project. Often, existing knowledge about the values and perspectives is insufficient, so the stakeholders must be characterized before engagement can start properly. Knowing the local context is important too, as events in the past can strongly influence attitudes to new projects.

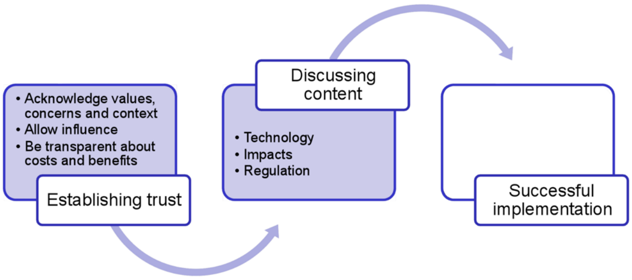


Figure 0.2 A basis of trust should be established before discussing content

Case study: understanding and acknowledging stakeholders' perspectives

Success factor: investigate – adapt – engage
Ekodoma's experience emphasizes the importance of flexibility when building trust. Energy companies need to be open about their own assumptions about the stakeholders and local context, and must be willing to change their communication approach when necessary.

Ekodoma, a Latvian consultancy, specializes in providing energy efficiency services. In a pilot project in the towns of Cesis and Sigulda, it aimed to renovate five multi-apartment buildings to improve their energy efficiency. Four apartment buildings that had already been renovated were investigated to learn from their experiences. A building management company (BMC) maintains the buildings, and each has a 'building elder' who represents the residents. Decisions about the renovations must be supported by 51% of the residents to be approved.

Initially, Ekodoma expected that a lack of information, a fear of high costs, and unwillingness on the side of residents would be the main reasons for residents opposing the renovation. It therefore focused on providing information about the efficiency measures, and their costs and benefits, to convince the residents of the advantages. Early in the project, Ekodoma realized that trust was a precondition for the residents accepting information, and that this trust was lacking in several cases. The company changed the project's objectives accordingly. Instead of simply providing information and urging residents to adopt efficiency measures, it started to examine the values and objectives of the residents as a basis for improving relations of trust. Through questionnaires, interviews and discussion meetings with residents and building elders Ekodoma learned about their needs and worries, and improve its understanding of opinion formation between the actors.

>

The interaction with the residents highlighted the importance of flexibility. Each group of residents and 'elder' had their own needs and wishes. For example, in some cases all residents wanted to be involved in the decision making through a bottom-up process, while in others they trusted the building elder to take the right decisions, so that a top-down process was more effective. Ekodoma learned to tailor the information it provided in each case, adapting to the specific needs and questions of the residents.

Ekodoma also decided to change the project's timeline, dedicating additional time to learning about the residents' needs and to building trust. Instead of aiming for quick energy efficiency gains, it worked with the residents and building elders to develop long-term renovation plans and apply for support from the government, which offered 40% co-financing. This non-prescriptive approach gave the stakeholders a say in the design and execution of the plan, establishing lasting support for the renovations in three of the buildings.

Understanding and acknowledging values, objectives and context are especially important when discussing utility and necessity. The need for decarbonising the power sector may be obvious for people involved in the energy industry, but other, local issues often have priority for other people. In the Dutch Green Energy Train project in The Hague, for instance, the target group indicated improving the safety and living environment of their apartment blocks as their first priority. Saving energy was of secondary importance. The project developer therefore shifted the focus of the project from saving energy to these co-benefits. The Hungarian Global Environmental Social Business program, on the other hand, emphasized financial benefits because the chosen target groups lived in poor social conditions, so costs savings were their main concern.

2. *Allow main stakeholders equal power to influence the decision making process.*

Taking people seriously also means giving them influence in the decision making process. This implies that stakeholders could decide together not to go ahead with the project.

The public may be able to influence the objectives for the energy supply indirectly, for instance through the political process, but this does not address concerns about developments or projects that have a bearing on their daily lives. People therefore want a say when directly affected themselves, or they may consider seek other means to voice their opinions.

3. *Be transparent about costs and benefits.*

Costs and benefits are rarely equally distributed, which can lead to serious conflicts. Discussing costs and benefits is difficult, as the motives of each stakeholder are always implicit in the dialogue. If one participant fails to acknowledge certain costs or benefits, others will not only disagree with the argument, but also start to question the stakeholder's integrity.

Successful stakeholder processes therefore require that all main parties are involved in mapping the magnitude and distribution of costs and benefits, and understanding the value each party attaches to them. Once dialogue has led to agreement on these, the discussion can turn to the size and nature of possible compensation for disadvantaged stakeholders.

Case study: dealing with open outcomes

Success factor: avoid decide-announce-defend approach
Giving stakeholders influence in decision making process helps establish trust. It gives companies credit among the public and builds wider support in the long-term, even if individual projects may be rejected.

Successful stakeholder participation requires that the outcome of the process is open for all main parties to influence. This entails that the dialogue can lead to a project being rejected at the end. For the project developer this is clearly undesirable, so the prospect of an open outcome can create hesitance in the stakeholder process. The value of an open stakeholder process becomes clear when taking the medium to long term perspective, as it increases the likelihood that future projects are supported, even if an individual project is rejected. The stakeholders have, after all, got a good impression of the company, and are likely to approach new proposals with a positive mindset. Pushing a project through in spite of local opposition, however, can limit the possibilities for realising future projects, as happened in Burgervlotbrug in the Netherlands.

Case study: guidelines for sharing benefits

Success factor: guidelines for sharing benefits create clarity and trust
Transparency about project costs and benefits and the value stakeholders attach to these greatly contributes to the trust between project developers and local communities.

Argyll and Bute, on the Scottish west coast, has a good potential for wind energy. The local Council believes that harnessing renewable energy resources, and managing them in a sustainable way, can help to improve social and economic conditions for people in the area. The Council has developed its own policy for ensuring that all renewable energy projects in the area provide concrete benefits for the local community. It established the Community Wind Farm Trust Fund, setting out clear principles for benefits sharing.

- The community benefit should be at least £2,000 per MWe per year, with an additional £1,000 per MWe, depending on the actual annual output of the wind farm.
- Developers are encouraged to allocate 60% of community trust funds to the immediate local community, and 40% to the wider Argyll and Bute Community.

Scottish Power, the local utility, adopted these guidelines in its strategic partnership with Argyll and Bute Council.

Conclusion: think project, talk process

Success factor: stakeholder engagement that acknowledges the importance of the process tend to be more effective, and the associated initiatives are more likely to succeed.

Paying attention to process

Establishing trust is all about the process, and less about the project itself. Having a sound rationale for one's project is clearly important, but ensuring smooth stakeholder participation with all main parties represented is equally important.

Focussing on the process implies starting early. Investigating the local situation and tailoring ones messages takes time. Stakeholders also appreciate being involved early, as otherwise they may question whether their views are considered seriously in taking the final decisions.

Investigate, adapt, engage

Successful stakeholder engagement starts with fact-finding, as the stakeholder groups are rarely fully understood. This is necessary locally, as factors that affect the perception of trust differ. A community that has negative experience with previous projects, for instance, is likely to be wary of initiatives from outside parties, even if the previous project was proposed by a different company, or unrelated to energy. Project developers need to map the stakeholder groups, their motives, objectives and assess how the project will affect them. Monitoring local and national media is also valuable. With this information the project developer can tailor its message to each group, and decide on the appropriate communication channels.

Figure 0.3 Investigating the local situation and adapting ones messages supports effective engagement.

Dialogue – design – implement

Having established this bespoke toolkit and approach, the actual stakeholder can start. The process should be characterized by open dialogue in which all main parties are involved in decision making, the design of the initiative and the implementation. This means abandoning the traditional decide-announce-defend approach, in favour of dialogue-design-implement.

Community Acceptance Of Wind Energy Projects

Geraint Ellis, Stefanie Huber and Robert Horbaty
IEA Task Force 28

By the end of 2012, world wind power capacity reached 273 GW, an eleven-fold growth from the 24GW installed in 2001[1]. Supported by ambitious national targets for renewables[2] and in the case of the European Union, enforced through its Directive on Renewable Energy (2009/28/EC)[3] this impressive growth has clearly been a reaction to the energy crisis brought about by the combined threats of climate change, energy security and peak oil and facilitated by technological innovation, supportive regulatory regimes and market support mechanisms. As the wind energy sector continues to grow, it faces a range of technological and economic challenges, yet the social aspects of renewables, particularly the relationship with host communities, is often overlooked. While this is not always a problem, there are indications that as wind energy schemes become more prevalent, so do the concerns of local communities. In some areas it is the level of community acceptance of these projects that will come to define the upper limit of wind energy deployment. For this reason it is imperative that we develop a better understanding of the issues that drive community attitudes to wind energy projects and develop strategies and good practice that developers, regulators and other stakeholders can adopt to increase community acceptance.

IEA Task 28

In 2008, in the light of growing anti-wind discourse in the world's media, the International Energy Agency (IEA) established Task 28 to tackle social acceptance under its Wind Agreement, with the aim of reducing implementation risks, overcoming misinterpretations and improving communication between different stakeholders in the deployment of wind. This has involved the participation of the USA, Canada, Japan and seven European countries (Norway, Finland, Ireland, Denmark, the Netherlands, Germany, Switzerland), each of whom have been represented by high-level policy officers, experts or researchers from a wide range of disciplinary backgrounds. The working group has developed a series of country-specific reports, a synthesising 'state of the art' report[4] and a project database that brings together the experience of a wide range of countries[5]. At the time of writing, the group is finalising a report on recommended good practices in community acceptance of wind energy projects. The results of the group are disseminated widely – at international conferences and by country representatives engaging with different audiences in their home countries. This short paper highlights some of the findings of the group.

Understanding Community Acceptance

There are many perspectives of what drives community acceptance – indeed the very notion of the "community" that may be affected by a wind energy scheme is itself a contested concept, often abused by different sides in the debates over wind energy. Rather than a monolithic block of local opinion, the "community" is likely to be made up of a variety of highly differentiated groups, such as: landowners who will profit from hosting the turbines on their land; "neo-rurals" who have come for the rural idyll; local environmental organizations who will fight for measures related to the local ecosystems and endangered species; a usually silent majority who might see positive and negative aspects of the project. A proposed scheme will also involve municipal utilities concerned over costs, reliability or operational issues; and local officials who, thinking they are representing the community with its various interests, will often be the ones to finally decide on the project. Furthermore, within those that support and those that oppose projects, there is likely to be a great variety of opinions and motivating factors[6] and pre-existing divisions such as those between elected officials and the local community, or between traditional and neo-rural population, will also influence how a community reacts to an energy proposal[7].

The response of these stakeholders will also be shaped by the local historical context, which may engage close community ties to the landscape or how different local groups have related to the development of other infrastructure projects. A critical influence will also be previous experience with those proposing or consenting the project – if there is a lack of trust with these, then it is likely that the level of opposition will be increased.

From the large number of case studies that are now available throughout the world, combined with the experience of those involved with Task 28, there appears to be a set of core issues that appear again and again in community concerns over wind energy projects. These are discussed below.

Ecosystem and landscape impacts

The landscape is an intrinsic part of personal and community identity and as such, any impacts arising from wind projects need to be sensitively handled, openly discussed and not disguised as health or environmental concerns[8]. People also value the wildlife in their local area and show special aversion where endangered species or conservation

1 *http://www.wwindea.org/ Accessed 5th March 2013.*

2 *For example, Scotland has a target that it will produce an equivalent of 100% demand for electricity from renewable energy by 2020.*

3 *This commits the EU to commits to a 20% share of energy from renewable sources by 2020 and binds nation states to targets that will deliver this.*

4 *Huber S. and Hobarty R. (2010) IEA Wind Task 28 State of the Art Report on Social Acceptance of Wind Energy, http://www.socialacceptance.ch/images/IEA_Wind_Task_28_technical_report_final_20110208.pdf (Accessed 5th March 2013).*

5 *See www.socialacceptance.ch*

6 *For example see Ellis, G., Barry, J. and Robinson, C. (2007) 'Many ways to say "no", different ways to say "yes": applying Q-Methodology to understand public acceptance of wind farm proposals', Journal of Environmental Planning and Management, 50; 4, 517–551.*

7 *See Huber and Horbarty (2010) above for an extended discussion on how we should understand the communities affected by wind energy projects.*

8 *Wester-Herber M. (2004) Underlying concerns in land-use conflicts – the role of place-identity in risk perception. Environmental Science & Policy, 7(2): 109-116*

areas are at stake[9]. While the impacts of wind projects on local ecosystems have reduced in recent decades through improved design and better siting, there have also been technological innovations, such as detection of birds by radar, allowing turbines to be stopped as a flock approaches. Close engagement between regulators, developers and environmental organizations has also led to the development of how best to respect wildlife issues in the design and planning of wind farms which have further facilitated the identification of less damaging locations[10].

Standard of living

People in host communities often expect that wind energy projects should result in positive impacts on the local economy, through job creation, maintenance contracts etc. A number of US studies have shown positive long-term impacts on economic development, especially where there is a prominent community wind sector[11] and very significant economic benefits have been projected for Wales, one of the most wind-rich parts of the UK[12]. While we need to treat such claims carefully, we also need to dispel a number of misconceptions about the economic impacts of wind energy projects – for example their detrimental impact on tourism which has been shown to be negligible[13] and the reduction of local property values also appears to be minimal[14]. There are also a range of measures that can be taken to increase the involvement of the communities and the local economic multipliers that can arise from wind projects[15].

Quality of life and well-being

Adequate set back distances between wind energy projects and dwellings can also influence the impact of turbines on well-being, encompassing issues such as annoyance, stress and health impacts arising from lighting, noise, low frequency sound or shadow flicker. Improved design, increased understanding of how certain technologies are perceived and experience with existing wind farms, coupled with better regulation have diminished these externalities. But perception is influenced by many different factors, some of them subjective. Therefore, quality of life around wind farms could remain a controversial topic regardless of the solutions presented.

Distribution of costs and benefits

Perceptions of the relative costs and benefits of a project will always play an important role in determining the level of acceptance of a project, so it is important the local communities are convinced of the aggregative positive benefits. A range of strategies have been developed to maximize local benefits, including;

- While some countries do not require any, or just have minimal compensation available for host communities (for example Finland or Greece[4]) in others, such as Germany, 70% of the excise tax now remains in the host municipality by federal tax law[16].
- Involving the local population as investors has given local communities enhanced economic opportunities and fostered greater levels of community acceptance[17]. Many countries (including Denmark, Germany, the US and Canada) have a long tradition of "community wind" – used here to describe all ownership models involving local individuals, groups and municipalities. In the English speaking countries, "toolkits" for such projects are available which aim to stimulate and provide guidance for those wishing to engage with such ownership models[18].

Increasing Community acceptance

Although wind energy projects are a vital element in developing a more sustainable energy system, we must acknowledge that they result in localized impacts and every effort must be made to mitigate, ameliorate or compensate for these consequences. In order to properly understand these impacts, it is important to include local communities in the consenting process for wind energy projects. If their concerns and values are not acknowledged and incorporated into the decision-making process it is likely that they will perceive the outcome as unfair or poorly legitimized[19]. It is also important for developers to remain flexible and adaptable[20] and if all stakeholders approach a process of deliberation with honesty and integrity, it may be possible to channel debate around wind energy projects to facilitate a broader transition to a low carbon society[21]. It is not always easy to bring all the parties together for an open debate, so a number of countries (e.g. Netherlands and Canada[22]) have successfully engaged neutral intermediaries to arbitrate in wind energy disputes. Such collaborative processes do not always meet with universal success and we will need to acknowledge that total acceptance will never be possible, and indeed in countries with a healthy democracy, we should always expect opinions will differ. Nevertheless, to acknowledge and seek to incorporate the social dimension of wind energy development should be viewed as critical as the technological or economic aspects and to overlook this means we may be ultimately limiting the success of our renewable revolution.

For more information on the IEA's Task 28 Working group, see http://www.socialacceptance.ch

9 Dimitropoulos A, Kontoleon A. (2009) Assessing the determinants of local acceptability of windfarm investment: A choice experiment in the Greek Aegean Islands. Energy Policy, 37(5): 1842-1854

10 For example, see Rodrigues L, Bach L, Dubourg-Savage MJ, Goodwin J, Harbusch C. (2008) Guideline for consideration of bats in wind farm projects, EUROBATS Publication Series No. 3. 2008, 27. http://www.eurobats.org/publications/publication%20series/pubseries_no3_english.pdf (accessed March 3, 2013). Another example is Centre for Environmental Design of Renewable Energy. Pre- and post-construction studies of conflicts between birds and wind turbines in coastal Norway. http://www.cedren.no/Projects/BirdWind.aspx (accessed March 3, 2013).

11 See Lantz, E and Flowers, F.(2010) IEA Wind Task 28 State-Of-The-Art Report Country Report of United States http://www.socialacceptance.ch/images/State-of-the-Art_Acceptance_Wind_Energy_USA.pdf (Accessed March 5, 2013)

12 RenewableUK Cymru (2013) Economic Opportunities for Wales from Future Onshore Wind Development, UK Renewables, Cardiff.

13 British Wind Energy Association (2006) The Impact of Wind Farms on the Tourist Industry in the UK; BWEA, London.

14 For example, Hoen B, Wiser R, Cappers P Thayer M, Sethi G. The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis, 2009, 164. http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf (accessed March 3, 2013)

15 Munday M, Bristow G and Cowell R 2011 'Wind farms in rural areas: how far do community benefits from wind farms represent a local economic development opportunity?' Journal of Rural Studies 27, 1-12.

16 Hübner G, Zoellner J, Meyer A (ed.). Social acceptance of Wind Energy Projects: State-of-the-Art in Germany, 2010, p. 18.

17 See for example the successful "Fintry Model" from Scotland, http://www.fintrydt.org.uk/index.php?page=history

18 For example, Community Energy Scotland Limited (2009) Community Renewable Energy Toolkit, 2009, 110. http://www.scotland.gov.uk/Publications/2009/03/20155542/0 (accessed March 3, 2013)

19 Gross C. (2009) Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. Energy Policy 35(5): 2727-2736.

20 BBC Research & Consulting (2002) Wind Power Facility Siting Case Studies: Community Response. p.51. http://www.bbcresearch.com/reports/Wind%20Power%20Facility%20Siting%20Case%20Studies.pdf (accessed March 3, 2013)

21 Barry, J and Ellis, G. (2010) 'Agonism, contestation, republicanism and a low carbon future' Chapter in Devine-Wright, P. (ed) Renewable Energy and the Public, Earthscan, London.

22 IEA Task 28 Working Group (2013) Recommended Practices: Social Acceptance of Wind Energy Projects, Available at www.socialacceptance.ch

Brief biography of authors

Geraint Ellis is a Professor in the School of Planning, Architecture and Civil Engineering in Queen's University, Belfast and has published widely on issues related to sustainability, energy and planning. He also is Editor of the Journal of Environmental Policy and Planning.

Stefanie Huber is a partner in ENCO Energie-Consulting AG, based in Switzerland where among other activities she works on the International Energy Agency's Wind Task 28 on Social Acceptance coordinating its activities and managing its publication of good practice recommendations and other outputs.

Roert Horbaty is an energy and sustainable development expert with over 25 years of experience. He currently runs his own company, ENCO Energie-Consulting AG, based in and acts as the operating agent for the International Energy Agency's Wind Task 28 on Social Acceptance.

A comprehensive technology acceptance framework applied to acceptance of a hydrogen refueling facility

Nicole Huijts
Delft University of Technology

Public acceptance of technologies has proven to be crucial for the successful implementation of a new technology. The recent cancelation of the carbon capture and storage project under the city of Barendrecht, for example, has shown how public opposition can contribute to the cancellation of the project.
Public support and public opposition is influenced by how people perceive and evaluate factors related to the technology and it's implementation. Understanding how the public decides to take action can provide insights into how to improve the design of technology, the decision making or communication to the public to arrive at a more accepted technology. Therefore, it is valuable to investigate public acceptance of technologies and psychological factors that explain public acceptance.

Many studies have investigated technology acceptance, but they have often focused on one or a few psychological factors. A more comprehensive approach would be beneficial as a next step in technology acceptance research (see also Gupta et al., 2011; Huijts et al., 2012a). To that end, my colleagues and I have designed such a comprehensive technology acceptance framework (Huijts et al., 2012b). Subsequently, we used the framework to explain citizens' intention to act towards a local hydrogen refueling facility. Hydrogen may be an energy carrier that replaces current fossil fuel use in transport and thereby reduces current problems caused by fossil fuel use, such as air pollution, climate change, and energy insecurity. Recent events in the UK have shown that opposition can arise against hydrogen refueling facilities (Mumford and Gray, 2010). Understanding the acceptance of this technology is thus important in the making of wise policy decisions about the technology. I will further explain the study and the lessons learned.

Study summary

We designed this comprehensive framework based on an extensive literature review, using theories from the fields of social psychology, environmental psychology, risk perception and using findings of empirical technology acceptance studies. The dependent variable in the framework is behavior, which is directly preceded by behavioral intention with respect to technology. To empirically test the model, 1214 Dutch citizens were asked to fill in an online questionnaire in October 2010. These citizens were selected from a database of the market response bureau Intomart to represent the Dutch population taking into account age, gender, education, income and living area (rural or urban). We expected citizens to have very little knowledge of hydrogen and hydrogen technology. Therefore, we gave a majority of respondents (800 respondents) information about the topic before they filled in the questionnaire. The information concerned neutral information about costs, risks and benefits of the technology and short summaries of viewpoints of involved actors, including government, industry and environmental NGOs (see Huijts et al., 2013). This information was designed based on reports and short interviews with experts and stakeholder representatives.

The respondents were asked to consider the placement of a hydrogen refueling facility on the premises of the nearest petrol station. The respondents were then asked how they would vote (for or against the facility) if their town would let the citizens vote on this. Those that answered that they might vote in favor of a local hydrogen refueling facility were considered supporters, those that answered that they might vote against it were considered opponents. Those that voted neutral were left out of the analysis; approximately 56% answered as supporters and 11% as opponents . All those identified as supporters or opponents were asked to answer questions related to the psychological variables in the model plus additional questions that will be used for other studies. Structural equation modeling was used to estimate the models; one for explaining intention to act in favor of the technology and one for explaining intention to act against the technology. The framework was found to explain intention to act rather well. The explained variance of intention to act was rather high in both models (namely .78 for supporters and .72 for opponents) and the models fit was sufficiently high.

Lessons learned

A number of interesting findings were revealed by the models. First, it was found that both intention to act by both supporters and opponents of the technology was most strongly explained by 'feelings of moral obligation to act in favor of (for supporters) or against (for opponents) the technology. In short this variable is called 'personal norm'. Personal norm is suggested by the Norm Activation Model (Schwartz and Howard, 1981) to influence moral behaviors, such as behaviors that have beneficial social or environmental effects. The strong explanatory effect of personal norms suggest that citizens' responses to technologies nearby are quite strongly based on moral considerations. This is different from what is suggested when using the term 'NIMBY' (Not In My BackYard). This term is used to indicate that people are against a technology or facility out of personal interest or selfishness; they are against it when it if placed in their own living area, but not when it is placed elsewhere (Dear, 1992).

Second, 'feelings felt when thinking of the technology' are the second strongest determinant of intention to act in both groups. This variables is also called 'affect'. Positive affect quite strongly explained intention to act in favor of the technology, while negative affect quite strongly explained intention to act against the technology. Affect was a stronger predictor than the evaluation of costs, risks and benefits of the technology. This finding supports the idea that feelings are very important for human decision making and human behavior. A growing interest in the recent decades has been identified in the field of psychology with respect to the role of affect in decision making, after a time in which the focus has been solely or mainly on more cognitive or rational evaluations influencing decision making (Loewenstein and Lerner, 2003).

Intentions of both groups (supporters and opponents) are also explained by the citizens' evaluation of costs, risks and benefits of the technology (summarized as 'perceived effects') and by the expectation as to whether action taking would influence decision making related to the actual placing of a local hydrogen refueling facility (called 'outcome efficacy'). An interesting difference between the two groups is that intention to act by supporters is also explained by more 'rational' factors such as an evaluation of taking action in favor or against the refueling facility in terms of bad-good (independent from whether they planned to perform the action), an estimation of how people important to them would evaluate their actions and the perceived ease or difficulty of the actions (called 'attitude towards acting', 'subjective norm', and 'perceived behavioral control' respectively), while this was not the case for opponents. These three variables are described in the Theory of Planned Behavior (Ajzen, 1991) to influence behavior and have often been found to predict a whole array of behaviors that are considered planned or based on rational cost-benefit analysis. Supporters' intention are thus also predicted by variables that are assuming more rational, planned behavior. Another difference between the groups is that opponents' intentions are more strongly influenced by trust in industry and by perceived fairness of the distribution of costs, risks and benefits than supporters' intentions. Opponents that had little trust in industry showed a higher likeliness to take action against the placing of the hydrogen refueling facility at the nearest petrol station than those who had more trust in industry. Similarly, those that felt that an unfair distribution of costs, risks and benefits is problematic and should be avoided, were more likely to take action against a local hydrogen refueling facility. This latter variable was called in short 'distributive fairness.' While trust has often been studied as a determinant of technology acceptance, distributive fairness seems not often studied yet (an overview of psychological variables studied as predictor of technology acceptance can also be found in Gupta et al., 2011). A third factor that has not been empirically studied by us, but which is also expected to fuel opposition is procedural fairness (are the procedures leading to the final decision evaluated to be fair in the eyes of the respondents?). It was for, example, also an important determinant of the acceptability of carbon storage in Barendrecht, next to trust and perceived costs and risks (Terwel et al., 2012); those that found the procedure unfair were more negative about CCS. Finally, the variables trust in the municipality, energy security problem perception and environmental problem perception were found to have little or no effect on intention to act both in favor of and against a local hydrogen refueling facility. The fact that environmental problem perception does not explain intention to act towards a local hydrogen refueling facility is especially interesting, as environmental problems related to current fossil fuel use are a very important reason for policy makers to support this technology.

To sum up, we learned that a large number of participants would vote in favor of a local hydrogen refueling facility (56%) and that support is thus more common than opposition. The supporters' intention to act in favor of the technology was quite strongly explained by personal norm, positive affect towards the technology, and perceived effects of the technology and somewhat less strongly by outcome efficacy, attitude towards acting, perceived behavioral control, subjective norm, energy security problem perception, negative affect, trust in the municipality, trust in industry, and distributive fairness.
Only a small number of participants (11%) indicated they would vote against a local hydrogen refueling station. Their intention to take action against it is quite strongly influenced by personal norm, negative feelings towards the technology, trust in industry, and perceived effects of the technology, and somewhat less strongly by outcome efficacy, positive affect, distributive fairness and trust in the municipality. Had a procedure already taken place, then an unfair perceived decision making process (e.g. a process in which citizens did not have a voice) might have also influenced opponents' intention to act against a local hydrogen refueling facility.

Concluding remarks

The framework designed to better understand, and comprehensively and thoroughly study citizen's acceptance of technologies, has proven fruitful for creating understanding into citizens' potential responses to a hydrogen refueling facility at their nearest petrol station. Not only do we conclude that psychological factors are very important for technology acceptance, our results also show the added value of a combination of multiple psychological theories and models. Studying technology acceptance comprehensively and through a common framework gives more extensive insights and provides opportunities to compare between cases or between groups of citizens, for instance between supporters and opponents as in our study. The framework will likely also prove to be successful in studying citizens' responses to other technologies.
Citizens' opinion of technologies and their supporting or opposing actions have been shown to influence whether a technology is successfully introduced. Gaining an early understanding into citizens' opinions and intentions to take action can prove fruitful in directing policy making and investments by governments and industries towards technological projects with greater public approval and thus higher chances of success.
More information about the study, about the provided information and about the results can be retrieved from the author.

Brief biography of the author

Ir. Nicole Huijts studied Technology and Society (recently renamed Innovation Sciences) at the Eindhoven University of Technology and graduated with honorable mention in 2003. After that she studied religion sciences, philosophy and theology at the Radboud University Nijmegen and subsequently worked as a consultant in the IT sector. Since 2007, she has been working as a researcher at the Delft University of Technology in the group Transportation and Logistics. She has studied the acceptance of technologies in general, and of carbon capture and storage and of hydrogen refueling facilities specifically. She is currently finalizing her PhD thesis on this topic. The research presented here has been performed in cooperation with several researchers, most notably with Prof. dr. Bert van Wee and dr. Eric Molin.

Sources

Ajzen, I., 1991. The theory of planned behavior. Organizational Behavior and Human Decision Processes 50, 179-211.
Dear, M., 1992. Understanding and overcoming the NIMBY syndrome. Journal of the American Planning Association 58, 288-300.
Gupta, N., Fischer, A.R.H., Frewer, L.J., 2011. Socio-psychological determinants of public acceptance of technologies: a review. Public Understanding of Science 21, 782-795.
Huijts, N.M.A., De Groot, J.I.M., Molin, E.J.E., Van Wee, B., 2013. Intention to act towards a local hydrogen refueling facility: moral considerations versus self-interest. Transportation Research Part A: Policy and Practice 48, 63–74.
Huijts, N.M.A., Molin, E.J.E., Chorus, C.G., Van Wee, B., 2012a. Public acceptance of hydrogen technologies in transport: A review of and reflection on empirical studies, in: Geerlings, H., Shiftan, Y., Stead, D. (Eds.), Transition towards sustainable mobility: the role of instruments, individuals and institutions. Ashgate, Hampshire.
Huijts, N.M.A., Molin, E.J.E., Steg, L., 2012b. Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. Renewable and Sustainable Energy Reviews 16, 525-531
Loewenstein, G., Lerner, J.S., 2003. The role of affect in decision making, in: Davidson, R.J., Scherer, K.R., Goldsmith, H.H. (Eds.), Handbook of Affective Sciences. Oxford University Press, New York, pp. 619-642.
Mumford, J., Gray, D., 2010. Consumer engagement in alternative energy - Can the regulators and suppliers be trusted? Energy Policy 38, 2664-2671.
Schwartz, S.H., Howard, J.A., 1981. A normative decision-making model of altruism, in: Rushton, J.P., Sorrentino, R.M. (Eds.), Altruism and helping behavior: social, personality and developmental perspective Erlbaum, Hillsdale, NJ, pp. 189-211.
Terwel, B.W., ter Mors, E., Daamen, D.D.L., 2012. It's not only about safety: Beliefs and attitudes of 811 local residents regarding a CCS project in Barendrecht. International Journal of Greenhouse Gas Control 9, 41-51.

Transformation of energy systems and the public

Roger E. Kasperson
The George Perkins Marsh Institute, Clark University, Worcester, MA

Bonnie J. Ram
Ram Power LLC and University of Delaware, Washington, D.C.

Much recent worldwide discussion has centered on the need for rapid deployment of new energy technologies although this debate has been narrow and limited. A key issue in the embrace of any new technology will certainly involve questions of public acceptance. Whether it is a "second renaissance for nuclear power," a major dash to embrace hydraulic fracturing and natural gas, or the emerging prospects for renewable energies like wind and solar power, little is still known about how diverse publics across the globe will respond to the advent of these new energy sources. Complicating all this is a growing debate about old energy sources, and the extent to which a fossil-fuel based energy system should be central to the world economy as well as its incompatibility with international efforts to address climate change. An enhanced understanding of the issues involved in public acceptance will be central to any international progress.

In the midst of a global economic downturn and rampant unemployment in a number of countries, the vision of new technologies beckons. The nuclear dream appears in a new guise – the "second nuclear renaissance" of a safer and more acceptable technology, and the prospect of decentralized nuclear reactors operating at a community or neighborhood scale. Searching for a bridge to an energy system that has moved beyond fossil fuels, fracking has burst upon the energy arena as a salvation with abundant supply and an energy source with potential to reduce greenhouse gas emissions by roughly 50 percent when compared with coal.

Meanwhile, renewable energy sources – especially wind and solar energy – continue to be touted as long-term solutions for achieving a low-carbon economy as the new German national energy policy has indicated. Accordingly, the race is on to assure that the needed technology will be there, even in the midst of financial austerity.
Not all of these new energy ventures are technically new technologies, however. Some are new applications of existing or old technologies. Windmills have abounded for several centuries and fracking involves different processes for liberating natural gas from shale formations but established technologies have largely been the instruments of capturing this new energy source. Even the exploration of decentralized nuclear plants has largely drawn upon existing technology but oriented new deployment at a different scale.

Accordingly, issues surrounding public acceptance are not simply about the adoption of new and unfamiliar technology, but also new and unfamiliar applications of familiar technology. Uncertainty plays a major role in how technology adopters and various policies respond to what are likely unfamiliar risks, and uncertainty plays a major role in public response. Lack of experience inevitably contributes to large and multiple uncertainties in the appearance of these new technologies and new applications. New deployments occur while data are often scarce. While modeling is an intrinsic part of characterizing new benefits and risks, the models are often early in development and model parameters still rudimentary and incomplete. Even what may be termed "deep uncertainty" – the limited knowledge of basic phenomena – may often be more of a major problem. Underlying these various issues is a focus on developing the needed technology or application and not whether the social dimensions of what is, at heart, a social-technical system is in place to support rapid and effective diffusion of some new energy pathway. Clearly, system approaches are needed that integrate potential risks and benefits across multiple sectors and stakeholders (Ram 2011). No problem is more stark, troublesome, and problematic than that of public acceptance. We know from past risk studies that there is often a marked divergence between expert scientific assessment and public perception. At one time, it was often believed that the public was ignorant and that the gap between them and experts could best be narrowed by more education, still a favorite solution of many experts. Yet subsequent studies have revealed quite conclusively that the public is not irrational – the people can rank risks, for example, in an orderly and consistent manner (Slovic et al., 1979, 1980). But it is also clear that the public assesses technologies and applications in a very different manner than experts do – they consider, for example, ethical issues that may be involved, the trustworthiness of managers, and the adequacy with which they have been consulted and decisions made.

The uncertainty and complexity of new energy technologies greatly complicate risk issues. Siting is where the rubber meets the road in the deployment of new facilities, energy or otherwise. So we have discovered, sometimes to our pain, that there may be benign and supportive attitudes at a general level toward renewable energy facilities, such as wind, solar, geothermal and biomass facilities, but when location and actual local development begin, it is not unusual for new concerns to surface. In overly simplistic and often misleading terms, this is often referred to as the so-called "NIMBY" syndrome – people object to any risk as long as it is in their backyard rather than someone else's. This is, in fact, often a well-honed means of "blaming the victim." And so, if there were deficiencies in the risk communication or public participation processes, blame is not shifted to the manager or the process but remains on the "victims."

Stakeholder Involvement

Everywhere the call is out for "stakeholder" involvement as a means for improving public acceptance and developmental decisions, particularly those involving complex technology, uncertain risks, and conflicting values. Various reports of the National Research Council (NRC) in the United States have highlighted stakeholder participation as a central element in a well-orchestrated policy of seeking public acceptance for new policy or technology solutions. Stern and Fineberg (1996), for example, in their influential report Understanding Risk, give a prominent place to deliberative processes which they see as central for "developing the understanding required to inform decisions". These views have been reaffirmed and expanded in the NRC's recent reports on Science and Decisions (2009) and Public Participation in Environmental Assessment and Decision Making (2008). Internationally, major assessments of global environmental risks, such as those of the Intergovernmental Panel on Climate Change and the Millennium Ecosystem Assessment, have recognized widespread stakeholder participation as essential for addressing world-wide environmental threats, new and old. Even in remote villages in China, India, and sub-Saharan Africa, the call is out for greater local involvement in decisions made at higher levels of government that affect local peoples' lives and their human security. There is great faith that broader public participation will increase public acceptance and make ongoing decisions better informed and more sensitive to local conditions, limit the power of elite interests, and assure greater implementation of needed projects and development.

The stakeholder involvement imperative abounds with allusions to democratic ideals and principles and the good things assumed to result from such exercises. Implicit throughout is the notion that broad public involvement is the principal route to improved decision making, especially where the risks are controversial and disputed. Outcomes to be expected, it is claimed, include increased trust in experts and decision makers, greater consensus among the public and between science and politics, reductions in conflict and controversy, greater public acceptance of preferred solutions, and increased ease in implementation. In this light, it is not surprising that public involvement is becoming routinized and a standard component of risk deliberations, while a host of consulting institutions have emerged to provide the analytic support that environmental managers require and, of course, to exploit a new lucrative opportunity.

Beyond Stakeholder Involvement

But the impediments to transforming energy systems and deploying new technologies are formidable, pervasive, and often underestimated, and go well beyond stakeholder involvement issues. Perhaps it is not surprising that an expectation exists that there will be ready acceptance of new energy technologies. After all, people increasingly point to the historical embrace of coal technologies in the U.S. where mountaintops were casually removed, or in China where air pollution threatens human health and environmental damage to lakes and streams is widespread. But it is now well known that there may be historical differences as well, given changing attitudes across countries to technology. New and unfamiliar risks often involve perceptions of dread and severity and cause high concern over the risk among publics. These issues reflect a basic tendency of laypeople to assess risks using a different, and often broader, framework than do experts. As a result, risks newly appearing in the mix of energy options may generate concerns that are not likely to be easily assuaged by information and assurances from experts and managers.

Social Trust

Further complicating this impediment is the long-term decline in social trust in many societies. Social trust provides the essential lubricant for the concert of changes required, especially the base of supporting public values needed for the wrenching changes that adoption of new energy technology may sometime involve. Where trust is in short supply, needed institutions, behavior, cost and price adjustments, and social value change may be difficult to achieve.

Social trust is a complex concept and certainly multidimensional in its nature – competence, predictability and caring all enter in and are sometimes in consonance and at other times in conflict (Kasperson, 2004). For example, early release of risk information is certainly essential to provide evidence of a manager's openness and caring. But if the provided information is found in subsequent studies to be flawed and/or misleading, then distrust rather than trust is likely to be the result. Those at risk need to believe in the high scientific quality of analyses and managers (Siegrist et al., 2007). As a result, the manager's interactions with stakeholders and particularly risk-bearers are always fraught with potential risk to social trust.

Where does social trust come from? It is often assumed that if a manager behaves in a trustworthy fashion greater social trust will be the result, but this may not be the case (Flynn and Löfstedt, 1999). While personal experience with particular institutions or managers can be a driver of greater social trust or distrust, the long-term erosion of social trust in many societies makes clear that trust is built and lost systemically. There is much evidence that new energy technology in many countries, for example, will need to proceed under conditions of high distrust. Indeed, trust in corporations is at an all-time low in many countries. There is little reason to believe that substantially greater social trust will soon appear in many countries, whatever the urgency of energy security and global climate change.

Complicating the paucity of social trust are the ethical and equity issues that arise in the adoption of new energy technologies. Energy technologies are not value neutral; all have varying combinations of distributional and generational issues. Often these issues remain implicit and are not openly discussed. Geothermal energy carries localized risks but benefits occur over broader regions. Fracking has similar distributional disjunctures but may entail generational issues as well. To the extent that solar and wind technologies contribute to reducing climate change, the benefits are global in nature as well as national. These issues need to be explicitly raised and addressed – they are not matters of technology innovation and robust engineering systems – and the public processes that are used to address them are very important.

This highlights the problem of determining "acceptable" or "tolerable" risk. It is too often assumed that judging whether the risk is too much and must be reduced is a matter of science; it is not. From experience and comparative analysis it is well established that such issues always involve public values. We also know that the acceptability of risk varies with the magnitude of perceived benefits (Starr, 1969) and whether the risks are voluntary or involuntary (Slovic et al, 1979). Again, the process of assessing public values will be critical and requires a sustained commitment.

Given the array of challenges facing efforts to win greater public acceptance and to draw social science thinking into the process, it is clear that major efforts in capacity-building in most countries are needed. Previously, little social science expertise has existed to address risk assessment and public acceptance processes. Accordingly, public acceptance is often seen as primarily an outreach effort to be undertaken by advertising and public relations (PR) officials. Major government entities at all levels in most countries tend to be staffed by engineers, biophysical scientists, and lawyers. That has been the makeup of many governments over the past several decades and is unlikely to change soon, since the hiring process tends to reproduce existing expertise. Accordingly, understanding how people and social institutions behave in a social-technical system is essential. What we do know is that the most difficult problems in the deployment of new solutions and technologies are rooted in social issues and public acceptance and are unlikely to change anytime soon.

The process issues referred to in many of these problems highlight issues of collaboration, stakeholder participation, and risk communication. Elsewhere we have described the overall process as the "social amplification of risk" (Pidgeon et al., 2003). Identifying an alternative decision process may be an effective means for moving forward effectively. Public acceptance is a key issue in transforming energy systems toward an alternative vision and requires as much attention as developing the needed technology. So here we list major steps that are needed if countries are to achieve energy technology transformations and a flow of new innovations:

- Early efforts through surveys, interviews, and focus groups to define a baseline of public concerns and public perceptions of risks;
- A national commitment to an alternative energy future, with supporting justification in climate change and energy security (American Academy of Arts and Sciences, 2011);
- Collaborative approaches to assessment and decision-making, particularly in a context of meager social trust. If social trust is low,

empowerment of those communities hosting the facility and bearing the risks is essential;

- Closely related is the recognition that public acceptance of new energy facilities at particular sites will require a consent-based approach rather than the imposition of risk by decisions made by others (as the cooperative development of wind power in Denmark shows);
- Important in this process will be active public involvement in the monitoring of facility performance and impacts on the community and local ecology. If risks prove to have been underestimated and facility performance fails to meet regulatory standards, provisions should be provided by which local officials can petition for or effect closure of the facility;
- Evaluation, jointly arranged by the developer and the host community, should be ongoing through the stages of site development – planning, construction, operation, and decommissioning. This evaluation should involve serious peer review, as designed by experts, regulators, and state and local officials. Evaluation should be seen as a key element in mid-course corrections and adaptive management.
- Building greater social science capability in risk management issues is a pressing need that requires extraordinary measures. Long-term initiatives should be put in place to build a capability now lacking in government and private agencies in many countries at all levels.

While there is no assured process for success in public acceptance, and greater stakeholder participation does not guarantee better decision (Dietz and Stern, 2008), meeting existing regulatory requirements by no means carries promise for the adoption of new energy technologies and applications. Probabilities for success improve greatly with serious early attention to and investment in achieving public acceptance.

Acknowledgement

The authors wish to express their appreciation to the support of the Marsh Institute at Clark University, and particularly to the sterling efforts of Lu Ann Pacenka.

References

American Academy of Arts and Sciences. 2011. Beyond technology: Strengthening energy policy through social sciences. Cambridge, MA: The Academy.

Dietz, T. and P. C. Stern, eds. 2008. Public participation in environmental assessment and decision making. Washington: National Academies Press.

Flynn, J., and R. Löfstedt, eds. 1999. Social trust and the management of risk. London: Earthscan.

Kasperson, R. E. 2004. Siting hazardous facilities: Searching for effective institutions and processes. In S. H. Lesbirel and D. Shaw, eds. Managing conflict in facility siting. London: Edward Elgar, 13-35.

National Research Council. 2009. Science and decision: Advancing risk assessment. Washington: National Academies Press.

Pidgeon, N., R. E. Kasperson, and P. Slovic, eds. 2003. The social amplification of risk. Cambridge: Cambridge University Press.

Ram, B. 2011. Assessing Integrated Risks of Offshore Wind Projects: Moving Towards Gigawatt-scale Deployments in Wind Engineering. 35 (2). Multi-Science Publishing. (Pages 247-265).

Siegrist, Michael, Timothy C. Earle, and Heinz Gutscher, eds. Trust in Cooperative Risk Management. London: Earthscan.

Slovic, P. B. Fischhoff and S. Lichtenstein. 1980. Facts and fears: Understanding perceived risk. In R. C. Schwing and W. A. Albers, Jr., eds. Societal risk assessment: How safe is safe enough? NY: Plenum.

Slovic, P., B. Fischhoff, and S. Lichtenstein. 1979. Rating the risks. Environment 2 (3): 19-29, 36-39.

Starr, C. 1969. Social benefit vs. technological risk. Science 165: 1232-1238.

Stern, Paul C. and Harvey V. Fineberg, eds. 1996. Understanding risk: Informing decisions in a democratic society. Washington: National Academies Press.

The importance of public trust in the context of CO_2 capture and storage (CCS)

Bart W. Terwel
Leiden University

The viability of energy technologies such as CO_2 capture and storage (CCS) not only depends on their technical and economic feasibility, but also on public acceptance. Research within CATO – the Dutch national research program on CCS – indicates that public attitudes towards the implementation of CCS are codetermined by trust in CCS stakeholders. This article discusses some findings of this research.

Based on the assumption that an increase in laypeople's knowledge and understanding of CCS should lead to an increase in public acceptance of CCS, it is sometimes suggested that the existence of negative public attitudes towards CCS implies that stakeholders have failed in their communications on the issue, but the reasoning is overly simplistic. In particular, it largely ignores the fact that many people are not very motivated to process information about CCS in order to reach an informed and well-considered opinion. When information provision fails to increase knowledge and understanding of (and support for) CCS among the public, it probably has to do with the fact that people may not be motivated to increase their personal knowledge of the issue rather than the quality or mode of stakeholder communications.

Research has shown that people tend to rely on their sense of trust in stakeholders when they lack the motivation to reach an informed and well-considered opinion about CCS (Terwel et al., 2011). Stated differently, trust is used as "a tool for the reduction of cognitive complexity" (Earle & Cvetkovich, 1995). This idea is supported by the findings of Siegrist and Cvetkovich (2000), who examined the relationships between public trust in parties that are responsible for the management of a range of different hazardous issues, public perceptions of the risks and benefits associated with these issues, and the level of public knowledge of these issues. People seemed to rely on their sense of trust in authorities when they lacked personal knowledge about a hazard: When the level of personal knowledge was low, trust was significantly correlated with risk/benefit perceptions. As such, it may be more important to create public trust in stakeholders than to increase public knowledge and understanding of CCS.

Trust has been defined as "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (Rousseau et al., 1998). These positive expectations (or "trusting beliefs") specifically relate to the competence, integrity, and benevolence of the trustee (Mayer et al., 1995). Accordingly, people may trust a company involved in CCS when they think that it (1) has significant expertise concerning the issue at hand, (2) adheres to moral principles (e.g., honesty and openness), and (3) cares about the public interest. However, research shows that members of the general public are relatively mistrusting of companies involved in CCS, which is primarily due to the fact that these types of organizations are perceived to act upon firm-serving motives (such as profit maximization) rather than public-serving (e.g., pro-environmental) motives (Terwel et al., 2009a).

Importantly, stakeholders should realize that their communications may be intended to educate people (perhaps in the anticipation of more positive public attitudes), but might at the same time provide cues that people find relevant to determine organizational trustworthiness. For example, a company may inform members of the general public about the environmental benefits of CCS and communicate that this is the reason why it invests in the development of the technology. Such communications are typically seen as dishonest and will decrease rather than create public trust (i.e., reduced integrity instead of increased benevolence) as a result of perceived incongruence with inferred organizational motives (Terwel et al., 2009a). In fact, such communications might even lead to suspicions of corporate greenwashing (De Vries et al., in press). By contrast, people respond more positively when a company communicates the economic benefits of CCS because such communications are considered more congruent with the inferred motives of the company. Companies might be most successful in creating trust in the public when they inform people about the environmental benefits of CCS, but at the same time acknowledge that economic motives play a role as well (Terwel et al., 2009a).

Moreover, it is important to realize that the level of public trust in stakeholders affects how people interpret and judge the information communicated by these stakeholders and, as a consequence, public attitudes towards CCS. To illustrate, laypeople in an experiment were informed about risks and benefits associated with CCS and evaluations of the magnitude of risks and benefits depended on the level of trust in the organization that communicated the information. For instance, when the organization was a proponent of CCS and trusted for its competence, people considered the reduced contribution to the greenhouse effect a larger benefit than when the organization was an opponent of CCS. In turn, the perceived magnitude of the risks and benefits affected people's willingness to accept the implementation of CCS. Accordingly, this study shows that public attitudes towards the implementation of CCS are more positive when people trust rather than distrust proponents of CCS (and more negative when people trust the opponents) (Terwel et al., 2009b). The suggestion that it might be more important to create public trust in stakeholders than to increase public knowledge and understanding of CCS may even apply when people are confronted with plans for a CO_2 storage project in their own residential area. At least, an extensive survey shows that public trust (or lack thereof) has played an important role in the context of the proposed CO_2 storage project in Barendrecht (lack of local support was one of the reasons why the government canceled the project in 2010). Two results of this survey are especially worth noting here. First, public awareness of the proposed CO_2 storage project was sky-high (virtually everyone had heard about it), but high levels of public awareness do not automatically imply high levels of knowledge about the project. For example, concerning knowledge of the depth of the storage reservoir, only 41 percent of the respondents correctly answered that the CO_2 would be stored at a depth of more than 1500 meters (a sizeable minority thought that the CO_2 would be stored at depths of 500 meters or much less). At the same time, nearly two-thirds of the respondents said that they had no need for additional information about the proposed project. Second, the results show that a range of factors contributed to the overwhelmingly negative public attitudes towards the proposed project – the perceived unsafe nature of CO_2 storage was the most influential factor, but socio-political factors such as a lack of trust in the proponents of the project (project initiator Shell and the national government) and perceived procedural unfairness played key roles as well. These results suggest that greater personal involvement with CCS does not necessarily lead to the desire to have more knowledge about CCS and that trust in stakeholders remains important.

References

- De Vries, G., Terwel, B. W., Ellemers, N., & Daamen, D. D. L. (in press). Sustainability or profitability? How communicated motives for environmental policy affect public perceptions of corporate greenwashing. Corporate Social Responsibility and Environmental Management.
- Earle, T. C. & Cvetkovich, G. T. (1995). Social trust: Towards a cosmopolitan society. Praeger Publishers, Westport CT.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. Academy of Management Review, 20, 709-734.
- Rousseau, D. M., Sitkin, S. B., Burt, R. S., Camerer, C. (1998). Not so different after all: A cross-discipline view on trust. Academy of Management Review, 23, 393-404.
- Siegrist, M., & Cvetkovich, G. T (2000). Perception of hazards: The role of social trust and knowledge. Risk Analysis, 20, 713-720.
- Terwel, B. W., Harinck, F. Ellemers, N., & Daamen, D. D. L. (2009a). How organizational motives and communications affect public trust in organizations: The case of carbon dioxide capture and storage. Journal of Environmental Psychology, 29, 290-299.
- Terwel, B. W., Harinck, F. Ellemers, N., & Daamen, D. D. L. (2009b). Competence-based and integrity-based trust as predictors of acceptance of carbon dioxide capture and storage (CCS). Risk Analysis, 29, 1129-1140.
- Terwel, B. W., Harinck, F. Ellemers, N., & Daamen, D. D. L. (2011). Going beyond the properties of CO_2 capture and storage technology: How trust in stakeholders affects public acceptance of CCS. International Journal of Greenhouse Gas Control, 5, 181-188.
- Terwel, B. W., Ter Mors, E., & Daamen, D. D. L. (2012). It's not only about safety: Beliefs and attitudes of 811 local residents regarding a CCS project in Barendrecht. International Journal of Greenhouse Gas Control, 9, 41-51.

Biography

Bart Terwel is senior researcher at the Department of Social and Organizational Psychology at Leiden University. His research is part of CATO – the Dutch national research program on CCS – and focuses on factors that (co)determine public perceptions and acceptance of CCS.

EDI

Market Under Transformation

The efforts aimed at price liberalisation, improved trading liquidity and diversification of gas transportation routes to Poland are quickly advancing. The market has positively responded to the direction of changes set by the regulator and implemented by the transmission system operator.

The Polish economy with a level of gas consumption around 14 billion cubic meters and economic growth sustained throughout all the years of the financial crisis[1] has achieved a relatively stable financial position. Therefore it is time for major projects to diversify the sources and directions of supply to our country: the construction of an LNG terminal in Świnoujście is underway along with a major infrastructure expansion (1000 km of new gas pipelines to be completed just by 2014), which is necessary to leverage the potential of trade from the west (upgrading of the Polish-German interconnector) and the south (first historical Polish-Czech cross-border connection).[2] These projects are also designed to prepare the ground for potential growth in production from domestic gas fields. The investment projects completed by the Transmission System Operator (GAZ-SYSTEM S.A.) in Poland in 2011, including the launch of a virtual reverse flow service for the Yamal pipeline, resulted in a 30% increase of import capabilities from alternative directions, other than the historical eastern one. This adds a new level of quality and security to the Polish economy.

The status of a Transmission System Operator (the sole owner and administrator of transmission assets in Poland) that, at the same time, performs the function of the operator of the Polish section of the Yamal pipeline (ITO model applied based on the assets owned by EuRoPolGaz[3]) and the ownership structure of the company (full independence of the TSO from the upstream and downstream alike, 100% controlled by the State Treasury) guarantee transparency and address the responsibility for investments to GAZ-SYSTEM S.A.

The key challenge in the Central and Eastern European region concerns similar needs for the modernisation of the energy transmission infrastructure and, specifically, the improvement of interconnectors.
The growing experience of the Polish Transmission System Operator to attract business partners (i.e. from neighbouring operators), as well as institutional (e.g. European Commission) and financial ones (EIB, EBRD[4]) and engage in the development of interconnections represents a valuable contribution to further development of the gas market in Poland and the region. The 2020 investment programme of GAZ-SYSTEM includes projects concerning further expansion of Polish-Czech interconnectors, physical reverse-flow at the Polish-German border, a new Polish-Slovak interconnection and one between Poland and Lithuania. In the time horizon, construction of further 1000 km of gas pipelines is anticipated to upgrade and improve the flexibility of the Polish transmission network.

The concept of regional integration through implementation of the above-mentioned projects fits into the proposed route of the North-South Gas Corridor which would connect the Polish LNG terminal in Świnoujście with one in Croatia through the transmission systems of Poland, the Czech Republic, Slovakia and Hungary. This specific routing of the Corridor supports flexibility and security of supply through the following business synergies: integration of landlocked countries with the global LNG market; elimination of energy islands in the Baltic region (through the planned gas pipeline connecting Poland with Lithuania); implementation of obligatory bi-directional interconnectors crossing the Polish/Slovak and Polish/Czech border; development of national gas exchanges with a regional hub (e.g. in Baumgarten); bringing new gas volumes to customers with the possibility of supply from the North and (upon completion of the Southern Gas Corridor) also from the South.[5] Regional consolidation based on the above-mentioned interconnections will be conducive to the achievement of the above goals while supporting business goals pursued by shippers.

Looking for regional synergies, the operator works together with its counterparts in the neighbouring countries. In cooperation with ONTRAS GmBH, GAZ-SYSTEM is implementing a pilot project for

1 *Source: Eurostat, Real GDP growth rate - volume, European Commission, 2012-11-05 (availability as of 16.01.2013).*

2 *Source: GAZ-SYSTEM, Annual Report 2011,10.2011 (availability as of 17.01.2013).*

3 *As of 17 November 2010 GAZ-SYSTEM acts as an independent operator of the Polish section of the Yamal-Europe gas pipeline, which makes part of the assets of EuRoPolGaz, a company owned by GAZPROM Export, PGNiG and GAZ-Trading. Source: GAZ-SYSTEM, Transit Gas Pipeline System, 17.11.2010 (availability as of 16.01.2013) and EuRoPol GAZ, The Yamal-Europe Transit Gas Pipelines System,17.11.2010 (availability as of 17.01.2013).*

4 *Source: GAZ-SYSTEM, GAZ-SYSTEM raised financing for the development of the LNG Terminal in Świnoujście, 01.10.2012 (availability as of 16.01.2013).*

5 *Projects that already enable the implementation of this concept include the combination of completed interconnectors (Croatia-Hungary, Poland-Czech Republic), the LNG terminal in Świnoujście (operational in 2013) and the expansion and modernisation of domestic networks in Poland, Slovakia and Hungary, ongoing feasibility studies and economic analyses of the routing of gas pipelines Poland-Slovakia and Poland-Lithuania, as well as the upgrading of the Polish-Czech interconnector.*

6 *Source: GAZ-SYSTEM, Bundled product, November 2012, (availability as of 17.01.2013).*

7 *Source: Entsog, NC CAM, 17.09.2012 (availability as of 17.01.2013).*

offering bundled capacity service at the Lasów border point through the TRAC-X platform. The project is intended to promote the harmonisation of auction procedures at the cross-border point in Lasów which was upgraded in 2011.[6] In this manner we are pilot-testing a bundled capacity product that the operators in the EU will be required to offer according to CAM Network Code.[7]

Flexible conditions for gas supply are being developed in order to meet the current and projected demand for gas in Poland. In 2012, GAZ-SYSTEM received orders for the connection of aggregate new capacity of 38 885 059 kWh to be used in 2020. Major industrial consumers, such as the chemical and power generation sectors, are undergoing ownership changes or are setting up new gas trading units which will contribute to modernisation of the generation asset base in Poland. The consolidation of the chemical industry in Poland[8] is coupled with the development of procurement competencies related to effective supplier switching, remodelling of the natural gas supply portfolio of chemical industries and reference to exchange market pricing for fuel which was previously sold at regulated prices.

The gas market in Poland is undergoing deep transformation aimed at market liberalisation and price deregulation. On July 24, 2012 a new Network Code was approved by the decision of the Polish regulator[9]. When drafting the network code, GAZ-SYSTEM harmonised the gas day and gas year and switched to settlements based on energy units in accordance with European standards. The operator revised contracting and balancing arrangements and implemented a number of services that offer system flexibility to market participants in order to cater to their business needs. Specifically, the model of virtual contractual points is currently being established (to support transactions entered into both on the gas exchange and the OTC market), a Balancing Services Market is being launched (to stabilise the operation of the transmission system through market-based offers from the balancing market participants) and bundled products are about to be offered (as of 2013 cross-border products will be offered as part of auction procedures).

A crucial part of the TNC concerns the preparation of all the arrangements that will enable physical transmission of gas from entry points to exit points in the system for transactions formed at the gas exchange, as a precondition to the launch of the gas exchange in Poland (POLPX)[10]. On December 20th, 2012 the first transaction on the newly launched gas exchange in Poland (POLPX)[11] was formed with a nomination taking effect as of January 1st, 2013. Participants in the gas market in Poland will decide how they will want to use the exchange where, so far, minor volumes made available by the dominant player are traded. The most significant aspect of the existence of the exchange is that the gas traded on this market is not subject to tariff pricing. Accordingly, the conditions for real market pricing are to be ultimately created.

With a view to compensation of deficiencies that have isolated Poland from the western gas supply, the operator is also preparing a new project that integrates all the above-described steps towards the target, flexible market model. New storage capacity is a much needed investment for the Polish market, as it would ensure more flexible operation of the modernised transmission network and further facilitate trade (more flexible planning of the daily balance of market participants) while reinforcing security of supply to our country.

The gap between the Polish market and the target European model has quite clearly been narrowing. Past efforts and comprehensive dialogue between the regulator, market institutions, the operator and competence teams within all the players interested in entering the Polish market are bringing results in the form of market regulations tailored to Polish capabilities. The implementation of European solutions such as the ITO model applied by GAZ-SYSTEM for the Yamal pipeline has been progressing as part of an effective, professional business discussion.

'We estimate that the upgrading of the technical capabilities of the domestic transmission system through the construction of new gas pipelines we are currently undertaking, as well as gas storage facilities we are planning for, will enable the development of a competitive gas market and flexible trade in gas, driven by the laws of supply and demand. Efficient management of the existing system capacity and the development of new capacity we are planning to establish for the region will unleash business synergies based on a real demand for gas. Owing to the integration of systems in the region and investments in new capacity we stand a chance to create an attractive sales market in this part of Europe.'
– said Jan Chadam, President of the Management Board of GAZ-SYSTEM S.A.

8 Source: Polish Ministry of State Treasury, Equal and partner consolidation of Polish chemical companies, 6.09.2012 (availability as of 17.01.2013).

9 Source: GAZ-SYSTEM; Transmission Network Code, 24.07.2012 (availability as of 17.01.2013).

10 These preconditions include: new agreements between the transmission system operator and distribution and storage system operators (interconnection transmission contracts), a model of virtual contractual points for Gas Exchange and OTC transactions, entry-exit tariff.

11 Source: POLPX(TGE), From Today, Poland Has a Gas Exchange, 12.12.2012 (availability as of 17.01.2013).

The perspective of the chemical industry on the Polish Gas Hub?

Wojciech Lubiewa – Wieleżyński
PIPC – Polska Izba Przemysłu Chemicznego
Polish Chamber of Chemical Industry, Warsaw
www.pipc.org.pl

Marcin Krupa
ISE – Instytut Studiów Energetycznych Sp. z o.o.
Energy Studies Institute, Warsaw
www.ise.com.pl

Andrzej Sikora
ISE – Instytut Studiów Energetycznych Sp. z o.o.
Energy Studies Institute, Warsaw
www.ise.com.pl

Is there any rationale for a gas hub in Poland? With one of the lowest consumption of natural gas in the EU per capita (448 m^3 per person in 2012), an energy sector based on coal/lignite and with the unexpected possibility (see fig.1.) for a shale revolution the future is bright. In addition, the cleanest source of carbon & hydrogen is generally used for the heating households (see fig.2.) and rarely as a fuel for CHPs while its main industrial use is as a hydrogen feedstock for fertilizers and the petrochemical industry(see fig.4.).

"The fertilizer industry is the largest single sectoral user of natural gas amongst the EU's manufacturing sectors, and as such the European nitrogen fertilizer industry applauds the EU institutions' continued drive to establish a truly world competitive EU single energy and gas market. EU manufacturing, however, requires greater urgency and speed from the EU authorities in delivering a competitive and efficient energy market across Europe. Europe is typically up amongst the world's highest energy cost regions and as a result must improve all sources of supply to the market including access to LNG and shale gas". This quotation comes from www.fertilizerseurope.com with whom the Polish Chamber of Chemical Industry used to cooperate. So let's try to understand: "D'où venons nous? Que sommes nous? Où allons nous?" (Where do we come from? What are we? and Where are we going?)

Economy

According to the International Monetary Fund Poland's economy is doing quite well in comparison to the rest of the European Union. The

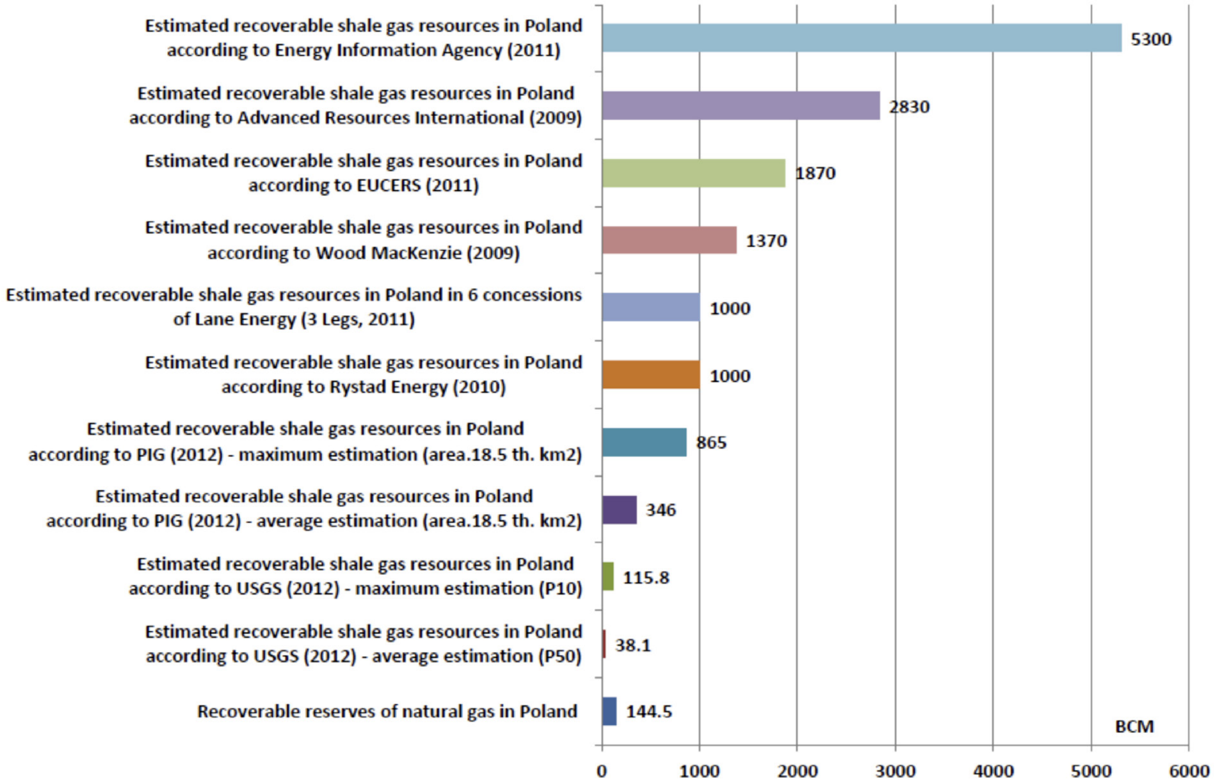


Fig. 1. Shale gas - How much do we have?
Source: Kaliski M., Krupa M., Sikora A., „Forecasts and/or scenarios, including quantification of the distance, timing and costs". (Tytuł polski: "Prognozy i / lub ich scenariusze, w tym kwantyfikacja obszaru prognozowania, czasu i kosztów".) Arch. Min. Sci., Vol. 57 (2012), No 2, p. 423–439

1 *Kaliski M., Nagy S., Siemek J., Sikora A., Szurlej A., "NATURAL GAS IN POLAND AND IN THE EUROPEAN UNION" Tytuł polski: „Gaz ziemny w Polsce I w Unii Europejskiej" Archives of Energetics. Archiwum Energetyki. TOM XLII 2012 Nr 1 PL ISSN 0066-684X. Str. 93-109. Gdańsk 2012.*

2 *http://www.indexmundi.com/map/?v=137000 Accessed on 02/02/2013.*

3 *Siemek, J., Kaliski, M., Janusz, P., Sikora, S., Szurlej, A., 2011 – Wpływ shale gas na rynek gazu ziemnego w Polsce. Rynek Energii nr 5, ss. 118–124. (Impact of shale gas on the natural gas market in Poland. Energy Market No. 5, pp. 118-124.)*

in million cubic meters	2005	2006	2007	2008	2009	2010	2011
Oil and gas upstream	24	107	102	104	125	195	215
Mining	115	42	44	50	43	68	67
Manufacturing industry for fuel purposes, including:	3971	4078	4399	4265	4256	4618	4860
Non-metallic mineral products industry	1095	1158	1141	993	1163	1209	1187
Refining industry	661	708	861	819	787	909	1134
Basic metal production industry	821	788	836	747	640	657	685
Food industry	498	517	574	558	581	596	609
Chemicals industry (fuel purposes)	198	193	255	208	258	341	410
Paper industry	49	70	115	157	147	159	144
Other branches	648	645	617	784	681	746	691
Manufacturing industry for non-fuel purposes (chemical industry)	2400	2335	2328	2340	1846	1956	2206
Construction	34	33	46	43	54	53	42
Transport (including pipelines)	349	445	435	473	422	399	354
Energy (utilities)	1512	1416	1320	1339	1344	1338	1416
Water supply	23	25	26	29	17	20	22
Agriculture	30	35	52	53	44	42	43
Commercial sector	1678	1677	1720	2057	1957	2055	2032
Households	3793	3888	3730	3695	3786	4182	3806
Natural gas industry own consumption (nitrogen removal and distribution)	189	249	201	152	115	168	55
Losses and statistical difference (storage)	261	192	172	167	171	10	-19
Total country	14380	14523	14575	14767	14181	15105	15098
Average low heating value for 1 CM in MJ	35,62	35,67	35,55	35,57	35,61	35,49	35,60

Fig.2. Natural gas consumption in Poland (source: ISE calculation based on Central Statistical Office data)

Fund predicted that in 2010 Polish GDP was to increase some 3.4% and by another 3.7% in 2011. "Poland's economy performed well throughout the crisis, due to very strong economic fundamentals and effective counter-cyclical policies. Nevertheless, Poland's strong trade and financial links to Europe continue to make it vulnerable to potential shocks from the region. Its status as a "gate-keeper" economy for Eastern Europe and its relatively deep and liquid financial markets make it susceptible to a retrenchment in global risk appetite"[…]. Poland is one of the biggest primary energy producers in the European Union (8.0% share in 2010); among other EU member states more primary energy is produced only in the United Kingdom, France , Germany and Netherlands.

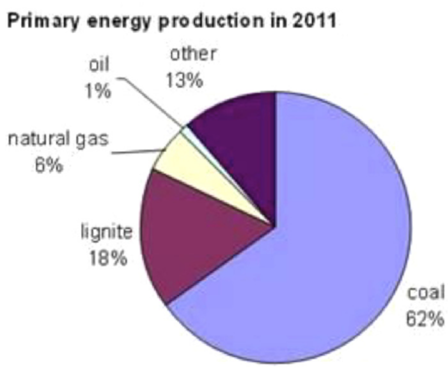


Fig.3. Primary energy production in 2011 in Poland (source: Central Statistical Office data)

Energy generation/consumption

During the last 10 years in Poland primary energy (PE) consumption was almost stable, while production systematically decreased. A relatively slow decrease in PE consumption was accelerated significantly in 2007, and in 2008 production fell below 3000 PJ, continuing to fall in 2009 In contrast,total energy consumption amounted to 4,410 PJ in 2011. The most important energy carrier is hard coal, accounting for 62% of PE in 2011. The structure of primary energy production and consumption is presented in figure 3.

According to the report "Polish Energy Policy until 2030 [PEP]" the Polish energy sector will be still dominated by coal and the role of natural gas in generation of electric energy is to be marginal (below 7% share in 2030, currently 3.5%) even in the future. This is mostly derived from the angle of energy security – large domestic resources of coal make it much "safer" fuel than imported natural gas. However, the discovery of large natural gas (shale) deposits should change this point of view dramatically – gas would be as safe as coal, but much more environmentally friendly. Large volume of domestic natural gas production is one of the necessary (but not sufficient) preconditions to start large scale base-load power generation.

4 World Economic Outlook Database-October 2012; International Monetary Fund. Accessed on 02/02/2013
http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx,
http://www.imf.org/external/pubs/ft/scr/2013/cr1321.pdf

5 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Energy_production_and_imports Accessed on 02/02/2013

6 http://www.mg.gov.pl/files/upload/8134/Polityka%20energetyczna%20ost_en.pdf Accessed on 02/02/2013

Pillar of the Polish Energy Policy

There are two pillars of the Polish Energy Policy. The first pillar is the dominant role of coal (lignite and hard coal), while the second one is an obligation arising from EU climate policy. On this basis the authors of the PEP have calculated the total amount of renewable generation required In addition, the possibility of biomass and biofuel production was evaluated and the remaining value was allocated to wind energy and nuclear energy Finally, the remaining energy production was allocated to natural gas, explaining why natural gas makes up only 14.5% of total primary energy, and 6.6% in electricity production in 2030. However, the authors did not mention the new possability of domestic shalr gas production.

The switch from coal to natural gas can be done in a relatively easy and "natural" way, taking into consideration the future scale of necessary investments in the energy generation sector. Poland plans to close down approx. 14.5 GW (out of 35 GW) of existing generating capacity in base load power plants by 2030. Surprisingly, natural gas is to replace only 600 MW. However, taking into consideration probable influence of a shale gas revolution and especially CO_2 emission costs gas fired energy generation should be cheaper than coal fired. Therefore we would expect significant growth of natural gas based generation, and our perception is supported by the Polish market: there are about around10 gas-fired power plants currently discussed., and no one plans to build new hard coal- or lignite-fired power plants in Poland.

Natural gas market

Total gas consumption in Poland in 2012 amounted to about 14.9 bcm. Approx. 2/3 of natural gas is imported, and 1/3 is produced domestically. The most important portion of imported gas is of Russian origin; in 2010 Poland has signed an agreement with Gazprom, which allows for an import of approx. 10 bcm per year between 2012 and 2022.
As in most of the other natural gas market areas final customers are supplied mostly by POGC Group companies (six regional division but starting from 2013 one distributor DSO) with a market share of approx. 97%, while the remaining 3% comes from small independent companies.

Infrastructure

According to the Energy Law there is only one transmission system operator in Poland which is GAZ-SYSTEM S.A and also an owner of the Polish natural gas transmission grid. There is also a one transit pipeline – Yamal, owned by EuroPolGaz, however Gaz-System is its operator since 2011. Approximately 97% of the total length of the distribution system belongs to POGC; while the remaining 3% is in hands of above-mentioned independent companies or other local distributors. The transmission system in Poland is primarily aimed at transport of gas from the eastern border (mostly south-east) to the western and northern parts of the country. Currently, Poland has few connection points with neighboring countries including entry points, allowing import of natural gas from: Belarus and Ukraine (four entry points with total capacity of 1.3 mcm/h); Germany (180 tcm/h; and the Czech Republic (with initial annual capacity of 0.5 bcm). Additional import capacity is provided via the Yamal pipeline, with two entry points in Poland (total capacity of 620 tcm/h). Almost all of the import capacity is booked by POGC and there is still lack of mechanisms allowing for the release of unused capacity, this being one of the major obstacles preventing other entrepreneurs from importing natural gas. At the moment Gaz System is carrying out a large investment program aiming at reducing system bottlenecks and operating costs, ensuring: security of gas transmission, connection of new entities and increase of transmission capacities. The most important investments are implemented due to a construction of the LNG regasification terminal in Świnoujście.

Tariffs

All prices in the natural gas market in Poland (both fuel itself and logistic services) are regulated in the form of tariffs accepted by the Regulator. In spite of the announcement of the first trade on the Natural Gas Exchange in Poland on Dec., 20th. 2012 , a natural gas wholesale market still does not exist. In consequence there is no market liquidity and commercial transactions are carried out only within the framework of long term or open-ended bilateral contracts. The President of the Energy Regulatory Office (the Regulator) is a central body of state administration dealing with the energy market (including natural gas) as well as promoting competition. Tariffs are usually approved on the yearly basis. According to EU regulations Poland had an obligation to introduce the entry-exit tariff system in 2011 . However it is not expected that the new system will significantly change the current structure of payments for transmission services. In case of gas distribution and supplies tariffs define: customers groups and group selection criteria; tariff rate and subscription fee, principles of the monthly payment calculation.

Future - forecasts

There are two basic forecasts covering majority of issues regarding the Polish energy sector, including natural gas. These are: the Energy Market Agency, (EMA) prognosis and EU one (PRIMES). While the bases for both prognoses are slightly different, results also differ, in some cases – substantially. EMA forecasts (base of the Polish Energy Policy) expect huge growth of renewable energy generation to reach 12.5% of total demand in 2030, as a result of EU climate package implementation. With regards to natural gas demand both prognoses expect an increase of consumption level, from today's 14 bcm to 16-19 bcm in 2030.
But – and this is the most important factor discussing future consumption of natural gas – all existing forecasts are based on today's consumption structure and today's trends (coal as the dominant fuel). Therefore, we have to ask the key question - what volumes of natural gas can be absorbed by the Polish economy in case that gas is available domestically and its price is attractive in comparison to other energy carriers? Considering the potential of shale hydrocarbons in Poland , one raises other questions, i.e. what to do with shale gas findings in the short- and long-term?

7 POGC – Polish Oil and Gas Company – (pol. Polskie Górnictwo Naftowe i Gazownictwo S.A.) – www.pgnig.pl

8 http://en.gaz-system.pl// see also article : March 2013 edition ENERGY DELTA INSTITUTE

9 http://www.bloomberg.com/news/2012-12-20/poland-exchange-traded-natural-gas-begins-at-4-9-premium-to-ttf.html

10 URE www.ure.gov.pl

11 Kaliski M., Krupa M., Sikora A., "Entry-Exit tariff system in Poland versus analysis of the situation with the Yamal pipeline". MONOGRAFIA "Dilemmas of the contemporary economy facing global changes" Edited by Jarosław Kaczmarek, Tomasz Rojek str. 747 i dalsze ISBN 978-83-62511-51-8 Cracow University of Economics 2012.

12 Albrycht I., Boyfield K., Jankowski J.M., Kaliski M., Kołaczkowski M., Krupa M., Ndhlovu Z., Lewis G., Perry K.F., Poprawa P., Rewald P., Riley A., Ruszel M., Rychlicki S., Siemek J., Sikora A., Smith T., Szlagowski P., Tarnawski M., Zawisza A., Editor: Izabela Albrycht. „Unconventional Gas – a Chance for Poland and Europe? Analysis and Recommendations." Edition completed: June 2011 The Kosciuszko Institute 2011. ISBN: 978-83-931093-5-7

13 See chapter on tariffs.

Wholesale market regulations

Poland is significantly different from the others EU countries than other EU countries: most EU members adopted a solution preserving regulated prices for small customers (households and small companies) and abolishing regulations for medium and large customers, while some have completely abolished regulation and approval of natural gas prices by regulators.

In contrast, Poland decided to regulate prices in the wholesale gas trade as well and as a result there is no market liquidity and commercial transactions are not carried out on natural gas exchanges or in trade hubs but only within the framework of long term or open-ended bilateral contracts. Considering the this, the breakdown into wholesale and retail segments of natural gas sales is rather irrelevant at the moment.

We expect that there is one necessary (but maybe not sufficient) precondition to the origination of the wholesale market in Poland the emergence of new natural gas suppliers, delivering gas with non-Russian origin. Such an event would significantly change the balance of the market (without that Poland was paying to Gazprom 526 USD per 1000 m3 in 2012 of natural gas in comparison to 379 USD paid by Germany). Particularly with the appearance of indigenous gas (having in mind that production costs of domestic gas could be 2-3 times lower than the price of imported Russian gas) we would expect the Regulator to change their policy towards the future shape of the market, which may allow for the creation of a real wholesale natural gas market in Poland.

Finally, it is worth mentioning that according to current tariff regulations companies dealing with natural gas trade are obliged to calculate the gas sales price for customers in Poland as a weighted average of purchase prices (which in the case of Poland means POGC's import prices) and the costs of producing natural gas from their own sources. Provided that POGC's natural gas production costs from domestic sources are 2-3 times lower than gas prices in import contracts, the tariff calculation methodology causes domestic gas prices to be determined at a level below the attainable prices of imported natural gas. This would make other potential market new-comers incapable of competing[14]. The only solution is either development of domestic independent gas outside of the POGC Group or deliveries to Poland of non-Russian or non-GAZPROM origin natural gas with a price lower than the current import price.

Fig.4. Map of ammonia and urea plants in Poland. (source: ISE own work)

Ammonia and urea plants including existing and proposed feedstock types.

Fertilizers and intermediates for fertilizers are produced in ten plants in Poland and a number of smaller plants exist for special types of fertilizer.[15] In addition, five large ammonia plants exist in Poland (Fig. 4).

Ammonia production in all Polish plants is based on natural gas steam reforming technology (ZCh. Police, Anwil, Azoty Tarnów) and natural gas partial oxidation technology (ZA Puławy, ZA Kędzierzyn)

Plant	Ammonia production capacity in th. tons/year	GJ per ton of NH_3 (LHV)	Natural gas per ton of NH_3 (m^3/ton)	Theoretical gas consumption for NH_3 in million m^3	Ammonia production in 2010 in th. tons	Ammonia production in 2009 in th. tons	Ammonia production in 2008 in th. tons	Natural gas consumption *2011 in million m^3	Natural gas consumption *2010 in million m^3	Natural gas consumption* 2009 in million m^3	Natural gas consumption* 2008 in million m^3
Zakłady Azotowe Puławy	1130	29,5	820	927	811	835	680	1000	1000	800	800
Zakłady Chemiczne Police	560	32,0	890	498	293	247	470	400	300	300	500
Anwil	520	31,5	875	455	373	407	502	500	400	400	600
Zakłady Azotowe Kędzierzyn	384	32,0	890	342	391	333	367	300	300	300	400
Azoty Tarnów	240	32,0	890	214	191	179	191	200	200	100	100
TOTAL	**2834**	**31,4**	**873**	**2435**	**2059**	**2001**	**2210**	**2400**	**2200**	**1900**	**2400**

Table.1. Ammonia plants in Poland: ammonia production capacity, production volume and gas consumption in 2008-2010. (source: Company data, ISE estimations)

14 This is one of the reasons why Poland remains a closed market, practically disconnected from the markets of other EU countries.
15 http://grupaazoty.com/en/

Currently[16] domestic capacity of existing ammonia plants is equal to 2.83 million tons of NH_3 per year Capacity utilization was at the level of 91% in 2007, then dropped to 73% in 2009 and 77% in 2010. We expect that capacity utilization will remain at the same level in next years, which means 1.83-1.95 billion m^3 of natural gas demand for ammonia production only and 2.1 - 2.2 billion m^3 of total natural gas consumption in the five plants mentioned in Table 1.

After the construction of an air separation unit and intensification of ammonia and urea production in ZA Puławy (at total cost of nearly half a billion PLN) we do not expect any major investments in capacity expansion for ammonia production in Polish plants.

Proposed and planned petrochemical and chemical (other than fertilizers) facilities (location, facility type, capacity, alternative fuels/ feed-stock, efficiency).

Chemical and petrochemical sector

In 2011 employment in the Polish chemical industry was 245.000, 10.000 more than in 2010, while total revenues increased from PLN 102.6 billion to PLN 116.9 billion. This revenue growth has been observed in pharmaceutical products, rubber and plastic products and all chemicals and chemical products except the production of soaps and detergents.

In 2011 gross turnover profitability rate in the production of chemicals and chemical products increased to 7.8% (from 6.3%). The production of pharmaceutical substances and medications decreased to 7.8% (from 9.5%). Profitability decrease has been observed in the production of rubber and plastic products, from 5.1% to 4.6%.

The chemical industry provides raw materials for manufacturing modern products and the use of chemicals is growing. As a result, we are observing growth in demand for plastic, rubber, paints and varnishes, and in consequence, for basic petrochemical raw materials (i.e. petroleum refining products). Unfortunately, domestic production does not satisfy current demand for these chemicals, leading to to an increase in the (already high) foreign trade deficit. In 2011 the negative balance[17] amounted to EUR 8.3 billion (compared to EUR 7.4 billion in the previous year) and exports in chemical industry increased to EUR 18.8 billion (from EUR 15.5 billion) and imports increased to EUR 27.1 billion (from EUR 22.8 billion).

A potential natural gas consumption growth.

Now let us try to assess potential natural gas consumption growth in the area of fertilizers production – the largest non-energy application of gas. Being a source of hydrogen natural gas may account for 80-90% of total cost of fertilizers ammonia production, depending on technology applied.

		2006	2007	2008	2009	2010	2011	3Q 2012
Ammonia production	thous. t	2 434	2 417	2 417	1 958	2059	2172	1922
Installed capacities	thous. t	2 920	2 920	2 920	2 920	3100	3100	3100
Effective capacities*	thous. t	2 680	2 680	2 680	2 680	2843	2843	2843
Utilization rate	%	83%	83%	83%	67%	66%	70%	62%
Effective utilization rate	%	91%	90%	90%	73%	72%	76%	68%
Nitrogen fertilizer production in nitrogen equivalent	thous. t	1 707	1 818	1 692	1 503	1692	1785	1580
Export of nitrogen fertilizers	thous. t in N of product	536	632	547	245	410	323	287
Share of export in total production	%	31%	35%	32%	B.D.	B.D.	B.D.	B.D.
Natural gas consumption to ammonia and nitrogen fertilizers production***	mcm [bcf]	2166	2151	2151	1743	1833	1933	1711

Table.3 Ammonia and nitrogen fertilizer production in Poland in 2006-20. (source: Own calculations based on Production of main industrial products I-XII 2009 published by Central Statistical Office, Annual Report for 2009 of Polish Chamber of Chemical Industry, Polish Customs data for 2007-2008, and Best Available Techniques (BAT) Guidelines for the Chemical Industry in Poland: Large Volume Inorganic Chemicals - Ammonia, Acids and Fertilisers Industries prepared on the order from Ministry of Environment, September 2005.

* *Effective capacities were calculated assuming a 30-day plant shutdown per year.*

** *Foreign trade turnover by commodities 2011 – Central Statistical Office*

*** *Own calculation assuming average gas consumption of 31 Gj per one ton of NH3 (average value derived from capacities based on conventional steam reforming and partial oxidation.*

16 *After Zakłady Azotowe Puławy expansion in April 2010 from 960 th. tons to 1130 th. tons per year*

17 *Data for 2009 are initial estimations by the Ministry of Economy.*

The crisis in the fertilizer market was clearly visible in 2009, where a strong decline of 21% was observed in ammonia production. This has resulted in significantly lower demand for natural gas from fertilizer manufacturers from the level of 2.2 bcm to merely 1.8 bcm per year. Maximum potential demand for gas of all ammonia plants amounts to 2.66 bcm per year, however due to maintenance reasons and temporary shutdowns, a 100% effective utilization rate matches gas consumption of 2.45 bcm per year.

Mineral fertilizer (NPK[18]) consumption in Poland per hectare of cultivated area amounts to 132.6 kg, compared to 140 kg in Germany, 200kg in Netherlands, 115kg in the Czech Republic, 120 kg in France, 125 kg in Lithuania and only 30 kg in Romania[19]. Nitrogen fertilizers account for 53.3% share of all mineral fertilizers. Therefore, the growth potential on the domestic market is not impressive. Additionally installed supply capacities are bigger than domestic demand, which result in substantial export amounting to 30% of total production volume. Unfortunately, recently mispriced natural gas on the Polish market, in relation to spot prices in Europe, resulted in a significant decline of competitiveness of fertilizer manufacturers in Poland which was clearly visible in capacity utilization rates for 2009. In case that decline in production appears permanent (no release of the gas market), demand for gas from the chemical industry could be lower by 0.400 bcm per year. Indeed,it is rather unlikely that demand for gas from the chemical industry will soar, an optimistic scenario assumes comeback to 2006-2008 level of consumption. Therefore we see a potential annual consumption growth of approx. 0.4-0.50 bcm over this time horizon.

The remaining groups of customers consist mainly of small entities (considering volume of gas consumption), often dispersed, so efficient gas delivery to these customers will require active participation of gas distribution companies.[20] The author would like to draw readers attention to the fact that there are (articles available (in Polish)focusing on mentioned topic. [21]

Impact of LNG receiving terminal (infrastructure and pricing).

The first LNG terminal in Poland is under construction in Świnoujście, and to be more precise in Warszowa – which is the right bank area of Świnoujście, and about 40 km from the Nordstream entry point to GermanyIn the first step of operation, the LNG terminal will allow for the off-take amounting to 5 bcm of natural gas annually. In the next step, provided sufficient demand for gas exists, there is a possibility to increase the dispatch capacity to 7.5 bcm.

In 2007 POGC established a company called Polskie LNG (Polish LNG) to build the LNG terminal. Then, by the Resolution of the Council of Ministers of August 19th 2008, gas transmission system operator Gaz-System became the owner of Polskie LNG. The technical project of the terminal was accomplished in 2009. The consortium of Saipem S.p.A. (Italy) – Saipem SA (France) – Techint Compagnia Tecnica Internazionale S.p.A. (Italy) – Snamprogetti Canada Inc. (Canada) – PBG SA (Poland) – PBG Export Sp. z o.o. (Poland) was chosen as the General Contractor for the investment in a public tender. Construction started in September 2010 and according to the schedule the terminal will be ready for operation by 30th of June 2014.[22]

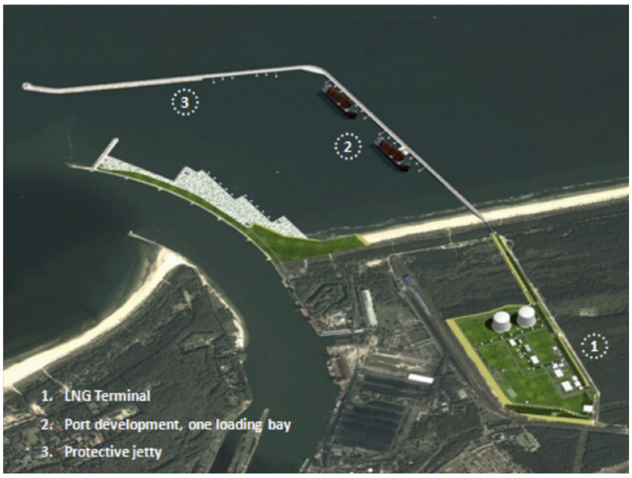


Fig.7. LNG Terminal in Świnoujście. (source: www.Gaz-System.pl)

According to government strategy Gaz-System is supervising the construction of the LNG terminal, whereas POGC is responsible for the supply and transport of the liquefied natural gas to the terminal in Świnoujście. In June 2009 Gaz-System started an "open season" procedure for the LNG terminal. On the basis of binding order made by POGC, an agreement between Polskie LNG and POGC was signed in March 2010 concerning regasification and auxiliary services. As a result the terminal regasification capacity of 3.2 bcm per year) was granted to POGC out of total capacity amounting to 5 bcm per year. This means that still approximately 200 thousand cm per hour (1.8 bcm per year) remains available.

In June 2009 POGC signed a contract with Qatargas Operating Company Ltd concerning LNG sales and delivery from Qatar to Poland. The agreement concerns the delivery of 1 million ton LNG per year (approx. 1.5 bcm) through 20 years starting from 2014). The beginning of deliveries is bound with planned start-up of LNG terminal. Deliveries are to be realized by Qatargas on an ex-ship basis, utilizing 217 thousand cu. m capacity Q-Flex type ships. According to the reliable sources of information a price formula is set in a way that makes the Qatargas contract the most expensive natural gas in Poland, with price approx. 30% higher (before regasification) than "Gazprom" gas.

18 NPK – nitrogen, phosphorus and potassium (potash).

19 Zalewski A., Supply-demand balances on the world and domestic mineral fertilizers market in 2008, Scientific Yearbook of Agrobusiness Association, Volume XI, part 3.

20 It is important to notice a substantial role of oil products and LPG in Poland in the consumption structure. These energy carriers are easiest to substitute with natural gas, and their annual energy demand amounts to more than 1 bcm of high methane gas equivalent. As a result an effective potential of substitution within this group is only slightly smaller than in processing industry and may equal to 1.2 bcm of high methane gas per year (which means the rate of substitution of 30%).

21 Sikora A., Lubiewa – Wieleżyński W., 2009: „Surowce dla przemysłu chemicznego ich zapotrzebowanie i logistyka." Przemysł Chemiczny czerwiec 2009 r. Krupa M., Majchrzak J., Sikora A., 2009: „Paliwo alternatywne - gaz propan-butan. Cz. 1 Przemysłowe zastosowanie propanu – butanu. LPG JAKO SUROWIEC CHEMICZNY" Chemia Przemysłowa 5/2009
Krupa M., Majchrzak J., Sikora A., 2009: „Paliwo alternatywne - gaz propan-butan. Cz. 2 Przemysłowe zastosowanie propanu – butanu. LPG JAKO SUROWIEC CHEMICZNY" Chemia Przemysłowa 6/2009

22 "Despite the reported construction delay due to the financial problems at Italy's Saipem and Poland's PBG, Poland expects the planned LNG terminal at Swinoujscie to be finished on time, according to Reuters. http://www.lngworldnews.com/polish-lng-terminal-on-schedule-despite-reported-delays/ accessed on 02/02/2013.

The price formula is set as follows[23]:
P(LNG) in USD/mBTU = (P(Brent) in USD/bbl) x 0,16 + 1,00

That is, if a Brent crude price reaches 75 USD/bbl then LNG price will amount to: 75 USD x 0.16+1= 13 USD/mBTU. In the same circumstances (i.e. the same crude price) "Gazprom" natural gas is to be priced at 10 USD/mBTU.
Taking into consideration regasification capacity and existing import contracts (Gazprom will be still dominating natural gas import) it is necessary to underline that the Świnoujście terminal will not significantly change the situation of Poland in terms of a long term contracts and diversification of gas supplies based on spot deliveries. The terminal will rather be a "peak shaving terminal", and allow for potential gas supplies in time of any "gas crisis". On a daily basis the terminal may be also utilized for supply of large gas customers in a northern Poland.
Gaz-System investment plans are tightly connected with market demands and strategic investments will be implemented in a North-Western Poland, among others: Szczecin – Gdańsk, Włocławek – Gdynia and Szczecin – Lwówek pipelines, as well as compressors station in Goleniów.
Gaz-System also intends to develop a natural gas transmission network to connect a number of new gas consumers. However, investments in a northern Poland are forced by terminal construction, as well as potential construction of interconnectors with Germany and Denmark (Baltic Pipe).
At the moment construction of the Świnoujście terminal is directly supported by following investments:

Szczecin – Gdańsk pipeline (length - 265 km, to be finalized in 2013): will allow for a direct supply of Gdańsk area from the LNG terminal, as well as second option of gas deliveries to Gdańsk, Grudziądz and Bydgoszcz.

Szczecin-Lwówek pipeline (length – 186 km, to be finalized in 2014) supported by compression station in Goleniów: will allow for supply of western and central Poland from the LNG terminal and potential Baltic Pipe.

Fig.8 Gas transmission –investments until 2015.
Source: map - Gaz System; markups – Gazoprojekt.

Conclusions
The internal profile of consumption in Poland indicate that nobody can expect a real gas hub in Poland in near future. Successful shale gas project in Poland can change such radical point of view but:

- *In a very optimistic scenario,* the growth potential of natural gas consumption in Poland may be more than 15 billion m^3 a year. Compared with the level of current consumption, we obtain a giant increase in demand, over 100%, but in the view of production growth from 40-80 billion m^3 per year, this is not a volume that would give the adequate level of comfort for potential energy investors.
- However, we should keep in mind that 100% gasification of the whole economy would be able to manage all or most of these volumes, and such a scenario is quite improbable.
- In the intermediate variant, the increase in demand for gas may be less than 5 billion m^3 per year, which means that domestic market potential would constitute a significant barrier to the development of gas production from unconventional sources.
- The largest increase in demand for natural gas may come from the energy sector based today on solid fuels.
- On the basis of our knowledge regarding results of the first two boreholes (unofficial, no statements have been released) shale gas in Poland is a reality. However, its is uncertain.
- We expect the first economic assessments of the shale gas production in Poland to be determined and revealed in 2013 the earliest.
- Large scale production of shale gas in Poland would not take place before 2015-2016 and only in case that significant reserves are discovered, and all abovementioned necessary preconditions fulfilled.
- Production volumes and the economy of shale gas production – when determined – will allow assessment of the impact of domestic gas production on the Polish energy sector. Only then one will be able to foresee its influence on the future coal vs. gas energy generation.
- We do not expect any changes in Polish Energy Policy at least until 2015. After this time point shale gas may have an impact on the future energy mix. Its scale will be determined by the amount of domestic reserves and productivity of shale gas fields.
- However according to our estimations we believe that 7-10% of energy in Poland will be produced in gas-fired generators by 2020, and 15-20% by 2025.

Shale gas in the USA has dramatically changed the perception of "peak oil" and the role of hydrocarbons from unconventional resources. Technology changed the view that "conventional means cheaper". Such changes, considering predicted American self-sufficiency and "petrochemical and chemical business leakage" toward cheaper sources of hydrogen, set off warning bells for the EU, and Germany especially. "Actions at regional, national, EU and global levels are urgently required to correct any uncompetitive situation especially when it arises from unfair state fixing of energy pricing by suppliers inside or outside the EU. For natural gas in particular, and for other energy commodities, it is necessary to develop financial and physical commodity hubs that promote and encourage transparent interconnected prices. For gas, a European super-hub could supply enormous benefits to consumers[24]."

Let the power and simplicity of natural gas raise the economy, open minds, form the base for a sustainable energy future.

23 According to an article „Qatargas Signs HoA To Supply Polish Terminal"; www.poten.com LNG in World Market. Apr. '09 accessed on 29/04/2009 (now for subscribers only).
24 A quotation comes from the www.fertilizerseurope.com

Conferences 2013

March

March 14 - 15, 2013:
ener.CON Europe 2013
Location: Berlin, Germany
http://enercon2013.we-conect.com/en

March 18 - 19, 2013:
Energy Storage
Location: Dusseldorf, Germany
http://www.energy-storage-online.com

March 18 - 19, 2013:
2nd Annual Advanced Hydropower Generation Forum
Location: London, UK
http://www.bis-grp.com/business-events/energy/2nd-annual-advanced-hydropower

March 18 – 21, 2013:
Solar Power Finance & Investment Summit
Location: San Diego, USA
http://infocastinc.com/events/solar13

March 20 - 21, 2013:
Power-to-Gas
Location: Arnhem, the Netherlands
http://www.iir.nl/energy/event/power-to-gas

March 28 – 29, 2013:
CISWIND – 2013
Location: Kiev, Ukraine
http://rencentre.com/en/ciswind

April

April 3 – 4, 2013:
LNG India
Location: New Delhi, India
http://www.lng-india.com/Home.aspx

April 8 – 10, 2013:
Global Trade Compliance & Export Controls for the Oil & Gas Industry
Location: London, UK
http://www.marcusevans-conferences-paneuropean.com/marcusevans-conferences-event-details.asp?EventID=19823

April 9 – 10, 2013:
Lebanon Oil, Gas & Energy Conference (LOGEC) 2013
Location: Beirut, Lebanon
http://www.lboilgas.com

April 9 – 11, 2013:
3rd Colombia Oil & Gas Summit and Exhibition
Location: Cartagena, Colombia
http://www.cwccolombia.com

April 9 – 11, 2013:
SAP Conference for Oil and Gas
Location: Amsterdam, the Netherlands
http://uk.tacook.com/sapoilandgas

April 10 – 11, 2013:
Arctic Oil & Gas North America
Location: St. John's, Canada
http://www.ibcenergy.com/event/arcticnorthamerica

April 10 – 11, 2013:
Biomass to Power
Location: Krakow, Poland
http://www.wplgroup.com/aci/conferences/eu-ebp3.asp

April 11 – 12, 2013:
CISOLAR – 2013
Location: Moscow, Russia
http://rencentre.com/en/cisolar

April 15 – 17, 2013:
Russian Arctic Oil & Gas 2013
Location: Moscow, Russia
http://www.adamsmithconferences.com/event/arctic-oil-gas-russia

April 16 – 18, 2013:
International Conference on Fundamentals & Development of Fuel Cells
Location: Karlsruhe, Germany
http://fdfc2013.eifer.uni-karlsruhe.de

April 16 – 18, 2013:
3rd Annual Arctic New Frontier Exploration Forum
Location: London, UK
http://www.marcusevans-conferences-paneuropean.com/marcusevans-conferences-event-details.asp?EventID=19310

April 16 – 19, 2013:
17th International Conference and Exhibition on Liquefied Natural Gas (LNG 17)
Location: Houston, USA
http://www.lng17.org

April 16 – 20, 2013:
Solar 2013
Location: Baltimore, USA
http://www.ases.org/solar2013

April 16 – 17, 2013:
EU Energy Conference on Shale Gas
Location: Brussels, Belgium
http://www.claeys-casteels.com/shalegas

April 17 – 18, 2013:
Argus European Biomass Trading 2013
Location: London, UK
http://www.argusmedia.com/events/argus-events/europe/argus-euro-biomass/home

April 22 – 23, 2013:
European Power Generation
Location: Düsseldorf, Germany
https://www.platts.com/ConferenceDetail/2013/pc391/index

April 22 – 23, 2013:
2nd Edition Eastern Mediterranean New Frontiers Forum
Location: London, UK
http://www.marcusevans-conferences-paneuropean.com/marcusevans-conferences-event-details.asp?EventID=19834

April 22 – 23, 2013:
World Smart Grid Conference
Location: Abu Dhabi, UAE
http://www.szwgroup.com/SGME2013

April 22 – 24, 2013:
19th Western Africa Oil, Gas & Energy
Location: Windhoek, Namibia
http://www.petro21.com/events/?id=794

April 23 – 25, 2013:
Energy Storage World Forum
Location: Berlin, Germany
http://www.energystorageforum.com

April 23 – 26, 2013:
CBM and Shale Exploration & Production Technologies
Location: Johannesburg, South Africa
http://neo-edge.com/event-line-up/energy-utilities/cbm-and-shale-exploration-and-production-technologies

April 24, 2013:
Better Building Conference
Location: Dublin, Ireland
http://www.betterbuilding.ie

April 24 – 25, 2013:
Financing Renewable Energy Conference
Location: San Francisco, USA
http://www.novoco.com/events/conferences/retc/2013/san_francisco/index.php

April 24 – 25, 2013:
European Algae Biomass 2013
Location: Vienna, Austria
http://www.wplgroup.com/aci/conferences/eu-eal3.asp

April 29 – 30, 2013:
Clean Power Asia 2013
Location: Bangkok, Thailand
http://www.cleanpower-asia.com

June

June 19-21:
Energy and Sustainability 2013
Bucharest, Romania
http://www.wessex.ac.uk/13-conferences/energy-and-sustainability-2013.html

Recent Publications

Malcolm Keay, February 2013. Renewable Energy Targets: The Importance of System and Resource Costs. The Oxford Institute for Energy Studies.

The government has an ambitious renewables programme whose costs have been much discussed. Unfortunately, due to the polarised nature of the debate, it has not produced clarity and some basic points remain obscure – are renewables cheap or expensive? Are renewables costs rising or falling? This Comment, by Malcolm Keay, looks at two important aspects of the issue – resource and system costs – which have often been neglected but which throw light on the debate and help explain some of the uncertainties about the likely cost of meeting the government's targets.

This paper is available at:
http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/02/Renewable-energy-targets-the-importance-of-system-and-resource-costs.pdf

Jonathan Stern, Howard Rogers. February 2013. The Transition to Hub-Based Pricing in Continental Europe – A Response to Sergei Komlev of Gazprom Export. The Oxford Institute for Energy Studies.

This energy comment is a response to a paper by Sergei Komlev, from the Contract Structuring and Pricing Directorate of Gazprom Export, which challenged the conclusions of previous OIES research on European gas pricing and suggested that OIES had "refused to engage constructively with those who offer opposing viewpoints." In this comment, Jonathan Stern and Howard Rogers set out the differences between their research and that of Sergei Komlev and respond to his criticisms.

They conclude that contractual linkage of European natural gas prices to oil no longer has any market reality, and is only held in place by existing long-term contracts. By contrast they suggest that Komlev is refusing to recognize that the era of oil-linked gas pricing is drawing to a close in Europe (and is subject to increasingly serious challenge in Asia) and also refuses to accept that such changes represent a secular trend which will not be reversed. This is far from an academic argument: the extent to which Gazprom is willing to change its views on pricing will have a significant impact on Russian gas supplies to Europe, and hence on the future of the entire European gas market.

This paper is available at:
http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/02/Hub-based-Pricing-in-Europe-A-Response-to-Sergei-Komlev-of-Gazprom-Export.pdf

Simon Pirani, January 2013. Consumers as Players in the Russian Gas Sector. The Oxford Institute for Energy Studies.

This energy comment by Simon Pirani is published in conjunction with an paper by James Henderson. The comment and paper evaluate the development of competition in the Russian gas production sector and the impact of the recession and pricing policies on demand for Russian gas in its main markets.
While Gazprom has generally been focused on developing giant, but remote, fields such as Bovanenkovskoye on the Yamal peninsula and Shtokman (postponed during 2012), it has seen the market for these relatively high cost base supplies at best static in Europe and shrinking within Russia as others gain market share. The rising tide of Russian domestic gas prices has 'lifted all boats'. Certainly Gazprom has benefitted, but this has provided strong incentives for its domestic upstream competitors who have demonstrated robust production growth over the past few years. James develops this thesis with a wealth of analysis and insight based on his long experience of the sector.
This comment provides an update of the analysis in his paper 'Elusive Potential: Gas Consumption in the CIS and the Quest for Efficiency', OIES 2011. The three main markets for Russian gas; namely the domestic market, CIS and European markets have seen consumption levels significantly impacted by a range of factors in the last four years. These include the impact of the financial crisis and subsequent recession, the growth of renewables (and coal) in Europe, the increasing competition between suppliers of gas as well as the consequences of abrupt changes in gas price levels in specific market geographies.

This paper is available at:
http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/01/Consumers-as-players-in-the-Russian-gas-sector.pdf

James Henderson. January 2013. Competition for Customers in the Evolving Russian Gas Market. The Oxford Institute for Energy Studies.

This paper by James Henderson is published in conjunction with an Energy Comment by Simon Pirani (January 2013). The paper and comment evaluate the development of competition in the Russian gas production sector and the impact of the recession and pricing policies on demand for Russian gas in its main markets.

This paper is available at:
http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/01/NG_73.pdf

Chris N Le Fevre. January 2013. Gas Storage in Great Britain. The Oxford Institute for Energy Studies.

During the last decade any discussion of Great Britain's natural gas security of supply has touched on the issue of the adequacy, or otherwise, of underground storage capacity. Simplistic comparisons with neighbouring continental European national gas markets are questionable due to the differing pace of market liberalisation, changing demand and supply patterns and the availability of other forms of flexibility. The 'right' level of storage has been an elusive quantity, still less the appropriate means by which it can be brought into existence. Chris Le Fevre's paper provides a thorough and comprehensive review of gas storage in Great Britain covering the practicalities of storage, the evolution of the UK storage sector and the attendant debate on security of supply. The paper examines the role of storage and other sources of flexibility in recent winter periods and the factors which will determine future flexibility needs. The suite of potential storage projects is described together with a realistic assessment of the barriers and challenges to their successful implementation. In addressing these issues Chris considers the UK's situation in the context of increasing infrastructure linkages to the European continent and to the world LNG market.

This paper is available at:
http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/01/NG-72.pdf

International Energy Agency. 2013. Developing a Natural Gas Trading Hub in Asia.

The trading of natural gas in the Asia-Pacific region is dominated by long-term contracts in which the price of gas is indexed to that of oil. As the price of gas between Asia and other parts of the world has widened in recent years, observers have raised serious doubts about the sustainability of this pricing model. In this report, the IEA shows what it would take to create a functional, regional natural-gas trading hub in which prices reflect the local supply and demand fundamentals.
The report aims to provide stakeholders with insights on the changes that are required in the Asia-Pacific natural gas sector - both downstream and upstream - to allow a competitive natural gas price to emerge. Building on OECD Europe and OECD America experiences, this report sets out to assess perspectives for these changes in the Asia-Pacific natural gas markets. It identifies obstacles and opportunities for a competitive natural gas price in the Asian economies to emerge.

This publication is available at:
http://www.iea.org/publications/freepublications/publication/AsianGasHub_FINAL_WEB.pdf

International Energy Agency, 2012. Electricity in a Climate-Constrained World.

After experiencing a historic drop in 2009, electricity generation reached a record high in 2010, confirming the close linkage between economic growth and electricity usage. Unfortunately, CO_2 emissions from electricity have also resumed their growth: Electricity remains the single-largest source of CO_2 emissions from energy, with 11.7 billion tonnes of CO_2 released in 2010. The imperative to "decarbonise" electricity and improve end-use efficiency remains essential to the global fight against climate change.

The IEA's Electricity in a Climate-Constrained World provides an authoritative resource on progress to date in this area, including statistics related to CO_2 and the electricity sector across ten regions of the world (supply, end-use and capacity additions). It also presents topical analyses on the challenge of rapidly curbing CO_2 emissions from electricity. Looking at policy instruments, it focuses on emissions trading in China, using energy efficiency to manage electricity supply crises and combining policy instruments for effective CO_2 reductions.
On regulatory issues, it asks whether deregulation can deliver decarbonisation and assesses the role of state-owned enterprises in emerging economies. And from technology perspectives, it explores the rise of new end-uses, the role of electricity storage, biomass use in Brazil, and the potential of carbon capture and storage for 'negative emissions' electricity supply.

This publication is available at:
http://www.iea.org/w/bookshop/add.aspx?id=445

World Energy Council. December 2012. World Energy Trilemma 2012: Time to Get Real – The Case for Sustainable Energy Policies.

This report was published to assist policymakers and the energy industry with pressing forward sustainable energy systems. Based on interviews with more than 40 industry CEOs and senior executives from across the global energy sector, this report aims to provide policymakers with the energy industry's views on what is needed from policies in order to meet the challenges of the Energy Trilemma: energy security, social equity and environmental impact mitigation.

This report is available at:
http://www.worldenergy.org/publications/2012/world-energy-trilemma-2012

The EDI Quarterly is published in order to inform our readers not only about what is going on in EDI, but also and in particular to provide information, perspectives and points of view on gas and energy market developments.

Read the latest developments in the energy industry, published daily on the website of EDI.

EDI Quarterly contact information
Energy Delta Institute
Laan Corpus den Hoorn 300
P.O. Box 11073
9700 CB Groningen
The Netherlands
T +31 (0)50 5248337
F +31 (0)50 5248301
E quarterly@energydelta.nl

**EDIAAL is an Energy Delta Institute program that aims to gather, edit and make available independent knowledge on the role of gas in the transition to a low carbon economy. The EDIAAL project is partly made possible by a subsidy granted by The Northern Netherlands Provinces (SNN), Koers Noord. EDIAAL is co-financed by the European Union, European Fund for Regional Development and The Ministry of Economic Affairs, Agriculture and Innovation, Peaks in the Delta.*

SNN

Ministerie van Economische Zaken, Landbouw en Innovatie